A SYSTEM

OF

PRACTICAL ARITHMETIC,

ADAPTED TO

BRITISH INDIA



PUBLISHED BY PERMISSION OF

HIS EXCELLENCY THE MOST NOBLE

RICHARD MARQUIS WELLESLEY, K. P.

Governor and Captain General, &c. &c. &c.

BY

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FORMS of ACCOUNTS CURRENT, INTEREST ACCOUNTS, INVOICES, ACCOUNTS SALE, AND BILLS of EXCHANGE.

INTRODUCTION.

COMMERCE, is the exchange of commodities; or the buying, selling, or trafficking of merchandize, money, or even paper, in order to profit by the same.

There is no doubt but commerce is nearly as ancient as the world itself; neceſſity ſet it on foot; the deſire of conveniency improved it; and variety, luxury, and avarice, have brought it, to its preſent ſtate.

A MERCHANT, is one who buys, or trades, in any thing; and as merchandize includes all goods, and wares, expoſed to ſale; ſo the word MERCHANT formerly extended to all ſorts of traders, buyers, and ſellers. But every one that buys, and ſells, is not at this day under the denomination of MERCHANT; only thoſe who traffic in the way of commerce by importation, or exportation, or carry on buſineſs by way of barter or exchange, and who make it their living to buy and ſell by a continual aſſiduity or frequent negociation, in the myſtery of merchandizing, are eſteemed MERCHANTS.

The MERCANTILE profeſſion is eſteemed noble and independent; and no where more valued than in England, where the younger ſons, and brothers of the beſt families are frequently bred up to merchandize.

The principal qualifications for a MERCHANT, are:

1ſt.—To write properly and correctly.

2d.—To underſtand all the rules of arithmetic, which have any affinity or relation to commerce.

To keep books of ſingle and double entry, as Journals, Ledgers, &c.

3d.—To know the agreement between the monies, weights, and meaſures of different parts.

5th.

5th.—The rates of exchange, according to the courſe of different places.

6th.—The cuſtoms, or duties, due on importation and exportation of merchandize, according to the uſage of the places that he trades to.

7th.—That he ought on all occaſions to have a ſtrict regard to truth, and avoid fraud and deceit, as corroding cankers to his reputation, and fortune; for, however cunningly the maſk is worn, chance may, but time certainly will diſcover the cheat, and render the wearer expoſed to the contempts and inſults of thoſe he has impoſed on. That he ſhould act with great caution and circumſpection; as firſt, to make himſelf maſter of that branch of commerce he intends to engage in; and if he does not tranſact this buſineſs perſonally, to be cautious in his choice of factors, or agents, above all, that they be noted for their capacity and integrity, otherwiſe, inſtead of an expected advantage, through the treachery, neglect or ignorance of his agent, the beſt laid ſcheme may produce conſiderable loſs: for which reaſon he ſhould not be drawn in to employ an agent, with whoſe character he is unacquainted, even from that moſt prevailing one, of ſerving for a leſs commiſſion, as no trade is worth carrying on, that will not afford the allowance generally made.

In buying of merchandize, it is neceſſary to be extremely circumſpect in his words, that his deſire of having the goods he is treating for, may not appear, and ſhould not ſlight or undervalue them, in order to be thought not to want them, as this cunning only ſerves to embaraſs the mind, and make him (the ſeller) more firm and tenacious under the uncertainty: on the contrary, he ought to act with ſincerity and frankneſs, accompanied, however, with prudence, and to avoid tricks and ſubtlety.

In conducting his ſales, a merchant ſhould avoid many words and

circumlocutions,

circumlocutions, as this looks more like a retailer, than one who is not so; and ſuppoſing he is treating with one of this laſt diſtinction, he may be aſſured, the buyer underſtands the value of the goods, ſo that the merchant only occaſions himſelf an unneceſſary trouble to aſk much out of the way; therefore, what is principally to be obſerved in ſales on truſt is, that his debtor be one noted for his punctuality and honeſty, and alſo diſpatching large quantities of goods, which ſhould induce a preference (though with leſs profit), than to another of inferior credit, and a ſhorter trade.

If it happens, that debtors omit paying what they owe at the time agreed upon, the creditors ſhould not oppreſs them with an extravagant intereſt, for though neceſſity obliges them ſeemingly to ſubmit, it is a ſure canker to their fortunes, which too often at laſt involves the truſted, and him that truſts, in ruin. Beſides, if the latter eſcape a failure, he has drawn the other into, I ſhould think he could not the laſhes of conſcience, when he reflects on his occaſioning the debtor's misfortunes, by the extortion he had impoſed.

He ought never to lend to any ſort of perſon, whatſoever on an unjuſtifiable ſecurity nor to take an unwarrantable intereſt; for this is a deteſtable act, and expoſes the USURER to the penalty of the law, and renders him abominable, both in the ſight of God, and man.

A MERCHANT ſhould never ſell any of his goods in ſmall parcels, except drove thereto by mere neceſſity, as this is derogating from his character, and will occaſion him the loſs of his retail cuſtomers.

There is not, in the whole circle of ſociety, a claſs of men more eminently uſeful than that of the merchants. Their active induſtry ſupplies ſubſiſtence and proviſions for a whole country, and their efforts animate the induſtry of the manufacturer and the artiſt. In general, we may obſerve, they become rich with the increaſing wealth and comfort of the community;

community; their credit reſt upon a reputation of probity and fair dealing, and their profits are in proportion to the riſques which they may encounter. They cannot augment their fortunes without expoſing them, and augmenting at the ſame time the fortunes of the public; and their profeſſion and their talents are in eſtimation wherever any portion of good ſenſe is to be found. They have been uniformly encouraged in every country where there ever has exiſted any ſhadow of a reaſonable and legitimate government; and they are naturally the friends and ſupporters of liberty and law, becauſe without liberty and law, no commerce can be expected to flouriſh, or even to exiſt. Within the period of the laſt century, they had been gradually riſing into importance and general eſtimation, and philoſophy had numbered them among the moſt ſteady beneſactors of the human race.

A FACTOR or AGENT, is a perſon who acts for a merchant by commiſſion, either in the buying, or in the ſelling, of goods, or in both; they ſhould ſtrictly obſerve the orders of their principals, or elſe, they are liable to the damage accruing from the neglect of them. AGENT is more properly, for the receiving and paying of monies.

BROKERS are of three kinds, EXCHANGE-BROKERS, STOCK-BROKERS and PAWN-BROKERS.

EXCHANGE-BROKERS, are a ſort of negociators, who contrive, make and conclude bargains, between merchants and tradeſmen, in matters of money or merchandize, for which they have a fee, or premium called BROKERAGE. At ſeveral places, the manner of negociating has ſomething in it very particular; after the brokers have launched out into long, and uſually impertinent diſcourſes, coming towards a concluſion, they only converſe with their fingers. The buyer's, and ſeller's broker, each take the other by the right hand, which they cover with a cloth, or otherwiſe; the finger ſtretched out ſtands for ſix; bent for five; the

tip

tip of the finger for one; the whole hand 100; and the hand clenched for 1000. They will expreſs even fractional parts, as annas, and pauys, by their hands. During all this myſtic commerce, the two brokers appear as cold and compoſed, as if there were nothing paſſing between them.

STOCK-BROKERS are thoſe employed to buy and ſell ſhares in the joint ſtock of a company or corporation.

PAWN-BROKERS are perſons who keep ſhops, and lend money to neceſſitous people, upon pledges for the moſt part on uſurious conditions.

BANK, in commerce is a denomination given to certain ſocieties, or communities, who take on them the charge of the money of private perſons, to be put ſecure, and may be properly defined, a common repoſitory, where many perſons agree to keep their caſh, to be always ready at their call or direction. The buſineſs of the bank is for the moſt part, diſcounting bills, advancing money on ſecurities, circulating their own notes, &c. &c.

OF FAILURES or BANKRUPTCIES,

How to be guarded againſt.

Could Trade be always carried on with that credit which is neceſſary to ſupport it and with that ſucceſs which every one hopes for, by adventuring in it—it would be the moſt pleaſant, as well as the moſt beneficial employ that any one could undertake; but, as we are all ſubject to the uncertain fluctuating ſtate of humanity, our ſerenity will be ſometimes intercepted and our calms and ſun ſhine be obſcured and ruffled by the clouds and tempeſts of adverſity, as well in this as in all other employs of life, and the ſmooth paths of buſineſs will often become rugged and ſtrewed with thorny troubles, to the utter change of the pleaſing ſcene, by introducing inevitable loſſes and misfortunes, inſtead of the advantages,

tages we flattered ourſelves with the hopes of reaping from our commercial engagements. Thus, the beſt laid ſcheme may be overſet by ſome intervening occurrence, and a trifling accident frequently demonſtrates the weakneſs of our judgment, and the ſhallowneſs of our deſigns; though, whilſt we ſubmit our actions to the directions of prudence, and ſuffer our ſteps to be guided by her, we may juſtly be ſaid to act like reaſonable men; and, however providence (for our puniſhment) may diſpoſe otherwiſe, we certainly take the beſt and likeleſt methods of ſecuring to ourſelves, that ſucceſs and proſperity which we are ſoliciting; and in order to guard againſt their reverſe, permit me to ſhew the cauſes which naturally drive men to ſplit on that rock, where ſo many thouſands have been wrecked.

The failures of merchants often proceed from ignorance, imprudence, and ambition, than from malice and deſign; and I will endeavour to guide them from running on the aforementioned ſhoals, by perſuading them to aim at the diſſipation of the fogs of ignorance by the ſun ſhine of learning, to correct imprudence, and to baniſh vain-glory or ambition. The firſt may be done by a ſtrict attention to buſineſs, whilſt under the tuition of a merchant in an apprenticeſhip; or if this has been neglected, and my reader comes into trade, without ſuch uſual form and inſtruction, REASON if engaged and uſed, will be too hard for imprudence; and ambition, I ſhould think would be checked by diſplaying the fatal conſequences of it; and by theſe means, a failure proceeding from all, or any of the abovementioned cauſes, may be prevented; though ſtill there remains one, from which no foreſight or care can defend us: I mean the immediate diſpoſitions of providence, to which we ought chearfully to ſubmit, with a perfect reſignation, and never murmur nor repine at any of his diſpenſations, under a full aſſurance that he will

afford

afford ſupport and comfort under the affliction, to every one who ſincerely truſts in him; and, when he ſees convenient, give a happy releaſe from it. It is true, theſe are hard leſſons to mankind, and rendered more irkſome by the barbarous treatment the unhappy too commonly meet with; for though it is natural to imagine that a man who has been truly honeſt in all his dealings, and ſeemingly been eſteemed for his integrity, ſhould on a reverſe of fortune, meet with that pity and kind uſage he has ſhewn to others under ſimilar diſtreſſes; but experience convinces us, that this is rarely the caſe; on the contrary it is generally found, that though friends may ſeem many, and ſtaunch in the time of proſperity, yet on a change of circumſtances, they will drop off like blaſted fruit, quite forgetful of favors ſhewn to, and kindneſſes done them; and at the time you become a bankrupt in your fortune, you will certainly find them ſo, in affections and returns of gratitude. Favors ſeem no longer regarded than you are in a capacity to continue them, and obligations are thruſt among the number of nonentities, or at leaſt are become ſuch unfaſhionable things, as only to be owned by the very few conſcientious and benevolent.

Actions of benevolence are not to be expected from creditors, whoſe paſſions generally ſour their tempers, and keep their reſentments warm againſt the unhappy occaſion of them, even to the extinction ſometimes of humanity. But one ſhould think that the lamentation of a fallen familiar and intimate (frequently heightened by the tears of a tender wife, and affecting cries of their innocent babes) would be prevailing objects to excite compaſſion from thoſe who have always experienced a courteous and gentle treatment from the unhappy ſufferers; but philanthropy is almoſt loſt among us, and mankind are grown ſo degenerate, as to become inſenſible to the diſtreſſes of others, much leſs to defend them from, and adminiſter relief under them; the unfortunate man is now equally ſhunned with the infected one, and the beſt uſage he finds is ſlights from every individual

dividual of his quondam acquaintance, whilſt the worſt is ſwelled to an immoderate height, by inſults offered him, contumelies and reproaches thrown out againſt him, and abuſes, invectives, and unmerited aſperſions, are frequently added to complete the catalogue, and augment his miſeries. Few regard him, fewer ſtill careſs him, and the paucity of thoſe who protect or aſſiſt him, are reduced to the loweſt degree of compariſon. This is generally the caſe with thoſe whom fortune has proſtrated and laid low; though there is ſtill a ſmall remnant of men among us, who actuated by every tender ſentiment of humanity, and as opportunities offer, exerciſe every ſocial virtue; whoſe compaſſion is extended to all afflicted objects, and their charity ſtretched to the utmoſt limits that prudence and diſcretion can warrant; they remain uninfluenced by the example of their neighbours, and continue fixed and immoveable in the principles of goodneſs and benevolence: but theſe guardian angels are ſcarce, and even when found, can (at beſt) only alleviate, and in ſome degree mitigate and take off the ſharp edge of affliction, though they cannot reſtore loſt credit and reputation; this only can be done by the man himſelf, and the ſole means is the making every ſatisfaction to his creditors, that his abilities will permit. This leſſon, honeſty and a juſt reflection on things will teach you; and as the miſeries ſubſequent to and attendant on a failure are extenſive, as have been (though but faintly) repreſented, it is natural to ſuppoſe, the bare deſcription, will render every other perſuaſive ſuperfluous—for avoiding the cauſes of ſuch great unhappineſs.

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Wellesley Moſt Noble Richard Marquis	4
Walters William Greene	1
Wallerlow John	1
Wadlern W.	1
Watſon Peter	1
Walker Lt. W. B.	1
Watſon Col. S.	1
Wauchope J.	1
White Capt. H. V.	1
Williams Robert	1
Walpole R.	1
Williams H. A.	1
Wyatt G. N.	1
Winter F.	1
Wilford Capt. F.	1

ARITHMETIC,

IN WHOLE AND COMPOUND NUMBERS.

ARITHMETIC is the art of numbering and teaches how to compute, truly, and with expedition and eaſe. It conſiſts chiefly in five great or fundamental rules, for the operations, viz.

NUMERATION OR NOTATION, ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION.

An integer or whole number, is an unit or 1, or any number of units; as 7, 48, 105, 1785, &c.

A compound number, conſiſts of different denominations; as rupees, annas, and paaee; or mons, ſars, and chuttaaks; thus, 4 rupees, 6 annas, 5 paaee; or 13 mons, 6 ſars, 4 chuttaaks, &c.

NUMERATION.

IS the reading or writing in words any number given in figures; alſo, the writing in figures any number expreſſed in words, according to its true value.

The figures by which numbers are expreſſed, are the nine following, viz. 1, 2, 3, 4, 5, 6, 7, 8, 9; with theſe there is uſed the mark or character 0, called a cipher, which of itſelf ſtands for nothing, but being annexed to the right hand of a figure, alters its value; thus, 40, ſignifies forty; 400, ſignifies four hundred, &c.

TABLES.

Tens of Krores.	Krores.	Tens of Lacs.	Lacs.	Tens of Thouſands.	Thouſands.	Hundreds.	Tens.	Units.
								5
						7	5	4
				5	0,	2	1	6
			4,	2	3,	3	0	1
		5	6,	2	1,	7	6	0
	3,	2	1,	7	8,	2	3	7
5	4,	3	2,	1	2,	3	4	5

100 Thouſands,	make one Lac
100 Lacs	Krore
100 Krores	Puddum
100 Puddums	Khurrub
100 Khurrubs . . .	Sunkun

Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thouſand.	Tens of Thouſands.	Thouſands.	Hundreds.	Tens.	Units.
								6
						7	5	4
					4,	5	6	7
			5	6,	7	8	9	1
		7,	6	7	8,	9	0	1
	8	9,	0	1	2,	3	4	5
9	8	7,	6	5	4,	3	2	1

EXAMPLES.

Write down 350 . 4567 . 75302 . 207600 . 5003200 . 76549005 . 753627180 . in words at length.

Expreſs in figures, five thouſand and ſeventy-four.

Expreſs in figures, nine hundred and eighty-ſeven millions.

Expreſs in figures, five lacs.

Expreſs in figures, three lacs, forty-four thouſand, five hundred and ten.

Expreſs in figures, ninety-eight krores, five lacs, and ninety thouſand.

The

The Bengaleſe have a method of reckoning by the joints of their fingers, beginning with the lower joint of the little finger and proceeding to the thumb, the ball of which is alſo included as a joint, and thus the whole hand contains fifteen.

From this method of performing numeration on the joints, ariſes the well known cuſtom among the Indian merchants of ſettling all matters of purchaſe and ſale, by joining their hands beneath a cloth, and then touching the different joints, as they would increaſe or diminiſh their demands.

ADDITION OF INTEGERS.

IS to add two or more numbers of like kind together, into one ſum called the TOTAL.

RULE.

1.—Place all the numbers of a like kind under one another, that is, units under units, tens under tens, hundreds under hundreds, &c.

2.—Begin at the units place and reckon up all the figures in that column from the bottom to the top, and what overplus there is above even tens, ſet down, and carry one for every ten to the next column, and ſo on, continuing to the laſt or left hand column, at which ſet down the Total.

PROOF.

Begin at the top and reckon the figures downwards, in the ſame manner as you added them upwards; and if the ſum comes the ſame as before, you may conclude it is right.

EXAMPLES.

8765	76543	2345578	98765432
327	21012	987654	12938475
542	3456	321	64534219
29	78901	4796598	28374655
TOTAL 9663	179912		

What is the ſum of 126983, 81621, 2118, 312, 604, and 24? Anſwer 211662.

Add together into one ſum 234563, 41234, 312, 2, 4286, 302, 56. Anſwer 280755.

Add together into one ſum 878761, 2180, 815, 47, 124, 4210, 432, 25.

Anſwer 886590.

SUBTRACTION

SUBTRACTION OF INTEGERS.

Is the taking of a leſſer number out of a greater of like kind, whereby to find out a third number, which is the difference, and is called the REMAINDER.

RULE.

1.—Place the greater number uppermoſt, and the other under it, ſo that units may be under units, tens under tens, &c. and draw a line under them.

2.—Begin at the right hand or place of units, and ſubtract the lower figure from the upper, and ſet down the difference underneath them, do the ſame with the reſt of the figures.

3.—When the under figure exceeds that which ſtands above it, you muſt borrow 10, and add it to the upper number, from which ſubtract the lower, and ſet down the remainder; carry one to be added to the next lower figure, and ſubtract the ſum from the upper, ſetting down the remainder, and ſo on from one row to another.

PROOF.

To the leſſer number add the remainder, if the ſum be like the greater, the work is right.

EXAMPLES.

FROM . . .	94567	368149	86459	869426017
TAKE . . .	72363	126154	21821	2149*1764
REMAINDER	22204	241995		
PROOF . .	94567	368149		

From 543210, take 46502. From 76540329, take 500398.
I borrowed 5000, and paid in part 575 Rupees, what ſum remains to be paid.
What is the difference between 5555 and 99.

MULTIPLICATION OF INTEGERS.

Is the increaſing of any one number by another, ſo often as there are units in that number by which the one is increaſed, and ſerves inſtead of many additions.

In this rule there are two numbers given, called factors; viz. one to be multiplied, called the multiplicand, and another by which it is multiplied, called the multiplier, to find a third or the number produced in multiplying, which is called the product.

PROOF

PROOF.

The moſt correct method is to divide the product by the multiplier, and the quotient, if the work be right, will be the ſame as the multiplicand, but as the learner is ſuppoſed not yet to know the rule of Diviſion, he cannot prove by it; he muſt therefore make the multiplicand the multiplier, then if the product is the ſame as the other, the work is right.

There is a way of proving Multiplication, by caſting away the nines, and is very expeditious, but liable to error, therefore not to be depended upon, I ſhall ſhew both ways in its proper place.

TABLE,

TO BE PERFECTLY BY HEART.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	—	9	12	15	18	21	24	27	30	33	36
4	—	—	16	20	24	28	32	36	40	44	48
5	—	—	—	25	30	35	40	45	50	55	60
6	—	—	—	36	42	48	54	60	66	72	
7	—	—	—	—	49	56	63	70	77	84	
8	—	—	—	—	—	64	72	80	88	96	
9	—	—	—	—	—	—	81	90	99	108	
10	—	—	—	—	—	—	—	100	110	120	
11	—	—	—	—	—	—	—	—	121	132	
12	—	—	—	—	—	—	—	—	—	144	

THE

THE USE OF THE TABLE.

☞ *Find one of the two figures on the left ſide, and the other at top, then in the angle of meeting is their product ſought.*

Thus, to multiply 5 *by* 8, *ſeek* 8 *in the upper line, and under it againſt* 5 *on the left hand, is* 40, *the product; and ſo of others.*

CASE.

1.—To multiply by a ſingle figure, or when the multiplier is under 13.

RULE.

1.---Place the multiplier underneath the units place of the multiplicand.

2.---Multiply from the right hand to the left; thus, multiply the units figure of the multiplicand by the multiplier, if the product be leſs than 10, ſet it down under its own place of units, but if their product exceeds 10 (or tens), then ſet down the exceſs only (as in Addition) and carry 1 for every 10 to the product of the next figure of the multiplicand, ſetting down the exceſs above 10 (or tens) as before; do thus untill you come to the laſt figure, whoſe product muſt be ſet down entire.

EXAMPLES.

Multiplicand	5243		7546	9876	567839
Multiplier	2	5 1/1 2/2	3	4	5
Product .	10486		22638		

Multiply .	7653	8953	5476	9549	9876
By . . .	6	7	8	9	12
Product .					

To prove the foregoing examples by caſting away the nines, make a croſs, add all the figures of the multiplicand together, as units, thus, (take the example 1;) 5 and 2 is 7 and 4 is 11 and 3 is 14, throw away the nines, and ſet the remainder 5 on the ſide of the croſs; do the ſame with the multiplier (2), but as there are no nines to throw away, I ſet down 2 on the other ſide the croſs. Do the like in the product; thus, 1 and 4 is 5,

and

and 8 is 13 and 6 is 19, throw away the nines and there remains 1, to be ſet at the top of the croſs. Laſtly, multiply the figures on the ſides, thus, twice or two times 5 is 10, throw away the nines and ſet the remainder 1 at bottom of the croſs, which being the ſame as the top, proves the work to be right.

CASE.

2.—When the multiplier conſiſts of ſeveral figures.

RULE.

1.—Place each figure in the multiplier reſpectively under its own kind in the multiplicand, that is, units under units, tens under tens, &c.

2.—Multiply the multiplicand by each figure of the multiplier, obſerving to place the firſt figure of each particular product, underneath that figure of the multiplier, which you mutliply with.

3.—Add the particular products together and their ſum, will be the deſired or whole product.

EXAMPLES.

Multiplicand	5432	7659	9873	3547
Multiplier	13	15	16	18
Particular Products .	16296 5432			
Product	70616	114885	157968	63846

PROOF OF THE FOREGOING EXAMPLES.

Multiplicand	13	15	16	18
Multiplier	5432	7659	9873	3547
	26 39 52 65			
Product	70616	114885	157968	63846
Multiplicand	528	374	798	546
Multiplier	374	528	546	798
	2112 3696 1584			
Product	197472	197472	435708	435708

Multiply

Multiply	31246812 by 16.	Anſwer 499948992.
Multiply	34216812 by 23.	Anſwer 786986676.
Multiply	3841265 by 63.	Anſwer 241999695.
Multiply	21806847 by 84.	Anſwer 1831775148.
Multiply	281642 by 458.	Anſwer 128992036.
Multiply	864927 by 653.	Anſwer 564797331.
Multiply	302614 by 362.	Anſwer 109546268.
Multiply	621452 by 984.	Anſwer 611508768.
What is the product of 368121456 and 2345. Ans. 863244814320.		
Multiply	460136527 by 3615.	Anſwer 1663393545105.
Multiply	746542 by 253648.	Anſwer 189358885216.
Multiply	253648 by 746542.	Anſwer 189358885216.

CASE.

3.—When ciphers are intermixed with the figures in the multiplier.

RULE.

Omit the ciphers and place the firſt figure of each particular product under its reſpective multiplier.

EXAMPLES.

804700625
207008009

7242305625
6437605000
5632904375
1609401250

166579474222305625

Multiply	82164973 by 3027.	Anſwer 248713373271.
Multiply	16358724 by 7040006.	Anſwer 115166398483 44.
Multiply	9217600035 by 520007091.	Anſwer 4793217544004081 85.

CASE.

4.—When there are ciphers at the right hand of either or both the multiplicand and multiplier.

RULE.

Multiply as before, neglecting the ciphers untill all the particular products are added together, and to that ſum place the number of ciphers that are on the right hand of both factors. Multiply

EXAMPLES.

Multiply . . .	234000	36840	3684000
By	2600	230	306000
	1404		
	468		
Product	608400000	8473200	1127304000000

If you have any number to multiply by 10, 100, 1000, &c. annex as many ciphers thereto, as there are in the multiplier, and the work is done.

Multiply 1781 by 10. Anſwer 17810.
Multiply 1781 by 100. Anſwer 178100.

CASE.

5.—When the multiplier is ſuch a number that any two figures or numbers, (in the table) being multiplied together with produce it.

RULE.

Multiply the given number by one of thoſe figures or numbers, (which are called component parts) and that product by the other, which will give the deſired product.

EXAMPLES.

Multiply	36421	by 16.	Multiply	48612	by 36.
	4	times 4 is 16.		6	times 6 is 36.
	145684			291672	
	4			6	
Product	582736			1750032	

Multiply 24574 by 108. Anſwer 2653992.
Multiply 4364213 by 72. Anſwer 314223336.
Multiply 78905 by 144. Anſwer 11362320.

CASE.

6.—When the Multiplier is any number between 12 and 20.

RULE.

Multiply each figure in the multiplicand, by the figure in the units-

place

place of the multiplier, and as you multiply, add to the product of each ſingle figure, that figure of the multiplicand which ſtands next on the right hand.

EXAMPLES.

Let it be required to multiply 954 by 17,

954
17
16218

Say 7 times 4 is 28, ſet down 8 and carry 2; then 7 times 5 is 35 and 2 I carried is 37, and the 4 in the units place of the multiplicand makes 41, ſet down 1 and carry 4; then 7 times 9 is 63 and 4 I carried is 67, and 5 in the multiplicand is 72, ſet down 2 and carry 7 which being added to 9 in the multiplicand makes 16 to be ſet down: ſo the product is 16218.

Multiply	4263	by	16.	Anſwer	68208.
Multiply	36124	by	18.	Anſwer	650232.
Multiply	48965	by	17.	Anſwer	832405.
Multiply	32145	by	19.	Anſwer	610755.
Multiply	5643	by	14.	Anſwer	79002.

CASE.

7.—When the multiplier conſiſts of the ſame figure in all the places that is, all nines, or all ſevens, &c.

RULE.

For each figure in the multiplier, annex a cipher to the multiplicand, and from that number ſubſtract the multiplicand, and if the repeating figure is 9, the remainder is the product; but if any other figure, multiply it into the 9th part of the remainder; or for the figure 3, take the 3d part of the remainder; and for 6, multiply the 3d part by 2.

EXAMPLES.

Multiply 47627 by 9999

476270000
47627
476222373

Multiply 27464 by 11111

2746400000
27464
9)2746372536
305152504

multiply

Multiply 4674 by 2222		Multiply 47694 by 7777	
	46740000		476940000
	4674		47694
	9)46735326		9)476892306
	5192814		52988034
	2		7
	10385623		370916238

Multiply 74760 by 3333. Anſwer 249175080.

Multiply 42763 by 6666. Anſwer 285058158.

DIVISION OF INTEGERS.

TEACHETH us to find how often one number called the DIVISOR, is contained in another, called the DIVIDEND, and ſerves inſtead of many ſubtractions; the number which ſhews, how often the DIVISOR is contained in the dividend, is called the QUOTIENT.

CASE.

1.—When the diviſor is not greater than 12.

RULE.

Firſt, ſeek how often the diviſor is contained in the firſt figure of the dividend; or if the firſt figure of the dividend be leſs than the diviſor, then in the two firſt figures of the dividend and ſet the quotient figure down, and if any thing remains carry it to the next figure in the dividend, where it muſt be reckoned as ſo many tens, that is, if 1 remains

you

you muſt call it 10; if 2, 20; and ſo on; bearing in mind the remainder of each figure, and adding it to the next, until you have made uſe of all the figures, in the dividend. This is called SHORT DIVISION.

OBSERVE.

The remainder muſt be always leſs than the diviſor.

PROOF.

Multiply the quotient by the diviſor, and as you multiply add the remainder (if any), or add the whole remainder to the product at laſt, and if it comes the ſame as the dividend, the work is right.

EXAMPLES.

Divide 57431 by 2.

Place your numbers as follows; when there is a remainder at laſt, (as in this queſtion) to complete the quotient, ſet it at the end, above a ſmall line, and ſet the diviſor under it.

Diviſor Dividend.
2) 57431

Quotient 28715½

Proof. 57431

Divide 76543210 by each number ſeperately from 3 to 12.

CASE.

2.—When the diviſor conſiſts of many figures.

RULE.

Place your numbers, as follows; then ſeek, how often the firſt figure (on the left) of the diviſor is contained in the firſt figure of the dividend; or in the two firſt figures when that of the diviſor is greater, and place the anſwer in the quotient, by which multiply the diviſor, and place the product under the ſaid figures of the dividend, drawing a line underneath it; ſubtract it therefrom, and to the remainder annex the following figure of the dividend, proceeding as before; but if this product be greater than that part of the dividend, a leſs figure muſt be placed in the quotient.

Diviſor

Diviſor Dividend Quotient

83)	17654	(	212 $\frac{58}{83}$
	166		83
	105		636
	83		1696
	224		17596
	166		58 rem.
Rem.	58		17654 proof.

2.—In caſe the remainder be ſo ſmall that when the figure of the dividend joined with it, make a leſs ſum than the diviſor, then a cipher is to be placed in the quotient and another figure brought down from the dividend, then proceed as before. This is called LONG DIVISION.

72)	74546	(	1035 $\frac{26}{72}$
	72		72
	254		2070
	216		7245
	386		74520
	360		26
Rem.	26		74526 Proof.

EXAMPLES.

Divide 74638105 by 37.	Anſwer	2017246 $\frac{3}{37}$
Divide 567098 by 648.	Anſwer	875 $\frac{98}{648}$
Divide 987654 by 3065.	Anſwer	322 $\frac{724}{3065}$
Divide 32101234 by 54321.	Anſwer	590 $\frac{51844}{54321}$
Divide 5678901234 by 684573.	Anſwer	8295 $\frac{368199}{684573}$
Divide 3210123456 by 97.	Anſwer	33094056 $\frac{24}{97}$
Divide 3233238699 by 684573.	Anſwer	4723 $\frac{420}{684573}$
Divide 98839054780 by 476085.	Anſwer	207608 $\frac{100}{476085}$

CASE.

CASE.

3.—When the diviſor has ciphers on the right hand.

RULE.

Strike them off, and likewiſe ſtrike off as many places on the right hand of the dividend; and perform the diviſion by the remaining figures. And when the diviſion is finiſhed, annex the figures cut off to the remainder.

When the dividend has the ſame number of ciphers on the right hand as the diviſor, ſtrike them off from each, and the remainder will be ſo many of what you divide by, without annexing the ciphers that were cut off.

EXAMPLES.

Divide 119282 by 2800

28 | 00)1192 | 82(42 $\frac{1682}{2800}$
112

72
56

1682 Remainder.

Divide 506500 by 4700

47 | 00)5065 | 00(107 $\frac{36}{47}$
47

365
329

36 Remainder.

Divide	370149 by 20	Anſwer	$18507\frac{19}{20}$
Divide	3108690170 by 1200	Anſwer	$2590575\frac{17}{1200}$
Divide	3108690170 by 7100	Anſwer	$437843\frac{497}{710}$
Divide	7380964 by 23000	Anſwer	$320\frac{2\,964}{23000}$

CASE.

4.—When the diviſor is ſuch a number, that any two figures or numbers (in the multiplication table), multiplied together, will produce it.

RULE.

Divide the given number by one of thoſe numbers, or component parts, and that quotient by the other, which will be the anſwer or quotient required.

If there be a remainder in the laſt diviſion, it will be ſo many times the firſt diviſor, which added to the firſt remainder (if any) will give the true remainder.

EXAMPLES.

EXAMPLES.

Divide 56785 by 84
7 times 12 is 84

7)56785

12)8112 1

Anſwer . 676 $\frac{1}{84}$

Divide 4276 by 48
6 times 8 is 48

6)4276

8)712 4

$89\frac{4}{48}$

Divide 42768 by 48. Anſwer 891.

Divide 74682 by 72. Anſwer $1037\frac{18}{72}$

Divide 14276 by 144. Anſwer $99\frac{20}{144}$

Thoſe who are well acquainted with the nature of diviſion, may ſubtract each figure of the product, as he produces it, and ſo only write down the remainder, which will ſhorten the work conſiderably and is much the beſt method. Practice will ſoon make it familiar.

EXAMPLES.

17)690489(40617

104

28

119

6125)8649753(1412$\frac{1253}{6125}$

25247

7475

13503

Rem. 1253

Divide 5343698 by 84. Anſwer $63615\frac{38}{84}$

Divide 2148686 by 467. Anſwer $4601\frac{19}{467}$

Divide 24939844 by 6074. Anſwer 4106

REDUCTION,

OF MONEY, WEIGHTS AND MEASURES.

Is the converſion of numbers from one name to another, but ſtill retaining the ſame value.

If the reduction to be a leſs name, it is commonly called REDUCTION DESCENDING, but if to a greater, REDUCTION ASCENDING.

RULE.

Conſider how many of the leſs name concerned make one of the greater, and by that number multiply the given number, if the reduction be deſcending; but divide if aſcending; and the product, or quotient, will be the value in the other name.

NOTE.

1.—When there are names between the propoſed and required one, reduce the propoſed to the next leſs, or greater name, and this to the next leſs, or greater again, and ſo on until you have reduced it to the name required.

2.—When in reduction deſcending the propoſed is a compound number, you muſt add or take in the ſmall numbers in the names below the greateſt to the ſame names, as you proceed in the reduction.

3.—When in reduction aſcending, you have any remainders after dividing, they will have the ſame names as their reſpective dividends, and may be placed after the laſt quotient, according to the order of their names, the greateſt firſt; ſo ſhall the compound number thus formed be the anſwer.

BENGAL MONEY.

The loweſt ſpecies of money in Bengal is ſea ſhells, called KOREE. Petty retailers in the bazars or markets keep their accounts; alſo, accounts

counts of ſmall diſburſements, as houſe-expences, cooly hire, &c. are kept according to the following table, and is called the KAUCHAU account.

ko.	4 korees	make	1 gundah.
gun.	20 gundahs . . .	make	1 pun or pon.
pn.	4 puns	make	1 anna.
an.	4 annas	make	1 kaahun of about

four to a rupee according to the price of korees in the market, which fluctuates much.

5 gundahs of a kauchau account, are in the bazar called a BOOREE; and 4 puns are generally denominated one CHOK or SEEKEE.

Native merchants and others generally keep their accounts according to the following table, which is denominated the PAUKAU account.

4 quarters	make	1 pauy or pun, commonly called pie.
4 pauys or puns . .	make	1 anna.
16 annas	make	1 taukau, or rupee.

The generality of European merchants, &c. keep their accounts in ſicca rupees, reckoned thus:

pa.	12 pauy	make . . .	1 anna.
an.	16 annas	make . . .	1 rupeee. ſa. r.

European merchants, &c. kept their accounts formerly in current rupees, an immaginary coin.

100 Sicca Rupees are equal to 116 Current Rupees.

SEE BATTA.

The coins current in Bengal are gold mohurs, halves and quarters; ſilver ſicca rupees, halves, and quarters; and copper pauys, and half pauys; 4 copper pauys make one anna; and 16 ſicca rupees make

one

one gold mohur, but ſometimes alters according to the ſcarcity of ſilver.

The copper pauys are iſſued from the Treaſury at the rate of 64 for a ſicca rupee, and paſs at that rate in all the Government Offices; but they are current in the bazar and in ſmall payments, generally at 25 gundas each, or 56 to a ſicca rupee, but the rate often alters according to the price of korees.

EXAMPLES.

In 44 rupees how many annas?

This reduction is deſcending, ſo I multiply the rupees by 16, becauſe 16 annas make one rupee, and the product is annas.

45
16

Annas 720

Reduce 720 annas to rupees.

This reduction is aſcending, ſo I divide the annas by 16 (in a rupee) and the quotient is the anſwer in rupees, which proves the preceeding example.

16)720

Rupees 45

In 45 rupees how many pauys?

Here I multiply by 16 as before, and the product is 720 annas, which I multiply by 12, becauſe 12 pauys make one anna, and the product is 8640 pauys required. See Note 1.

44
16

720
12

8640

Reduce 8640 pauys, to rupees.

Here I divide by 12 pauys (in one anna) and the quotient is 720 annas, then I divide by 16, as before, and the quotient is the anſwer in rupees.

12)8640

16)720

Rupees 45

Rs.

Rs. an. pa.
In 565 15 5, how many annas and pauys?

See Rule. Note 2. 565 15 5
16 take in 15

Annas 9055
12 take in 5

Paaee 108665

In 108665 pauys, how many annas and rupees.

12)108665 rem. 5 pa.

See Rule. Note 3. 16) 9055 rem. 15 an.

Anſwer 565 r. 15 an. 5 pa.

Reduce 1 kaahun; to annas, puns, gundas and k

Anſwer 4 an. 16 pn. 320 gun. 1280 ko.

In 1280 korees, how many gundas, puns, annas, and kaahun?

Anſwer 320 gun. 16 pn. 4 an. 1 kaahun.

In 5 kaahun, 2 an. 3 pa. how many puns? Anſwer 91 puns.

In 91 puns, how many kaahun? Anſwer 5 kaa. 2 an. 3 pa.

In 1 taakaa, how many korees? Anſwer 5120 korees.

Reduce 5120 koress; to taakaas? Anſwer 1 taakaa.

Reduce 28 ſicca rupees, 10 an. 6 pa. to pauys. Anſwer 5502 pauys.

In 5502 pauys; how many ſicca rupees? Anſwer 28 ſa. r. 10 an. 6 pa.

[illegible]00 ſicca rupees, how many pauys? Anſwer 960000 pauys.

In 55569 ſa. r. 6 an. 7 pa. how many pauys? Anſwer 10669327 pa.

Reduce 597865 pauys, to ſicca rupees. Anſwer 3113 ſa. r. 14 an. 1 pa.

WEIGHTS.

GOLD AND SILVER.

dh.	4 dhaans or grains, ...	make	1 rutty.
rut.	8 rutties, ...	make	1 maaſhaa.

ma.

maa. 12 maashaas, ... make . . . . 1 tolaa, or sa. wt.
equal to 179 $\frac{2}{3}$ grains troy weight.

EXAMPLES.

Reduce 1 tolaa; to mashaas, rutties and dhaans.

Answer 12 maa. 96 rut. 384 dh.

In 5000 dhaans; how many tolaas. Answer 13 tol. 2 rut.

In 6 tolaas, 6 maa. 2 dhs. how many dhaans. Answer 2498.

SMALL BAZAR WEIGHTS.

kh.	4 khaanchaas, ...	make	1 chuttaak.
ch.	4 chuttaaks, ...	make	1 poaa.
po.	4 poaas, ...	make	1 sar.
sr.	5 sars, ...	make	1 patcherry.
pat.	8 patcherries, ...	make	1 mon or mun. mn.

GREAT WEIGHTS.

FACTORY WEIGHTS.

According to the Standard received from England in 1787.

			lb.	oz.	drs.	
ck.	16 chuttaaks . . .	make . . 1 sar, equal to	1	13	13 . 86	avoir.
sr.	40 sars, ...	make . . 1 mon. mn.	74	10	10 . 6	

BAZAR WEIGHTS.

			lb.	oz.	drs.	
sa. wt.	1 sicca weight, ...	is equal to	0	0	6 . 576	avoir.
	5 sicca weight, . . make . .	1 chuttaak,	0	2	0 . 853	
ck.	16 chuttaaks, . . make . .	1 sar,	2	0	13 . 853	
sr.	40 sars, ... make . .	1 mon,	82	2	2 . 86	

Bazar weight is 10 per cent. more than Factory weight.

See COMPARISON of WEIGHTS.

EXAMPLES.

In 5 mons; how many kaanchaas? Answer 12800 khaanchaas.

In 12800 khaanchaas; how many mons? Anſwer 5 mons.
Reduce 66 pat. 4 ſr. 3 po. 3 ck. and 3 kh. to khaanchaas. Anſwer 21439 kh.
Reduce 54 fact. mn. to chuttaaks. Anſwer 34560 chuttaaks.
Reduce 34560 chuttaaks; to mons. Anſwer 54 mons.

MEASURES.

LONG MEASURE.

j.	3 jow or barley corns . .	make . . .	1 unglee or finger breadth.
ung.	4 unglees	make . . .	1 moot or hand breadth.
mt.	4 moots	make . . .	1 haat or cubit.
ht.	4 haats	make . . .	1 dunnook or bow's length.
dun.	2000 dunnooks	make . . .	1 kros, about 2¼ Engliſh miles.

The kros alters in different parts of India.

EXAMPLES.

Reduce 1 kros; to jows. Anſwer 384000 jows.
Reduce 384000 jows; to kros. Anſwer 1 kros.

LIQUID MEASURE.

ſa. wt.	5 ſicca weight	make	1 chuttaak.
ch.	4 chuttaaks	make . . .	1 poaa.
po.	4 poaas	make	1 ſar.
ſr.	40 ſars	make . . .	1 mon.

EXAMPLES.

Reduce 1 mon; to ſicca weight. Anſwer 3200 ſa. wt.
In 3200 ſa. wt. how many mons; Anſwer 1 mon.

CLOTH MEASURE.

	3 jows.	make	1 unglee.
ung.	3 unglees	make	1 gheriaa.

gh.

gh.	8 gheriaas	make	1 haat or cubit of 18 inches.
gz.	2 haats	make	1 guz or yard.

EXAMPLES.

In 1 guz how many jows. Anſwer 144 jows.

Reduce 144 jows; to guz. Anſwer 1 guz.

GRAIN MEASURE.

ck.	5 chuttaaks	make . . .	1 khoonkee.
ko.	4 khoonkees	make . . .	1 raik.
rk.	4 raiks	make . . .	1 paalie.
pall.	20 paalies	make . . .	1 ſoaalie.
ſoa.	16 ſoaalies	make . . .	1 kaahun or 40 bazar mons.

EXAMPLES.

Reduce 1 khaahun; to chuttaaks; Anſwer 26500 ck.

In 27500 chuttaaks; how many kaahun. Anſwer 1 kaa.

LAND OR SQUARE MEASURE.

j.	3 jows	make	1 unglee.
ung.	4 unglees	make	1 moot.
mt.	3 moots	make	1 begot.
be.	2 begots	make	1 haat or 18 inches.
in.	324 inches	make	1 ſquare haat or cubit.

5 cubits long and 4 broad, or 20 ſquare cubits make 1 chuttaak.

16 chuttaaks, or 80 cubits long and 4 cubits broad, or 320 ſquare cubits, make 1 cottaa.

20 cottaas, or 80 cubits ſquare, or 6400 ſquare cubits make 1 beegaa.

A beegaa of Land in Bengall is ſaid to be equal to about 1555 ſquare yards; but RENNELL in his Map of Bengal and Behar, computes at the rate of 1600 ſquare yards, to a ſquare beegaa.

EXAMPLES.

In 1 haat; how many jow? Anſwer 72 jows.

Reduce 5 haats, 1 be. 2 mt. 3 ung. 1 j. to jows. Anſwer 430 jows.

TIME.

18 polloks . . .	make . .	1 coſlaa.

cos.	30 coſſaas	make	1 kollaa.
kol.	30 kollas	make	1 onoopoll.
o. p.	60 onoopolls	make	1 be poll.
b. p.	60 be polls	make	1 poll.
p.	60 polls	make	1 ghurrie or 24 minutes.
gh.	7½ ghurries	make	1 p.haar or 3 hours.
pr.	8 p.hars	make	1 day.
dy.	7 days	make	1 ſaaftaa.
	15 days	make	1 puhkee.
pu.	2 puhkees	make	1 mos.
ms.	12 mos.	make	1 bhaatſaarh or year.

EXAMPLES.

In 1 ghurrie; how many polloks? Anſwer 3499200000.

In 50 gh, 10 p, 5 bp, 15 op; how many onoopolls. Anſwer 10980315

TALE.

4 particulars	make	1 gundaa.
10 ditto	make	1 kordge or kooree.

MADRAS MONEY.

There are a variety of coins in circulation on this coaſt, but the moſt common are the ſilver Arcot rupee, and the Madras gold ſtar pagoda, thus:

c.	10 caſh	make	1 doodee.
d.	8 doodies	make	1 fanam.
fan.	12 fanams	make	1 Arcot rupee.
a. r.	3¼ Arcot rupees	make	1 ſtar pagoda. ſt. p.

Government accounts are kept, thus:

c.	80 caſh	make	1 fanam.
fan.	42 fanams	make	1 ſtar pagoda. ſt. p.

This

This is the value at which this coin is iſſued from and taken at the treaſury, but the rate or number of fanams (a ſilver coin) to a rupee or pagoda, fluctuates in the bazar, according to the ſcarcity of ſilver. Merchants, uſually keep their accounts at the rate of 45 fanams to a ſtar pagoda, and the computations in this book are at that rate, unleſs mentioned otherwiſe.

EXAMPLES.

Reduce 52 ſtar pagodas, to caſh. Anſwer 187200 caſh.

In 187200 caſh, how many ſtar pagodas? Anſwer, 52 ſt. p.

Reduce 32 ſt. p. 35 fan. 54 c. to caſh. Anſwer 118054 caſh.

In 118054 caſh; how many ſtar pagodas? Anſwer 32 ſt. p. 35 fan. 54 c.

Reduce 5000 arcot rupees, to caſh. Anſwer 1800000 caſh.

In 1800000 caſh, how many Arcot rupees? Anſwer 5000.

WEIGHTS.

			lb.	oz.
pag. wt.	10 pagodas weights make	1 pollam, equal to	0	1 . 25 avoir.
pol.	40 pollams . make	1 viſs	3	2
v.	8 viſs . . . make	1 mon	25	6
mn.	20 mons . . make	1 candy or 12	500	0

Gold wrought or unwrought to be ſold by the current pagoda weight, equal to 2 dwts 4¼ grs. troy.

EXAMPLES

Reduce 115 candies, to pagoda weights. Anſwer 736000 pag. wt.

In 736000 pag wt. how many candies. Anſwer 115 candies.

Reduce 35 can. 15 mn. 4v. 25 pol. and 8 pag. wt. to pagoda weights.

Anſwer 2289858 pag. wt.

In 2289858 pag. wt. how many candies? Anſwer 35 can. 15 mn. 4v. 25 pol. 8 pag. wt.

GRAIN MEASURE.

ol.	8 olluks	make	1 meaſure or puddy.
mea.	8 meaſures . . .	make	1 marcal.
ml.	5 marcals . . .	make	1 parah.
par.	80 parahs	make	1 garſe. gar.

When grain is ſold by weight 9256½ lb. avoir. is allowed to a garſe.

EXAMPLES.

EXAMPLES.

In 5 garſe; how many olluks? Anſwer 128000 olluks.

Reduce 128000 olluks; to garſe. Anſwer 5 garſe.

Reduce 8 gar. 30 par. 4 ml., 5 mea., and 6 oll.; to olluks.

Anſwer 214702 olluks.

In 214702 olluks; how many garſe?

Anſwer 8 gar. 30 par. 4 ml. 5 mea. 6 oll.

BOMBAY MONEY,

2	reas (imaginary)	make	1	urdee	
4	reas	make	1	doogany or ſingle pauy.	
6	reas	make	1	doreea.	
8	reas	make	1	ſuddea or double pauy.	
3½	fuddeas or pauy	make	1	anna.	imaginary.
12½	pauy or 4 annas	make	1	quarter rupee	imaginary.
25	pauy or 8 annas	make	1	half rupee.	
50	pauy or 16 annas	make	1	rupee.	
5	rupees or 80 annas	make	1	paanchea.	
15	rupees	make	1	gold mohur.	

Such is the relative table of Bombay current and imaginary coins, while in account they are confined to the following reckoning:

1.	100 reas	make	1	quarter.
qr.	4 quarters or 400 reas	make	1	rupee (foortee).

EXAMPLES.

Reduce 75 rupees, 2 qrs., 63 reas., to reas. Anſwer 30263 reas.

Reduce 30263 reas; to rupees. Anſwer 75 r. 2 qrs. 63 reas.

WEIGHTS.

SMALL AND SILVER WEIGHTS.

ch.	6 chowe	make	1	gonze.
g.	2½ gonze	make	1	vall.
v.	40 valls	make	1	tolaa.
t.	24 tolaas	make	1	ſar.

Silver is commonly ſold from 90 to 100 doogannies or ſingle pauys per tolaa, but computations in money are made by the ſuddeas or double pauys.

GREAT WEIGHTS.

			lb.	oz.	drs.
pa.	30 pauys . .	make 1 far . . equal to . .	0	11	3.2 avoir.
fr.	40 fars . . .	make 1 mon	28	0	0
mn.	20 mons . .	make 1 candy	560	0	0

See Surat Weights.

EXAMPLES.

Reduce 1 candy; to pauys. Anſwer 24000 pauys.

In 24000 pauys, how many candies. Anſwer 1 candy.

Reduce 15 can., 5 mn., 15 fr, 15 pa., to pauys. Anſwer 366465 pa.

In 366465 pauys, how many candies. Anſwer 15 can. 5 mn. 15 fr. 15 pa.

GRAIN MEASURE.

tip.	2 tipprees	make	1 far.
fr.	4 fars	make	1 adowly or paly.
ad.	16 adowlies	make	1 parah.
ph.	8 parahs	make	1 candy.

This ſerves for wheat and all grain, except rice and batty, which are ſold by the batty meaſures, but in wholeſale, grain is ſold by weight.

2	tipprees	make . . . . . 1 far
7½	fars	make . . . . . 1 adowly.
20	adowlies	make . . . . . 1 parah
6¼	parahs . . .	make . . . . . 1 candy
4	candies or 25 parahs . .	make . . . . . 1 morah.

EXAMPLES.

Reduce 1 candy, to tipprees (1ſt table). Anſwer 1024 tipprees.

In 1024 tipprees; how many candy? Anſwer 1 candy.

SURAT WEIGHT.

				lb.	oz.	drs.
30	pauys . . .	make 1 far, .	equal to	0	14	15
40	fars . . .	make 1 mon, .	. .	37	7	6
20	mons . . .	make 1 candy,	. .	749	4	2

Although the foregoing tables repreſent the commonly received ſtandard of the groſs weights at Bombay, and Surat, it is not only impoſſible to lay down a rule whereby to judge what commodities in the market are ſeparately governed by them; but there is a great variety of articles too numerous to diſtinguiſh here, in the ſale of which the foregoing relations do not obtain, particularly with reſpect to the Surat mon, which, notwithſtanding it is ſaid to contain only 40 ſars or 37 lbs. 7 oz. 6 drs; is ſometimes 41, 2, 3, through all the intermediate gradations to 46 ſars: nor is the candy uniformly confined to 20 mons; for example, pepper and ſandal wood are ſold by the Bombay candy of 21 mons; and cotton the great ſtaple commodity of the market, by the Surat candy of 21 mons.

CHINA.

There is but one piece of coin uſed in China, which is of baſe metal called a CASH, and is uſed to pay labourers and ſmall expences.

MONEY.

The money, or the weights in which accounts are kept, are thus:

					l.	s.	d.
c.	10 caſh	make	1 candarine, equal to		0	0	0¼.2
can.	10 candarines	make	1 mace,		0	0	8
m.	10 mace	make	1 tale or 3 ſa. rs.		0	6	8
tale.	3 tales	make			1	0	0

WEIGHTS.

			oz.	dwts.	
100 tales ſhould weigh			120	16.	troy.
100 ſpaniſh dollars			88	13	
			lb.	oz.	drs.
1 tale weighs			0	0	19 . 75. avoir.
16 tales	make	1 catty	1	3	12
100 catties	make	1 pecul	133	5	5.28.

In China all ſorts of proviſions, as milk, fowls, hogs, greens, &c. are ſold by the catty.

EXAMPLE

EXAMPLES.

Reduce 1 tale; to cash. Answer 1000 cash.

In one pecul; how many tales? Answer 1600 tales.

ENGLAND.

	The current coins are as follows:	lb. s. d.	sa. r. a. pa.
Gold	Guineas	value 1 1 0 or about	9 0 0
	Half guineas	value 0 10 6 . .	4 8 0
Silver	Shillings	value 0 1 0 . . .	0 6 10
	Six pences or half shillings . .	value 0 0 6 . . .	0 3 5
Copper	Half pence	value 0 0 0½ . . .	0 0 3½

Accounts are kept thus:

q.	4 farthings . .	make .	1 penny	¼ is written for 1 farthing.
d.	12 pence . . .	make .	1 shilling	½ 2
s.	20 shillings . .	make .	1 pound sterling. £.	¾ 3

The pound sterling, is an imaginary coin, value about 8 sa. r. 9 an. 2 pa.

EXAMPLES.

In 24 pounds; how many pence. Answer 5760 pence.

In 5760 pence; how many pounds. Answer 24 pounds.

In 36 £. 10 s. how many pence? Answer 8760 pence.

In 302 £. 16 s. 4½ d. how many farthings? Answer 290707 farthings.

In 35040 farthings; how many pounds? Answer 36 £. 10 s.

In 1 pound; how many shillings, pence, and farthings? Answer 20 s. 240 d. 960 farthings.

WEIGHTS.

TROY WEIGHT.

gr.	24 grains . . .	make . . .	1 penny weight.
dwt.	20 penny weights . .	make . . .	1 ounce.
oz.	12 ounces . .	make . . .	1 pound. lb.

By this weight, gold, silver, Jewels, &c. are weighed.

Note. One grain of troy weight, is equal to 1½ grain of found dry wheat.

1 lb. 2 oz. 11 dwts. 15½ gr. troy, is equal to 1 lb. avoirdupois weight.

EXAMPLES.

EXAMPLES.

How many ounces, penny weights, and grains; in 37 lb.

Anſwer 444 oz. 8880 dwts. 213120 grs.

Reduce 213120 grains; to pounds. Anſwer 37 lb.

In 59 lb. 13 dwts. 5 grs. how many grains. Anſwer 340157 grs.

APOTHECARIES WEIGHT.

grs.	20 grains . . .	make . . .	1 ſcruple.
℈	3 ſcruples . .	make . . .	1 dram.
ʒ.	8 drams . . .	make . . .	1 ounce.
℔.	12 ounces . . .	make . . .	1 pound. lb.

Apothecaries make up their medicines by this weight, but drugs are bought and ſold by avoirdupois weight.

EXAMPLES.

In 17 lb. how many ſcruples; Anſwer 4896 ſcruples.

In 231 lb. 3 oz. 5 grs. how many grains. Anſwer 1332005 grs.

In 1332005 grs. how many lbs. Anſwer 231 lb. 3 ʒ. 5 grs.

AVOIRDUPOIS WEIGHT.

dr.	16 drams	make	1 ounce.
oz.	16 ounces . . .	make	1 pound.
lb.	28 pounds . . .	make	1 quarter.
qrs.	4 quarters . . .	make	1 hundred weight or 112 lb
cwt.	20 hundred weight .	make	1 ton.

By this weight all groſs goods of a coarſe or droſſy nature, and all metals, except gold and ſilver are weighed.

NOTE.

1 lb. avoirdupois . .	makes	1 lb.	2 oz.	11 dwts.	15½ grs. troy.
1 oz.	makes	0	0	18 dwts.	5½ grs.
1 dr.	makes	0	0	1 dwt.	3½ grs.

EXAMPLES.

In 15 tons; how many pounds? Anſwer 33600 lb.

In 9 cwt. 5 lb. how many ounces? Anſwer 16208 oz.

In 16208 ounces? how many hundred weight. Anſwer 9 cwt. 5 lb.

MEASURES.

MEASURES.

CLOTH MEASURE.

na.	4 nails	make	1 quarter of a yard.	yd.
qrs.	3 quarters	make	1 ell flemiſh.	ell fl.
	4 quarters	make	1 yard.	yd.
	5 quarters	make	1 ell Engliſh.	ell eng.
	6 quarters	make	1 ell French.	ell fr.
	4 quarters 1 $\frac{1}{5}$ inch	make	1 ell Scotch.	ell ſc.

EXAMPLES.

In 37 yards ; how many nails ? Anſwer 592 nails.

Reduce 15 yds. 3 qrs. 1 n., to nails. Anſwer 253 nails.

In 253 nails , how many yards ? Anſwer 15 yds. 3 qrs. 1 n.

LONG MEASURE.

b. c.	3 barley corns	make	1 inch.
in.	12 inches	make	1 foot.
ft.	3 feet or 36 inches	make	1 yard.
yd.	2 yards or 6 feet	make	1 fathom.
p.	5½ yards	make	1 pole, rod, or perch.
fur.	40 poles or 220 yards	make	1 furlong.
m.	8 furlongs or 1760 yards	make	1 mile.
lea.	3 miles	make	1 league.
	23 $\frac{1}{6}$ leagues or 69½ miles	make	1 degree.

360 degrees. is the circumference of the globe.

5 feet, is a geometrical pace.

16½ feet, is a pole.

ALSO,

4 inches	make	1 hand or hand's breadth.	
3 hands breadth	make	1 foot.	
1½ foot	make	1 cubit.	
2 cubits	make	1 yard.	

By this meaſures diſtances of places or any thing elſe, that has length only, are meaſured.

EXAMPLES.

EXAMPLES.

In 273 miles; how many inches? Anſwer 17297280 inches.

Reduce 5 m. 6 fur. 3 yds. into inches. Anſwer. 364428 inches.

In 364428 inches; hhw many mils? Anſwer 5 in 6 fnr. 3 yds.

LAND MEASURE.

yds.	5½ yards	make	1 perch, rood, or pole.
po.	40 poles	make	1 rood.
roo.	4 roods	make	1 acre.
ac.	30 acres	make	1 yard of land.

EXAMPLES.

In 15 acres; how many poles? Anſwer 2400 poles.

Reduce 27 ac. 1 roo. 32 po. to poles. Anſwer 4392.

WINE MEASURE.

pts.	2 pints	make	1 quart.
qts.	4 quarts	make	1 gallon.
galls.	10 gallons	make	1 anchor.
galls.	84 gallons	make	1 puncheon.
galls.	63 gallons	make	1 hogſhead.
hhds.	2 hogſheads	make	1 pipe.
pp.	2 pipes	make	1 tun.

By this meaſure all wines, ſpirits, cyder, &c. are meaſured.

A tun of wine is 18 cwt. avoirdupois.

EXAMPLES.

In 19 hogſheads of wine; how many pints? Anſwer 9576 pints.

In 1 pipe of wine, how many quarts? Anſwer 504 quarts.

ALE AND BEER MEASURE.

pts.	2 pints	make	1 quart.
qts.	4 quarts.	make	1 gallon.
galls.	48 gallons of ale . . .	make	1 hogſhead.
galls.	54 gallons of beer . . .	make	1 hogſhead.
hhds.	2 hogſheads	make	1 but or 108 gallons.
bts.	2 butts	make	1 tun or 216 gallons.

EXAMPLES.

EXAMPLES.

In 13 hogſheads of Beer; how many gallons? Anſwer 702 gallons.
How many hogſheads in 702 gallons of Beer? Anſwer 13 hogſheads.

TIME.

'''	60 thirds	make	1 ſecond.
ſec.	60 ſeconds	make	1 minute.
min.	60 minutes	make	1 hour.
h.	24 hours	make	1 day.
d.	7 days	make	1 week.
w.	4 weeks or 28 days.	make	1 month.
mo.	52 weeks, 1 day, 6 hours or 13 months, 1 day, 6 hours or 365 days, 6 hours	make	1 Julian year.

365 days, 5 hours, 48 min. 57 ſec. 39''' make 1 ſolar year.

The year is divided into 12 unequal calendar months, called January, February, March, April, May, June, July, Auguſt, September, October, November, December.

And to know how many days are in each month, obſerve (to get by heart) the following lines:

Thirty days hath September,
April, June, and November;
February hath twenty-eight alone,
And all the reſt have thirty-one;
Except leap-year and then's the time,
February's days are twenty-nine.

NOTE

To find the the leap-year. Divide the given year by 4, if 0 remains, it is leap-year; but if 1, 2, or 3 remains, it is ſo many years after.

Every fovrth year is leap-year, ſo called from leaping or advancing a day more that year, than any other; that year has then 366 days in it, and February 29 days.

EXAMPLES.

EXAMPLES.

In a calendar month of 30 days; how many hours. Anſwer 720 hours.

How many minutes are in 1763 months of 28 days each.

Anſwer 71084160 minutes

How many ſeconds are in a ſolar year. Anſwer 31556937 ſeconds.

SQUARE OR SUPERFICIAL MEASURE.

144	ſquare inches	make	1 ſquare foot.
9	ſquare feet	make	1 ſquare yard.
30¼	ſquare yards	make	1 ſquare pole.
40	ſquare poles	make	1 ſquare rood.
4	ſquare roods	make	1 ſquare acre.
640 ſquare acres or 4840 ſquare yards		make	1 ſquare mile.

By this meaſure all things in which length and breadth are only conſidered; are meaſured.

EXAMPLES.

Reduce 27 acres, 1 r. 32 po. to poles. Anſwer 4392 poles.

In 4392 poles, how many acres; Anſwer 27 ac. 1 r. 32 po.

SOLID MEASURE.

1728 ſolid inches	make	1 ſolid foot.
27 ſolid feet	make	1 ſolid yard.
40 ſolid feet round timber or 50 ſolid feet hewn timber	make	1 ſolid ton or load.

By this meaſure, all things, in which length, breadth, depth or thickneſs are conſidered; are meaſured.

EXAMPLES.

In 27 ſolid yards; how many ſolid inches? Anſwer 1259712 in.

In 1259712 ſolid inches; how many ſolid yards? Anſwer 27 yards.

OF SOME PARTICULAR THINGS.

12	make	1 dozen.
12 dozen	make	1 groce.

12 groce.

make	1 great groce.
make	1 ſcore.
make	1 hundred.
make	1 great hundred.
make	1 thouſand.

COMPOUND ADDITION.

IS to add two or more ſums or numbers together of the ſame kind but of different denominations; as, money; weights; &c,

RULE.

1.—Place the numbers of a like denomination, under each other, viz. rupees under rupees, annas under annnas, and pauys under pauys.

2.—Begin to add at the loweſt denomination, then divide that ſum by as many of the ſame denomination as make one of the next greater, ſetting down the remainder under the row added, and carry the quotient to the next ſuperior or greater denomination, whoſe ſum you muſt alſo find, proceed in this manner to the laſt, or greateſt denomination, which add as in Integers.

PROOF.

The ſame as in addition of Integers.

EXAMPLES.

kaahun	an.	pu.	gun.	ko.
25	3	3	19	3
4	2	2	18	2
13	1	1	17	1
19	0	1	16	2
3	1	0	15	3
18	2	1	14	1
7	3	2	13	0
Sum. 9[illegible]	3	3	15	0

Sa. r.	an.	pa.	gun.	ko.
15	15	1	13	2
2	14	2	12	3
1	13	3	11	1
17	14	0	10	0
9	1	2	13	2
6	8	0	13	1
7	5	3	11	3
61	9	3	6	0

Sa. r.	an.	pa.
540	15	11
1	14	10
15	13	9
14	12	8
6	13	7
5	11	6
4	10	5
590	12	8

tolaa.

tolas	ma.	rut.	dh.	mons.	pat.	fr.	po.	ck.	kh.	mons.	fr.	ck.
40	11	7	3	77	7	4	3	3	3	789	39	15
5	4	5	2	99	6	3	2	2	2	32	38	14
19	10	3	1	66	5	2	1	1	1	5	37	13
55	9	6	0	33	4	1	0	0	0		36	12
	5	2	3	44	3	0	1	1	1	52	4	3
7	6	5	2	88	2	1	2	3	2		17	2
Sum												

NOTE.

You muſt be carefull to write down the numbers of the ſame denomination exactly under each other, as in the preceding examples, and add them in the ſame manner; only take care to carry from one denomination to another, according to the table pertaining to each particular queſtion.

Add 570 ſa. r., 4 an., 6 pa.; 79 ſa. r., 14 an., 9 pa.; 5 ſa. r., 5 an., 5 pa.; 15 an., 6 pa., 9 pa., 59 ſa. r. 6 an. 7 pa; and 4 ſa. r. 15 an. into one ſum.

Anſwer 720 ſa. r. 14 an. 6 pa.

Add 20 mons, 7 pat. 4 fr. 3 po. 3 ck. 3 kh.; 49 mn. 4 pat. 3 fr. 2 po. 3 ck. 2 kh.; 7 mn. 6 pat. 3 fr. 2 po. 2 ck. 1 kh.; and 15 mn. 5 pat. 2 fr. 2 po. 2 ck. 3 kh. into one ſum. Anſwer 94 mn. 1 pat. 1 kh.

Add 155 mons, 35 fr. 5 ck., 16 mn. 7 fr. 15 ck.; 2 mn. 15 fr. 2 ck.; 66 mn. 25 fr. 9 ck.; 576 mn. 15 fr. 15 ck.; and 1700 mons; into one ſum.

Anſwer 2517 mons, 19 fr. 14 ck.

Add 15 kaahun, 15 ſoa. 19 paa. 3 rk. 3 khoo. 4 ck.; 3 kaa. 5 ſoa. 15 paa. 1 rk. 2 khoo. 2 ck.; 59 kaa. 3 paa. 3 khoo. 14 ſoa. 9 paa. 2 rk. 2 khoo. 1 ck.; 18 paa. 3 rk. 1 khoo. 3 ck.; 1 rk. 1 khoo. 3 ck.; 2 khoo. 2 ck.; and 3 ck. into one ſum.

Add 15 ſtar pagodas, 44 fan. 7 d. 9 c.; 14 ſt. pag. 43 fan. 6 d. 8 c. 59 ſt. pag. 41 fan. 4 d. 6 c.; 22 ſt. pag. 40 fan. 3 d. 5 c.; and 33 ſt. pag. 39 fan. 2 d. into one ſum. Anſwer 161 ſt. pag. 27 fan. 6 d. 5 c.

Add 555 ſt. pag. 44 fan. 79 c.; 666 ſt. pag. 43 fan. 78 c.; 444 ſt. pag. 42 fan. 77 c.; 333 ſt. pag. 41 fan. 76 c.; and 222 ſt. pag. 40 fan. 75 c. into one ſum. Anſwer 2224 ſt. pag. 34. fan. 65 c.

Add.

Add 30 Madras candy, 19 mn. 7 v. 29 pol. 9 pag wt.; 5 can. 18 mn. 6 v. 38 pol. 9 pag. wt.; 6 can. 17 mn. 5 v. 37 pol.; 7 pag. wt. 5 can. 16 mn. 4 v. 36 pol. 6 pag. wt.; and 4 can. 15 mn. 3 v. 35 pol. 5 pag. wt. into one ſum.

Anſwer 74 can. 8 mn. 5 v. 28 pol. 6 pag. wt.

Add 5062 Bombay rupees, 3 qrs. 99 reas.; 22 B. r. 2 qrs. 95 re.; 556 B. r. 2 qrs. 98 re.; 444 B. r. 1 qr. 97 re.; 333 B. r. 3 qrs. 96 re. into one ſum.

Anſwer 6420 B. r. 3 qrs. 85 re.

Add 7 £. 13 s. 3 d; 3 £. 5 s. 10¼ d.; 6 £. 18 s. 7½ d.; 2 s. 5¼ d.; 4 £. 3 d. and 7 £. 15 s. 10¼ d. into one ſum. Anſwer 29 £. 16 s. 4½ d.

Add 17 lb. 3 oz. 15 dwts. 3 grs.; 4 lb. 6 oz. 15 dwts. 3 grs.; 10 oz. 7 dwts. 21 grs.; 9 lb. 5 oz. 8 grs.; and 76 lb. 2 oz. 17 dwts. into one ſum.

Anſwer 108 lb. 4. oz. 15 dwts. 11 grs.

Add 5 cwt. 3 grs. 27 lb.; 4 cwt. 2 grs. 26 lb.; 3 cwt. 1 qr 25 lb.; 2 cwt. 3 qrs. 24 lb.; 1 cwt. 2 grs. 23 lb. and 1 qr. 22 lb. into one ſum.

Anſwer 19 cwt. 1 qr. 7 lb.

Add 14 lb. 15 oz. 15 dr.; 13 lb. 14 oz. 1 dr.; 12 lb. 13 oz. 2 drs.; 11 lb. 12 oz. 3 drs. and 10 lb. 11 oz. 4 drs. into one ſum. Anſwer 64 lb. 2 oz. 9 drs.

COMPOUND SUBTRACTION.

Is to find the difference between any two given ſums of the ſame kind but different denominations, as money; weights; &c.

RULE.

Subtract as in integers; only when the lower number in any denomination happens to be the greater, borrow one, that is, add as many to the upper number as makes one of the next ſuperior denomination, and then ſubtract the lower number, and ſet down the remainder; then carry one and add it to the lower number of the next denomination, and ſubtract as before.

PROOF.

The ſame as ſubtraction of Integers.

EXAMPLES.

EXAMPLES.

	kaahun an. pn. gun. ko.	Sa. r. an. pa.	Sa. r. an. pa.
From	25 2 2 17 1	[illegible]	449 15 10
Take	5 2 2 18 1	6 [illegible]	14 15 11
Rem.	19 3 3 19 0		
Proof	25 2 2 17 1		

	Sa. r. an pa.	Sa. r. an. pa.	Sa. r. an. pa.
From	5000 0 0	55 14 6	560 0 5
Take	79 15 9	[illegible]	10 0
Difference			

	Mon. pat. fr. po. ck. kh.	Mon. fr. ck.	Mon. pat. fr. po. ck. kh.
From	4 5 2 1 1 1	55 16 15	25 0 0 2 3 2
Take	3 6 3 2 3 2	19 20 4	6 0 0 3 0 3
Remainder	6 3 2 1 3		

	St. pag. fan. d. c.	St. pag. fan. c.	St. pag. fan. d. c.	St. pag. fan. c.
Borrowed	14 16 6 6	66 5 17	78 15 3 5	5 20 18
Paid	10 44 7 7	59 40 72	57 43 4 6	40 19
Remains	3 16 6 79	6 9 25		

	Mad. can. mn. v. pol. pag. wt.	Mad can. mn. v. pol. pag. wt.
Bought	59 15 3 25 5	45678 0 0 15 5
Sold	19 19 7 39 9	26399 1 1 16 6
Remains	39 15 3 25 6	

Bom

	Bom. r. qrs. reas.	[illegible] r. qrs. reas.	Bom. r. qrs. reas.
From.	50790 2 70	[illegible]7 0 0	576 2 99
Take	29491 3 76	[illegible] 3 55	575 3 99
Remains	21298 3 94		

	£. s. d.	£. s. d.	£. s. d.
Borrowed	142 17 6¾	7779 15 1	5555 17 3¾
Paid	12 4 6¾	880 16 2¾	4666 18 5
Unpaid	130 12 11¼		

	lb. oz. dwts. grs.	cwt. qrs. lb.	lb. oz. drs.
Bought	14 10 12 17	50 2 17	7543 15 12
Sold	11 11 14 21	15 3 18	6934 5 13
Remains			

COMPOUND MULTIPLICATION.

TEACHETH to multiply (by one common multiplier) any ſum or number conſiſting of divers denominations.

CASE.

1.—When the given quantity does not exceed 12.

RULE.

1.—Write the multiplier or given quantity under the loweſt denomination of the multiplicand.

2.—Begin at the loweſt denomination, and multiply it by the given number, and ſee how many of the next denomination is contained in the product, ſet down the remainder underneath its own place and add the quotient to the next ſuperior denomination, as you multiply, in this manner, proceed with all the other denominations to the higheſt.

EXAMPLES.

EXAMPLES.

	Sa. r. an. pn. gun. ko.	Sa. r. an. pa.	Sa. r. an. pa.
Multiply	5 13 2 15 2	500 14 6	560 0 10
By	3	4	5
Product	17 9 0 6 2	2003 10 0	2800 4 2

Multiply 54 ſa. r., 9 pa.; by 5. Anſwer 270 ſa. r. 3 an. 9 pa.

6 garce of rice, at 59 ſt. pag. 14 fan. 55 c. per g. Anſwer 355 pag. 43 fan. 10 c.

7 candies of wheat, at 105 Bom. r. 3 qrs. 70 reas each.

Anſwer 741 r. 1 q. 90 reas.

12 dozen of wax candles, at 6 s. 8 d. per dozen. Anſwer £. 4 0 0.

11 barrels of beer, at 10 s. 6 d. per bar. Anſwer 5 £. 15 s. 6 d.

10 mons of ghee, at 3 ſa. r. 6 an., per mon. Anſwer 33 ſa. r. 12 an.

9 mons of ſugar, at 6 ſa. r. 5 an. 4 p. per mon. Anſwer 57 ſa. r.

CASE.

2.—When the multiplier or given quantity exceeds 12, and is ſuch a number, that any two figures or numbers (in the Multiplication Table) being multiplied together, will produce it.

RULE.

Multiply the given price by one of thoſe numbers, and the product by the other, which will give the anſwer.

EXAMPLES.

What will 56 mons of wheat coſt, at 4 ſa. r. 6 an. 6 pa. per mon?

4 6 6
7 times 8 is 56.
30 13 6
8
Sa. r. 246 12 0 Anſwer.

What will 28 mons of tallow candles coſt, at 44 ſa. r. 14 an. 6 pa. per mon.

44 14 6
4 times 7 is 28
179 10 0
7
Sa. r. 1257 6 0 Anſwer.

24 mons of sugar, at 22 R. pag. 34 fan. 45 c. per mon. Answer 1457 pag. 7 fan.
35 mons of rice, at 68 Bom. r. 2 qrs. 5 reas, per mon. Answer 2397 B. r. 3 q. 75 r.
55 cwt. of sugar, at 5 £. 14 s. 6 d. per cwt. Answer 314 £. 17 s. 6 d.
18 lb. of butter, at 4½ per lb. Answer 6 s. 9. d.
244 lb. of tea, at 4 s. 6 d. per lb. Answer 32 £. 8 s.

CASE.

3.—When the given quantity cannot be produced by the multiplication of any two small numbers.

RULE.

Find the next less number, and multiply as before; then for what is wanting, multiply the price by that number, and add it to the last product, and the sum will be the answer.

EXAMPLES.

What will 38 mons of sugar come to, at 6 sa. r. 14 an. 6 pa. per mon?

	6	14	6
			6 times 6 is 36 and 2 is 38
	41	7	0
			6
	243	10	0
	13	13	0 twice the given price.
Sa. r.	262	7	0 Answer.

What will 19 sars of Tea cost. at 5 r. 4 an. 3 pa. per sar?

	5	4	3
			2 times 9 is 18 and 1 is 19
	10	8	6
			9
	94	12	6
	5	4	3 once the given price.
Rs.	100	0	9 Answer

38 pair of stockings, at 3. r 5 an. per pair. Answer 125 r. 14 an.
46 pair ditto, at 8 r. 5 an. 6 pa. per pair. Answer 383 r. 13 a[illegible]

29 yards of Cloth, at 6 r. 7 an. per yd. Anſwer 186 r. 11 an.

58 mons of ſugar, at 3 ft. pag. 15 fan. per mon. Anſwer 193 ft. pag. 15 fan.

29 candys of rice, at 12 Bom. r. 3 qrs. 10 reas per can. Anſwer 370 r. 1 qr. 90 reas.

65 ſheep, at 1 £. 5 s. 4 d. each. Anſwer 82 £. 6 s. 8 d.

75 dozen of ſoap, at 6 s. $3\frac{1}{2}$ per doz. Anſwer 23 £. 11 sh. $10\frac{1}{2}$ d.

86 dozen of ſtockings, at 2 £. 4 s. 2 d. per doz. Anſwer 189 £. 18 s. 4 d.

106 cwt. of raiſins, at 12 ſa. r. 15 an. 4 pa. per cwt. Anſwer 1373 r. 9. an. 4 pa.

CASE.

4.—When the given quantity conſiſts of $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$;

RULE.

Divide the upper line (the price of one) by 4 for $\frac{1}{4}$; by 2 for $\frac{1}{2}$; by 2 firſt for $\frac{3}{4}$: then divide that quotient by 2 for $\frac{1}{4}$; add them to the product, and the ſum will be the anſwer.

EXAMPLES.

$5\frac{1}{4}$ fir. at 1 r. 2 an. 5 pa. per fr.

4) 1 2 5

5

5 12 1

4 $7\frac{1}{4}$

ſa. r. 6 0 $8\frac{1}{4}$ Anſwer

$7\frac{1}{2}$ lb. at 6 s. 6 d.

2) 6 6

7

2 5 6

3 3

£ 2 8 9 Anſwer

$5\frac{1}{2}$ mons, at 2 r. 2 qrs. 5 reas.

2) 2 2 5

5

12 2 25

2) 1 1 $2\frac{1}{2}$

2 $5\frac{1}{4}$

Eo. r. 14 1 $7\frac{3}{4}$

The foregoing methods, of finding the value of any quantity of goods under 100, at any price per mon, far, pound, &c. is of excellent uſe in retail buſineſs.

But for great quantities, there are other methods much better. (See PRACTICK).

NOTE.

NOTE.

Weights, meaſures, &c. are multiplied after the ſame manner as money, only you muſt be carefull to carry according to each denomination or table pertaining thereto.

Multiply 66 bazar mons, 35 ſr., 14 ck.; by 9. Anſwer 602 mn. 2 ſr. 14 cks.

Multiply 17 cwt. 24 lb.; by 12. Anſwer 206 cwt. 2 grs. 8 lb.

Multiply 14 lb. 10 oz. 21 grs.; by 7. Anſwer 103 lb. 10 oz. 6 dwts. 3 grs.

Multiply 49 baz. mons. 15 ſr. 15 ck. by 99. Anſwer 4890 mn. 17 ſr. 13 ck.

Multiply 15 cwt. 3 qrs. 16 lb. by 72. Anſwer 1144 cwt. 1 qr. 4 lb.

COMPOUND DIVISION.

TEACHETH to divide by one common diviſor, either a ſimple or compound number, into any propoſed number of equal parts whereof each ſhall be a compound number.

CASE.

1.—When the diviſor doth not exceed 12.

RULE.

1.—Place the diviſor and dividend, as in integers, writing the quotient under each reſpective dividend.

2.—Begin at the higheſt denomination, which divide by the given diviſor, and ſet the anſwer in the quotient and to be of the ſame denomination; if there be a remainder, you muſt find how many of the next lower denomination it is equal to, and add to the given number of that denomination in the dividend, divide as before. Proceed thus through all the denominations.

EXAMPLES.

Divide 55 ſa. r. 15 an. 5 pa. between 2 perſons.

First I divide the integers 55 by 2, and the quotient is 27 and 1 remains, which remainder (1) reduced to the next lower denomination makes 16 annas and thoſe added to 15 an. in the devidend make 31 annas, which divided by 2, gives 15 an. to the quotient and 1 anna remains; which is equal to 12 pauys and thoſe added to 5 pa. in the dividend make 17 which divided by 2, gives 8 pa. to the quotient and 1 or ½ pauy remains.

	2)55	15	5
Anſwer Rs.	27	15	8½
			2
Proof Rs.	55	15	5

Divide

Divide 77 ſa. r. 14 an. 3 pa.; by 3. Anſwer 25 ſa. r. 15 an. 5 pa.

Divide 19 ſa. r. 13 an. 2 pa.; by 4. Anſwer 4 ſa. r. 15 an. 3 $\frac{2}{4}$

Divide 5 kahun, 3 an. 3 pa. 15 gun. 3 ko.; by 5. Anſwer 1 ka. 3 pa. 3 gun 0 ko. $\frac{3}{5}$

Divide 13 ſa. r. 6 an. 3 pa. 4 gun. 2 ko.; by 6.

Anſwer 2 r. 3 an. 3 pa. 4 gun. 0 ko. $\frac{2}{6}$

Divide 15 Ar. r. 3 fan. 50 c.; by 7. Anſwer 2 Ar. r. 2 fan. 18 c. $\frac{4}{7}$

Divide 52 ft. pag. 13 fan. 50 c.; by 8. Anſwer 6 pag. 27 fan. 76 c. $\frac{2}{8}$

Divide 17 Bam. r. 2 qr. 55 reis; by 9. Anſwer 1 r. 3 qrs. 83 c. $\frac{8}{9}$

Bought 4 cwt. of cheeſe, for which I give 8 £. 10 s. 4 d.; what did it coſt per cwt.

Anſwer 2 £. 2 s. 7 d.

If 10 dozen of candles coſt 3 £. 17 s. 1 d. what is the price of one dozen.

Anſwer 7 s. 8½ d.

CASE.

2.—When the diviſor exceeds 12. and is ſuch a number that any two figures or numbers (in the Multiplication Table) will product it.

RULE.

Divide the given ſum by one of thoſe numbers, and that quotient again by the other, which will give the anſwer.

EXAMPLES.

Divide 45 ſa. r. 15 an. 5 pa. by 16.

4 times 4 make 16.

4)45 15 5

4)11 7 10 1 rem.

Sa. r. 2 13 11 $\frac{9}{16}$ Anſwer.

Divide 77 ſa. r. 3 an. 5 pa.; equally amongſt 44 perſons. Anſwer 1 r. 12 an 9 $\frac{29}{44}$ pa.

Divide 43 ſa. r. 4 an. 2 pa. 6 gun. 3 ko., between 72 coolies.

Anſwer 10 an. 5 gun. 0 ko. $\frac{27}{72}$

Bought

Bought 80 mons of rice for 120 Ar. r. 9 fan. 6 c.; what did it coſt per mon.

Anſwer 1 r. 6 fan. 9 c.

A quantity of ſugar ſold for 540 ſt. pag. 44 fan. 70 c.; which muſt be equally divided between 81 perſons; how much is each perſons ſhare?

Anſwer 6 pag. 30 fan. 44 c. $\frac{15}{81}$

It is required to divide 375 Bom. r. 2 qrs. 99 reas, between 121 perſons; what is each perſons ſhare? Anſwer 4 r. 3 qrs. 3 reas $\frac{36}{121}$

Divide 7 £. 6 s. equal between 24 perſons? Anſwer 6 s. 1 d.

What is cloth per yard, when 36 yards coſt 64 £. 19 s. Anſwer 1 £. 16 s. 1 d.

CASE.

3.—When the diviſor cannot be produced by the Multiplication of any two ſmall numbers.

EXAMPLES.

Divide 55679 ſa. r. 14 an. 6 pa. by 549

549)55679 14 6 (101 ſa. r. 6 an. 8 $\frac{414}{549}$ pa. Anſwer.

rem. 230
16

549)3694 (6 annas

rem. 400
12

549)4806 (8 pauys

rem. 414

Here, I divide the Integers firſt, which gives the quotient 101 rupees being the ſame denomination as the Integers of the dividend; then multiply the remainder 230 by 16 (annas in a rupee), being the next lower denomination, and take in the (15) annas given in the dividend, and divide the product by the ſame diviſor, which gives 6 annas to the quotient, being the ſame denomination as you multiplied by; then again multiply the remainder 400 by 12 (pauys in one anna), taking in the 6 pauy from the dividend, which product divide as before, which gives 8 pa. to the quotient and 414 remainder; laſtly, place the ſeveral quotients in regular order as above, gives the anſwer complete.

Divide

Divide 1054350 ſa. r. 15 an. 6 pa., equaly between 1000 men.

Anſwer 1054 ſa. r. 5 an. 7 pa. $\frac{386}{1000}$.

A frigate took a prize, worth 5562 £. 15 s. 6 d., to be divided equally between 215. men, what is each man's ſhare? Anſwer 25 £. 17 s. 5 d. $\frac{131}{215}$.

Diviſion of weights, &c. is worked in the ſame manner, with eaſe and accuracy, paying a due regard to their different denominations, according to the Tables.

CHARACTERS USED IN ARITHMETIC.

\+ plus, or more, the ſign of Addition; as 3+4, ſignifies 3 added to 4.

\- - minus, or leſs the ſign of Subtraction; as 4—2, ſignifies 2 ſubtracted from 4.

× the ſign of Multiplication; 3×4, ſignifies 3 multiplied by 4.

÷ the ſign of Diviſion, as 9÷3, ſignifies 9 divided by 3. This is ſomtimes expreſſed thus $\frac{9}{3}$.

=== the ſign of equality; as, 3+4=7, ſignifies 3 added to 4 is equal to 7.

: : : . the ſign of arithmetical proportion; as 2 : 4 : : 6 : 12.
ſignifies as 2 . is to 4 : : ſo is 6 : to 12.

EXAMPLE.

(+)—3×5÷2===30; ſignifies 9 added to 6, from the ſum ſubtract 3, the remainder multiplied by 5, and that product divided by 2, is equal to 30.

VULGAR FRACTIONS.

A FRACTION is ſome part or parts of an Integer, or whole thing repreſented by 1; as $\frac{3}{4}$ is a fraction, denoting three-fourths of any thing, or parts of an integer or 1. Every fraction conſiſts of two numbers, placed one above the other, with a line between them; as in the fraction $\frac{2}{3}$; the lower number 3 is called the DENOMINATOR, and ſhews how many parts the Integer is divided into; the upper number 2 is called the NUMERATOR, and expreſſes how many of theſe parts the fraction conſiſts of. And both numerator and denominator are called TERMS OF THE FRACTION.

A vulgar fraction, is either proper, improper, ſingle, compound or mixed.

A proper fraction, is that wherein, the numerator is leſs than the denominator, as $\frac{3}{4}$.

An improper fraction, is ſuch whoſe numerator is equal to, or greater than its denominator; as $\frac{3}{3}$; $\frac{4}{3}$.

A ſingle fraction, is that which conſiſts of but one numerator and one denominator and is referred immediately to ſome integer; as $\frac{1}{4}$ or $\frac{1}{2}$ of any thing.

A compound fraction, is the fraction of a fraction, conſiſting of two or more ſimple fractions, referred to one another in order, and the laſt, referred to ſome integer; as $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{1}{6}$ &c.

A mixed number, is compoſed of a whole number and fraction; as $6\frac{1}{2}$, $34\frac{2}{3}$ $152\frac{6}{8}$, &c.

REDUCTION OF VULGAR FRACTIONS.

CASE.

1.— TO reduce a fraction to another of equal value.

RULE.

Multiply or divide both terms of the fraction, by the ſame number, and you will have a new fraction, equal to that given.

EXAMPLE.

Let the given fraction be $\frac{4}{6}$, now (per rule) multiply both terms by 5, thus:

$$\begin{array}{cc} 6 & 4 \\ 5 & 5 \\ \hline 20 & 30, \end{array}$$

whence the new fraction $\frac{20}{30}$ equal to $\frac{4}{6}$

again, divide both terms of the fraction by 5, thus.

$$5\Big)\frac{20}{30}\Big(\frac{4}{6}$$ the fraction given.

CASE.

CASE.

2.—To reduce a whole number to an improper fraction.

RULE.

Set 1 under it for a denominator.

EXAMPLE.

Suppose 8, 4, 6, 36, were numbers to be reduced to fractions.

Then (per rule) $\frac{8}{1}$, $\frac{4}{1}$, $\frac{6}{1}$, $\frac{36}{1}$, the fractional quantity required.

CASE.

3.—To reduce a whole number to a fraction of a given denominator.

RULE.

Multiply the whole number by the given denominator, and under the product write the denominator.

EXAMPLE.

[illegible] number, whose denominator shall be 6.

[illegible]

Numerator, then $\frac{54}{6}$ is the fraction required.

NOTE

The preceding three cases being so exceedingly easy, more than one example in each case, would be quite unnecessary.

CASE.

4.—To find the greatest common measure or divisor, for the numerator and denominator, of any given fraction, or for any two numbers.

RULE.

Divide the greater term by the lesser, and the last divisor by the remainder, and so on continually till nothing remain, the last divisor is the common measure required.

NOTE.

If the last remainder is 1, the fraction is already in its lowest terms.

EXAMPLES.

EXAMPLES.

What is the greateſt common meaſure of $\frac{252}{364}$?

Anſwer 28, which is the laſt diviſor, and is the greateſt number that will divide the numerator and denominator without a remainder.

252)364(1
252
---
112)252
224

Anſwer 28)112(4
112

0

What is the greateſt number that will divide the numbers 336 and 896, without leaving a remainder? Anſwer 112.

What is the greateſt common meaſure of $\frac{144}{560}$? Anſwer 16.

What is the greateſt common meaſure of $\frac{1476}{1033}$? Anſwer 6.

CASE.

5.—To reduce a fraction to its leaſt or loweſt terms.

RULE.

Find the greateſt common meaſure by the preceding caſe; then divide both terms of the fraction by it, the quotients will be the anſwer required.

EXAMPLES.

Reduce $\frac{192}{336}$ to its loweſt terms.

192)336(1
144)192(1
greateſt common diviſor 48)144(3

0

then 48) $\frac{192}{336}$ ($\frac{4}{7}$ Anſwer.

Reduce $\frac{336}{896}$ to its loweſt terms. Anſwer $\frac{3}{8}$

Reduce $\frac{2832}{12848}$ to its loweſt terms. Anſwer $\frac{177}{803}$

CASE.

6.—To reduce a compound fraction to a ſingle fraction of the ſame value.

RULE.

RULE.

Multiply all the numerators, together for a new numerator, and all the denominators for a new denominator; then reduce the new fraction to its loweſt terms by the preceding caſe.

EXAMPLES.

Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$, to a ſingle fraction. $\frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}=\frac{24}{60}$ or $\frac{2}{5}$.

2	3
3	4
6	12
4	5
numerator 24.	denominator 60,

then $\frac{24}{60}$ is the ſingle fraction, which being reduced to its loweſt terms, by the laſt caſe is equal to $\frac{2}{5}$ Anſwer.

Reduce $\frac{4}{9}$ of $\frac{5}{7}$ of $\frac{9}{10}$, to a ſingle fraction. Anſwer $\frac{2}{7}$.

Reduce $\frac{2}{9}$ of $\frac{3}{4}$ of 4, to a ſingle fraction. Anſwer. $\frac{2}{3}$

Reduce $\frac{3}{7}$ of $\frac{1}{3}$ of $\frac{7}{8}$, to a ſingle fraction. Anſwer $\frac{1}{8}$

CASE.

7.—To reduce any mixed number to an improper fraction.

RULE.

Multiply the whole number by the denominator of the fraction, and to the product add the numerator, which ſum place over the given denominator.

EXAMPLES.

Reduce 26 $\frac{3}{8}$ to an improper fraction. $26\times 8+3=211$ or $\frac{211}{8}$

26 $\frac{3}{8}$
8
Num. 211, then $\frac{211}{8}$ is the fraction required.

Reduce 4 $\frac{2}{7}$ to an improper fraction. Anſwer $\frac{30}{7}$

Reduce 16 $\frac{1}{2}$ to an improper fraction. Anſwer $\frac{33}{2}$.

Reduce

Reduce $442\frac{17}{83}$ to an improper fraction. Anſwer. $\frac{3283}{23}$

CASE.

8.—To reduce an improper fraction, into its equivalent or proper terms.

RULE.

Divide the numerator by the denominator, the quotient gives the whole number, and under the remainder (if any) ſubſcribe the denominator.

EXAMPLES.

Reduce $\frac{211}{8}$, to its proper terms. $211 \div 8 = 26\frac{3}{8}$

8)211

$26\frac{3}{8}$ Anſwer.

Reduce $\frac{30}{7}$, to its proper terms. Anſwer. $4\frac{2}{7}$

Reduce $\frac{33}{2}$, to its proper terms. Anſwer $16\frac{1}{2}$.

CASE.

9.—To reduce fractions of different denomination to fractions of equal value, that ſhall have one common denominator.

RULE.

Multiply each numerator by all the denominators, except its own for a new numerator, then multiply all the denominators together for a common denominator.

EXAMPLES.

Reduce $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{4}{5}$, to a common denominator

or thus.

$2\times4\times5=40$ num.	2	3	4	3
$3\times3\times5=45$ num.	4	3	4	4
$4\times4\times3=48$ num.	8	9	16	12
$3\times4\times5=60$ den.	5	5	3	5
	40 num.	45 num.	48 num.	60 den.

Therefore

Therefore $\frac{2}{3}=\frac{40}{60}$; $\frac{3}{4}=\frac{45}{60}$; $\frac{4}{5}=\frac{48}{60}$. Anſwer.

Reduce $\frac{3}{4}$, $\frac{11}{24}$ and $\frac{7}{10}$, to a common denominator. Anſwer. $\frac{360}{480}$; $\frac{440}{480}$; $\frac{336}{480}$.

Reduce $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$ of $\frac{7}{8}$, to a common denominator.

Anſwer. $\frac{960}{2880}$, $\frac{720}{2880}$, $\frac{576}{2880}$, $\frac{420}{2880}$.

Reduce $\frac{5}{6}$, $\frac{7}{10}$, $\frac{3}{4}$, and $\frac{3}{4}$, of 3, to a common denominator.

Anſwer $\frac{800}{960}$ $\frac{672}{960}$ $\frac{720}{960}$ and $\frac{240}{960}$.

Reduce $14\frac{2}{3}$, 7, and $\frac{2}{3}$ of $\frac{5}{8}$ and $\frac{4}{7}$ to one common denominator.

Anſwer $\frac{11088}{756}$ $\frac{5292}{756}$ $\frac{105}{756}$ and $\frac{432}{756}$.

CASE.

10.—To reduce money, weights, meaſures, &c. into fractions.

RULE.

Reduce the given quantity to the loweſt name or denomination mentioned and make it the numerator; then reduce the Integer, of which the given quantity is a part, to the ſame denomination, and make it your denominator, then reduce that fraction to its loweſt terms, by caſe 5, which is the fraction required.

EXAMPLES.

Reduce 8 an. 10 pa. to the fraction of a rupee.

8 10 then 16 an. in a rupee.

12 12

Num. 106 den. 192, the fraction is $\frac{106}{192}$, which reduced to its loweſt terms, is $\frac{53}{96}$ Anſwer.

Reduce 15 fan. 20 c. to the fraction of a pagoda. Anſwer $\frac{61}{180}$ pag.

Reduce 10 an. 8 pa. to the fraction of a rupee. Anſwer $\frac{15}{16}$ r.

Reduce 4 s. $2\frac{1}{2}$ d. to the fraction of a pound ſterling. Anſwer $\frac{101}{120}$ £.

Reduce 5 ſar. 15 ck. to the fraction of a mon. Anſwer $\frac{19}{128}$ mon.

Reduce

Reduce [illegible] 15 fr. 15 pa. to the fraction of a Bombay candy. Anſwer $\frac{925}{1200}$

Reduce [illegible] 5 v. 5 pol. 5 pag. wt. to the fraction of a Madras candy.

Anſwer $\frac{2331}{32000}$ can.

Reduce 3 qr. 4 lb. to the fraction of 1 cwt. Anſwer $\frac{1}{7}$ cwt.

Reduce 6 oz. 17 dwt. 21 gr. to the fraction of a lb. troy wt. Anſwer $\frac{357}{5760}$ lb.

Reduce 3 qrs. 3 lb. 1 oz. 12 drs. to the fraction of a cwt. Anſwer. $\frac{5575}{6918}$ cwt.

NOTE.

Any other money, weights, &c. may be reduced to fractions, in the ſame manner, proper attention being paid to the tables of the different denominations.

CASE.

11.—To reduce fractions of one denomination to another retaining the ſame value.

RULE.

1.—If the fraction given is to be brought from a leſs to a greater denomination; multiply the denominator by the ſeveral parts contained in the ſeveral denominations between it, and that you would reduce it to, for a new denominator, which placed under the given numerator will give the new fraction, which reduce to its loweſt terms.

2.—If the fraction given is to be brought from a greater to a leſs denomination, then multiply the numerator in the ſame manner as you did before the denominator, and place it over the given denominator, and it will give the new fraction, which alſo reduce to its loweſt terms.

EXAMPLES.

Reduce $\frac{3}{8}$ of a pany, to the fraction of a rupee.

8
12
—
96
16
—
536, the new fraction is $\frac{3}{1536}$ or $\frac{1}{512}$ r. its loweſt terms.

Reduce

Reduce $\frac{1}{512}$ of a rupee ficca, to the fraction of a penny.

$1 \times 16 \times 12 = 192$, the new fraction is $\frac{192}{512}$ or $\frac{3}{8}$ pa. its loweſt terms.

Reduce $\frac{1}{620}$ of a pound ſterling, to the fraction of a penny. Anſwer $\frac{12}{31}$ d.

Reduce $\frac{5}{7}$ of a penny, to the fraction of a pound. Anſwer $\frac{1}{336}$ £.

Reduce $\frac{5}{143}$ of a lb. troy, to the fraction of a dwt. Anſwer $\frac{25}{3}$ dwt.

CASE.

12.—To find the proper quantity or value of a fraction in money, weights, &c.

RULE.

Multiply the numerator of the given fraction, by the parts contained in the Integer to which it belongs, then divide that product by the denominator; and if any thing remains, reduce it to the next denomination leſs and divide again by the denominator; thus proceed to the leaſt denomination, as in Compound Diviſion, caſe 3.

EXAMPLES.

What is the value of $\frac{7}{9}$ of a ficca rupee.

$$\begin{array}{r} 7 \\ 16 \\ \hline 9)112 \\ \hline \text{an. } 12 \ldots 4 \\ 12 \\ \hline 9)48 \\ \hline \text{pa. } 5\frac{3}{9} \text{ or } \frac{1}{3} \end{array}$$

Anſwer 12 an. $5\frac{1}{3}$ pa.

Required the value of $\frac{135}{400}$ of a pound ſterling. Anſwer 5 s. $7\frac{1}{2}$ d.

What is the quantity of $\frac{7}{8}$ of a bazar mon. Anſwer 35 ſars.

What is the value of $\frac{7}{10}$ of a ſtar pagoda. Anſwer 31 ſan. 40 c.

NOTE

The value of any fraction may be found in the ſame way.

ADDITION OF VULGAR FRACTIONS.

RULE.

1.—REDUCE the given fractions to a common denominator, by caſe 9, in Reduction.

2.—Add all the numerators together for a new numerator, under which, ſubſcribe the common denominator. And if it be an improper fraction reduce it to its proper terms, by caſe 8 in Reduction, and you have the ſum of all the fractions.

EXAMPLES.

Add $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$ together. $\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}=\frac{60}{120}+\frac{480}{720}+\frac{540}{720}+\frac{576}{720}+\frac{600}{720}=\frac{2556}{720}$ or $3\frac{11}{20}$ Anſwer.

$1\times3\times4\times5\times6$ . .	360	new numerators added together make $\frac{2556}{720}$, which reduced to its proper terms is $3\frac{11}{20}$.
$2\times2\times4\times5\times6$ . .	480	
$3\times2\times3\times5\times6$ . .	540	
$4\times2\times3\times4\times6$ . .	576	
$5\times2\times3\times4\times5$ . .	600	
$2\times3\times4\times5\times6$ . .	720	common denominator.

Add $\frac{3}{7}$, $\frac{1}{4}$, $\frac{5}{6}$, together. Anſwer $\frac{254}{168}$ or $1\frac{43}{84}$.

Add $\frac{2}{3}$ of $\frac{4}{5}$, and $\frac{13}{15}$, together. Anſwer $\frac{21}{15}$ or $1\frac{2}{5}$.

To add the mixed numbers.

RULE.

Reduce the fractions to a common denominator and add them together, as before directed in the preceding caſe, and annex their ſum to the ſum of the Integers.

EXAMPLE.

What is the ſum of $\frac{3}{4}$ of $\frac{5}{9}$, and $2\frac{1}{2}$. Firſt $\frac{3}{4}$ of $\frac{5}{9}$ is equal to $\frac{15}{36}$; and $2\frac{1}{2}$ is

equal

equal to $\frac{5}{2}$; thefe reduced to a common denominator are equal to $\frac{}{72}$, $\frac{}{72}$, whofe fum $\frac{20}{72}$ reduced to its proper terms is $2\frac{11}{12}$ Anfwer.

Add $7\frac{2}{3}$, $9\frac{4}{5}$, and $6\frac{7}{10}$, together. Firft $\frac{2}{3}+\frac{4}{5}+\frac{7}{10}$ is when reduced to a common denominator equal to $\frac{100}{150}+\frac{120}{150}+\frac{105}{150}$ whofe fum is $\frac{325}{150}$ which reduced to its proper terms is $2\frac{1}{6}$. Then $7+9+6$ and $2\frac{1}{6}$ make $24\frac{1}{6}$ the fum required.

or thus.

$7\frac{2}{3}$ equal to $7\frac{100}{150}$

$9\frac{4}{5}$ ..... $9\frac{120}{150}$

$6\frac{7}{10}$ ..... $6\frac{105}{150}$

$24\frac{25}{150}$ or $\frac{1}{6}$ Anfwer.

Add $8\frac{1}{2}$, $9\frac{2}{3}$, $10\frac{3}{4}$, $11\frac{4}{5}$, and $12\frac{5}{6}$, into one fum. Anfwer $53\frac{11}{20}$.

When the given fractions are of feveral denominations.

RULE.

Reduce them to one denomination, by cafe 11 in Reduction, then add them together as before directed, or you may reduce them to proper quantities by cafe 12, and add as in Compound Addition.

EXAMPLES.

What is the fum of $\frac{271}{460}$ of a ficca rupee, and $\frac{1}{8}$ of an anna?

Firft $\frac{1}{8}$ of an anna, by cafe 11, is equal to $\frac{1}{128}$ of a rupee.

Then $\frac{271}{460}$ and $\frac{1}{128}$ of a rupee, reduced to a common denominator are equal to $\frac{256}{5880}$ and $\frac{460}{5880}$, the fum whereof is $\frac{26188}{58880}$ or $\frac{6547}{14720}$ in its loweft terms, equivalent in value, by cafe 12, to 7 an. $1\frac{91}{230}$ pa. Anfwer.

or thus.

		an.	pa.
$\frac{271}{460}$ of a rupee by cafe 12, equal to	6 an. $11\frac{103}{115}$ pa. or	6	$11\frac{206}{230}$
$\frac{1}{128}$ ditto	ditto ... $1\frac{1}{2}$ pa or	0	$1\frac{115}{230}$
	Anfwer. Annas	7,	$1\frac{91}{230}$ as before.

What

What is the ſum of $\frac{2}{5}$ of a pound, $\frac{2}{10}$ of a ſhilling, and $\frac{1}{8}$ of a penny?

Anſwer 12 s. $6\frac{3}{4}$ d. $\frac{960}{1920}$.

Add $\frac{201}{400}$ of a £. to $\frac{1}{8}$ of a ſhilling. Anſwer 8 s. 10 $\frac{3}{4}$ d. $\frac{1}{28}$.

Add $\frac{5}{8}$ of a mon, to $\frac{7}{8}$ of a far. Anſwer 20 ſars, 14 ck.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

1.—PREPARE the fractions, as before directed in Addition.

2.—Subtract one numerator from the other, and their difference will be a new numerator, under which ſubſcribe the common denominator; but when the lower fraction is greater than the upper, ſubtract the numerator of the lower fraction, from the denominator, and to that difference add the upper numerator, carrying one to the units place of the lower whole number, then proceed as in Integers.

EXAMPLES.

From $\frac{4}{5}$ take $\frac{2}{5}$

4
2
—
2, the remainder is $\frac{2}{5}$.

From	$389\frac{6}{8}$	$555\frac{2}{4}$	$47\frac{10}{15}$
Take	$142\frac{2}{8}$	$29\frac{3}{4}$	$39\frac{14}{15}$
Rem.	$247\frac{4}{8}$	$525\frac{3}{4}$	$7\frac{11}{15}$
Proof.	$389\frac{6}{8}$	$555\frac{2}{4}$	$47\frac{10}{15}$

Take $9\frac{1}{3}$ from $12\frac{3}{4}$. Firſt $12\frac{3}{4}$, by caſe 7, in reduction, is equal to $\frac{51}{4}$ and $9\frac{1}{3}$ to $\frac{28}{3}$; both which being reduced to a common denominator, by caſe 9, are equal to $\frac{153}{12}$ and $\frac{112}{12}$, the difference is $\frac{41}{12}$, which being reduced to its proper terms, by caſe 8, gives $3\frac{5}{12}$. Anſwer.

From

From $\frac{5}{8}$ of a ficca rupee, take $\frac{4}{6}$ of an anna.

Firſt $\frac{4}{6}$ of an anna, is by caſe 11 in Reduction, equal to $\frac{4}{96}$ of a rupee;

Then $\frac{5}{8}$ and $\frac{4}{96}$ reduced to common denominator are equal to $\frac{480}{768}$ and $\frac{32}{768}$,

The difference is $\frac{448}{768}$ or $\frac{7}{12}$ in its loweſt terms, equivalent in value to 9 an. 4 pa

Anſwer.

or thus.

	r.	an.	pa.
$\frac{5}{8}$ of a ficca rupee is, by caſe 12, equal to	0	10	0
$\frac{4}{6}$ of an anna . . . . . ditto	0	0	8
Anſwer	0	9	4 as before.

What is the difference between $\frac{5}{9}$ of a pound ſterling, and $\frac{2}{3}$ of $\frac{3}{4}$ of a ſhilling. Anſ. $\frac{1}{12}$ or 1es. $7\frac{1}{4}\frac{1}{3}$ d.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.

1.—PREPARE the fractions to be multiplied, by the rules of reduction thus, reduce compound fractions to ſimple ones, by caſe 6; mixt numbers into improper fractions, by caſe 7; then reduce the fractions into their loweſt terms, by caſe 5.

2.—Multiply the numerators into one another for a new numerator, and the denominators for a new denominator.

NOTE.

Multiplication of fractions decreaſe the value in the ſame proportion as whole numbers increaſe it. It is the nature of integers to increaſe, and of fractions to decreaſe, yet, the purpoſe of multiplication is equally anſwered in both caſes, as will appear by the following:

EXAMPLES.

Multiply 4 annas by 4 annas, as the fraction of a rupee.

Firſt 4 annas is $\frac{4}{16}$ of a rupee, therefore $\frac{4}{16}$ multiplied by $\frac{4}{16}$ is equal to $\frac{16}{256}$, or 1 anna, Anſwer.

Multiply

Multiply $\frac{87}{91}$ by $\frac{7}{88}$. Anſwer $\frac{7}{88}$.

Multiply $12\frac{1}{4}$ by 6. Anſwer 75.

Multiply $17\frac{3}{5}$ by $\frac{5}{9}$. Anſwer $\frac{77}{5}$ or $15\frac{2}{5}$.

Multiply $2\frac{1}{8}$ by $\frac{1}{4}$ of $\frac{1}{9}$. Anſwer $\frac{237}{128}$ or $1\frac{109}{128}$.

N O T E.

It ſeems incongruous and contradictory to the definition of multiplication, that it decreaſes the value of fractions, but if we conſider that the more any integral is increaſed, the farther is the higheſt place removed from unity; and the more any part of an integer is decreaſed, the farther will its value alſo be removed from its relative unit.

Suppoſe the firſt example was propoſed. and an anna to be the integer; then the work would have been $4 \times 4 = 16$ annas or one rupee; which ſhews that your product will alter in value, according as you alter your integer.

DIVISION OF VULGAR FRACTIONS.

R U L E.

PREPARE the fractions (as before directed) by the rules of reduction then multiply the denominator of the diviſor by the numerator of the dividend, for a new numerator; and then the numerator of the diviſor by the denominator of the dividend for a new denominator; or invert the diviſor and proceed as in multiplication.

E X A M P L E S.

Divide $\frac{8}{117}$ by $\frac{4}{13}$.

$\frac{4}{13}\overline{)\frac{8}{117}}\left(\frac{104}{468}\right.$ or $\frac{2}{9}$ or $\frac{13}{4} \times \frac{8}{117} = \frac{104}{468}$ Anſ.

Divide $\frac{2}{5}$ by 7. Anſwer $\frac{2}{35}$.

Divide $5\frac{1}{7}$ by $2\frac{3}{5}$. Anſ. $\frac{190}{91}$ or $2\frac{8}{91}$.

Divide $\frac{19}{114}$ by $\frac{6}{13}$.

$\frac{19}{6} \times \frac{36}{114} = \frac{684}{684}$ or 1.

Divide 7 by $\frac{2}{5}$. Anſwer $\frac{35}{2}$ or $17\frac{1}{2}$

Divide $\frac{21}{37}$ by $5\frac{1}{17}$. Anſwer $\frac{231}{2.92}$.

Divide

Divide $\frac{3}{4}$ of a rupee, by $\frac{2}{3}$ of an anna. Answer [illegible] rupees.

Divide $\frac{2}{3}$ of a ſhilling, by $\frac{3}{4}$ of a £. Answer 10s. 8d. $\frac{8}{9}$.

N O T E.

If you divide by a proper fraction, the quotient is always a greater number than the dividend; contrary to whole numbers, and likewiſe contrary to the ſtrict ſenſe of the word diviſion, which implies the leſſening of a thing. Conſequently, if the diviſor be a proper fraction, Multiplication prevails; but Diviſion prevails, if the diviſor be an improper fraction, as is ſhewn in the laſt two examples.

DECIMAL FRACTIONS.

IN decimal fractions, the figures of the numerator are only expreſſed, the denominator being omitted, becauſe it is always (or underſtood to be) 1, with as many ciphers affixed, as there are places or figures in the numerator.

A decimal fraction, is diſtinguiſhed from an Integer or whole number, by a point, dot, or comma, prefixed, called the SEPERATRIX; thus, .5 ſtands for $\frac{5}{10}$; .75 for $\frac{75}{100}$; .874 for $\frac{874}{1000}$; &c.

Ciphers placed to the right hand of a decimal fraction do not alter its value; for .5; .50; .500; or .5000, are each the ſame value, but ciphers on the left of a decimal fraction decreaſes its value in a ten fold proportion, thus:

1. . . .	unit or integer	
.1 . .	one tenth part of the Integer	called primes
.01 . .	one hundredth part	ſeconds
.001 .	one thouſandth part	thirds
.0001.	one ten thouſandth part	fourths
.00001	one hundred thouſandth part	fifths, &c.

It therefore plainly appears, that as integers increaſe in a tenfold proportion towards the left, ſo decimal parts or fractions decreaſe by the ſame proportion to the right.

Vulgar fractions being the foundation of decimal fractions, the manner of reducing them to decimals is ſhewn in the following rule.

By

which means all thoſe computations hitherto deemed ſo intricate, may be performed with the utmoſt eaſe, pleaſure, and accura-

REDUCTION OF DECIMALS.

CASE 1.—TO reduce a vulgar fraction to a decimal.

RULE.—Annex ciphers to the numerator at pleaſure and divide it by the denominator; the quotient will be the decimal fraction required.

Take notice what number of ciphers in the numerator you make uſe of, becauſe you muſt point off the ſame number of places or figures in the quotient; but when it happens, that there be not a ſufficient number of figures in the quotient, the defect muſt be ſupplied by preſixing ciphers on the left.

NOTE.—In all operations, if the reſult conſiſt of ſeveral nines, reject them, and make the next ſuperior place one more, thus: for 4. 666, write 4. 7; for 6. 999, write 7. &c.

EXAMPLES.

Reduce $\frac{3}{4}$ to a decimal.

Here, I affix two ciphers to the numerator 3, and dividing by the denominator, the quotient is 75; two ciphers having been annexed and uſed, to which therefore I perfix the ſeperatrix or decimal point. When there is no remainder as in this example, the decimal is complete and called a FINITE DECIMAL.

4)3.00
.75

Reduce $\frac{1}{16}$ to a decimal.

Here, I annex four ciphers, but as the quotient gives only three places, that is, 625, I ſupply the defect by preſixing a cipher.

16)1.0000
.0625

Reduce $\frac{7}{3125}$ to a decimal.

Here, I have annexed five ciphers, but the quotient gives only three decimal places (224), therefore prefix two ciphers.

3125)7.00000(.00224
6250
7500
6250
12500
12500

Reduc

Reduce $\frac{1}{3}$ to a decimal.

Here, the remainder being ſtill the ſame, that is, 1; the ſame figure will be conſtantly repeated in the quotient, and the repeating figure is called a SINGLE REPETEND, and is denoted by a point above it, thus; $\dot{3}$; 3, ſo $\frac{4}{9} = .\dot{4}$; $\frac{5}{9} = .\dot{5}$ &c.

3)1.00
.33

Reduce $\frac{4}{15}$ to a decimal.

When a figure or a cipher, or figures come between the decimal point and the repeating figure, as in this example, the decimal is called a MIXED REPETEND, and the figure or figures ſo intervening, are called FINITE PARTS of ſuch decimal, which in this example is 2.

15)4.00(.2
30
100
90
10

Reduce $\frac{1}{11}$ to a decimal.

When the decimal conſiſts of two or more repeating figures, as $.\dot{1}\dot{4}$, $.\dot{1}\dot{4}\dot{8}$, $.\dot{3}\dot{1}\dot{3}$, or, as in this example, 0909, &c. it is called a PURE CIRCULATE, and is denoted by a dot above the firſt and laſt figure of the circle. When the decimal conſiſts of figures, between the ſeparating point and the circulate it is called a MIXED CIRCULATE, as 17.176984, and 17 are the finite parts.

11)1.0000(.0909 &c
99
100
99

Reduce $\frac{32}{721}$ to a decimal.

Whatever number of ciphers you annex it will often happen, that there will ſtill be a remainder, as in this example, but if the quotient be extended to four or five places, it will be exact enough for buſineſs, but where great accuracy or nicety in calculation is required, it may be extended to any number of places, that may be thought neceſſary, and this decimal is called an INFINITE, becauſe it never ends, nor arrives at a repeater, and is uſually denoted by writing AD INFINITUM, as in the margin.

721)35.000(.048, &c. ad infinitum
2884
6160
5768
392

Reduce $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ to decimals. Anſwer .25; .5; .75.

Reduce $\frac{5}{24}$ to a decimal. Anſwer .2083.

Reduce $\frac{5}{12}$ of $\frac{3}{4}$ to a decimal. Anſwer .3125.

Reduce $\frac{4}{7}$ to a decimal. Anſwer $.\dot{5}7142\dot{8}5\dot{7}$.

Reduce $\frac{2}{3}$ to a decimal. Anſwer $.\dot{6}$

Reduce $\frac{5}{48}$ to a decimal. Anſwer $.10\dot{4}1\dot{6}$

NOTI

NOTE.—.5 is equal to ½ .25 to ¼ and .75 to ¾ of any thing.

CASE 2.—To reduce money, weights, &c. into decimals.

RULE.—Reduce the given money, weights, &c. into the loweſt denomination or name mentioned for a dividend, then reduce the Integer into the ſame denomination for a diviſor, and the quotient will be the decimal required.

OR

Write the given denominations or parts, orderly under each other, the inferior or laſt parts uppermoſt, let theſe be dividends; againſt each part on the left hand, write the number thereof contained in one of its ſuperior, let theſe be diviſors; then beginning with the loweſt denomination, with ciphers annexed. (making a dot between the ciphers and the figures) and divide, writing the quotient of each diviſor, as decimal parts on the right hand of the dividend next below it, and let this mixed number be divided by its diviſor, and ſo on, till all be finiſhed, and the laſt quotient will be the decimal required.

NOTE 1.—In reducing decimals, it is unneceſſary to mind any ciphers on the right of the diviſor, as ciphers muſt be annexed to the remainders to bring on the quotient.

2.—When in any diviſion, the dividend is a repetend, or circulate, the diviſion is carried on, not by annexing ciphers, but by that repetend or circulate.

EXAMPLES.

Reduce 15 an. 3 pie to the decimal of a rupee.

Here the given money 15 an 3 pi. reduced to the loweſt denomination is 183 p. and the integer (one rupee), reduced to the ſame denomination is 192 p. which forms the vulgar fraction $\frac{183}{192}$, which being reduced, by the laſt caſe, gives the finite decimal in the margin.

```
192)183.000000(.953125  Anſwer
    ---
    rem. 0
```

OR

Here, the leaſt given parts are 3 p. which ſet down; the next are 15 an. which place underneath the 3 p. then annexing cipher, divide by 12 (pany in an anna), and ſet the quotient .25 down on the right hand of the next dividend, 15 an.), and divide it, by 16 (an. in a rupee), the quotient (being the laſt) is the anſwer, as per margin.

```
12)3 00
   --
16)1,250000
   -------
   .953125 as before.
   -------
```

Reduce 30 ſars, 10 ck. to the decimal of a mon.

1ſt WAY.		2d WAY.
30 ſr. 10 ck. reduced is	490 ck.	16) 10.000
1 mon . . ditto	640 ck.	.0) 30.625000

then divide as in the laſt example, gives the decimal . 765625 Anſwer. .765625 Anſwer.

Reduce

Reduce 5 an. 4 pa. to the decimal of a rupee. Anſwer $\dot{3}$

Reduce 17 s. 6¼ d. to the decimal of a pound. Anſwer .878125

Reduce 6 ſars, 7 ck. to the decimal of a mon. Anſwer .1609375

Reduce 25 fanams, 10 caſh, to the decimal of a ſtar pagoda. Anſwer 5583̇

Reduce 3 qrs. 5 reas, to the decimal of a Bombay rupee. Anſwer 7625

Reduce 5 pauy, to the decimal of a ficca rupee. Anſwer .015625

Reduce 5 annas, to the decimal of a ficca rupee. Anſwer .3125

Reduce 11 dwts. to the decimal of a lb. troy. Anſwer .04583̇

Reduce 10 drams, to the decimal of a lb. avoirdupois. Anſwer .03906

Reduce 4 inches, to the decimal of a foot. Anſwer ·3̇

Reduce 3 qrs. 14 lb. to the decimal of a cwt. Anſwer .875

Decimal Tables are conſtructed by this rule; and they who think ſuch tables contribute any thing to expedition, may eaſily conſtruct them; but any decimal parts may be found more expeditiouſly, than picked out of a table, by one converſant in figuring, and with the further advantage, that by calculating them on all occaſions, one gains a certain practice which renders it eaſy and familiar, at the ſame time that he avoids the errors which ſuch tables (when printed) are liable to, and alſo the meanneſs of borrowing the abilities of another perſon.

CASE 3.—To find the value of a decimal fraction in money, &c.

RULE.—Multiply the given decimal by the number of parts contained in the next inferior denomination, pointing off ſo many places for decimals to the right hand as your decimal conſiſts of, and thoſe on the left will be integers, then multiply the remaining decimals, by the next inferior denomination, and point off for decimals as before; thus proceed until you have brought it into the leaſt parts of an integer.

EXAMPLES.

What is the value of .953125 of a ficca rupee?

The given decimal conſiſts of ſix places; multiply it by 16 (annas in a rupee), point off ſix places from the right to the left of the product, and the figures remaining on the left are annas (15); then multiply the remaining decimals by 12 (pauy in an anna) and point off, as before; the integer (one rupee) is then reduced into its leaſt parts and the anſwer is 15 an. 3 p.

.953125	
16	
15.250000	
12	
3.000000	

NOTE.—It is unneceſſary to ſet down the ciphers on the right hand, becauſe they are of no value.

If the given decimal terminates in a repetend, carry 1 for every 9 in the product of the firſt figure of the multiplicand.

What is the value of .3625 of a ſtar pagoda. Anſwer 16 fan, .25 c.

Wh

What is the value of .984375 of a Bombay rupee. Anſwer 3 qrs. 93.75 r.

How much is .525675 of a bazar maun. Anſwer 21 ſars, 0.432 ck.

What is the value of .873125 of a pound ſterling. Anſwer 17 s. 6¼ d.

What is the value of .175 of a cwt. Anſwer 19 .6 lb.

What is the value of .00243 of a lb. troy? Anſwer 14 grains.

What is the value of .578 of a Madras candy. Anſwer 11 vis, 22 .4 pol.

CASE 4.—To reduce a decimal fraction, to its primitive vulgar fraction.

1.—When the given decimal is finite.

RULE.—Divide both numerator and denominator of the given decimal by their greateſt common meaſure (by caſe 4 and 5 in Reduction of vulgar fractions), and the quotient is the vulgar fraction required in its loweſt terms.

EXAMPLES.

Reduce .875. to a vulgar fraction in its loweſt terms.

thus $.875 = \frac{875}{1000} = \frac{7}{8}$ Anſwer.

.875)1000(1
875

greateſt com. mea. 125) 875(7
875
0

then, 125) $\frac{875}{1000}$ ($\frac{7}{8}$ Anſwer

Or, inſtead of dividing by the greateſt common meaſure, you may divide by 2, 5, 10, or any number that will divide both numerator and denominator without a remainder, continuing the operation until the fraction be reduced to its loweſt terms;

thus: 5) $\frac{875}{1000}$ ($\frac{175}{200}$ ($\frac{35}{40}$ ($\frac{7}{8}$ as before.

Reduce .765625, to a vulgar fraction in its loweſt terms. Anſwer $\frac{153125}{200000}$.

Reduce .00224, to a vulgar fraction in its loweſt terms. Anſwer $\frac{224}{100000}$.

Reduce .0625, to a vulgar fraction in its loweſt terms. Anſwer $\frac{1}{16}$.

2.—When the given decimal is a pure repetend or a pure circulate.

RULE.—Make the repeating figure or figures of the circle, the numerator of the vulgar fraction; the denominator is 9 for the repeating figure

figure, or 9 for every figure in the circle, and then, if occaſion require, reduce this fraction to its loweſt terms.

EXAMPLES.

Reduce $.\dot{3}$; $.\dot{6}$; $.\dot{2}\dot{7}$; $.\dot{7}14\dot{2}$; to vulgar fractions.

thus $\frac{3}{9}$ or $\frac{1}{3}$; $\frac{6}{9}$ or $\frac{2}{3}$; $\frac{27}{99}$ or $\frac{3}{11}$; $\frac{7142}{9999}$.

3.—When the given decimal is a mixed repeater or a mixed circulate.

RULE.—From the mixed repeater, or the mixed circulate, ſubtract the finite part and the remainder is the numerator of the vulgar fraction; the denominator is 9 for every place in the circulate with as many ciphers annexed as there are places in the finite part.

EXAMPLES.

Reduce $.0\dot{3}$; $.1\dot{6}$; and $.08\dot{3}$, to vulgar fractions.

thus; $\frac{03}{90}$ or $\frac{1}{30}$; $\frac{16}{1}$ $\frac{15}{90}$ or $\frac{1}{6}$; $\frac{083}{08}$ $\frac{75}{900}$ or $\frac{1}{1}$.

Reduce $.04\dot{1}6$; $.5\dot{8}3$ and $.1\dot{1}53846$ to vulgar fractions.

$\frac{041}{1}$ $\frac{58}{1}$ $\frac{1153845}{1}$

Anſwer $\frac{375}{9000}$; $\frac{525}{900}$; $\frac{11538445}{99999990}$ or $\frac{1}{24}$; $\frac{7}{12}$ and $\frac{3}{10}$.

In this manner may any mixed number conſiſting of an Integer with a repetend or circulate, be reduced to an improper vulgar fraction, but no ciphers are to be annexed to the denominator for the figures of the Integer.

EXAMPLES.

Reduce $8.\dot{3}$; $4.1\dot{6}$; and $65.29\dot{6}$ to an improper vulgar fraction.

$\frac{8}{1}$ $\frac{41}{1}$ $\frac{65}{1}$

Anſwer $\frac{75}{9}$, $\frac{375}{90}$ $\frac{65231}{999}$, or $\frac{25}{3}=8\frac{1}{3}$; $\frac{25}{6}=4\frac{1}{6}$, and $65\frac{8}{27}$.

NOTE.—Infinite or approximate decimals being imperfect or incomplete, cannot be reduced back exactly to the vulgar fractions from whence they reſulted; but if the remainder of the infinite decimal be affixed to it in the form of a vulgar fraction, the remainder being the numerator, and the diviſor the denominator, you will have a mixed number, which you may reduce to an improper vulgar fraction; then to the denominator

annex

annex as many ciphers as there are places in the infinite decimal, and this fraction reduced to its loweſt terms will be the vulgar fraction required.

Reduce .048 ad infinitum, the remainder being 392 and the diviſor 721 (ſee caſe 1 ex. 7) to a vulgar fraction.

$$.048\,\frac{392}{721}$$

721

50
105
392

35000, the improper fraction is $\frac{35000}{721}$, then $\frac{35000}{721000}$ or $\frac{35}{721}$

CASE 5.—To reduce diſſimilar or unlike circulates to others that are ſimilar and conterminous.

Similar or like circles are ſuch as conſiſt of an equal number of places, thus, $.\dot{5}$, and $.\dot{0}\dot{3}$ are ſimilar circles, becauſe they conſiſt of two places each, but $.\dot{6}$, and $.14\dot{8}$ are unlike; becauſe the former conſiſts of two and the latter of three places.

Conterminous circles are ſuch as begin and end at the ſame diſtance from the ſeperatrix or decimal point, thus, $.15\dot{9}$ and $.38\dot{4}\dot{6}$, are conterminous, becauſe they begin and end at the ſame place; and $.07\dot{1}\dot{4}$, and $.53\dot{2}\dot{1}$, are alſo conterminous, but $.\dot{6}3$ and $.5\dot{3}\dot{4}$ are not conterminous, becauſe they have not the ſame number of places, for circles cannot be conterminous, unleſs they be unit ratio.

Unlike circulates or circles are reduced to ſimilar ones by the following method.

RULE.—Find the leaſt multiple of the numbers denoting the number of places in the given circles, and extend each of the given circles to as many places as there are units in the leaſt multiple.

NOTE.—The leaſt common multiple of ſeveral numbers is found thus: write the numbers in a line and divide them by 2, 3, or any other number which will meaſure two or three of them exactly, place the quotients with the numbers undivided below, and divide them continually, till their quotients be 1; then the product of all the diviſors multiplied continually, is the leaſt multiple required.

What is the multiple of 6, 4, 3, 8.

4	6.	4.	3.	8
2	6.	1.	3.	2
3	3.		3.	1
	1.		1.	

Then $4\times2\times3=24$ Anſwer.

EXAMPES.

EXAMPLES.

Reduce .63 and .148 to similar circles.

Thus, I extend the circles to six places, because 6 is the least multiple of 2 and 3, the number of places in the given circles.

.63 ===.
.148===.

Reduce .72 and .02439 to similar circles.

Here, I extend each of the circles to ten places, because 10 is the least multiple of 2 and 5, the number of places in the given circulate.

.72 ===.7272
.02439===.0243

In a circle, any one of the circulating figures may be made the first of the circle; 7.592, may be expressed thus, 7.5925; or thus, 7.59259, without changing its consequently a pure circulate may put on the form of a mixed circulate, if one figures on the left be set aside for the finite part, thus, .72=.727; 7 being th part; also .571428=.57142857, and thus .35=.35353.

That the value is not changed may be thus demonstrated.

$$727 = \frac{720}{990} = \frac{72}{99} = 72$$

Hence two or more given circles may be made conterminous l following method:

RULE.—Set aside by a comma on the left, as many figures as there are places in the longest finite part, and then long the several circles to as many places as will make them lar.

EXAMPLES.

Make .5463 and .9148 conterminous.

Here, because 54 is the longest finite part consisting of two places, I set aside 91 in the other circulate, for a finite part and then I prolong both circles to fix places which renders them similar.

.5463 . . . 54,6
.9148 . . . 91,4

Make .714285714, .3571428, and .36 conterminous.

Here, because the first circulate, has a finite part of three places, I set off three figures in each of the other two, for finite parts, and then to render them similar, I extend the figures of the circles to six places.

.714,285714
.3571428
.36

.714,28
.357,14
.363,63

Diffi

Diſſimilar.	Made ſimilar and conterminous.
9.814	9.81,481481
1.5	1.50,000000
87.26	87.26,666666
.083	.083,333333
124.09	124.09,090909

Make, 3,.27, and .045 conterminous and ſimilar.

Make. 321,. 8262,. 05 and . 0902 counterminous and ſimilar.

Make. 5217, 3643, and 17 . 123 ſimilar and counterminous.

CASE 6.—To find whether the decimal fraction, equal to a given vulgar fraction, be finite or infinite, and how many places the repetend or circulate will conſiſt of.

RULE 1.—Reduce the given fraction to its leaſt terms (by caſe 5 in reduction of vulgar fractions), and divide the denominator by 2, 5, or 10 as often as poſſible.

2. Divide 9999, &c. by the former reſult, 'till nothing remains and the number of nines uſed will ſhew the number of places in the circulate, which will begin after as many places of figures as there were 10's, 2's, or 5's divided by.

If the whole denominator vaniſhes in dividing by 2, 5 or 10, the decimal will be finite, and will conſiſt of as many places as you perform diviſions.

EXAMPLES.

Required to find whether the decimal equal to $\frac{210}{1120}$ be finite or infinite, and if infinite how many places that repetend will conſiſt of.

Firſt $\frac{210}{1120}=\frac{3}{16}$; then 2) 16 ($^{2}8$ ($^{2}4$ ($^{2}2$ (1. Hence the decimal will be finite, and there being four diviſions, the decimal will conſiſt of four places, $\frac{210}{1120}=.1875$.

Let $\frac{1}{11}$ be the fraction propoſed.

11) 1.00 11) 99, having uſed two nines the circulate muſt therefore

.09 9 conſiſt of two places thus. $\dot{0}\dot{9}$

Let $\frac{2}{7}$ be the fraction propoſed.

Let

Let $\frac{15}{404}$ be the fraction propoſed.

Let $\frac{1}{8544}$ be the fraction propoſed.

N O T E.—In finite decimals, the denominator is always ſome aliquot part of the numerator of the vulgar fraction increaſed by annexed ciphers, and ſuch decimals take their riſe from vulgar fractions, whoſe denominator is 2 or 5 or ſome power of 2 or 5, or the product of ſome of their powers.

If the denominator of a vulgar fraction be neither 2 nor 5, nor any of their powers, nor product of their powers, ſuch a denominator will not divide the numerator with annexed ciphers without a remainder infinitely.

POWERS OF 2 AND 5.

2^1	= 2	5^1	= 5
2^2	= 4		25
2^3	= 8	5^3	= 125
2^4	= 16	5^4	= 625
2^5	= 32	5^5	= 3125
2^6	= 64	5^6	= 15625
2^7	= 128	5^7	= 78125
2^8	= 256	5^8	= 390625
2^9		5^9	= 1953125

ADDITION OF DECIMALS.

R U L E. PLACE the given decimals, ſo that the decimal points may ſtand directly under each other, and conſequently, tenths under tenths, hundreds under hundreds, &c., then if the given decimals be all finite or infinite, add as in Integers, placing the decimal point directly under the column of points; then the figures on the left of the point are Integers, and thoſe on the right are a decimal of the Integer, conſiſting of as many places as there are figures in the longeſt of the given decimals.

E X A M P L E S.

What is the ſum of .75; .895; .5; .625; and .725

Ciphers on the right hand of a decimal fraction do not alter its value, if therefore ciphers be annexed, ſo as to give each decimal an equal number of places, they will be reduced to a common denominator, as is ſeen in the margin.

.75	.750
.895	.895
.5	.500
.625	.625
.725	.725
3.495	3.495

1.000

What

What is the ſum of .276; .39; .213; 72014.7; 417; and .5032.

.276	.2760
.39	.3900
.213	.2130
72014.7	72014.7000
417.	417.0000
.5032	.5032
72433.0822	$72433.\frac{0822}{10000}$

What is the ſum of .04.6; 21.476; .0067; .64; 17.6; and .20764.
Anſwer 39.977791.

What is the ſum of .427; 64.075; 27.6421; 10.8; .0074; 104.046842.
Anſwer 206.998342.

CASE 2.—To add decimals wherein there are ſingle repetends.

RULE.—Make every line end at the ſame place, filling up the vacancies with the repeating figures, then add as before; only for every nine in the right hand row carry 1; and the figure under that place will be a repetend; then carry 1 at every 10 as uſual.

EXAMPLES.

What is the ſum of $47.67\dot{4}$; 4.02642; $32.\dot{6}$; $6.1\dot{4}$: and $27.0\dot{6}4\dot{6}$.

$47.67\dot{4}$	. . thus . .	$47.67\dot{4}4\dot{4}$
4.02642		4.02642
$32.\dot{6}$		$32.\dot{6}6\dot{6}6$
$6.1\dot{4}$		$6.1\dot{4}4\dot{4}$
$27.0\dot{6}4\dot{6}$		$2\ .0\dot{6}4\dot{6}6$
	Anſwer	$117.57\dot{6}6\dot{4}$

What is the ſum of $11.\dot{4}$, 6.14274, $91.7\dot{8}$, $37.6\dot{7}1$, and $146.4\dot{7}6\dot{7}42$.
Anſwer $293.523\dot{9}1$.

CASE 3.—When all or any of the given decimals are circulates.

RULE.—Make all the circles or circulates ſimilar and conterminous, by caſe 5 in reduction of decimals, then add up the left hand column of the circulates, and for every ten carry one to the right hand column, then proceed as in integers.

If

If repeaters be mixed with circulates, give the repeaters the form of circulates, by extending the repeating figure, 'till it becomes conterminous with the other circles.

EXAMPLES.

In order to find the carriage from the left hand column of the circles, I add the column next to it on the right; the sum of it is 22, then I carry 2 to the left column, the sum of which is 26, then I carry 2 to the right hand column, and the sum is 23, put down 3 and proceed as in addition of integers.

3.6	3.6666666
78.3476	78.3476476
735.3	735.3333333
375.	375.0000000
.27	0.2727272
187.4	187.4444444
	1380.0648193

If finite decimals are joined with the circulates, extend the finite parts of all the circulates to as many places, as there are figures in the longeſt finite decimal; therefore, in this example I extend the finite parts of the circulates to three places, becauſe 875, the longeſt finite conſiſts of three places.

18.78571428	18.785714285
25.81	25.818181818
14.5	14.500000000
29.75	29.750000000
35.875	35.875000000
24.013	24.013333333
32.7	32.777777777
	Anſwer 181.520007215

If the decimals to be added are of different denominations, firſt reduce them into one denomination, and then add.

What is the ſum of .725 of a pound ſterling, and .625 of a ſhilling.
Firſt .725 by caſe 3 in Reduction, is equal to 14.500 s.
then add .625 s.

s. 15.125
12
d. 1.500
4
f. 2.0 Anſwer 15 s. 1½ d.

OR

You may reduce the fraction of a ſhilling to that of a pound by caſe 11 in vulgar fractions, and then add.

If the decimals to be added run on to a great many places, it will be ſufficient

ficient in moſt caſes to uſe only five or ſix places, and obſerve to increaſe the figure at which you break off by an unit, if the rejected figure on the right exceed 5, and in adding ſuch decimals, omit the right hand figure of the ſum as uncertain, but take in the carriage.

AT LARGE.	CONTRACTED.
12.2352946	12.23529
8.15789325	8.15789
7.086968435	7.08697
6.32143482	6.32143
4.75	4.75
38.551591105	38.5515

Set 5391.357, 72.38, 187.21, 4.2965, 217.8496, 42.176, .523, and 58.30048 be added together.

Anſwer 5974.10371

Add 9.814, 1.5, 87.26, 0.83, and 124.09 together. Anſ. 223.505729.

What is the ſum of .725 of a ſicca rupee, and .625 of an anna.

Anſ. .7640625 or 12 an. 2.7 pa.

SUBTRACTION OF DECIMALS.

CASE 1.—IF the given decimals be finite or infinite.

RULE.—Place the leaſt under the greateſt number, ſo that the decimals points may be exactly under each other, as directed in addition; then proceed as in ſubtraction of integers.

If the greateſt and leaſt numbers, have not the ſame number of places, imagine the void ſpaces to be filled up with ciphers.

EXAMPLES.

From	2464.21	48.525	54.6875
Take	327.07643	18.634375	36.875
Remainder	2137.13357	29.890625	17.8125
Proof	2464.21	48.525	54.6875

From 127.62, take 13.725 Anſwer 113.895
Take 6213.725 take 162.25 Anſwer 6051.475

CASE

CASE 2.—If one of the given decimals, be a repetend and the other a finite, or if both have ſingle repetends.

RULE.—Give the repetend one place more than the finite decimal, and in ſubtracting, the firſt figure on the right, you muſt borrow (if neceſſary) 9 inſtead of 10, then proceed as in integers.

If both numbers have repetends, give each an equal number of places, then ſubtract as before.

EXAMPLES.

From	.7145$\dot{8}\dot{3}\dot{3}$	.5$\dot{2}\dot{5}$	.9989$\dot{5}\dot{8}\dot{3}$
Take	.631$\dot{4}\dot{3}\dot{7}\dot{5}$	.$\dot{3}\dot{3}\dot{3}\dot{3}$	.0291$\dot{6}\dot{6}\dot{6}$
Rem.	.0802$\dot{0}\dot{8}\dot{3}$	.19$\dot{1}\dot{6}$	.9697$\dot{9}\dot{1}\dot{6}$

From 647 take .00$\dot{7}\dot{4}\dot{6}$. Anſwer 646.99$\dot{2}\dot{5}\dot{3}$

From 74.5$\dot{2}$ take 21.94648. Anſwer 52.57$\dot{5}\dot{7}\dot{4}\dot{2}$

From 16.126 take 4.1942$\dot{7}\dot{6}\dot{4}$. Anſwer 11.9323902$\dot{6}$.

CASE 3—To ſubtract decimals that have circulates.

RULE 1.—If both numbers be circulates, make both circles conterminous and proceed as in integers. only if in the left hand column of the circulates, you foreſee that in ſubtracting, you muſt borrow, in this caſe add 1 to the right hand figure of the leaſt number and then ſubtract

2.—If one of the given decimals be a circulate and the other a repeater, give the repeater the form of a conterminous circulate and then ſubtract as before.

3.—If one of the given decimals be a circulate and the other a finite decimal, extend the finite part of the circulate to as many places as there are figures in the finite decimal, and then ſubtract.

EXAMPLES.

RULE 1.

From . thus .64,2857$\dot{1}\dot{4}$ Obſerve that 8 cannot be taken

Take .17857$\dot{1}\dot{4}\dot{2}$ .17,857$\dot{1}\dot{4}\dot{2}$ from 2, in the left hand column

Remainder . . . . . 46.428571 of the circulates, therefore add

1 to the right hand (2) according to the rule.

RULE 2.

From	.9285714	thus .9285714	Here, I cannot take 6 from 2 on
Take	.6	.6666666	the left, therefore add 1 to the right
		———	(6), as before.
Remainder	. . . . .	.26.9047	

RULE 3.

From	.384165 thus	.384,165	Here, I extend the finite part of the cir-
Take	.125	.125,	culate to three places becauſe the finite
		———	decimal 125 conſiſts of three places.
Remainder		.259165	

From 85.62, take 13.76432. Anſwer 71.86193
From 3.8564 take .0382. Anſwer 3.81824
From .75 take .07142857 Anſwer .67857142

MULTIPLICATION OF DECIMALS.

CASE 1.—IF both factors are finite or infinite.

RULE.—Place your factors and multiply exactly as in Multiplication of Integers, then point off ſo many places of decimals from the right towards the left of the product, as are in both factors, and if the product has not ſo many places, ſupply that defect by prefixing ciphers.

EXAMPLES.

Multiply	.785 by .75.	Multiply 73. by 2.5.	Multiply .125 by .25.
	.75	2.5	.25
	3925	365	625
	5495	146	250
Product	.58875	182.5	.03125

Mult.	.0375 by .05.	Mult.	85. by. 5.	Mult.	.95 by 7.	Mult.	4.75 by 6.
	.05		.5		7		6
	.001875		42.5		6.65		28.50

Mult. 79.347 by 23.15 Anſwer 1836.88305.
Mult. .63478 by .8204 Anſwer .520773512.

Mult.

Mult. .385746 by .00464 Anſwer .00178986144.

To multiply by 10, 100, 1000, &c., move the decimal point ſo many places towards the right hand as there are ciphers in the multiplier, thus :

$$.4375\times 10 = 4.375 \qquad .4375\times 1000 = 437.5$$
$$.4375\times 100 = 43.75 \qquad .4375\times 10000 = 4375.$$

CASE 2.—To contract the operation ſo as to retain as many decimal places in the product as may be thought neceſſary.

RULE 1.—Write the units place of the multiplier inverted under that place of the multiplicand, whoſe place you intend the product ſhall extend to, and diſpoſe of the reſt of the figures in the contrary order to what they are uſually placed in.

2.—In multiplying reject all the figures that are to the right hand of the multiplying digit, and ſet down the products, ſo that their right hand figures may fall in a ſtraight line below each other; obſerving to increaſe the firſt figure of every line with what would ariſe, by carrying 1, from 5 to 15; 2, from 15 to 25; &c. &c. from the preceding figures when you begin to multiply, and the ſum is the product required.

EXAMPLES.

Let it be required to multiply 27.14986 by 92.41035 and to retain only four decimal places in the product.

CONTRACTED.		COMMON WAY.	
27.14986		27.14986	
53014.29		92.41035	
24434874		135749300	
542997		8144958	
108599		2714986	
2715		108599	44
81		542997	2
14		24434874	
2508.9280		2508.9280	650510

Multiply 245.378263 by 72.4385, reſerving five places of decimals in the product. Anſwer 17774.83330.

Multiply .248264 by .725234, reſerving ſix figures; five figures; and four figures in the product reſpectively. Anſwer .180049; .18005; .1800.

Multiply 8634.875 by 843.7527 reſerving only the Integers in the product. Anſwer 7285699.

CASE

C A S E 3.—If the multiplier be finite and the multiplicand repeat.

R U L E.—In multiplying carry 1 for every nine in the product of the firſt or right hand figure, and before you add extend the repeating figures of the particular products, till their right hand figures ſtand directly under one another and in adding carry 1 for every nine in the ſum of the right hand column.

E X A M P L E S.

Multiply $6.4\dot{3}$ by 123.

123

1930 .... thus 1930

1286 12866

643 64333

Product 791.30

Multiply $84.\dot{7}$ by 28000.

28000.

If the multiplier has ciphers on the right as in this example; inſtead of annexing ciphers to the product, repeat its right hand figure, ſo many times as there are ciphers.

$67\dot{8}2$

$169\dot{5}5$

$2373777.\dot{7}$

Turn both the terms into their equivalent vulgar fraction and find the product of thoſe fractions as uſual; then reduce the vulgar fraction expreſſing the product, to an equivalent decimal one. See caſes 4 and 1 in Reduction of decimal fractions.

thus $6.4\dot{3}$

64

$\frac{579}{90} \times \frac{123}{1} = \frac{71217}{90}$ or 791.3 as before ex. 1.

again $84.\dot{7}$

84

$\frac{763}{9} \times \frac{28000}{1} = \frac{21364000}{9}$ or $2373777.\dot{7}$ as before

C A S E 4.—If the multiplier be finite and the multiplicand a circulate.

RULE.

RULE.—To the product of the right hand figure of the circulate, add the carriage from the left, then proceed as in Multiplication of Integers, but before you add the particular products, make them conterminous by case 5 in Reduction, then add as in Addition of circulates.

EXAMPLES.

Multiply $.\dot{4}8\dot{1}$ by 7.

$$\begin{array}{r} .\dot{4}8\dot{1} \\ 7 \\ \hline 3.\dot{3}7\dot{0} \end{array}$$

I find the carriage from the left thus: 7 times 8 is 56, carry 5; then the left hand figure 7 times 4 is 28 and 5 make 33, carry 3 to the right and 7 times 1 is 7 and 3 make 10, set down 0 and go on as usual; the product circulates and its circle $.\dot{3}7\dot{0}$ is similiar to $.\dot{4}8\dot{1}$ the circle of the multiplicand.

or thus

$$.\dot{4}8\dot{1} = \frac{481}{999} \times \frac{7}{1} = \frac{3367}{999} \text{ or } 3.\dot{3}7\dot{0} \text{ as before.}$$

Multiply $7.\dot{5}1\dot{8}$ by .5. Answer $3.\dot{7}5\dot{9}2\dot{}$.

Multiply $7.\dot{5}1\dot{8}$ by .05 Answer $.3\dot{7}5\dot{9}2\dot{}$.

Multiply $7.\dot{5}1\dot{8}$ by .005. Answer $.0\dot{3}7\dot{5}9\dot{2}$.

Multiply $4.\dot{7}85714\dot{2}$ by 8.05. Answer 38.525.

Multiply $86.\dot{5}3571\dot{4}2\dot{8}$ by 58.75. Answer $5083.9\dot{7}32\dot{1}42\dot{8}57\dot{}$

NOTE.—The circle of every particular product, will consist of the same number of places as there are in the circle of the multiplicand, and after having made the particular products conterminous; in adding take the carriage from the left hand column of the circulates, as in addition of circulates.

Multiply $.\dot{4}7\dot{6}$ by 354.

$$\begin{array}{r} .\dot{4}7\dot{6} \\ 354 \\ \hline 1\dot{9}0\dot{5} \\ 2\dot{3}8\dot{2} \\ 1\dot{4}2\dot{9} \\ \hline \text{Product } 168.\dot{6}7\dot{2} \end{array} \quad \begin{array}{l} \text{. . thus . . . } 1\dot{9}0\dot{5} \\ \text{. . . . . } 2\dot{3}8\dot{2}3 \\ \text{. . . . . } 1\dot{4}2\dot{9}42 \end{array}$$

or thus.

$$\frac{476}{999} \times \frac{354}{1} = \frac{168504}{999} \text{ or } 168.\dot{6}7\dot{2}$$

If the multiplier has ciphers on the right; first, point the product in the same manner you would do, were the ciphers affixed; and then instead of ciphers, continue so many figures of the circle from the left to the right as serve to complete it.

Multiply

Multiply $3.96\dot{1}$ by 489000.

$3.96\dot{1}$
489000

31695 . . . thus . . . 31695
35657 , ... 356576
15847 1584784

Product 1973057.057

or thus.

$3.96\dot{1}$ or $\frac{3958}{999} \times \frac{489000}{1} = \frac{1971\cdot 84000}{999}$ or 1973057.057.

If the multiplier be infinite, reduce it to a vulgar fraction as directed in reduction of decimals, then multiply the given multiplicand by the numerator, and divide the product, by the denominator.

C A S E 5.—When a repeating multiplier, multiplies a finite multiplicand.

R U L E.—Reduce it to a vulgar fraction, as directed, in reduction of decimals case 4; then multiply the given multiplicand by the numerator and divide the product by the denominator, continuing the quotient if needful, till it arrives at a repeater.

E X A M P L E S.

Multiply 638.25 by $.\dot{4}$.

Here the multiplier $.\dot{4}$ is equal to $\frac{4}{9}$, therefore multiply by 4 and divide the product by 9. or thus, for last case.

$.\dot{4} = \frac{4}{9}$

638.25

9)2553.

638.25 or $\frac{63825}{100} \times \frac{4}{9} = \frac{255300}{900}$ or $283.\dot{6}$

Answer $283.\dot{6}$

Multiply 872.35 by $.07 = \frac{07}{90}$

Here I divide the product first by 9 which makes the quotient 678.494, then by 9×10 which is done by moving the decimal point one place to the left and gives 67.8494.

872.35

$07 = \frac{07}{90}$ 07

90)610645

Answer 67.8494

Multiply

Multiply 87.34 by 2.67 or $\frac{241}{90}$

The numerator of the vulgar fraction is found by subtracting the finite part, thus; 2.67 − 26 = 241

Then I divide first by 9 and then by 10 as in the last example; you may prove your work, according to the foregoing ex. 1.

87.34
241
8734
34936
17468
90)2104894
Answer 233.8771

Multiply 7989 by 47.5 = $\frac{428}{9}$

The numerator is found as before:
475
47
428 Numerator.

7989
428
63912
15978
31956
9) 3419292
379921.3

Multiply 680.748 by 3.216 = $\frac{2895}{900}$

3403740
6126732
5445984
1361496
900) 1970763462
Answer 2189.73940

Here, after dividing by 9 I divide by 100 which is done by moving the decimal point two places to the left.

Multiply 46.2762 by .8 Answer 41.1344
Multiply 261.276 by .47 Answer 124.83186

NOTE.—You may make your multiplicand the multiplier and work by case 3.

CASE 6.—When both factors repeat.

RULE.—Carry 1 for every nine in the product of the first figure.

RULE.

as in case 3, and when the product or dividend is exhausted in dividing by 9. continue the division by annexing to the remainders, the repeating figure of the dividend instead of ciphers and the quotient or product sought, comes out a mixed circulate.

EXAMPLES.

Multiply $6.8\dot{3}$ by $\dot{7} = \frac{7}{9}$.

9) 47.83

Answer $5.3\dot{1}4\dot{8}$

See cases 3 and 5, and you may prove your work by reducing both factors, to vulgar fractions, according to the foregoing case 3, thus:

$6.8\dot{3}$
68

$\frac{615}{90}$ or $\frac{41}{6}$ in its least terms; then, $\frac{41}{6} \times \frac{7}{9} = \frac{287}{54}$ or $5.3\dot{1}4\dot{8}$

Multiply 16.8 by $3.8\dot{4} = \frac{346}{90}$.
346 38

1013 346
6755
50666

90) 58435

$64.928395061\dot{7}$

Multiply $5.\dot{6}$ by $2.\dot{3}$ Answer $13.\dot{2}$
Multiply 141.14 by 8.47 Answer 1196.58911
Multiply 24.6072 by .496 Answer 12.2

CASE 7.—When the repeating multiplier, multiplies a circulating multiplicand.

EXAMPLES.

Multiply $555.23\dot{1}2\dot{1}95$ by $45.\dot{5} = \frac{410}{9}$
410 45

$555.23\dot{1}2\dot{1}95$ 410 see case 5.
22209248792

9)227644.799999

$25293.8\dot{6}$ Answer.

In multiplying take in the carriage from the left figure of the circle, as in case 4, and in dividing by 9, continue the division by annexing to the remainders the circulating figures of the dividend. After multiplying by 41, I again multiply by 10, which is done by placing the decimal point one place further to the right.

Multiply

Multiply 24.$\dot{3}\ddot{6}$ by .$\dot{4}$ Anſwer 10.$\dot{8}\ddot{2}$.
Multiply 38.$\dot{4}2857\dot{1}$ by .0$\dot{7}$. Anſwer 29.$\dot{8}$.

N O T E.—You may prove your work, by reducing both terms to vulgar fractions. See caſe 3.

C A S E 8.—When a circulate multiplies a finite multiplicand.

E X A M P L E S.

Multiply 56.874 by 4.$\dot{2}9\dot{6}$ $=\frac{4292}{999}$

56.874	4.$\dot{2}9\dot{6}$
4292	4
113748	$4292=\frac{4292}{999}$
511866	
113748	
227496	

999)244103.208(244.3475 Anſwer.
1998

4430
3996
4343
3996
3472
2997
4750
3996
7548
6993
5550
4995
555

N O T E.—You may prove your work as directed in the preceding caſe; or, make your multiplicand the multiplier and work by caſe 4.

Inſtead of dividing as above, it will be eaſier and ſhorter to annex as many ciphers to 1 as there are nines in the diviſor, for a new diviſor, and divide the dividend by it, and do the ſame with the quotient, till you get 0, then add up all the quotients together and the ſum will be the anſwer, thus:

1000)

1000) 244.103.208
.244 103
244

244.3475

In dividing by 10, 100, 1000, &c. you have only to move the decimal point as many places to the left, as there are ciphers in the divisor.

Multiply 825 by $.\dot{3}\dot{6}$. Answer 300.

CASE 9.—When a circulate multiplies a repeating multiplicand.

EXAMPLES.

Multiply $8.02083\dot{3}$ by $.\dot{7}\dot{2} = \frac{72}{99}$. See case 3.

72

1604166̇
56145833̇

99) 577.50(5.83̇ Answer or thus; 5.7750̇
495 577
5

825
792 Answer 5.8333̇ as before.

330
297

33

Multiply 18.783416̇ by $4.\dot{3}\dot{6} = \frac{432}{99}$ Answer 81.964

Multiply $198.7052083\dot{3}$ by $.0\dot{4}\dot{5} = \frac{45}{990}$ Answer $9.032054\dot{9}\dot{2}\dot{4}$

CASE 10.—When both factors circulate.

EXAMPLES.

Multiply $.7\dot{1}4285\dot{7}$ by $.\dot{3}\dot{6} = \frac{36}{99}$.

Carry from the left, as in case 4, and divide as in case 8.

.7̇14285̇7
36

4285714
21428571

99)25.7̇14825̇7

Answer .25974025̇

Multiply

Multiply 3.2142857 by $.681 = \frac{675}{990}$. Anſwer .2191558441 5

Multiply 78.45 by $8.296 = \frac{8288}{999}$. Anſwer 650.882154882

DIVISION OF DECIMALS.

IN diviſion of decimals, the work is performed as in whole numbers; the only difficulty is, in valuing the quotient, which will be very eaſy by obſerving the following general rules.

There are two general rules for pointing the quotient, and extend to decimals of every ſort, whether finite or infinite.

I. GENERAL RULE.

The decimal places in the diviſor and quotient together muſt always be equal in number to thoſe of the dividend.

The five following practical directions will make the application of this general rule perfectly eaſy.

1.—When the diviſor and dividend have an equal number of decimal places, the quotient is an Integer; as in the following example 2.

2.—When the decimal places of the dividend are more than thoſe of the diviſor; the number of decimal places in the quotient muſt be equal to the exceſs; as in ex. 1, 4, and 8.

3.—When the decimal places of the diviſor are more than thoſe of the dividend, annex ciphers to the dividend, ſo as to make them equal and the quotient, by direction 1, will be integers; as in ex. 3, 5 and 7.

4.—When after diviſion is finiſhed, the quotient has not ſo many figures, as by the general rule it ought to have decimal places, ſupply that defect by prefixing ciphers; as in ex. 6.

5.—If after the dividend is exhauſted, there be a remainder, annex a cipher, or ciphers, to the remainder, and continue the Diviſion till o remain, or till the quotient repeat or circulate, or till you have ſuch a number of places as you think neceſſary; as in ex. 9, 10, 11 and 12.

CASE.

C A S E 1.—If the divisor and dividend are both finite, or infinite.

R U L E.—Work exactly as in Integers, then point the quotient according to the foregoing directions.

E X A M P L E S.

1. Divide .58875 by .75

In this example, a decimal divides a decimal, and because the dividend has five places and the divisor only two, I give three decimal places to the quotient, by direction 2.

.75).58875(.785 Answer
525
637
600
375
375
0

2. Divide 182.5 by 2.5

Here a mixed number divides a mixed number, and the divisor and dividend having an equal number of decimal places, the quotient is an integer, by direction 1.

2.5)182.5(73. Answer
175
75

N O T E.—You may prove your work by reducing both factors to their equivalent vulgar fraction, by case 4 in reduction of decimals, and then proceed as in division of vulgar fractions, thus:

$\frac{5885}{100000}$ or $\frac{471}{800}$ in its least terms.

$\frac{75}{100}$ or $\frac{3}{4}$ in its least terms.

then $\frac{471}{800} \div \frac{3}{4} = \frac{1884}{2400}$ or .785.

again $\frac{1825}{10}$ or $\frac{365}{2}$ in its least terms.

$\frac{25}{10}$ or $\frac{5}{2}$ in its least terms.

then $\frac{365}{2} \div \frac{5}{4} = \frac{730}{10}$ or 73.

3. Divide 475 by .85.

In this example, a decimal divides an integer and the dividend having no decimal place, I annex two ciphers to it, because there are two decimal places in the divisor, and the quotient is an integer, according to direction 3.

.85) 476.00(560
425
510
510

4. Divide .875 by 7.

Here, an integer divides a decimal, and becauſe the dividend has three decimal places, and the diviſor none, the quotient has three places, according to direction 2.

```
7) .875
   ----
   .125
```

5. Divide 12.75 by .375

A decimal divides a mixed number, in this example, and the diviſor having three decimal places and the dividend only two, I ſupply that defect by annexing a cipher, and the quotient is an integer, by direction 3.

```
.375) 12.750(34
      11 25
      -----
       1500
       1500
```

6. Divide .22875 by 2.5

Here a mixed number divides a decimal; and becauſe the dividend has four decimal places more than the diviſor; and the quotient after the diviſion is finiſhed having only three decimal places, I ſupply the defect by prefixing a cipher to it, according to direction 4.

```
2.5) .22875( .0915
     225
     ---
      37

      125
      125
```

7. Divide 180 by 3.75.

In this example a mixed number divides an integer; and the dividend having no decimal places, I ſupply that defect by annexing two ciphers, the number of decimal places in the diviſor and the quotient is an integer, according to direction 3.

```
3.75) 180.00( 48
      1500
      ----
      3000
      3000
      ----
         0
```

8. Divide 243.2 by 38.

Here, an integer divides a mixed number; and the diviſor having no decimal place, and the dividend only one, I give one decimal to the quotient, by direction 2.

```
38) 243.2(6.4
    228
    ---
     152
     152
     ---
       0
```

9. Divide 29 by .8.

A decimal divides an integer in this example; and after the dividend is exhauſted, I annex a cipher to the remainder, and continue the diviſion until nothing remains, by direction 5.

```
.8) 29.0
    ----
    36.25
```

10. Divide .0024 by .018.

Here, a decimal divides a decimal; and after the dividend is exhauſted, I annex a cipher to the remainder, and continue the diviſion until I find the quotient repeats, by direction 5.

.018).0024(.133, &c.
18
60
54
60
54

11. Divide 8. by 11.

Here, an integer divides an integer, and the dividend being leſs than the diviſor, I annex a cipher to it, again after the dividend is exhauſted I annex a cipher to the remainder, and continue the diviſion, until I find the quotient circulates, by direction 5.

11)8.0
.7272, &c.

12. Divide 76.75 by 3.25

A mixed number divides a mixed number, in this example; and after the dividend is exhauſted, by annexing ciphers to the remainders, I continue the diviſion till the quotient has three decimal places, and there is ſtill a remainder; it might be carried further, but I limit it to three places, and five or ſix places is in moſt caſes ſufficiently accurate for buſineſs; according to direction 5.

3.25)76.75(23.615, &c.
650
1175
975
2000
1950
500
325
1750
1625

2. GENERAL RULE.

The place of the firſt figure of the quotient is the ſame with the place of that figure in the dividend which ſtands over the units of the firſt product.

EXAMPLES.

Divide 32095 by 35.

In this example of integers o ſtands over 5, the units of the product of 9 times 35, and is in the place of hundreds, and therefore 9, the firſt figure of the quotient is likewiſe hundreds, and ſo the quotient is 917 integers.

35)32095(917
315
59
35
245
245
0

Obſerve

Obſerve the following varieties in pointing the quotient.

VAR. 1.	VAR. 2.	VAR. 3.
35)3209.5(91.7.	35)320.95(9.17	35.)32.095(.917
315	315	315
59	59	59
35	35	35
245	245	245
245	245	245
0	0	0

In all the above varieties, the figure o in the dividend ſtands over the units of the firſt product: in var. 1. the figure o is in the place of tens and accordingly the firſt figure in the quotient, 9, is tens: in var. 2, the figure o is in the place of units, and ſo 9 is units: in var. 3, the figure o is in the place of primes or tenth parts, and ſo 9 is nine tenths.

Divide 3.2095 by .0917. Anſwer 35
Divide 3.2095 by 35. Anſwer .0917
Divide .32095 by 35. Anſwer .00917
Divide .032095 by 35. Anſwer .000917
Divide 32095 by 3.5 Anſwer 9170
Divide 32095 by .35 Anſwer 91700
Divide 32095 by .035 Anſwer 917000
Divide 32095 by .0035 Anſwer 9170000
Divide 320.95 by 3.5 Anſwer 91.7
Divide 32.095 by 3.5 Anſwer 9.17
Divide .32095 by .35 Anſwer .917
Divide .2095 by 3.5 Anſwer .0917
Divide 31415926 5 by 579268 Anſwer 542.33837, &c.
Divide 579.268 by 31415 Anſwer .018, &c.
Divide 31415926 5 by 579.268 Anſwer 542338.3, &c.
Divide 3.14159265 by 579268 Anſwer .00000542, &c.
Divide 31.4159265 by 57.9268 Anſwer .542, &c.

In dividing by 10, 100, 1000, &c. you have only to move the decimal point one place towards the left, for every cipher in the diviſor.

THUS	AND THUS.
10)768(76.8	10)17.68(1.768
100)768(7.68	100)17.68(.1768
1000)768(.768	1000)17.68(.01768
10000)768(.0768	10000)17.68(.001768

When the diviſor conſiſts of many places of decimal parts, the work may be much abbreviated as follows:

RULE.—Write the product of the firſt quotient figure under the dividend; and from the ſituation of the units place, conſider how many figures of the dividend muſt be retained to give the quotient the number of decimal places intended; cut off the other figures on the right, and alſo the figures correſponding to them on the right of the diviſor; then ſubtract; eſteem this and every following remainder a new dividual; and for each new dividual drop a figure on the right of the diviſor; but in multiplying the quotient figures into the diviſor, take in the carriage from the right hand, as in the following example.

Divide 95.43275646 3275 by 3.4637528 and limit the quotient to four decimal places.

3.46375 | 28)95.4327 | 56463275(27.5518
69 2750 | 56

In this example, the units of the firſt product ſtanding under the place of tens; the firſt figure of the quotient is tens; and hence it is eaſy to foreſee, that ſix figures of the dividend retained will give four decimal places to the quotient; and accordingly I cut off all the other figures on the right of the dividend, I cut off likewiſe from the diviſor two figures that correſpond with them. At every new dividual I drop or omit a figure on the right of the diviſor, and mark the figure ſo dropped by ſetting a point under it; and in multiplying the quotient figure 7 into the diviſor, I ſay 7 times 7 is 49 and 3 I carry from the right make 52; ſo I ſet down 2 and carry 5. The ſame method is obſerved in multiplying every other quotient figure into the diviſor.

26 1577
24 2462
1 9115
1 7318
1797
1731
66
34
32
27

I ſhall conclude diviſion of finite decimals with two very uſeful problems, by which you may prove your work in multiplication and diviſion; and work any caſe of diviſion by multiplication; and alſo, any caſe of multiplication by diviſion.

PROB. 1.

PROB. 1.

From a given multiplier to find a divisor, that gives a quotient equal to the product.

R U L E.—Divide an unit with ciphers annexed by the given multiplier and the quotient will be the divisor sought.

EXAMPLE.

What divisor will give a quotient equal to the product of any number multiplied by 125. for instance, let the given number to be multiplied be 7315.

Given multiplier 125)1.000(.008 divisor sought.

then .008)7315.000(914375 quotient

7315
125

36575
87780

product 914375

PROB. 2.

From a given divisor to find a multiplier that gives a product equal to the quotient.

R U L E.—Divide an unit with ciphers annexed, by the given divisor, and the quotient will be the multiplier sought.

EXAMPLE.

What multiplier will give a product equal to the quotient arising from tht same number divided by .008. Let 785 be the number to be divided.

as divisor .008)1.000(125 multiplier sought.

0

as 785
125

3925
9420

98125 product.

.008)785.000

98125 quotient.

CASE 2.—When a finite divisor divides a repeating dividend.

EXAMPLES.

Divide $78.8\dot{3}$ by 12.5.

Work as in integers, but in continuing the division, instead of annexing ciphers to the remainder, annex the repeating figure of the dividend.

Prove your work by cases 3 and 4 in multiplication.

12.5)$78.8\dot{3}$(6.3
750

383
375

833
750

83

Divide

Divide 4.19662 by 37. Anſwer 11.342

Divide 56.1 by 30. Anſwer 1.8703

C A S E 3.—When a finite diviſor, divides a circulating dividend.

E X A M P L E S.

Divide 1.17 by 25.

Inſtead of annexing ciphers to the remainder, annex the circulating figures of the dividend.

Prove your work caſes 3. 4 in multiplication.

25)1.17(.0468
100

171
150

217
200

17

Divide 3.7592 by 5. Anſwer .7518518.

Divide 25.071428 5 by 6.5. Anſwer 3.8571428.

C A S E 4.—When a repeating diviſor, divides a finite dividend.

R U L E.—Reduce the diviſor to a vulgar fraction. (by caſe 4 in reduction of decimals) then multiply the given dividend by the denominator and divide the product by the numerator.

OR

Place the dividend under itſelf, but removed one place toward the the right hand which ſubtract and the remainder will be a new dividend: which divide by the diviſor in the ſame manner as if it was a terminate or finite number; if the diviſor conſiſts of a repeater only.

E X A M P L E S.

Divide 23.5 by $.4=\frac{4}{9}$

9
---
4)211.5

52.875 Anſwer.

OR THUS

235
235
---
4)2115

52.875 as before.

Divide 759.011502 by 2

90 214

214)68311.040580(319.21047

When your multiplier is 9 or many nines, for each figure of the multiplier annex a cipher to the multiplicand and from that number ſubtract the multiplicand, the remainder is the product. See. Caſe 6 following.

The numerator of the vulgar fraction is found by ſubtracting the finite part.

Divide

Divide 758.816 by 6.8$\dot{3}$. Anſwer 111.04624390.

Divide 8567.28 by 4.86. Anſwer 1760.4.

C A S E 5.—When a repeating figure divides a repeating dividend.

R U L E.—Proceed as in the laſt caſe; obſerving only to carry at 9 from the product of the firſt figure.

E X A M P L E S.

Divide 43.26 by .3 $=\frac{3}{9}$

9

3)389.40

129.8 Anſwer.

OR THUS

432.66

43.26

3)389.40

129.8

Divide 21604.3 by 7.8$\dot{3}$ $=\frac{705}{90}$

783)216043.33

78 216043.3

705) 1944390.0(2758

Divide 25293.86 by 45.5. Anſwer 555.2312195.

Divide 56.034757 by 4.2. Anſwer 13.27159.

C A S E 6.—When a repeating diviſor, divides a circulate.

R U L E.—Proceed as in the laſt caſe; only take carriage from the product of the left hand figure of the circle.

E X A M P L E S.

Divide 92.518 by .4 $=\frac{4}{9}$

925'8 or thus 925185

9 92518

4)832.6 4)832666

208.16 Anſwer 208.16

Divide 363.5740 by 48.3

483)3635.7407

48 363.5740

435)3272.1666(7.52

2

Divide 93.0073170 by 2.47. Anſwer 37.53653.

C A S E 7.—When a circulate divides, a finite dividend.

EXAMPLES.

EXAMPLES.

Divide 9 by $.\dot{4}\dot{5} = \frac{45}{99}$

99 or thus 900

45)891 — 9

19.8 — 45)891

19.8

Divide 81.964 by $4.\dot{3}\dot{6} = \frac{432}{99}$

436)8196.400

4 81.964

432)8114.436(18.783416

Rem. 288

When the multiplier conſiſts of 9 or many nines; firſt multiply the given dividend by 10 for 9; by 100 for 99; by 1000 for 999; &c. which is done by moving the decimal point, as many places to the right as there are ciphers in the multiplier, and from that product ſubtract the given dividend: if the dividend conſiſts of an integer only, then annex to it as many ciphers, as there are nines, and then ſubtract as before; the remainder is the product ſought.

When there are ciphers annexed to the nines in the multiplier, as 90, 990, 9900, &c.; firſt, multiply by nines only as before, and that product by 10, 100, &c. according to the number of ciphers, then proceed as before.

Divide 72 by $.0\dot{1}4\dot{8} = \frac{148}{9990}$. Anſwer 4860.

CASE 8.—When a circulate divides a repeating dividend.

EXAMPLES.

Divide $5.\dot{8}\dot{3}$ by $.\ddot{7}\dot{2} = \frac{72}{99}$

583.33

5.83

72)577.50)8.02083

24

Divide 25.386 by $19.\dot{3}\dot{9} = \frac{1920}{99}$

19.39)2538.666

19 25.386

1920)2513.280(1.309

Divide 25293.86 by $555.\dot{2}3\dot{1}2\dot{1}95. = \frac{5552256672}{9999900}$ Anſwer $45.\dot{5}$.

CASE 9.—When a circulate divides a circulate.

RULE.—In dividing, when the dividend has a repeating figure or circulate; annex them inſtead of ciphers, to the remainders.

EXAMPLES.

EXAMPLES.

Divide .962 by .18 $=\frac{18}{99}$

96.296
.962

18)95.333(5.296 Ans.
Rem. 5

Divide 534.126 by 4.36 $=\frac{432}{99}$

436)53412.612
4 534.126

432) 52878486(122.40390
Rem. 16

Divide 340.90 by 53.571428 $=\frac{53571375}{999996}$ Anſwer 6.36.

RULE OF THREE DIRECT.

TEACHETH, by having three numbers given, to find a fourth, in the ſame proportion to the third, as the ſecond is to the firſt; or as the firſt is to the ſecond, ſo is the third to the fourth; for which reaſon it is called the the RULE OF PROPORTION; as it is called the RULE OF THREE from its having three numbers given: and becauſe of its excellent uſe in Arithmetic, it is often called the GOLDEN RULE.

To perform which, obſerve with great attention the following

RULES.

1. —Place that number or term, which is of the ſame kind with the number ſought, in the middle; the two remaining numbers or terms are always of the ſame kind and are called EXTREMES, and the middle is called the MIDDLE TERM.

2.—Conſider from the nature of the queſtion, whether the fourth term or anſwer ſought, muſt be greater or leſs than the middle term; and if the anſwer muſt be greater, the leaſt extreme muſt be placed on the left hand and the other on the right: but if the anſwer muſt be leſs, then place the greateſt extreme on the left and the other on the right of the middle term. Then multiply the ſecond and third terms together, and divide their product by the firſt; and the quotient gives the anſwer; which is always of the ſame name or kind as the middle term.

PROOF.—Multiply the fourth term or anſwer, by the firſt term; then multiply the ſecond and third terms together, and if their products are equal, your work is right.

In

IN VULGAR FRACTIONS.

1.—State your queſtion as before, obſerving that the extremes muſt be of the ſame denomination.

2.—Reduce mixed numbers and integers into improper fractions, and compound fractions to ſimple ones, by caſes 2 and 7 in reduction

3.—Then multiply the numerator of the firſt term, into the denominators of the ſecond and third, for the denominator of the anſwer; and multiply the denominator of the firſt term, into the numerators of the ſecond and third for the numerator of the anſwer, which being reduced to its proper value, gives the required anſwer.

IN DECIMAL FRACTIONS.

Reduce the fractional parts into decimals of the higheſt name mentioned; then proceed as before.

EXAMPLES.

If 4 yards of cloth coſt 12 ſicca rupees what will 6 yards coſt at that rate?

In this example, the kind of the number ſought is rupees, therefore I place the given number 12 rupees, in the middle and the two remaining terms are extremes of the ſame kind; that is both yards. Now, it is eaſy to perceive that the anſwer muſt be greater than the middle term; for 6 yards will evidently coſt more than 4 yards at the ſame price, therefore the leaſt extreme is placed on the left hand, and the greateſt on the right of the middle term, and after multiplying the ſecond and third terms together, I divide their product by the firſt term, and the quotient 18 is the anſwer, and of the ſame name with the middle term, that is, 18 rupees.

If 4 : 12 :: 6

6

—

4)72

—

Ans. 18 ſicca rupees

—

2.—If 7 mons of rice coſt 21 rupees, how much will 5 mons coſt at that rate?

Here the number ſought is the price of 5 mons, and the kind rupees, and the given term of the ſame is 21 rupees, which place in the middle, then it is obvious that the anſwer muſt be leſs than the middle term for 5 mons will coſt leſs than 7 mons at the ſame price, and therefore I place the greateſt extreme 7 on the left hand and the other extreme 5 on the right, and having multiplied and divided, as in the laſt example, the quotient is the anſwer of the ſame name with the middle term, that is, 15 rupees.

If 7 : 21 :: 5

5

—

7)105

—

Ans. 15 rupees.

—

3.—

3.—If 13 yards of muſlin coſt 21 ſicca rupees, what will 27 yards coſt at that rate?

When there happens to be a remainder, as in this example, it may be reduced to the next inferior denomination, and the operation continued, as in the margin; ſee caſe 3 in compound diviſion, or by decimals, thus;

13)567(43.6154
16

an. 9.8464
12

pa. 10.15 &c. Ans. 43 r. 9 a. 10 pa.

If 13 : 21 :: 27
27

13)567(43 r. 9 an. 10 pa.
Rem. 8
16

13)128(9 annas
117

Rem. 11
12

13)132(10 pauys
130

2

4.—If 14 lb. of tobacco, coſt 27 annas, what will 478 lb. coſt, at that rate?

Here the middle term being annas, the firſt part of quotient is alſo annas, which I divide by 16 and ſo reduce it to rupees; and proceed with the remainder as in the preceding example.

If 14 : 27 :: 478
27

14)12906(16)921 annas.
rem. 12 57 r. 9 a. 10 p.
12

14)144(10 pauys.
140

4

5.—If 15 ounces of ſilver be worth 3 £. 15 s. what are 86 oz. worth at that rate?

When the middle term is a compound number, as in this example, reduce it to the loweſt name mentioned and the anſwer will be of the ſame name, that is, ſhillings; ſo I divide by 20 and reduce it to pounds.

If 15 : 3 15 0 :: 86
20

75
86

15)6450(20)430 ſhillings.
0 £. 21 10 0 Anſwer.

6.—

If 1 mon 15 ſars of tobacco, coſt 20 ſa. 18. 10 an., what will 5 ſars coſt at that rate?

If your firſt and third terms conſiſt of divers denominations, reduce them to the loweſt name mentioned, for in the operation both extremes muſt be of the ſame name.

M. SR. R. A. SAR.
If 1 15 : 20 10 :: 5
40 16
55 ſr. 330 an.
5
55)1650(16)30
165
R. 1 14 0. Anſwer.
0

BY VULGAR FRACTIONS.

M. ſr. R. An. ſr.
1 15 is equal to $\frac{55}{40}$ or $\frac{11}{8}$; 20 10 equal to $\frac{330}{16}$ or $\frac{165}{8}$; 5 equal to $\frac{5}{40}$ or $\frac{1}{8}$

R. An.
then If $\frac{11}{8} : \frac{165}{8} :: \frac{1}{8} = \frac{1320}{704}$ or $1\frac{7}{8} = 1$ 14. thus, $8 \times 165 \times 1 = 1320$
$11 \times 8 \times 8 = 704$

BY DECIMALS.

M. ſr. R. an. ſr.
1 15 is equal to 1.375; 20 10 is equal to 20.625; and 5 is equal to .125.
then If 1.375 : 20.625 :: .125
.125 R. R. an.

1.375)2578.125(1.875 or 1 14 0 Anſwer
0 16
an. 14.000

7.—If 3 cwt. 1 qr. 14 lb. of raiſins, coſt 10 lb. 2 s. 6 d.; what will 6 cwt. 3 qrs. coſt at that rate?

Here, all the numbers are compound, and the two extremes are both reduced to lbs.; that being the loweſt name mentioned.

The middle term for the ſame reaſon is reduced to pence, and accordingly the quotient is pence, which reduce to ſhillings, then to pounds.

If 3 1 14 : 10 2 6 :: 6 3 0

4	20	4
13	202	27
28	12	28
108	2430 d.	756 lb.
27	756	
378 lb.	1458	
	1215	
	1701	

378)1837080(12) 4860

0 20)405

£. 20 5 0 Anſwer.

BY VULGAR FRACTIONS.

cwt. qr. lb. £. s. d. cwt. qrs.

3 1 14 = $\frac{27}{8}$; 10 2 6 = $\frac{81}{8}$; and 6 3 = $\frac{27}{4}$

Then, if $\frac{27}{8}$: $\frac{81}{8}$ :: $\frac{27}{4}$ = $\frac{17496}{864}$ or 20 $\frac{1}{4}$ = 20 £. 5 s. thus $8 \times 81 \times 27 = 17496$

$27 \times 8 \times 4 = 864$

BY DECIMALS.

cwt. qr. lb. £. s. d. cwt. qr.

3 1 14 = 3.375; 10 2 6 = 10.125; 6 3 = 6.75

6.75

£.

3.375)68.34375(20.25 = 20 £. 5 s. Anſwer.

6

I adviſe the learner to work all the following queſtions by each method, becauſe it will enable him to judge of the method beſt adapted to compute the queſtions in the ſubſequent rules. I preſume the ſuperior excellency of decimal arithmetic as the eaſieſt and moſt accurate, as well as the moſt expeditious in moſt caſes, will be obvious; and as diſpatch next to accuracy, is the principal object in computations, I recommend to his conſideration the following directions to abreviate or ſhorten his work; they are ſo very plain and eaſy, that a little practice will render them familiar.

IN COMMON ARITHMETIC.

1.—Divide the third term by the firſt; multiply that quotient by the ſecond, and their product will be the anſwer.

2.—

2.—Divide the ſecond term by the firſt, multiply that quotient by the third, and their product will be the anſwer.

3.—Divide the firſt term by the ſecond, and divide the third term by that quotient, which will give the anſwer.

4.—Divide the firſt term by the third; the ſecond by that quotient, and the laſt quotient will be the anſwer.

OR

Divide the firſt and ſecond terms, or firſt and third terms, of your ſtatement; as you perceive beſt adapted to ſhorten your work, by their greateſt common meaſure (ſee caſe 4 in reduction of vulgar fractions); then proceed as uſual.

BY DECIMALS.

You may contract your work by a greater variety of methods, in decimals, than the foregoing, becauſe you can divide any number by a greater number, which will be ſhewn in the ſubſequent example 4.

NOTE.—Although the progreſs of the Learner may be here a little retarded by attention to thoſe methods of abridging his operations; yet the facility derived from it will (in his future progreſs) amply compenſate it.

EXAMPLES.

1.—If 4 yards of cloth coſt 30 ſa. r. 5 an. 3 pa., what muſt I pay for 28 yards at that rate?

Here, I place the firſt and third terms in the form of a fraction, thus, $\frac{4}{28}$, which divided by the leaſt number or greateſt common meaſure gives $\frac{1}{7}$.

See Dir. 1.

	yds:	ſa.	r.	an.	pa.		yds.
ſtated thus, as	4	: 30	5	3		::	28
contracted	1	: 30	5	3		::	7
$4)\frac{4}{28}=(\frac{1}{7}$					7		
	Sa. Rs.	212	4	9		Anſwer.	

2.—If 3 cheſts of tea, each 3 cwt. coſt £. 11 13, what muſt I give for 72 cwt. of the ſame?

$9)\frac{9}{72}=(\frac{1}{8}$. See dir. 1.

Firſt $3\times3=9$ cwt. in the three cheſts

	cwt.	£.	s.	d.		cwt.
ſtated thus, as	9	: 11	13	0	::	72
contracted	1	: 11	13	0	::	8
				8		
	£.	93	4	0	Anſwer.	

3.—

3.—Suppoſe I give 78 ſicca rupees, for 26 ſars of raiſins, what muſt be given for 156 ſars of the ſame?

	fr.		fa. r.		fr.
ſtated thus, as	26	:	78	::	156
contracted . . .	1	:	3	::	156
					3
				Sa. Rs.	468

26) $\frac{26}{78}=\left(\frac{1}{3}\right.$ See dir. 2.

4.—If 55 ſars of tobacco coſt 20 ſa. r. 10 an.; what will 5 ſars coſt at that rate?

	fr.		fa. r.	an.	pa.		
ſtated thus, as	55	:	20	10	0	: :	5
contracted . .	11	:)	20	10	0	: :	1
					Sa. Rs.	1	14 0 Anſwer.

Here 5) $\frac{55}{5}=\left(\frac{11}{1}\right.$ by dir. 4.
See, foregoing ex. 6.

BY DECIMALS.

ſars.	mon.	ſars.	mon.		mon.		fa. r.		mon.		
55	=1.375	5	=.125	Stated thus, as	1.375	:	20.625	::	.125 . .	:	1.875
1.375)	$\frac{.125}{1.375}=\frac{.09}{1}$	. . .		contracted . .	1. . . .	:	20.625	::	.09 . .	:	1.875
.125)	$\frac{.125}{1.375}=\frac{1}{11}$	. . .		or thus . . .	11. . .	:	20.625	::	1. . .	:	1.875
20.625)	$\frac{1.375}{20.625}=\frac{.06}{1}$	. . .		or thus . . .	.06	:	1 . .	::	125 .	:	1.875
1.375)	$\frac{1.375}{20.625}=\frac{1}{15}$	. . .		or thus . . .	1 . .	:	15 . .	::	125 .	:	1.875
									15		

See, foregoing ex. 6. Anſwer. Sa. Rs. 1.875

or ſa. rs. 1 14 0

There are ſome queſtions where compound multiplication and diviſion, may be very conveniently applied.

EXAMPLES.

If 35 pipes of Madeira Wine coſt 410 ſa. r. 15 an., what muſt I pay for 15 pipes at that rate?

pipes

pipes	fa. r. an. pa.		pipes
As 35 :	410 15 0	: :	15
	3		
	1232 13 0		3×5=15
	5		5×7=35
	5)6164 1 0		
	7)1232 13 0		
Sa. Rs.	176 1 $10\frac{2}{7}$	Anſwer.	

or thus

As 7 : 410 15 0 : : 3

5) $\frac{35}{15} = \frac{7}{3}$

3

7) 1232 13 0

Sa. Rs. 176 1 $10\frac{2}{7}$ Anſ.

If 8 cubits of cloth, coſt 1 r. 8 an.; what will 59 cubits coſt at that rate?
Anſ. 11 r. 1 an.

What muſt I pay for 72 mons of rice, 9 mons of which coſt 9 ſa. r. 5 an.?
Anſ. 74 ſa. r. 8 an.

How many cubits of cloth may be bought for 11 ſa. r. 1 an., when 8 cubits coſt 1 ſa. r. 8 an.? Anſ. 59 cubits.

What will 9 mons of rice coſt, at the rate of 74 ſa. r. 8 an. for 72 mons?
Anſ. 9 ſa. r. 5 an.

If 7 mons, 10 ſars of ſugar, coſt 56 ſa. r. 4 an. 6 pa.; what will be the price of 43 m. 6 fr. 3 ck. at the ſame rate? Anſ. 335 ſa. r., 0 an., 1.3176 pa.

What quantity of ſugar may be bought for 335 ſa. r. 0 an. 1.3176 pa. at the rate of 7 mons 10 ſars for 56 ſa. r. 4 an. 6 pa.? Anſ. 43 m. 6 fr. 3 ck.

How many pieces of chintz may be bought for 500 ſa. r., whereof 9 pieces coſt 9 ſa. r. 7 an. 6 pa.? Anſ. 475 $\frac{25}{101}$ pieces.

What muſt be paid for 26 bags of pepper at the rate of 44 ſa. r. 6 an. for 7 bags?
Anſ. 164 ſa. r. 13 an. $1\frac{5}{7}$ pa.

How many yards of broad cloth may be bought for 700 ſa. r. 10 an.; 72 yards of which coſt 45 ſa. r. 9 an.? Anſ. 1106 yards 3 qrs. 0 $\frac{180}{729}$ nails.

What quantity of ſugar may be bought for 260 ſa. r. 10 an. when 43 mons 20 ſars, coſt 300 ſa. r. 6 an.? Anſ. 37 m. 29 fr. 11 $\frac{3879}{4806}$ ck.

A perſon failing in trade, owes in all 55000 ſa. r., and has property amounting to 2532 ſa. r. 14 an. 6 pa., ſuppoſing that ſum to be divided among his creditors, what will they get per rupee? Anſ. 8 $\frac{46318}{55000}$ pany; or 8.84 pany.

What muſt be given for a piece of ſilver weighing 73 lb. 5 oz. 15 dwts. troy, at the rate of 5 s. 9 d. per ounce? Anſ. 253 £ 10 s. 0 $\frac{3}{4}$ d.

Bought

Bought 3 cwt. 1 qr. 7 lb. of raiſins, what will they coſt at 2 £. 6 s. 6 d. per cwt. ?

Anſ. 7 £. 14 s. 0 $\frac{1}{4}$ d.

A Garriſon being beſieged has five months proviſion in it, at the rate of 12 oz. a day for each man, but being informed that it cannot be relieved till after 9 months, how much a day muſt each man have that the proviſion may laſt that time ?

Anſwer 6 $\frac{2}{3}$ oz.

What will the ground rent upon 846 r. 4 an. 6 pa. be, at the rate of 3 an. 3 pa. per rupee ? Anſwer 171 r. 14 an. 4 $\frac{186}{192}$ pa.

What quantity of ſilver may I have for 507 pag. 22 fan. at the rate of 22 fan. 50 caſh per oz. troy ? Anſwer 84 lb. 1 oz. 7 dwts. 9 $\frac{123}{181}$ grs.

What muſt be paid for 1 mon 20 ſr. 5 ck. of rice at 1 r. 2 an. per mon ?

Anſwer 11 r. 11 an. 1 p.

What quantity of rice may be bought for 5000 pagodas at 75 $\frac{1}{4}$ pagodas per garce ?

Anſwer 66 garce 18 par. 4 $\frac{648}{2718}$

A perſon failing in buſineſs owes to ſeveral perſons 9052 Bombay rupees, 3 qrs, 50 reas, but agrees with them to pay 2 qrs, 50 reas per rupee, what muſt he pay them in all ? Anſwer 5658 r. 0 qrs : 18 $\frac{1}{4}$ reas.

What muſt be paid for 7 Madras candies, 15 mons, 3 vis of ſugar at 4 pag. 2$\frac{1}{2}$ fan. per mon ? Anſwer 607 pag. 20 fan. 60 caſh.

A tradeſman failing in buſineſs, agrees with his Creditors to pay 12 an. 3 pa. per rupee, and at that rate pays them in all 5658 r. 15 an. 6 pa. what was the debt ?

Anſwer 7391 r. 4 an. 10.775 pa.

Bought 54 Bombay candies, 6 m. 5 ſr. of pepper, for 5000 B. r. 2 qrs. 56 re. what did it coſt per candy ? Anſwer 92 r. 0 qrs. 32 $\frac{38560}{43445}$ reas.

If the ground rent on 7052 ſa. r. 15 an. 6 pa. be 159 ſa r. 4 an. 5 pa., at what rate is it per rupee ? Anſwer 4 $\frac{455064}{1354170}$ pauy.

What muſt I pay for $\frac{1}{8}$ of a ſhip, which is valued at 70000 ſicca rupees.

Anſwer 262250 ſa. r ?

What will the carriage of 8 mons, 30 ſr. 3 ck, be, at 10 an. per ſar.

Anſwer 218 r. 15 an. 1.57 pa.

What coſt 30 pigs of lead, each weighing 1 By candy, 20 ſr. 5 pa. at 32 Bombay rupees per candy ? Anſwer 984 B. r. 0 qrs. 80 reas.

What muſt be paid for 450 Madras marcals of grain, at 75 ſt. pag. 15 fan. 20 caſh per garce ? Anſwer 84 pag. 34 fan. 2.5 caſh.

If 5 guz of cloth coſt 7 ſa. r. 2 an. what muſt I pay for 9 pieces, each containing 21 $\frac{1}{4}$ guz ? Anſwer 272 ſa. r. 8 an. 6 pa.

If

If a Gentleman's income be 3600 ſicca rupees a year, how much muſt he ſpend per month to ſave 1000 rupees a year? Anſwer 261 r. 10 an. 8 pa.

Suppoſe I buy 1 oz. of tea for $7\frac{1}{2}$ d. how much muſt I pay for 1 cwt? Anſwer £ 56.

Bought 75 cwt. 1 qr. 13 lb. tobacco, which coſt 387 £. 15 s. 8 d., how much did it coſt per lb. Anſwer 11 $\frac{217}{8441}$ d.

If 1 lb. of tobacco coſt $6\frac{1}{4}$ d, how much may be bought for 111 £. 15 s. 6 d.
Anſwer 35 cwt. 1 qr. 26 lb.

A Grocer bought 2 cwt. 1 qr. 14 lb. of cloves, which coſt him 32 £. 4 s. and he gained £. 5 by the bargain, at what rate did he ſell it per lb.
Anſwer 2 s. 9 d. $\frac{1}{2}$ $\frac{116}{266}$ grs.

Suppoſe I have by me 300 yards of Iriſh Linnen which coſt me £. 80, but ſome damage having happened to it, I am willing to loſe 6 £. 10 s. by the whole, at what rate then muſt I ſell it per yard. Anſwer 4 s. 10 $\frac{1}{4}$ $\frac{6}{30}$ d.

An Oilman bought 3 tons of oil, which coſt him 151 £. 14 s: it ſo chanced that it leaked out 85 gallons, but he is deſirous to ſell it again, ſo that he may be no loſer, how much muſt he ſell it for per gallon. Anſwer 4 s. 6$\frac{1}{4}$ $\frac{25}{671}$ d.

Suppoſe a Bankrupt owes £. 3000 and has in money, goods and recoverable debts 800 £. 12 s. 9$\frac{1}{2}$ d, now ſuppoſe thoſe things delivered to his Creditors what do they get per pound. Anſwer 5 s. 4 $\frac{615}{3000}$.

Suppoſe a perſon fails in trade and compounds with his Creditors to pay them 12 s. 6 d. in the pound; how much doth he owe, when all his caſh and effects amounts only £. 700. Anſwer 1120 £.

A woman bought 496 eggs at 2 for a penny, and 294 eggs at 3 for a penny, which ſhe ſold out together at 5 for two pence, I wiſh to know whether ſhe gained or loſt by the bargain and how much. Anſwer ſhe loſt 2 s. 6 d.

If 100 £. principal, gain 5 £. intereſt, in 12 months what will £. 40 gain in the ſame time. Anſwer £. 2.

A man ſold a parcel of cloths for 2 s. 10 d. per yard, on three months credit and found he gained 25 £. per cent. by them, what did they coſt him per yard.
Anſwer 2 s. 8 d.

I owe my khanſumah wages for 9 days, what muſt I pay him at the rate of 7 ſa. r. per month of 30 days. Anſwer 2 r. 1 an. 2 pn. 8 gun.

Bought 75 bazar mons, 5 ſr. 3 ck. of ſugar for 387 ſa. r. 15 an. 4 pa. beſides which the charges for godown rent, and cooly hire amounted to 29 ſa. r. 7 an., how much does it coſt per ſar. Anſwer 2 an. 2 p. $\frac{32082}{480833}$.

If $\frac{1}{4}$ of a yard coſt $\frac{2}{3}$ of a pound, what will $\frac{3}{5}$ of an Engliſh ell coſt at that rate.
Anſwer £. 2.

If $2\frac{2}{5}$ yards of cloth, coſt £. $3\frac{3}{4}$; what will $4\frac{4}{5}$ yards coſt at the ſame rate.

Anſwer 7 £. 10 s.

Bought 36 pipes of wine for 1221 ſa. r. 15 an. 4 pa., how may I ſell it per pipe to ſave one for my own uſe, and loſe nothing on the purchaſe.

Anſwer 34 ſa. r. 14 an. $7\frac{1}{3}$ pa.

What will 4 months and two days ſalary amount to at 275 ſa. r. per month.

Anſwer 1118 ſa. r. 5 an. 4 pa.

THE RULE OF THREE INVERSE.

EVERY queſtion in the rule of three may be divided into two parts, that is a ſuppoſition, and a demand, and of the three given number, two are always found in the ſuppoſition, and only one in the demand;

The rules given in the rule of three direct, are ſo framed as to preclude the diſtinction of direct, and inverſe, or to render it unleſs, the left hand term being always the diviſor: yet the direct queſtions being plainer in their own nature, and more eaſily comprehended by the Learner, I have exemplified the rules in a variety of queſtions of the direct kind, and ſhall now give a few of ſuch, as are inverſe.

When the diviſor happens to be the extreme found in the ſuppoſition, the proportion is called DIRECT; but when the diviſor happens to be the extreme in the demand, the proportion is called INVERSE.

EXAMPLES.

If 8 men can do a piece of work in 12 days, in how many days will 16 do the ſame?

If this queſtion the ſuppoſition is, If 12 men can do a piece of work in 12 days; and the two terms contained in it are 8 men, and 12 days; the demand lies in theſe words, In how many days will 16 men do the ſame? and the only term contained in it is 16 men.

16 . . . : . . . 12 . . . : . . . 8

8

—

16)96

—

Days 6 Anſwer.

—

It is obvious that the anſwer muſt be leſs than the middle term; for 16 men will do the work in fewer days than 8 men, and therefore by Rule 2. the greateſt extreme 16 is the diviſor, which I place on the left hand, and the other extreme on the right, then proceed as before; and becauſe the extreme found in the demand happens to be the diviſor, the proportion is inverſe.

If 30 yards of cloth that is 5 quarters broad, be required to hang a bed; how many yards of three quarters broad will ſerve the ſame purpoſe? Anſwer 50 yards.

If 1200 lb. weight be carried 36 miles for a ſum of money, how many miles ought 1800 lb. to be carried for the ſame ſum? Anſwer 24 miles.

If

If 100 £. in 12 months, gain a ſum of intereſt, what principal will gain the ſame ſum of intereſt in 8 months? Anſwer 150 £.

If I borrow of a friend 64 rupees for 8 months, what ſum ought I to lend him for 12 months, in order to requite the favor? Anſwer 42 r. 10 an. 8 pa.

If I lend a perſon 300 rupees for a year, how long ought he to lend 500 rupees to requite me. Anſwer 219 days.

COMPOUND PROPORTION,

OR

THE RULE OF FIVE DIRECT.

IS ſo called from its having five numbers or terms given to find a ſixth.

The given terms may be divided into two parts, viz. a ſuppoſition and a demand, three of which are always found in the ſuppoſition, and two in the demand.

The ſuppoſition and demand being diſtinguiſhed, proceed to ſtate the queſtion, that is, to put the terms in due order for operation, according to the following rules direct.

RULE 1.—Place that term of the ſuppoſition which is of the ſame kind as the number ſought, in the middle. The remaining terms are extremes, which muſt be claſſed into ſimilar pairs, by making each pair conſiſt of one term taken from the ſuppoſition and another of the ſame kind taken from the demand.

2.—Out of each ſimilar pair joined with the middle term, form a ſimple queſtion, and in each ſimple queſtion ſo formed, find the diviſor; viz. conſider from the nature of the queſtion, whether the anſwer muſt be greater or leſs, than the middle term; and if the anſwer muſt be greater, the leaſt extreme is the diviſor; but if the anſwer muſt be leſs than the middle term, the greateſt extreme is the diviſor.

3.—Place all the diviſors, on the left hand and the other extremes on the right, then multiply the diviſors or extremes on the left together for a diviſor; and multiply the extremes on the right hand and the middle term, continually for a dividend, and laſtly divide the dividend by the diviſor; and the quotient is the anſwer of the ſame name with the middle term. See General Rule in Simple Intereſt.

NOTE.

NOTE.—In every ſimple queſtion, when the diviſor is an extreme found in the ſuppoſition, the proportion is direct, but when the diviſor is an extreme found in the demand, the proportion is inverſe.

The three rules delivered above are ſo calculated as to make no difference between direct and inverſe, or ſo as to render that diſtinction needleſs, the left hand extremes being all diviſors, but yet, as queſtions conſiſting entirely of direct proportions, are the plaineſt and eaſieſt, I will, in the firſt place, exemplify the rules by queſtions of the direct kind; and afterwards introduce ſuch as are inverſe.

PROOF.—Is by two ſtatings in the ſingle rule of three; in the following manner viz.

The middle term with one pair of ſimilar extremes, make the firſt ſimple queſtion; and the anſwer to this queſtion, muſt be made the middle term to the next ſimilar pair of extremes, and the anſwer to the laſt ſimple queſtion is the anſwer; from thence, this rule is frequently called the DOUBLE RULE OF THREE.

But the joint operation preſcribed by Rule 3, is a ſhorter as well as eaſier method; for in working ſome of the ſimple queſtions there may happen to be a remainder, and conſequently the middle term of the next ſimple queſtion, will have ſome fractional part, which inconveniency is avoided by working jointly.

EXAMPLES.

If 14 horſes eat 56 buſhels of corn in 16 days, how many buſhels will 20 Horſes eat in 24 days.

	HORSES.	BUSHELS.	HORSES.
The ſuppoſition is; If 14 horſes, in 16 days, eat 56 buſhels of corn, and the three terms contained in it are, 14 horſes, 56 buſhels and 16 days; the demand is; How many buſhels will 20 horſes eat in 24 days? and the two terms contained in it are 20 Horſes, and 24 days. Now, the number ſought is buſhels, and the term in the ſuppoſition of the ſame kind is 56 buſhels, therefore by Rule 1. place it in the middle; then, the remaining four terms are extremes, which I claſs into ſimilar pairs, by making each pair conſiſt of one term taken from the ſuppoſition, and another of the ſame kind taken from the demand, thus, 14 horſes and 20 horſes, make one pair; again 16 days and 24 days make another pair.	14..	...56...	...20
	days 16		24 days.
	224		480
			56
			288
			240
			224)26880(120 buſh.
			0

Out

Out of the ſeveral ſimilar pairs, joined with the middle term, I form ſo many ſimple queſtions, according to rule 2, viz. I ſay

1.—If 14 horſes eat 56 buſhels in a certain number of days, how many buſhels will 20 horſes eat in the ſame time?

2.—If 16 days eat up or conſume 56 buſhels, how many buſhels will 24 days conſume?

In the firſt ſimple queſtion it is obvious, that the anſwer will be greater than the middle term, for 20 horſes, will eat more than 14 horſes will do in the ſame time, and ſo the leaſt extreme, 14, is the diviſor, and becauſe 14 is an extreme found in the ſuppoſition, the proportion is direct.

In the ſecond ſimple queſtion it is alſo plain, that the anſwer will be greater than the middle term, for 24 days will conſume more buſhels than 16 days; and conſequently the leaſt extreme 16, is the diviſor, and becauſe 16 is an extreme found in the ſuppoſition, the proportion is direct; proceed as directed in rule 3.

PROOF.

H.	B.	H.	DAYS.	B.	DAYS.
If 14 . : .	56 . ::: .	20	If 16 . : .	80 . ::	24
	20				80
	14) 1120 (80 B.				16) 1920 (120
	0			Anſwer 120 buſhels as before.	

You may contract your work in the manner preſcribed in the "ſingle rule of three"; thus;

14) $\frac{14}{56}=\frac{1}{4}$ . . . . . 1 . . : . . 4 . . :: . . 20

16) $\frac{16}{24}=\frac{1}{1\frac{1}{2}}$ . . . . . 1 . . : . . 30 . . :: . . $1\frac{1}{2}$.

Anſwer 120 30

If the intereſt of 100 ſicca rupees for 1 year or 365 days, is 12 rupees; what will be the intereſt of 5780 rupees for 120 days?

100 . : . 12 . : . . 5780
365 : 120

36500 693600
12
Sa. Rs.
365'00)83232'00(228 o 6 114/365
730
1023
730
2932
2920
12
16
365)192(o an.
12
365)2304(6 pa.
2190
Rem. 114

Contracted by Decimals, thus;

12)36500 : 12 : : 5780
3041.6 : 1 : : 120

3041.6) 603600.0(
3041 693600

27375) 6243400(228.0328
Rem. 21000

Anſwer Sa. Rs. 228.0328 &c.=o 6.3.

If 14 horſes eat 328 ſars of Gram in 16 days, how many ſars will 20 horſes eat in 24 days. Anſwer 702 ſars 13 160/224 cks.

If 40 beegahs of graſs be cut down by 8 men in 7 days; how many beegahs ſhall be cut down by 24 men in 28 days. Anſwer 480 beegahs.

If 6 men receive 40 ſa. r. 15 an. for 40 days work; how many men muſt be paid with 215 ſa. r. 3 an. for 16 days work. Anſwer 78 men.

If a carrier receive 42 ſhillings for the carriage of 3 cwt. 150 miles; how much ought he to receive for the carriage of 7 cwt. 3 qrs. 14 lb. 50 miles. Anſ. 1 £ 16 s. 9 d.

RULE OF FIVE INVERSE.

THE queſtions that fall under this rule, have commonly one of the proportions inverſe, and the other direct; and ſome times the upper and ſome times the lower, is the inverſe proportion; and in ſome few queſtions both proportions are inverſe. Though the three rules given in the "Rule

of

of five direct," make no difference betwixt direct and inverſe; yet, to bring the learner to an acquaintance with this uſeful diſtinction, I ſhall in ſtating the following queſtion, expoſe the ſame to view, by affixing an aſteriſk to the extremes of the inverſe proportion.

EXAMPLES.

If 14 horſes eat 56 ſars of gram in 16 days; in how many days will 20 horſes eat 120 ſars?

In this queſtion the ſuppoſition is; that 14 horſes, eat 56 ſars in 16 days; and the demand is, in how many days 20 horſes will eat 120 ſars.

*20	. : .	16	. : : .	14*		
56				120		
1120				1680		
				16		
				112'0)2688'0(24 days		

The number ſought is days, and the term in the ſuppoſition of the ſame kind is days 16, and accordingly I place 16 days in the middle. The remaining four terms are extremes, which I claſs into ſimilar pairs, by making each pair conſiſt of one term taken from the ſuppoſition and another of the ſame kind taken from the demand, thus: 14 horſes and 20 horſes make one pair; again 56 ſars and 120 ſars make another pair. Out of the ſimilar pairs, joined with the middle term, I form ſo many ſimple queſtions, namely,

1.—If 14 horſes eat a certain number of ſars in 16 days, in how many days will 20 horſes eat the ſame quantity?

2.—If 56 ſars are eat up in 16 days; in how many days will 120 ſars be eat up by the ſame eaters?

In the firſt ſimple queſtion it is plain that the anſwer muſt be greater than the middle term; for 20 horſes will eat the ſame number of ſars in fewer days than 14 horſes, and ſo the greateſt extreme, 20, is the diviſor; and becauſe 20 is an extreme found in the demand, the proportion is inverſe.

In the ſecond ſimple queſtion it is alſo obvious, that the anſwer muſt be greater that the middle term; for 120 ſars will require more days to be eat up in, than 56 ſars, and therefore the leaſt extreme, 56, is the diviſor; and becauſe 56 is an extreme found in the ſuppoſition, the proportion is direct; then multiply and divide as before direct.

Contractions. 560) $\frac{1120}{1680}=\frac{2}{3}$. 2) $\frac{2}{16}=\frac{1}{8}$

above ſtatement reſumed	1120	. . : . .	16	. . : :	1680	
contracted thus	2	. . : . .	16	. . : : . .	3	
or	1	. . : . .	8	. . : : . .	3	

Anſwer 24 days.

PROOF.—BY TWO STATINGS.

20 . . . : 16 : : . . 14: 11 days 4 h. 48 min.
56 . . . : 11 days . 4 h. 48 min : : 120 : 24
Anſwer 24 days.

If

If 40 beegahs of grafs be cut down by 8 men in 7 days; in how many days will 480 beegahs be cut down by 24 men. Anfwer 28 days.

If 100 £. principal in 12 months, gain 5 £. intereft; what principal will gain 2 £. 16 s. 3 d. intereft in 9 months. Anfwer £. 75.

If a carrier receive 42 fhillings for the carriage of 3 cwt. 150 miles; how many miles ought he to carry 7 cwt. 3 grs. 14 lb. for 36 s. 9 d. Anfwer 50 miles.

If 8 men in 5 days earn 40 fhillings wages, in how many days will 32 men earn 38 £. 8 s. Anfwer in 24 days.

If a perfon travels 300 miles in 10 days, when the day is 12 hours long; in how many days may he travel 600 miles, when the day is 16 hours long. Anf. 15 days.

PRACTICE.

PRACTICE derives its name from its general ufe among merchants and others concerned in trade and bufinefs.

All queftions in the Rule of three, where the firft term is one or 1, may be performed by this rule, in a more concife way, by taking aliquot or even parts, by which means many tedious reductions may be avoided; but as there are great variety of fuch parts, fo many therefore are the ways of applying them, that it would be an endlefs talk, to give all the eafy methods of operation adapted to every particular cafe, fo I fhall only give the general rules with a fufficient number of Examples to each.

A number which meafures another is called an aliquot part; as, 4 pauy is $\frac{1}{3}$ of one anna or 12 pauy; 2 annas is $\frac{1}{8}$ of a rupee or 16 annas; 10 fars is $\frac{1}{4}$ of a mon, or 40 fars; &c.

PROOF.—You may prove your work by Decimals, or by the Rule of three.

1.—When the price is lefs than one anna.

RULE.—Take the aliquot part or parts that are in one anna; add them together and the fum will be the anfwer in annas, which divided by 16 (annas in a rupee) will give the anfwer.

NOTE.—Queftions in any other money are computed after the fame method, obferving to take aliquot parts of the next higher denomination.

EXAMPLES.

EXAMPLES.

What muſt I pay for 1762 ſars of Rice at 1 pauy per ſar?

Here, 1 pa. is the $\frac{1}{12}$th part of an anna, therefore divide the given quantity 1762 by 12 and the quotient is 146 an. 10 pa.; which divided by 16 gives the anſwer 9 r. 2 an. 10 pa.

1 pa. ..is.. $\frac{1}{12}$ 1762

16)146 10

Anſwer Rs. 9 2 10

OR THUS

1 pa. is equal to .0052083

1762

104166

3125000

36458333

52083333

Rs. 9.177083

16

Anſwer 2.83

12

Pa. 10.0 Anſwer 9 r. 2 an. 10 p. as before.

What muſt I pay for 1762 lb. of Pepper at 5 pauys per lb.

In this example 5 pa. the given price is not an even part of one anna, it muſt therefore be divided into even parts, thus: firſt I take $\frac{1}{3}$ for 4 pa.; that is I divide the given quantity by 3, which gives 587 an. and 1 an. over, equal to 12 pa., and that divided by 3 gives 4 pa. and makes the quotient 587 an. 4 pa.; then I take $\frac{1}{12}$ for 1 pa. which gives 146 an. 10 pa.; thoſe quotients added together make 734 an. 2 pa., and that ſum divided by 16 gives the anſwer 45 r. 14 an. 2 pa.

P		1762	
4 is	$\frac{1}{3}$	587	4
1 is	$\frac{1}{12}$	146	10
5	16)	734	2
Anſwer Rs.		45	14 2

PROOF.

PROOF.

THUS

lb. pa. lb.
If 1 coſt 5 .. what will 1762 coſt

5

12)8810

16) 734 2

Anſwer Rs. 45 14 2

OR THUS.

5 pa. is equal to .0260416

1762

520833
15625000
182291666
260416666

Rs. 45.885416

16

an. 14.16

12

pa. 2.0 Ans. 45 r. 14 an 2 pa.

What will 1762 Limes coſt at 11 pauys each ?

This queſtion requires three aliquot or even parts ; thus ; firſt, take $\frac{1}{2}$ for 6 pa.; then $\frac{1}{3}$ for 4 pa.; and then $\frac{1}{12}$ for 1 pa.; preceed as before and the anſwer is 100 r. 15 an. 2 pa.

1762

6 is $\frac{1}{2}$ 881

4 $\frac{1}{3}$ 587 4

1 $\frac{1}{12}$ 146 10

Pa. 11 16)1615 2

Ans. Rs. 100 15 2

PROOF.

PROOF.

Lime Pa. Limes
If 1 : coſt 11 :: what will 1762 coſt.
11

12)19382

16)1615 2

Anſwer. Rs. 100 15 2

or thus
11 pa. is equal to .0572916
1762

1145833
34375000
401041665
572916666

Rs. 100 947916=15 2

An. 15.16
12

Pa. 2.0

What will 756 mangoes coſt, at 2 pauys each? Anſwer 7 r. 14 an.

What will 7050 cocoanuts coſt, at 3 pauys each? Anſwer 110 r. 2 an. 6 pa.

What will 672 peaches coſt, at 4 pauys each? Anſwer 14 r.

What will 576 fiſh coſt, at 27 reas each. Anſwer 38 r. 3 qrs. 52 reas.

What will 767 plumbs coſt, at $\frac{1}{4}$ d. each? Anſwer 2 £ 7 s. $11\frac{1}{4}$ d.

What will 767 walnuts coſt, at 45 caſh, each? Anſwer 9 pag. 26 fan. 35 c.

2.—When the price is leſs than a rupee.

RULE.—Take the aliquot part or parts that are in a rupee, add as in the laſt caſe, and the ſum is the anſwer; but when the given price is in pence, divide the ſum by 20, which gives the anſwer in pounds, &c. See Note, in the foregoing caſe.

EXAMPLES.

What will 1762 yards coſt 6 annas per yard?

Here, I take $\frac{1}{4}$ for 4 an.; becauſe 4 an. is $\frac{1}{4}$ of a rupee or 16 annas; then, for the ſame reaſon, I take $\frac{1}{8}$ for 2 an.; or, it would be the ſame if I took $\frac{1}{2}$ of the quotient of 4 an., becauſe 2 an. is $\frac{1}{2}$ of 4 an.

1762

4 an. is $\frac{1}{4}$ 440 8
2 an. is $\frac{1}{8}$ 220 4

Anſ. Rs. 660 12

PROOF.

PROOF.

If 1 yd. : 6 an. :: what will 1762 yards. coft.

1762
6
16) 10572
Anſ. Rs. 660 12 0

or thus

1762
6 an. is equal to .375
Rs. 660.75
or 660r. 12 an.

NOTE.—When the given price conſiſts of annas and pauys, you may multiply the given quantity by the annas, and take aliquot parts of an anna, for the pauys, as before.

1762 ſars at 5 an. 3 pa. per ſar?

Here, I take $\frac{1}{4}$ for 4 an.; and $\frac{1}{4}$ of 4 an. for 1 an. alſo, for 3 pa., I take $\frac{1}{4}$ of 1 an., all which added together gives the anſwer, 578 r. 2 an. 6 pa.

a.	p.		1762
4	... is ..	$\frac{1}{4}$ ..	440 8
1	.....	$\frac{1}{4}$ ..	110 2
0	3	$\frac{1}{4}$	27 8 6
5	3		Rs. 578. 2 6

or thus.

1762
5 an.
8810
p. 3 is $\frac{1}{4}$ 440 6
16)9250 6
Rs. 578 2 6 Anſ.

Proof

If 1 r : 5 3 :: 1762
12 63
63 5286
10572
12)111006
16 9250 6
Rs. 578 2 6

or thus.

5 an. 3 p. = .328125
1762
Rs. 578.156250
16
an. 2.5
12
pa. 5.0
or 578r. 2an. 6.

3741 yards at 5 an. 4 pa. per yard.

It frequently happens that the given price in annas and pauys, is an aliquot part of a rupee (as in this example), in which caſe divide by the aliquot part and the quotient is the anſwer.

a.	p.		3741
5	4	is $\frac{1}{3}$	1247 Rs. Anſ.

1762 ſars at 3 an. 3 pa. per ſar. Anſwer 357 r. 14 an. 6 pa.

1762 ſars at 4 an. 6 pa. per ſar. Anſwer 495 r. 9 an.

1762 ſars at 7 an. 9 pa. per ſar. Anſwer 853 r. 7 an. 6 pa.

1762 ſars at 15 an. 4 pa. per ſar. Anſwer 1688 r. 9 an. 4 pa.
1762 ſars at 21 an. 5 pa. per ſar. Anſwer 1257 r. 4 an. 2 pa.
1762 vis at 16 fanams per vis. Anſwer 626 pag. 22 fan.
1762 vis at 15 fan. 20 c. per vis. Anſwer 597 pag. 5 fan. 40 c.
7550 ſars at 3 qrs. of a rupee per ſar. Anſwer 5662 Bom. r. 2 qrs.
7550 ſars at 2 qrs. 27 reas per ſar. Anſwer 4284 Bom. r. 2 qrs. 50 reas.
6780 lb. at 1¼d. per lb. Anſwer 45£. 8s. 9d.
6780 lb. at 2¼d. per lb. Anſwer 70£. 12s. 6d.
6780 lb. at 7¼d. per lb. Anſwer 218£. 18s. 9d.
6780 lb. at 11¼d. per lb. Anſwer 324£. 17s. 6d.
6780 lb. at 2s. 6¼d per lb. Anſwer 86 £. 13s. 9d.
5620 lb. at 8 an. 6 pa. per lb. Anſwer 2985 r. 10 an.
5620 lb. at 41 fan. 15 c. per lb. Anſwer 5143 pag. 8 fan. 60 c.
5620 lb. at 3 qrs. 20 reas. per lb. Anſwer 4496 Bom. r.
5620 lb. at 15s. 7½d. per lb. Anſwer 4390£ 12s. 6d.

3.—When the price is given in rupees.

RULE.—Multiply the given quantity by the price; the product is the anſwer.

EXAMPLES.

What will 825 ſars coſt at 25 rupees per ſar?

25

Rs. 20625 Anſwer.

165 lb. at 46 pagodas per lb. Anſwer 7590 pagodas
157 lb. at 15 £. per lb. Anſwer 2355 £.

4.—When the given price is in Rupees; Pagodas, &c. and their fractional parts; as, annas and pauy; fanams and caſh; &c.

RULE.—Multiply the given quantity by the rupees, and take aliquot parts for the annas and pauy, according to caſe 2. See Note, caſe 1.

EXAMPLES.

What will 5040 Sheep coſt at 4r. 12 an. each?

		4	If 1 4	12 5040	*PROOFS.*
		20160	16	76	R. A. 5040
an. 8	½	2520			4 12 = 4.75
4	½	1260	76	16)383040	Rs. 23940.
Anſwer . . Rs.		23940	Anſ. Rs.	23940	

What

What will 1525 yards cost, at 6 r. 11 an. 10 pa. per yard?

PROOFS.

		1525		If 1 . . . . : 6 11 10 . . . . . . : : . . 1525		
		6		16		1294
An. pa.		9150		107		12) 1973350
8 — is	½	762	8			
2 —	¼	190	10	12		16) 164445 10
1 —	½	95	5			
— 6	½	47 10	6	1294		Rs. 10277 13 10 Answer
— 4	⅓	31 12	4			
11 10	Rs.	10277 13	10			

A. an. pa. or thus.

6 11 10 = 6.739583
1525 Rs. a. p.

Rs. 10277.8645 &c. or 10277 13 10

yards.		rs.	an.	pa.	
731	at	6	8	0 per yard.	Answer 4751 r. 8 an.
1924	at	9	12	0 ———	Answer 9009 r.
812	at	8	1	0 ———	Answer 6546 r. 12 an.
6418	at	2	5	0 ———	Answer 14841 r. 10 an.
200	at	7	1	4 ———	Answer 1416 r. 10 an. 8 pa.
739	at	6	3	9 ———	Answer 4607 r. 3 an. 3 pa.
729	at	7	3	11 ———	Answer 5281 r. 7 an. 3 pa.
900	at	9	15	11 ———	Answer 8995 r. 5 an.
641	at	31	5	4 ———	Answer 20084 r. 10 an. 8 pa.
1525	at	5£.10s.6d.		———	Answer 8425 £. 12 s. 6. d.

5.—When the given quantity is less than 12; or such a number that any two figures in the multiplication table being multiplied together will produce it.

RULE.—Multiply the given price, by the given quantity, or by the component parts, by cases 2 and 3 in compound multiplication.

EXAMPLES.

What will 50 Cows cost at 10 r. 8 an. 6 pa. each?

thus

THUS

	10	8	6
			5
5=10×50			
	52	10	6
			10
Ans. Rs.	526	9	0

OR THUS.

50	–	–
10	–	–
–	–	–
500	–	–
8 a. ½	. 25	– –
6 pa. 1/16	. 1	9-0
Rs.	526	9 0

PROOF.

If 1			10	8	6 50
			16		2022
			168		12)101100
			12		16)8425
			2022		Rs. 526 9 0

11 maunds at 17 r. 14 an 6 pa. each. Ans. 196r. 15 an. 6 pa.
8 maunds at 64 r. 10 an. 8 pa. each. Ans. 517 r. 5 an. 4 pa.
55 maunds at 14 r. 6 an. 2 pa. each. Ans. 791 r. 3 an. 2 p.
144 maunds at 19 r. 15 an. 7 pa. each. Ans. 2876 r. 4 an.
45 maunds at 20 pag. 20 fan. each. Ans. 920 pag.
36 maunds at 50 Bom. r. 3 qrs. each. Ans. 1827 Bom. Rs.
56 maunds at 5 £. 14 s. 6¼ each. Ans. 320 £. 15 s. 6 d.

6.—When both the price and quantity given conſiſt of ſeveral denominations; as, mons, ſars, &c.; and rupees, annas, &c.

R U L E.—Multiply by the price of quantity given, and take aliquot parts for the ſars, &c.; add them together, and the ſum will be the anſwer.

E X A M P L E S.

What is the value of 18 mons, 15 sr. 14 ck. at 6 r. 5 an. 4 pa. per mon?

		R.	an.	pa.
		6	5	4
2×9=18.				2
		12	10	8
				9
sar	ck	114	0	0
10	½	1	9	4
5	¼	12		8
8	1/10	1		3.2
4	½			7.6
2	¼			3.8
15	4	Rs. 116	8	2.6 Anſwer.

If

If 1 . . . 6-5-4 . . . . . 18 15 14

40	16	40
40	101	735
16	12	16
640	1216	11774
		1216

640)14317184(12)22370

Rem. $\frac{384}{640}$=.6 16).1864 2

Rs. 116 8 2

and pa. 5 . 4=6. $\frac{3}{6}$ num. 57 den. 9

OR THUS.

18. 3969=15 fr. 14 ck.
57

9)1048.6233

Rs. 116.5137

or Rs. 116 8 2.5

See. Cafe 5 Multiplication of Decimals .

Mons	fr.	ck.				
55	18	5	at 14 an.	5 pa.	per mon.	Anſwer 49 r. 15 an. 6 pa.
77	25	15	at 4 r.	6 an.	per mon.	Anſwer 339 r. 11 an. 4.6 pa.
99	1	4	at 8 r.	8 an.	per mon.	Anſwer 84 r. 12 an. 3 pa.
6	2	8	at 5 r.	4 an.	per mon.	Anſwer 31 r. 13 an. 3 pa.
12	8	4	at 72 r.	8 an.	per mon.	Anſwer 884 r. 15 an. 3 pa.
	5	2	at 25 r.	8 an.	4 pa. per mon.	Anſwer 3 r. 4 an. 3 pa. $\frac{8}{10}$

When the integer of the given quantity is large and ſuch a number that no two figures in the multiplication table being multiplied together will produce it.

Work for the price of the integers as already taught in cafe 4; then take aliquot parts of the given price, with the fars, &c. add them together and the ſum will be the anſwer.

Bought 5750 mons, 16 fars of rice at 2 r, 3 an, 6 pa, per mon: what does the whole amount to?

Mons

	Mons.	sar.		Mn.	R.	AN.	PA.	Mons.	sacs.	
	5750	16		If 1		2	3 6	5750	16	
	2			40		16		40		
	11500			40		35		230016		
2an. $\frac{1}{8}$	718	12				12		426		
1 $\frac{1}{16}$	359	6								
6p. $\frac{1}{2}$	179	11				426		4,0)9798681,6		
8sr. $\frac{1}{5}$		7	1.2					12)2449679	$\frac{16}{40}$=.4	
8 $\frac{1}{5}$		7	1.2					16) 204139	2	
Rs.	12758	11	2.4 Anſwer.					Rs.	12758 11	2.4

PROOF.

OR THUS.

2 r. 3 an. 6 pa. is equal to 2.21875
5750 m. 16 r. ——— 5750.4

Anſwer . . . . Rs. 12758.70 or Rs. 12758 11 2.4

NOTE.—When the decimals extend to many places, ſhorten your work, according to Caſe in multiplication of decimals.

What will 420 oz. 15 dwts. 16 grs. troy, coſt, at 3 £. 16 s. 10½ d. per ounce? Anſwer 1617 £. 7 s. 8½ d.

What muſt I pay for 15 mons, 4 pat. 3 ſr. 2 po. 2 ck. 2 khaa., at 4 r. 15 an. 3 pun. per mon? Anſwer 77 r. 11 an. 1 pn. 13 gun.

What muſt I pay for 6 mons, 39 ſr. 3 po. 3 ck.; at 25 r. 6 an. 3 pun. per mon? Anſwer 177 r. 14 an. 2 pn. 9 gun.

5 Madras candy, 10 mon; at 69 pag. 15 fan. per candy. Anſwer 381 pag. 15 fan.

75 garce, 50 par.; at 75 pag. 20 fan. per garce. Anſwer 5705 pag. 21 fan. 70 C.

5 Bombay candy, 5 mon; at 75 r. 3 qrs. 50 reas per candy. Anſ. 398 R. 1 q. 37 r.

14 cwt. 2 qrs. 21 lb. at 3 £. 17 s. 6 d. per cwt. Anſwer 56 £. 18 s. 3¼ .5 d.

73 ton. 17 cwt. 2 qrs, at 9 £. 12 s. 10 d. per tun. Anſwer 712 £. 5 s. 6¼.

Money of the ſame denomination, may be multiplied together as follow:

Multiply

Multiply £. 19 19 11 ¼ by £. 19 19 11 ¼.

£.	s.	d.	
19	19	11 ¼	
		3	3×64+1=19
59	19	11 ¾	
		6	
359	19	7 ½	
19	19	11 ¼	
379	19	7 ¼	

s.	d.				
10	....	½	.....	9 19 11	¼.5
5	....	¼	.....	4 19 11	¼.75
4	....	1/5	.....	3 19 11	¼.8
10	..	1/6	.....	16 7	¼.9583
1	..	1/10	.....	1 7	¼.99583
½	.	½	.....	9	¼.99791
¼	.	½	.....	4	¼.99895
19 11 ¼				£. 399 19 2	.001 Anſwer.

By Decimals.

See. Cafe 6 in multiplication of decimals.

4) ¼.

12) 11.75

20) 19.9791666

£. 19.9895833 equal to £. 19 19 11 ¼

19.9895833
19 9989 58

179990625 Numerator

9000000 Denominator

19.9989583
179990625

999947916
3999791666
119993750000
1799906250000
17999062500000
179990625000000
1799906250000000
139992708333333333
19998958333333333

9)3599625009.7656250

Rs. 399.95833441840 27 or Rs. 399 19 2.001.

After dividing by 9. I divide by 1000000, which is done by removing the decimal point six places to the left.

You may ſhorten your work by caſe in multiplication of decimals; or by the contractions, directed in the rule of three. thus:

As 9000000 : 179990625 :: 19.9989583 : 399.95 &c.
Or .0500026 . : . . . . 1 . . . . :: 19.9989583 : 399.95 &c.

Here. I form the contraction by dividing the firſt and ſecond terms, by the ſecond term.

BY VULGAR FRACTIONS.

£. 19 19 11 $\frac{3}{4}$ is equal to 19 $\frac{959}{960}$ or $\frac{19199}{960}$, multiplied by $\frac{19199}{960}$ gives $\frac{368601601}{921600}$ which is equal to £. 399 19 2 $\frac{1960}{1}$ or .001 Anſ. as before.

BATTA.

THE difference in value between any kind of rupee and currency or current rupees (which is an imaginary coin), or between one kind and another is called BATTA.

There are many kinds of ſilver rupees in Bengal, but the ſicca rupee is alone uſed or current in payments in buſineſs, and is meaned in all kinds of dealings or tranſactions, where it is not otherwiſe particularly expreſſed. See tables of Bengal Money.

A comparative view of the relative value of ſeveral denominations of rupees.

		C. R.	A.		S. R.	A.	P.
100 Sicca rupees	are equal to	116	.	or	100		
100 Arcot rupees	———	108	.	—	93	1	7.86
100 Bombay (Soortee) rupees .		110	.	—	94	13	2.895
100 Sunnaut rupees		111	.	—	95	11	0.446
100 Furruckabad rupees . .		112	8	—	96	15	8.7
100 Lucnow rupees		113	8	—	97	13	6.2
100 Current rupees		100	.	—	86	3	3.725

Miſtakes are frequently made by individuals in the calculation of BATTA, ariſing from their ignorance of the proper method or proportion between different kinds of rupees; for inſtance, in reducing current rupees into ſicca or 16 per cent rupees, they are apt to deduct 16 per cent. which makes 100 current, equal to 84 ſicca rupees, inſtead of 86 ſa. r. 3 an. 3.725 pa.; again, in reducing Arcot or 8 per cent rupees, into ſicca; or vice verſa; they are apt to add or deduct the difference in the centage, that is, 8 per cent; in which caſe 100 arcot rupees would be equal to 92 ſicca rupees, inſtead of 93 ſa. r. 1 an. 7.86 pa.; or, 100 ſicca be equal to 108 Arcot rupees, inſtead of 107 a. r. 6 an. 6.2 p.; and ſo on with the other kinds; they are therefore liable to be egregiouſly impoſed upon, which may be very eaſily obviated by attention to the following rules, which are deduced from this proportion, viz.

As the centage of the required rupees, added to 100:
Is to the centage of the given rupees, added to 100::
So is the given ſum: to the anſwer.

GENERAL RULE.

Multiply the given ſum by the centage of the given rupees added to 100. or by the component parts, according to caſes 2 and 3 in compound multiplication; then divide the product, by the centage added to 100, of the rupees you would have it reduced to, or if practicable by its component parts, according to caſe 2 in compound diviſion; and the quotient will be the anſwer.

NOTE.—You may contract your work as directed in the rule of three.

1.—To reduce ſicca or 16 per cent. rupees, to current rupees.

RULE.—Multiply the given ſum by 116, and divide the product by 100, the quotient will be the anſwer.

EXAMPLES.

Reduce 79 ficca rupees, to current rupees.

By Rule . . . . . as 100 . . . : . . . 116 . . . :: 79

$\frac{100}{116} = \frac{25}{29}$

Contractions:

23) $\frac{25}{79} = \frac{1}{3.16}$

25) $\frac{25}{29} = \frac{1}{1.16}$

29) $\frac{25}{29} = \frac{.862069}{1}$

25 . . . : . . . . 29 . . . :: 79

1 . . . : . . . . 29 . . . :: 3.16

1 . . . : . . . 1.16 . . . :: 79

.862069 . . . : . . . . . 1 . . . :: 79

BY THE RULE.

79
116

474
809

91,64
16
---
an. 10,24
12
---
p. 2,83

Anf. C. R. 91 10 2.88

BY RRACTICE.

79				
10 . . . $\frac{1}{10}$	7	14	4.8	
5 . . . $\frac{1}{2}$	3	15	2.4	
1 . . . $\frac{1}{5}$		12	7.68	
Currt. Rs.	91	10	2.88	Anſwer.

Reduce 79 ſa. r. 14 a. 3 p. to current rupees.

BY RULE.

79	14	3	
		9	9×12+8=116
719	0	3	
		12	
8628	3	0	
639	2	0	
10)9267	5	0	10×10=100.
10) 926	11	8	
C. Rs. 92	10	9.24	Anſwer.

OR THUS.

79	14	3	
		4	4×7+1=29
319	9	0	
		7	
2236	15	0	
79	14	3	
5)2316	13	3	5×5=25
5)463	5	10.2	
C. R. 92	10	9.24	

OR THUS. SA. P.

79.890625=14 3
1.16

R. 92.673124 or R. 92 10 9.24
16

A. 10.769984
12

P. 9.239 &c.

BY PRACTICE.

	79	14	3
10 . $\frac{1}{10}$.	7	15	9.9
5 . $\frac{1}{2}$.	3	15	10.95
1 . $\frac{1}{5}$.		12	9.39
	92	10	9.24

In 746 ficca rupees, how many current rupees? Anſ. 865 r. 5 an. 9.12 p.
In 576 ſa. r. 15 an. 11 p. how many current rupees. Anſ. 669 r. 5 an. 0.28 p.
Reduce 9 an. 3 p. ficca, to currency. Anſwer. 10 a. 8.76 p.

2.—To reduce current rupees to ficca rupees.

RULE.—Multiply the given ſum by 100, and divide the product by 116; the quotient will be the anſwer.

EXAMPLES.

Reduce 100 current rupees to ficca rupees.

BY RULE.

100
100

sa. r. a. p. 84
116)10000(86 3 3 116 Anſ.
928

720
696

24
16

116)384(3 an.
348

36
12

116)432 (3 p.
348

84 rem.=.7

CONTRACTED, SEE CONTRACTIONS LAST CASE. 2R.

.862069
100

Sa. R. 86.2069
16

a. 3.3064
12

p. 3.67 &c.

Sa. R. 86 3 3.8

OR THUS.

116) 10000. (86.2068=3 3.7

Rem. 112

Reduce

Reduce 5 c. r. 5 an. 6 p. to sicca rupees.

By general rule

20 × 16 = 100

5 5 6
10

53 7 0
10

Sa. R. a. p.

116)534 6 0(4 9 8 56/116
464

70
16

116)1126(9 a.
1044

82
12

116)984(8 p.
928

56

BY DECIMALS.

12)6.

16)5.5

a. p.
5.34375 = 5 6
100

Sa. R. a. p.
116)534.375(4.606 = 9 8
464 16

703 9.696
696 12

775 8.3 &c.
696

79

ON THUS.

5 5 6
5

26 11 6
5

S. R. a. p. 14
29)133 9 6(4 9 8 29/29
116

17
16

29)281(9 a.
261

20
12

29)246(8 p.
232

14

OR THUS, SEE FORFGOING EX.

5.34375
960168 inverted

4275000
320625
10687
321
48

4.6066 &c. or Sa. R. 4 9 8.4

Reduce

Reduce 1331 c. r. 8 a. 10 p., to ſicca rupees. Anſwer 1147 ſa. r. 14 an. 2 $\frac{96}{116}$ p.

Reduce 10985 c. r. 3 a. 2 p., to ſicca rupees. Anſwer 9469 ſa. r. 15 an. 11 $\frac{76}{116}$ p.

Reduce 14 an. 6 pa. currency, to ſicca. Anſwer 12 an. 6 p.

3.—To reduce Arcot (8 per cent.) rupees, to ſicca (16 per cent.) rupees.

RULE.—Multiply the given ſum by 108, and divide the product by 116, the quotient will be the anſwer.

EXAMPLES.

Reduce 589 arcot rupees to ſicca rupees.

BY RULE. . . . As 116 . . : . . 108 . . : : . . 589

CONTRACTIONS
- 29 . . : . . 27 . . : : . . 589 — $27)\frac{29}{27} = \frac{1.074}{1}$
- 1.074 . . : . . 1 . . : : . . 589 — $29)\frac{29}{27} = \frac{1}{.93103}$
- 1 . . : .93103 . . : : . . 589

BY RULE.

589
108
4712
5890
116)63612 (548 Sa.R. 6 a. 0 p. $\frac{96}{106}$
580
561
464
972
928
44
16
116)704(6 a.
696
8
12
116)96(0 $\frac{96}{116}$ p.

OR THUS.

589
27
4123
1178
29)15903 (548 Sa. R. 6 a. 0 p. $\frac{24}{29}$
145
140
116
243
232
11
16
29)176(6 a.
174
2
12
29)24(0 $\frac{24}{29}$ pa.

THUS;

THUS;

1.074)589.000
1 589

1073)5898411(548.379 &c.
5365
5191
4292
8991
8584
4070
3219
8510
7511
9990
9657
333

CONTRACTED

sa. rs.
16
6.064
12
.768

fa. r. 548 6 0.7?

Note. See case 4 in division of decimals.

OR THUS.

.93103
589
837927
744824
465515
548.37667
16
6.02672
12
0.32064

fa. r. 548 6 0.3 &c.

In 581 a. r. 0 a. 4 p., how many sicca rupees.

BY THE RULE

581 0 4
9
5229 3 0
12
fa. r. a. p.

9×12=108

116) 627504 4 0 (540 15 2 56/116
rem. 56

OR THUS

581 0 4
3
1743 1 0
9
fa. r. a. p.

3×9=27

29) 15687 9 0 (540 15 2 14/29
rem. 14

BY DECIMALS.

CONTRACTED.			OR THUS.	
1.0074) 581.0208=0 a. 4 p.			581.0208	
1 5810208			.93103	
1073) 580439.7792	(540.9504	sa. rs.	540.947895	&c.
		or		or
See. caſe 4 in diviſion of decimals.		ſa. r. 540 15 2	540 15 1.90	&c.

In 100 arcot rupees, how many ſicca rupees. Anſwer 93 ſa. r. 1 an. 7.86 p.

Reduce 15 an. 3 p. arcot, to ſicca. Anſwer 14 an. 2.37 p.

Reduce 576 a. r. 13 an. 6 p., to ſicca rupees. Anſwer 537 ſa. r. 0 a. 11.82 p.

Reduce 1 arcot rupee, to ſicca. Anſwer 14 an. 10.55 p.

4.—To reduce ſicca (16 per cent.) rupees to Arcot (8 per cent.) rupees.

RULE.—Multiply the given ſum 116 and divide the product by 108, and the quotient will be the anſwer.

EXAMPLES.

Reduce 548 ſicca rupees to arcot rupees.

BY THE RULE.				OR THUS.			
548				548			
116				29			
	a. r.	a.	p.		a. r.	a.	p.
108) 63568	(588	9	$5\frac{84}{108}$	27) 15892	(588	9	$5\frac{21}{27}$
rem. 84				Rem. 21			

BY

BY DECIMALS.

See, contractions in the foregoing case.

THUS

1.074
548
8592
42962
537037
588.592 or A. R. 588 9 5.7
16
9.480
12
5.764

See, case 4 in multiplication of decimals.

OR THUS. A. R.

.93103)548.00000(588.595 or A. R. 588 9 6
Rem. 30715

BY PRACTICE.

54800
10. 1/10 . 5480
5. 1/2 . 2740
1. 1/5 .. 548
9)63568
12) 7063 1 9.3
A. R. 588 9 5.7 Ans.

Reduce 540 sa. r. 15 an. 3 p. to arcot rupees.

BY GENERAL RULE.

	540	15	3
5×11+6=116			10
9×12=108	5409	8	6
			11
	59504	13	6
	3245	11	6
	9) 62750	9	0
	12) 6972	4	6
	A. R. 581	0	4.5 Anf.

OR THUS.

	540	15	3
4×7+1=29			4
3×9=27.	2163	13	0
			7
	15146	11	0
	540	15	3
	3) 15687	10	3
	9) 5229	3	5
	A. R. 581	0	4.5

BY

BY DECIMALS.

THUS.

540.9531
29

3×9=27. 3) 15687.6399

9) 5229.2133

A. R. 581.0237 or A. R. 581 0 4.5 Anf.

OR THUS; SEE CONTRACTIONS CASE 3.

.93103) 540.95310 (581.026 &c.

rem. 46322 or

Anf. A. R. 581 0 4.9

Reduce 100 ficca rupees, to Arcot rupees. Ans. 107 ar. r. 6 an. 6.2 p.
Reduce 15 an. 3 p. ficca to Arcot. Anfwer 1 a. r. 0 an. 4.55 p.
Reduce 72 fa. r. 9 an. 7 p. to Arcot rupees. Anfwer 77 a. r. 15 an. 7.5 p.
Reduce 1 ficca rupee, to Arcot. Anfwer 1 a. r. 1 an. 2.2 p.

5.—To reduce funnaut (11 per cent.) rupees, to ficca (16 per cent.) rupees.

R U L E.—Multiply the given fum by 111, and divide the product by 116, the quotient will be the anfwer.

E X A M P L E S.

Reduce 333 funnaut rupees, to ficca rupees.

CONTRACTIONS:

As . . . 116 . . . : . . . 111 . . . : : . . 333

Or . . 1.045 . . . : . . . 1 . . . : : . . 333 $111)\frac{116}{111}=\frac{1.045}{1}$

Or . . . 1 . . . : .95689 . . . : : . . 333 $116)\frac{116}{111}=\frac{1}{.95689}$

BY RULE.

333
111
——Sa.R. a. p.
116)36963 (318 10 3 $\frac{32}{116}$
348
——
216
116
——
1003
928
——
75
16
——
116)1200(10
1160
——
40
12
——
116)480(3 $\frac{32}{116}$
348
——
32
——

BY DECIMALS, THUS,

1.045) 333.000
1 333
——— ——— sa. rs.
1044) 332667 (318.6465 &c.
——— or
rem. 576 318 10 3 &c.
——— ———

See, diviſion of decimals caſe 4.

OR THUS:

.95689
333
———
Sa. Rr 318.64 &c. or Sa. Rs. 318 10 3
———— ————

In 52 ſun. r. 3 an. 5 p., how many ſicca rupees.

BY GENERAL RULE.

52 3 5
10×11+1=111
——— —
522 2 2
11
———
5743 7 10
52 3 5
——— ſa. r. a. p.
116)5795 11 3 (49 15 4 $\frac{100}{116}$ Anſ.
———
100
———

BY DECIMALS, SEE LAST EXAMPLE.

52.21343
98659 inverted
———
46992087
2610672
313281
41771
4699
——— ſa. r. an. p.
Anſ. Sa. Rs. 49.962510 or 49 15 4 &c.
———— ———

Reduce 100 ſunnaut rupees, to ſicca rupees. Anſwer 95 ſa. r. 11 an. 0.4 &c. p.

Reduce 79 ſun. r. 15 an. 9 p. to ſicca rupees. Anſwer 76 ſa. r. 8 an. 7 p.

EXCHANGE

EXCHANGE.

CONSISTS in finding the true ſum, PAR PRO PARI, or value for value, of the coin of one country, for that of another.

The par of exchange, is the fixed value of the coin of one country compared with that of another.

The courſe of exchange, is the current price, and is always unſettled, being ſometimes above and ſometimes below par, according to the various circumſtances, and accidents of trade and nations.

Money in the bank of ſome countries is finer and purer than that which is current, the difference in value is called Agio.

As it would be endleſs to treat of every kind of exchange, I ſhall only give the following adapted to Britiſh India.

MADRAS.

Accounts are kept in ſtar pagodas, fanams, and caſh; alſo, in Arcot rupees, fanams, and caſh; and reckon 80 caſh to one fanam and 12 fanams to one arcot rupee; and 42 fanams to one ſtar pagoda of exchange. The number of fanams to a pagoda, or rupee, fluctuates in the bazar from 36 to 47 according to the real or artificial plenty or ſcarcity of ſilver fanams. Merchants uſually keep their accounts at 45 fanams; and Government at 42 fanams, per ſtar pagodas; and the following examples are computed at the latter rate.

1.—To change rupees into ſtar pagodas.

RULE.—Multiply the given ſum, by 100, and divide the product the given rate of exchange; the quotient will be the anſwer.

EXAMPLES.

In 500 Arcot rupees, how many ſtar pagodas, exchange at 375 ar. rs. per 100 pagodas.

BY THE RULE	AS	375	:		100	::		500
		3·75	:		1	::		500
CONTRACTIONS.		1	:		26	::		500
		75	:		100	::		1

BY

BY THE RULE.

500
100
——— Pag. fan. c.
375) 50000 (133 . 14 . 0 Ans.
375
——
1250
1125
——
1250
1125
——
125
42
——
375) 5250 (14 fan.
——
0
—

BY DECIMALS.

Pag. . fan. c.
3·75) 500.00 (133·33 = 14. 0
——— 42
Rem. 125 ——
——— 66
1333
——
14.00
—

OR THUS.

·26
500
———
Pag. 133·33 as before.
——

OR THUS Pag.

·75) 100.00 (133·3
———
Rem. 25
—

In 500 ar. r. 14 an. 6 p., how many pagodas, exchange at 375 ar. r. per 100 pagodas?

375 : 100 :: 500 14 6
——— ———
72000 pa. 720,00) 96174,00 pa. (133 24 12 Ans.
Pag. fan. c.
Rem. 114
42
———
720) 17388 (24 fan.
———
108
80
———
720 (8640 (12 c.
8640
———
0.

NOTE.—Here I reduce the firſt and third terms, to pauys.

BY DECIMALS.

3·75) 50090.625 (133·574
———
0
—
or pag. 133 24 12
———
or

I want to draw a Bill of Exchange on Madras for 500 ficca rupees, exchange at 345 Arcot rupees per 100 pagodas, how many pagodas will my agent at Madras debit me for it in account.

First 500 ſa. rs. are equal to 537 ar. rs. 0 an. 7 p. See Batta, caſe 4.
Then 345 . . . : . . . 100 . . . :: . . . 537 0 7

16		16
5520		8592
12		12
66240		Pag. fan. c.
	66240)10311100(155	27 66 Anſwer.

OR THUS.

First, 345 ar. rs. are equal to 321 ſa. rs. 3 an. 3.724 p.
Then, 321 3 3.724 . . . : . . . 100 . . . :: . . . 500

16	16
5139	8000
12	12
61671	96000
1000	1000
61671724	96000000
	100
	Pag. fan. c.
	61671724)9600000000(155 27 66

BY DECIMALS.

Pag.
3.345)53703.64583(156.6627
or St. Pag. 155 27 66

Or as . 321.266896 . : . 100 . :: . 500 . : . 155.663=27 67

In 10000 current rupees, how many ſtar pagodas; exchange at 390 c. rs. per pagoda.
Anſwer 2564 ſt. pag. 4 fan 24 $\frac{24}{39}$ c.

In 557 ſicca rupees, how many ſtar pagodas, exchange at 379 current rupees per 100 pagodas. Anſwer 170 ſt. pag. 26 fan. 13.5 c.

2.—To change ſtar pagodas into rupees.

RULE.—Multiply the given ſum, by the rate of exchange, and divide by 100.

EXAMPLES.

In 133 ſt. pag. 24 fan. 12 c., how many Arcot rupees; exchange at 375 Arcot rupees per 100 pagodas;

100 : 375 :: 133 24 12

42 — 42

4200 — 5610

80 — 80

336000 — 448812

375

A.R. a. p.

3360,00)168304500 (500 14 6 Anſwer.

Rem. 3045

16

336,0(48720(14 an.

168

12

336(2016 6 p.

2016

0

BY DECIMALS.

fan. c.

133.575=24 12

3.75

Pag. 500.90625 or 14 a. 6 p.

In 7000 ſtar pagodas, how many ſicca rupees, exchange at 379 Arcot rupees per 100 pagodas? Anſwer 24700 ſa. r. 7 an. 6 p.

Imported goods into Calcutta, amounting per invoice to 5004 ſt. pag. 15 fan. 40 c.; reduce them into ſicca rupees, at the rate of 3¼ ſa. rs. per pagoda, in order to regulate the duties at the Cuſtom-houſe. Anſwer 18766 ſa. r. 4 an. 8 p.

BOMBAY.

Accounts are kept in Rupees, quarters, and reas, reckoning 100 reas to one quarter, and 4 quarters or 400 reas to one rupee.

100 Bombay (ſoortee) rupees are equal to 110 current rupees.

3.—To change Bengal, into Bombay Rupees.

RULE.—Multiply the given ſum by 100, and divide the product by the rate of exchange: the quotient is the anſwer.

EXAMPLES.

In 5000 current rupees, how many Bombay rupees, exchange at 116 current rupees per 100 Bombay rupees?

5000

5000
100

B. R. QR. REAS.
116)500000(4310 1 37 Anſ.
rem. 40
400
qr. reas.
116)16000)1 37
rem. 108

OR THUS. B. R.
1.16)500000.00(4310.344=1 37
rem. 96

Bengal remits to Bombay 500 cur. rs. 14 a. 6 p., exchange at 124 current rupees per 100 Bombay rupees, how much will Bengal be credited for it at Bombay ?

As 124 . . : . . 100 . . :: . . 500 14 6
16 16
1984 8014
12 12
23808 B.R. qrs. reas.
23808)9617400 (403 3 82 Anſwer.
Rem. 22776
400
qrs. reas.
23808)9110400 (3 82
15774

OR THUS.
B. R.
1.24)500.90625 (403.956
Rem. 81
OR
B. R. 403 3 82

Change 500 ſicca rupees, into Bombay rupees exchange 115 current rupees per 100 Bombay rupees.

Firſt, 500 ſa. rs. are equal to 580 current rs. See Batta caſe 1. and Madras Exchange caſe 1. Ex. 3.

Then, as 115 c. r. : is to 100 B. r. : : ſo is 580 c. r. : to B. r. 504 1 39 Anſ.

Or thus, as 115 . . : . . . 116 . . . : : . . . 500 . . . : . . B. r. 504 1 39

In 1515 current rupees, how many Bombay rupees, exchange at 110 current rupees per 100 Bombay rupees. Anſ. 1377 B. r. 1 qr. 9 reas.

In 100 ſicca rupees, how many Bombay rupees, at 110 current rupees per 100 Bombay rupees. Anſ. 105 B. r. 1 qr. 81 reas.

4.—To change Bombay into Bengal rupees.

RULE

RULE.—Multiply the given ſum, by the rate of exchange, and divide the product by 100, the quotient will be the anſwer.

In 5000 Bombay rupees, how many current rupees, exchange at 116 current rupees per 100 Bombay rupees.

116
5000

C. Rs. 5800.00

In 403 B. r. 3 qrs. 82 reas, how many current rupees exchange at 124 current rupees per 100 Bombay rupees.

100 . . . : . . . 124 . . . :: . . . 403 3 82 :
400 400

40000 161582
124

C. R. a. p.
4000(20036168 (500 14 5 Ans.

Rem. 36168
16

40000)578688(14 an.

Rem. 18688
12

40000)224256(5 p.

Rem. 24256.

OR THUS,
qrs. reas.
403.955=3 82
12.4

C. R. 500.9042=14 a. 5 p.

In 504 Bom. r. 1 qr. 31 reas, how many ſicca rupees, exchange at 115 current rupees per 100 Bombay rupees.

B.R. C.R. B.R. qr. reis. C.R. A. P. SA. R. A. P.
As 100 . : . 115 . : . 504 1 31 . : . 579 15 7 or 499 15 8, ſee Batta caſe 2.

OR THUS, BY GENERAL RULE IN BATTA.

100 . : : 115 . : . 504.3275 : Sa. R. 499 15 8

OR THUS.

504.3275
1.15

C. r. 579.976625=15 a. 7 p. or ſa. r. 499 15 8 Anſwer.

In

In 100 Bombay rupees, how many ficca rupees, exchange at 110 current rupees per 100 Bombay rupees. Anſ. Sa. Rs. 94 13 2.895.

In 55 Bombay rupees, 3 qrs. 50 reas how many ficca rupees, at 102 Bombay rupees per 100 ficca rupees. Sa. Rs. 54 12 5.56.

CHINA, MANILLA, &c.

To change Bengal currency into Spaniſh Dollars.

RULE.—Multiply the given ſum, by the rate of exchange, and divide the product by 100; the quotient is the anſwer.

34 Marvadies make one Rial,
8 Rials —— — Spaniſh Dollar.

EXAMPLES.

Bengal remits to China 1000 current rupees; exchange at 41 Spaniſh dollars per 100 current rupees; what will this remittance amount to at China in Spaniſh dollars?

1000
41

1,00) 10,00

Sp. Dol. 410 Anſ.

Bengal remits to Manilla 565 cur. rs. 8 an., exchange at 41½ Spaniſh dollars per 100 current rupees.

C. R. 100 : S. D. 41½ : C. R. A. 565 8

16

1600

9048

41½

370368

½ 4524

S. D. R. MAR.

1600)375492(234 5 15

rem. 1092

8

1600)8736(5 rials.

rem. 736

34

1600)25024(15 marvadies.

1024

OR THUS.

565.5

.415

S. D. 234.6825 or 234 3 15 r. m.

In 576 current rupees, how many Spaniſh dollars, exchange at 43 Spaniſh dollars per 100 current rupees. Anſ. Sp. Dr. 247 5 14 .96

In 720 cur. r. 13 an. 4 p. how many Sp. dollars, at 42½ Spaniſh dollars per 100 current rupees. Anſ. 306 2 28.3

To change Spaniſh dollars into Bengal currency.

R U L E.—When the exchange is in dollars, multiply the given ſum by 100, and divide the product by the rate of exchange; the quotient will be the anſwer.

When the exchange is in rupees, multiply the given ſum by the rate of exchange, and divide the product by 100; the quotient is the anſwer.

EXAMPLES.

China draws upon Bengal for 410 Spaniſh dollars, exchange at 41 Spaniſh dollars per 100 current rupees; how many current rupees will pay the bill.

410

100

41)41000

C R. 1000 Ans.

China

China draws upon Bengal for 410 Spaniſh dollars, exchange at 243 current rupees per 100 Spaniſh dollars; how many current rupees will pay the bill.

410
243
—— C.R. A. P.
100)996,30(996 4 9.6 Ans.
16 ————
—
an. 4,80
12
—
p. 9,60
—

Manilla draws on Bengal for 50000 Spaniſh dollars, 7 rials, [illegible]ervadies exchange at 230 current rupees per 100 Spaniſh dollars; how many current rupees, will pay the draft.
Anſwer 115002 cur. r. 1 an. 0.2 pa.

In 455 Spaniſh dollars how many ſicca rupees, exchange at 42 Spaniſh dollars per 100 current rupees. Anſwer ſa. r. 1139 2 6.

ENGLAND.

Accounts are kept in pounds, ſhillings, pence and farthings reckoning, 4 farthings to one penny; 12 pence to one ſhilling; and 20 ſhillings to one pound ſterling, which is an imaginary coin.

To change pounds ſterling into rupees; Pagodas; &c.

RULE.—Divide the given ſum, by the rate of exchange: the quotient is the anſwer.

EXAMPLES.

In 11 £. 13 s. 4 d. how many ſicca rupees, exchange at 2 s. 4 d. per ſicca rupee,

s.	d.		ſa. r.		£.	s.	d.
As 2	4	:	1	: :	11	13	4
12					20		
—					——		
28.					233		
					12.		
					——		
					28)2800 (100 Anſwer.		
					——		
					0		
					—		

OR THUS.

s. d.
2 4 = .116)11.666
11 1166
— ——
105) 10500
——
Anſ. ſa. r. 100
———

See, diviſion of decimals caſe 4.

In

In 40 pounds ſterling, how many ſtar pagodas, exchange at 8 ſhillings per ſtar Pagoda.

s.	pag.	£.	s. OR THUS.
As 8	: 1 ::	40	8=.4)40.0
		20	
		8)800	ſt. pag. 100 Anſ.
	Anſ. ſt. pag.	100	

In 12 £. 10 s., how many Bombay rupees, exchange at 2 s. 6 d. per rupee.
Anſwer 100 Bombay rupees.

In 37 £. 18 s. 4 d., how many China tales at 7 s. 7 d. per tale?
Anſwer 100 tales.

In 11 £. 5 s., how many current rupees, exchange at 2 s. 3 d. per rupee.
Anſwer 100 current rupees.

In 57865 £. 15 s. 6½ d., how many rupees, exchange at 2 s. 1 d. per rupee.
Anſwer Rs. 556471 7 6.24.

In 559 pounds ſterling, how many rupees at 2 s. 0½d per rupee.
Anſwer ſa rs. 5475 14 8.32.

In 777 pounds ſterling, how many pagodas, exchange at 7 s. 9 d. per pagoda.
Anſwer pag. 2005 6 62.

To change rupees; pagodas; &c. into pounds ſterling.

RULE.—Multiply the given ſum by the rate of exchange, and the product is the anſwer.

EXAMPLES.

In 100 ſicca rupees, how many pounds ſterling, exchange at 2 s. 4 d. per ſicca rupee.

BY PRACTICE.

s.	d.	far.
2	4.	100
12		28
28	12)2800 d.	
	20)233	4
Ans. £.	11	13 4

THUS.

	100
	2
d.	200
4 .. 1/6	33 4
	20)233 4
£.	11 13 4 Anſ.

OR THUS.

s.	
2 .. 1/10	100
d.	
4 1/6	10
	1 13 4
£.	11 13 4 Anſ.

In 544 cur. rs. 4 a. 6 p., how many pounds ſterling, exchange at 2 s. 3 d. per current rupee.

c.r.		s. d.		c. r. a. p.
1	:	2 3	::	544 4 6
16		12		16
16		27		8708
12				12
192				104502
				27

192)2821554(12) D. 14695½

Rem. 114(20) 1224 7

4

192)456(½

394

Rem. 62

£. 61 4.7 ½ Anſ.

BY PRACTICE.

		598	4	6
2 s. . . .	1/10	54	8	0
3 d.	1/8	6	16	0
4 an.	1/4		6	1/4
6 p.	1/8			1/4.37 &c.
		£. 61	4	7 1/2.37 Ans.

BY DECIMALS.

544.28125=4 6

.1125

£. 61.231640625

20

s. 4.63

12

a. 7.56

4

f. 2.2 &c. or £. 61 4 7 ½ &c.

In 55799 cur. rs., how many pounds exchange at 2 s. 0¼ per rupee.

Anſwer £. 5754 5 5 ¼.

In 555 pagodas, how many pounds ſterling, exchange at 8 s. per pagoda.

Anſwer £. 222 0 0.

SIMPLE INTEREST.

IS a profit allowed by the Borrower to the Lender, for the loan of any ſum of money, for any ſpace of time, and at any rate per centum per annum, (that is, for 100 for one year) agreed upon: the extremity of the rate or LEGAL intereſt, that can be taken in Great Britain is 5 per cent. per ann., but if a contract which bears intereſt be made in a foreign country, Britiſh Courts of Judicature will direct the payment of intereſt, according to the Law of that country in which the contract was made.

In Bengal the LEGAL intereſt extends to 12 per cent. per ann.

Any perſon reſiding in GREAT BRITAIN, who receives a higher rate of intereſt than 5 per cent. per ann.; or, any Britiſh ſubject reſiding in Bengal who may receive a higher rate of intereſt than 12 per cent. per ann, either directly or indirectly, commits uſury, and is liable to be proſecuted accordingly, and on conviction to pay, three times the principal or money lent, on which exceſſive intereſt was charged and paid, half of which, in Great Britain goes to the King, but in India, to the Eaſt India Company, and the other half to the proſecutor or informer, alſo, treble coſts of ſuit.

In the ſolution of queſtions in ſimple intereſt, four things are to be conſidered, viz.

1.—The principal, or money lent.

2.—The time, for which it is lent.

3.—The rate per cent. per ann.

4.—The amount, being the principal and intereſt together.

Any three of theſe being given, to find the fourth.

There are various methods of computing ſimple intereſt, which are all deduced from compound proportion, or the rule of five.

GENERAL RULES.

There are five numbers given to find a ſixth proportional, which may be anſwered by two ſucceſſive ſtatings or operations in the rule of three,

but

but more expeditiously as follows, or by the directions given in the rule of five, to which refer.

Of the given numbers, three are a ſuppoſition, and the other two a demand; therefore, of the three terms in the ſuppoſition, let that which is the principal cauſe of gain or loſs, be put for the firſt term; that number which denotes time be put for the ſecond term; then place the other two terms of the demand, in the ſame order as the preceding.

THEN

1.—If the term ſought be of the ſame name with the firſt or ſecond term, multiply the firſt, ſecond, and fifth terms continually for a dividend, and the other two for a diviſor; the quotient ariſing therefrom will be the ſixth proportional.

2.—But if the term ſought be of the ſame name with the third, the continued product of the three laſt terms, divided by the product of the firſt two, will quote the ſixth proportional.

CASE 1.—The principal, time, and rate per cent. per an. given; to find the intereſt.

SECTION 1.—When the given time is in years.

RULE 1.—Multiply the principal, by the rate, that product divided by 100, will give the intereſt for one year, which multiplied by the given number of years, gives the intereſt required.

2.—Divide the given ſum, by the aliquot parts of 100 with the rate, and multiply the quotient by the given number of years, as before.

BY DECIMALS.

3.—Multiply the principal, by the ratio, and that product multiplied by the time, will give the intereſt.

The ratio is the ſimple intereſt of 1 rupee, pagoda, &c. for one year at any given rate, and is thus found: Let it be required to find the ratio of 12 per cent.

As 100 : 12 :: 1

12

100)12.00(.12

1200

An

And in this manner the ratios in the following Table are found.

TABLE OF RATIOS.

RATES.	RATIOS.	RATES.	RATIOS.
3	.03	6	.06
3½	.035	7	.07
3¾	.0375	8	.08
4	.04	9	.09
4¼	.0425	10	.10
4½	.045	11	.11
5	.05	12	.12

EXAMPLES.

What is the intereſt of 265 rupees, 10 an. 8 p., for 6¼ years at 12 per cent. per annum.

BY GENERAL RULE 2.

r.	yr.	r.	r.	an.	p.	yrs.
If 100 in	1	gains 12	what will 265	10	8	gain in 6¼
					12	
			3188	0	0	
					6¼	
			19128	0	0	
½	½ ...		1594	0	0	
¼	¼ ...		797	0	0	
		100)	21519	0	0	
		Rs.	215	3	0.48	Anſwer.

BY RULE I.

265	10	8		Principal
		12		Rate
100) 3188	0	0		
31	14	0.96		Int. for 1 year
		6		years
191	4	5.76		Int. for 6 years
¼ .. ⅛ 23	14	6.72		..... for ¼
Rs. 215	3	0.48		Anſwer.

BY RULE II.

265	10	8		
10 1/10	26	9	0.8	
	5	5	0.16	
2 1/5	31	14	0.96	
			6	
	191	4	5.76	
¼ ... ⅛	23	14	6.72	
Rs.	215	3	0.48	Ans.

BY

BY RULE 3.

265.6=10 a. 8 p.
12 ratio

31.880 Int. for 1 year
6.75=6¾ years

159400
223160
191280

R. 2115.19 or R. 215 3 0.48 Anſ.

What is the intereſt of 525 r. 8 a. 6 p. for 8 years, at 12 per cent. per ann.
Anſ. 504 r. 8 a. 1.92 p.

What is the intereſt of 2870 ſt. pag. 22 fan. 40 c. at 8 per cent. per ann. for 6 years.
Anſ. ſt. pag. 1377 37 64.

What is the intereſt of 856 Bom. r. 1 qr. 50 reas, for 10 years, at 9 per cent. per ann.
Anſ. 770 r. 2 qrs. 95 reas.

What is the intereſt on 725 £. 10 s. 6 d. for 5 years, at 5 per cent. per annum.
Anſ. 181 £. 7 s. 7½ d

SECTION 2.—When the given time is in weeks.

RULE 4.—Find the intereſt of the given ſum for one year by rule 1; then multiply that intereſt by the given number of weeks and divide the product by 52, weeks in a year.

5.—Divide the intereſt of the given ſum for one year, by the aliquot parts of a year, that is, 52 weeks; with the given number of weeks, by the rule of practice.

EXAMPLES.

What is the intereſt of 565 r. 8 an. 6 p. for 32 weeks, 8 per cent. per ann.

BY GENERAL RULE 2.

r.	wks.	r.	r.	a.	p.	wks.
If 100	in 52	gains 8	what will 565	8	6	gain in 32

4×8=32

52
5200

2262 2 0
8
18097 0 0
8

r. a. p.

52[00)1447[76 0 0(27 13 5 Anſ.
104

407
364

Rem. 4376
16

5200)70016(13

Rem. 2416
12

5200[28992(5

Rem. 2992

BY RULE 4.

565 8 6
8

100)4524 4 0

45 3 10.56 Int. for 1 year.
4×8=32 wks.

180 15 6.24
8

52)1447 12 1.92

Anſ. R. 27 13 5.5

BY RULE 5.

45 3 10.56 Int. for 1 year

Weeks		
26	½	22 9 11.28
4	1/13	3 7 8.19
2	½	1 11 10.09

Rs. 27 13 5.5 Anſwer.

BY RULE 3.

565.53125=8 a. 6 p.
.08 Ratio.

45.2425. . .
.61538=32 weeks

Anſ. R. 27.8413 or R. 27 13 5.5

What

What is the intereſt on 378 ſa. r. 4 a. 3 p. for 35 weeks, at 12 per cent. per ann.
Anſ. 30 r. 8 a. 10 p.

What is the intereſt of 1276 pag. 10 fan. 60 c. for 48 weeks, at 8 per cent. per ann.
Anſ. 94 pag. 11 fan. 3.2 c.

What is the intereſt of 5885 Bom. rs. 1 qr. 80 reas, for 20 weeks, at 9 per cent. per ann.
Anſ. 203 r. 2 qr. 90 c.

What is the intereſt on 500 £. for 26 weeks, at 5 per cent. per ann. Anſ. 12 £. 10 s.

SECTION 3.—When the given time is for months.

RULE 6.—Find the intereſt of the given ſum, for one year; then multiply that intereſt by the given number of months, and divide the product by 12, months in a year.

7.—Divide the intereſt of the given ſum for one year, by the aliquot parts of a year, that is, 12 months; with the given number of months, according to the rule of practice.

8.—When the given rate is 12 per cent. per ann. divide the principal by 100, then multiply the quotient by the number of months given.

EXAMPLES.

What is the intereſt of 500 rs. 8 an. for 9 months, at 12 per cent. per ann.

BY GENERAL RULE 2.

r. mo. r. r. an. mo.
If 100 in 12 gains 12 what will 500 8 gain in 9.

12 9

1200 4504 8
12

r.
1200)54054 0(45 0 8 Anſ.

Rem. 54
16

864
12

1200)10368(8
9600

Rem. 768

BY

BY RULE 6.

500 8
12

100) 6006

60 0 11.52 Int. for one year
9 Months

12½) 540 8 7.68

Rs. 45 0 8.64 Anſwer

BY RULE 3.

500.5=8 an.
.75=9 months

375.375
.12 ratio.

R. 45.045 or R. 45 0 8.64

BY RULE 7.

60 0 11.52 Int. for 1 year

6 ½ 30 0 5.76
3 ½ 15 0 2.88

Rs. 45 0 8.64 Anſwer.

BY RULE 8.

100) 500 8

5 0 0.96 Int. for 1 month,
9

Rs. 45 0 8.64 Anſwer.

What is the Intereſt of 750 rupees for 5 months, at 6 per cent. per annum.
Anſwer Rs. 18 12 0

What is the Intereſt of 500 Pagodas, for 7 months, at 8 per cent. per annum.
Anſwer Pag. 23 15 0.

What is the Intereſt of 776 Bom. rupees, for 11 months, at 9 per cent. per annum.
Anſwer By. Rs. 64 0 08.

What is the Intereſt of 357 pounds ſterling, for 3 months, at 3½ per cent. per annum.
Anſwer £. 3 2 5½.

SECTION 4.—When the given time is in days.

RULE 9.—Find the intereſt of the principal for one year, by rule ; then, multiply that intereſt, by the number of days given, and divide e product by 365 days in a year.

10.—When convenient, divide the intereſt of the principal for one year, y the aliquot parts of a year, or 365 days, with the given number of ys, according to the rule of practice.

11.—Multiply the principal by the given number of days, for a divi- nd; then, multiply 365 by 100, and divide the product by 5, the quotient,

quotient will be 7300 for a diviſor; divide the dividend by that diviſor, the quotient will give the intereſt at the rate of 5 per cent. laſtly, multiply that quotient by the given rate and divide the product by 5; which will be the anſwer required.

BY DECIMALS.

12.—Multiply the principal, ratio and time continually; the product will be the anſwer.

13.—Multiply the Intereſt of one rupee for one day, at the given rate, by the principal and number of days; the product will be the anſwer.

THE INTEREST FOR ONE DAY IS FOUND THUS:

As 365 days : are to the ratio : : ſo is 1 : to the intereſt of 1 rupee for 1 day.

RATES.	INT. FOR ONE DAY.	RATES.	INTEREST FOR ONE DAY.
1 per cent.	. 0000273972	9 per cent.	0002465753
6 —.—	. 0001643835	10 ———	0002739726
8 —.—	. 0002191780	12 ———	0003287671

14.—Multiply the principal by the given number of days for a dividend; then multiply 365 by 100, and divide the product by the rate per cent. for a diviſor; divide the dividend by that diviſor, the quotient will be the intereſt required.

TABLE OF DIVISORS,

AT 365 DAYS TO A YEAR.

1 per cent.	36500	9 per cent.	4055.5
5 ———	7300	10 ———	3650
6 —.—	6083.3	12 ———	3041.6
8 —.—	4562.5		

EXAMPLES.

EXAMPLES.

What is the intereſt of 542 r. 15 an. 3 p. for 125 days, at 12 per cent. per annum.

BY GENERAL RULE 2.

R. DAYS. R. R. A. P. DAYS.
If 100 in 365 gains 12 what will 542 15 3 gain in 125
365 10×12×5=125

36500

5429 8 6
12

65154 6 0
2714 12 3

67869 2 3
12

r. a. p.
36500) 814429 11 0 (22 5 0 Anſwer.

rem. 4500

This queſtion may be abridged various ways, viz.

State reſumed 100 : ... 365 :: .. 12 .. : ... 542 15 3 . :: ...125
1 : ..... 1 :: .12 : ... 542.9531 :: .342
1 : 3041.6 :: 1 : ... 542.9531 :: 125
1 : .. 29.2 :: .12 : ... 542.9531 :: 1
.12

2.92)65.154372(22.313 &c. or Rs. 22 5 0

BY RULE 9.

542 15 3
12

100)6515 7 0

65 2 5.64
10×12+5=125

651 8 8.4
12

7818 8 4.8
325 12 4.2

365)8144 4 9

R. 22 5 0.12 Anſwer.

See Section 5. Ex. 3

BY RULE 11.

542 15 3
125

7300) 67869 14 3

9 4 9 int. at 5 per $\frac{0}{0}$
12

5) 111 9 0

R. 22 5 0 Anſwer.

BY RULE 12.

542.9531=15 a. 3 p.
.3425=125 days

185.9614 &c.
12 Ratio

Rs. 22.3153 or Rs. 22 5 0

BY RULE 13.

Principal 542.9531
Int. for 1 day .0003288

.1785229
Days 125

Anſwer R. 22.3125

Or R. 22 5 0

BY RULE 14.

542.9531
125

3041.6)67869 1375
3041 6786,1375

27375) 6108272375

Anſwer 22 5 0

See, caſe 4 in diviſion of decimals.

What is the intereſt of 6826 r. 9 an. 9 p. for 125 days at 12 per cent. per annum.
Anſwer 280 r. 8 an. 8 p.

What is the intereſt of 6750 pag. 22 fan. 40 c. for 216 days, at 8 per cent. per annum.
Anſwer 319 pag. 26 fan. 27 c.

What is the intereſt of 8296 Bom. r. 1 qr. 6 reas, for 250 days at 9 per cent. per annum. Anſ. Bom. r. 511 1 65.

What is the intereſt of 399£. 13 s. 4 d. for 4 days at 5 per cent. per annum.
Anſwer 4 s. 4½ d.

SECTION 5.—When the given time is in years, months and days.

RULE 15.—Find the intereſt of the given ſum, for one year by rule 1, which multiply by the number of years; take aliquot parts with the months,

months, according to rule 7; then find the intereſt for the days by ſection 4, of this caſe,

EXAMPLES.

What is the intereſt of 260 r. 6 a. for 2 years, 4 months and 25 days at 12 per cent. per annum.

r.	a.	p.		
260	6	0	Principal	
		12	rate	
100)3124	8	0		
31	3	11.04	Int. for 1 year	
		2	years	
62	7	10.08	Int. for 2 years	
⅓ 10	5	7.68	4 mos.	
2	2	2.89	25 days	
75	15	4.65	Anſwer.	

Days	r.	a.	p.	Days.
As 365 . : .	31	3	11.04 . :: .	25
			5×5=25	
	156	3	7.20	
			5	
365)	781	2	0.	
Rs.	2	2	2.89 Int. for 25 dys.	

It is not accurate in the calculation of intereſt to take aliquot parts of a month (or 30 days) for days, becauſe the year is not divided into months conſiſting of the ſame number of days each, but this method is notwithſtanding very commonly adopted in India, thus:

Find the intereſt for one year by rule 1, then, if the time is given in days, reduce them to months, &c. by dividing by 30; then proceed by taking aliquot parts of a year with the months by rule 7; and of a month or 30 days, with the days.

All the preceding rules in the caſe, are applicable to this method; reckoning only 360 days, inſtead of 365 days, to a year and 30 days to a month.

The time between one given date and another, is very commonly reckoned by months and days, for inſtance; let it be required to find the time from 30th April to 2d September following, thus; from April 30th to May 30th is one month; to June 30th, two months; to July 30th, three months; to Auguſt 30th four months; and from that time to Sept. 2d, three days; ſay, four months and three days.

But properly thus; May 31 days; June 30 days; July 31 days; Auguſt 31 days; September 2 days; making together 125 days, which being prepared for computing intereſt by the foregoing method, make 4 months and 5 days.

The following example, computed by three different methods, will exhibit the difference.

EXAMPLE.

EXAMPLE.

What is the intereſt of 10,000 ſicca rupees, from the 30th day of April, to the 2d day of September following, at 8 per cent. per annum.

May	31	10000		
June	30	8		
July	31			
Auguſt .	31	100)800.00	Int. for 1 year	
September	2	125	days	
30)125		365)100000		
4 mo. 5 days.		R. 273 15 6	Anſ.	

12)800	0	0	Int. for 1 year	
66	10	8		1 mo.
		4	months	
266	10	8	Int. for 4 mo.	
dys. 5 .. 1/6 11	1	9		5 days
R. 277	12	5	Anſwer.	

66	10	8	Int. for 1 mo. as before	
		4		
266	10	8	Int. for 4 months	
3 days. .. 1/10 6	10	8		3 days
Rs. 273	5	4	Anſwer.	

What is the intereſt of 542 r. 15 an. 3 p. for 125 days, at 12 per cent. per annum of 360 days.

BY RULE 9.

542 15 3
12

100)6515 7 0

65 2 5.64 Int. for 1 year
10×12+5=125.

651 8 8.40
12

7818 8 4.8
325 12 4.2

360)8144 4 9

Rs. 22 9 11.6 Anſwer.

BY RULE 14.

542.9531
125

3000)67.8691375

Rs. 22.623, &c. or Rs. 22 9 11.6.

See Section 4. Ex. 1.

BY RULE 10.

65 2 5.64

days

90 . . $\frac{1}{4}$ 16 4 7.41
30 . . $\frac{1}{3}$ 5 6 10.47
5 . . $\frac{1}{6}$ 0 14 5.74

Rs. 22 9 11.6 Anſwer.

BY RULE 11.

542 15 3
125

7200)67869 14 3

9 5 9.8
12

5)113 1 9.6

Rs. 22 9 11.5 Anſwer.

BY RULE 8.

100)542 15 3

5 6 10.47 Int. for 1 mo.
4

dys.

21 11 5.88
5 . . $\frac{1}{6}$ 0 14 5.74

Rs. 22 9 11.6 Anſwer.

NOTE.—The intereſt, added to the principal gives the amount.

When intereſt is to be calculated, on running caſh accounts, or where partial payments are made on account of bonds, bills, notes, &c. bearing intereſt; multiply the ſeveral balances by the number of days, they remain at intereſt; then multiply the ſum or balance by the rate per cent. and divide the product by 36500.

EXAMPLES.

EXAMPLE.

MR. J. DAVIS'S INTEREST ACCOUNT at 12 per cent. per annum.

Date.		Principal. R. A. P.		days.	Dr.	Cr.
1804						
April . 4	Paid	600 0 0	Int. to 12th Ap.	8	4800	
12	Received	89 0 0				
		511 0 0	..... to 10th May	28	14308	
May . 10	Received	940 0 0				
		429 0 0	..... to 25	15		6435
25	Paid	850 0 0				
		421 0 0	..... to 11th June	17	7157	
Add, bal. of Int. .. .		6 8 3				
					26265	6435
Am. due to J. DAVIS		427 8 3	Deduct		6435	
			Balance		19830	
					12	
					36500)237960	
			Balance of Int. Rs.		6 8 3	

CASE 2.—When the rate, time, and interest are given, to find the principal.

RULE 1.—Multiply the rate by the time, and divide the product by 100, the quotient will be the interest of 1 for the time and at the rate given; then divide the given interest or sum by it; the quotient will be the principal.

2.—Divide the interest, by the product of the ratio and time; the quotient will be the principal.

EXAMPLES.

What principal being put to interest for 3 years will gain 54 r. 3 an. 2 p. at 12 per cent. per annum.

BY GENERAL RULE 1.

If 100 ... : ... 1 ... :: ... 12 ... : ... 3 ... :: ... 54 3 2

3

36

10 × 10 = 100

541 15 8

10

36) 5419 12 8

R. 150 8 9 Anſwer.

BY RULE 1.

12

3

100) 36

0 5 9.12

12

69

100

6912

54 3 2

16

867

12

10406

100

6912) 1040600

Rs. 150 8 9 Anſ.

BY RULE 2.

.12

3

.36 (54.1979 (150.549

orR. 150 8 9

What principal being put to intereſt for 5½ years, will gain 64 £. 7 s. at 5 per cent. per annum. Anſwer £. 234 0 0

What principal being put to intereſt for 10 years will gain 500 ſicca rupees, at 8 per cent. per annum. Anſwer Sa. Rs. 625 0 0.

What principal being put to intereſt for 5¼ years will gain 100 pagodas, at 10 per cent. per annum. Anſwer Pag. 173 41 6.8.

What principal being put to intereſt for 10 years, will gain 72 Bombay rupees, at 9 per cent. per annum. Anſwer Bom. Rs. 80.

CASE 3.—When the amount, rate, and time are given, to find the principal.

RULE 1.—Multiply the rate by the time, and to the product add 100 for a diviſor; then multiply the given amount by 100, for a dividend; the quotient will be the principal.

2.—Add 1 to the product of the ratio and time; then divide the amount by that ſum; the quotient will be the anſwer.

EXAMPLES.

What principal being put out to intereſt, will amount to 204 r. 11 an. 11 p., in 3 years, at 12 per cent. per annum.

BY

BY RULE 1.

12	204	11 11
3		10
36	2047	7 2
100		10
136	136)20474	7 8

Rs. 150 8 9 Anſ.

BY RULE 2.

.12
3
.36
1.
1.36)204.74479(150.547 .

or R. 150 8 9

What principal being put to intereſt will amount to 500 ſicca rupees in 6 ½ years, at 6 per cent. per annum. Anſwer Sa. Rs. 359 11 4 74.

What principal being put to intereſt will amount to 500 pounds ſterling in 6 ¾ years, at 5 per cent. per annum. Anſwer £. 373 16 7 ¾.6.

CASE 4.—When the principal, intereſt, and rate, are given to find the time.

RULE 1.—Find the intereſt of the principal for one year, by caſe 1. rule 1; then divide the given intereſt by it; the quotient will be the anſwer.

2.—Divide the intereſt by the product of the principal and ratio; the quotient will be the time.

EXAMPLES.

In what time will 555 r. 6 an. gain 300 rupees, at 12 per cent. per annum.

BY RULE 1.

555 6
12

100)6664 8

Int. for 1 year Rs. 66 10

16
10: 6
12

127958) 576000(4 years 183 days Anſ.

R.
3.84.000
16
4800
12

Rem. 641664
365

127958) 234207360(183 days

Rem. 43488

BY RULE 2.

555.375=6 an.
.12

66.645..)300.000

Anſ. yrs. 4 183 days.

In

In what time will 100 ſicca rupees, gain 100 ſicca rupees, at 12 per cent. per annum.
Anſwer 8 years 121 days.

In what time will 100 pagodas, gain 100 pagodas, at 10 per cent. per annum.
Anſwer 10 years.

In what time will 100 pounds ſterling, gain 100 pounds ſterling, at 5 per cent. per annum. Anſwer 20 years.

CASE 5.—When the principal intereſt and time, are given to find the rate per cent.

RULE 1.—Multiply the gain or intereſt by 100, and divide the product by the principal; then divide the quotient by the time and that quotient will be the rate per cent.

2.—Divide the intereſt, by the product of the principal and time; the quotient will be the rate.

EXAMPLES.

At what rate per cent. per annum, will 150 rupees, 8 an. 9 p. gain 54 r. 3 an. 2 p. in 3 years.

BY RULE 1.

150	8	9	54	3	2	
16			16			
2408			867			
12			12			
28925	)		10403600	(	3	36

Anſwer. 12 per cent.

150.515 &c. = 8 a. 9 p.
3
451.638) 59.1979 &c.
Anſwer 12 per cent.

At what rate per cent. will 100 ſicca rupees, gain 100 ſicca rupees in 10 years.
Anſwer 10 per cent.

At what rate per cent. will 540 ſtar pagodas, gain 100 ſtar pagodas, in 3½ years.
Anſ. pag. 5.2908 or 5.13 6 .88 per cent.

At what rate per cent. will 100 pounds ſterling, gain 100 pounds ſterling, in 20 years.
Anſwer 5 per cent.

NOTE.—When the principal amount and time are given to find the rate; take the difference between the amount and principal, which is the intereſt, then proceed as before.

DISCOUNT.

Is an allowance made for the payment of any ſum of money, before it becomes due, according to a certain rate per cent. agreed on between the parties concerned.

The

The PRESENT WORTH of any ſum or debt, due ſome time hence, is ſuch a ſum as, if put to intereſt for that time, at a certain rate per cent. would amount to the ſum or debt then due.

RULE 1.—Find the intereſt of 100 for the time and rate given and add it to 100; then ſay, as that ſum or amount: is to 100:: ſo is the given ſum or debt: to the preſent worth. Subtract the preſent worth from the given ſum and the remainder is the diſcount.

2.—As the amount of 100 for the given time and rate; is to the intereſt of 100 for that time:: ſo is the given ſum to the diſcount.

3.—As the amount of 1 for the given time and rate: is to 1:: ſo is the intereſt for the debt for the ſaid time: to the diſcount. Subtract the diſcount from the principal, and the remainder will be the preſent worth.

4.—Add 1 to the product of the ratio and time, and divide the given ſum or debt, by that ſum; the quotient is the preſent worth.

EXAMPLES.

What is the diſcount on 500 ſicca rupees, due 73 days, hence, at 12 per cent. per annum.

BY RULE 1.

As 365 :... 12 .. : .. 73

73

365)876

2 6 4.8
100 0 0

102 6 4.8

THEN

As 102 6 4.8 : 100 :: 500

16 16

1638 8000
12 12

19660 96000
10 10

196608 960000
100

196608)96000000

Given sum . 500 0 0 R. 488 4 6 Present worth.
Present worth 488 4 6

Discount . R. 11 11 6 Answer.

Rate 12=.12 ; time 73 days=.2
.12×.2+1=1.024 amount of 1 for the given time.
500×.12×.2=12 interest of the debt for the given time.

BY RULE 3.

As 1.024 : 1 12

12

1.024)12.000

Ans. Rs. 11 11 6

BY RULE 4.

.12
.2

.024
1.

1.024)500.000

Present worth . Rs. 448 4 6

BY RULE 2.

As 102 6 4.8 : 2 6 4.8 :: 500

16 16 16

1638 38 8000
12 12 12

19660 4608 96000
10 10

196608 960000
4608

196608)442368000

Answer R. 11 11 6

OR THUS

Rule 1.—As 102.4 : 100 :: 500 : 488.281
2.—As 102.4 : 2.4 :: 500 : 11.756

What is the discount on 495 r. 12 an., due 2 months 3 days hence, at 12 per cent per annum.

BY

BY RULE I.

	12			
mo.				
2 .	$\frac{1}{6}$	2 0 0	Int. for 2 mo.	
		0 1 6.937	Int. for 3 dys.	
		2 1 6.937		
		100 0 0		
		102 1 6.937		

As 365 : 12 :: 3

3

365)36

0 1 6.937 Int. for 3 dys.

As. 102 1 6.937 : 100 :: 496 12 0

Or 196029370)95376000000

Anf. R. 486 8 7

Principal 496 12 0

Preſent worth . 486 8 7

Diſcount .. Rs. 10 3 5 Anſwer

OR THUS.

102.0986)49675.0000

Preſent worth R. 486 8 7

What ready money will diſcharge a debt of 45000 ſicca rupees due 2 years, 9 months, and 25 days hence, at 10 per cent. per annum. Anſwer 35105 8 5 .87.

What is the diſcount on £. 210 for 7 months, 6 days, at 5 per cent. per annum. Anſwer 6 £. 2 s. 3½.

What is the preſent worth of £. 100 due 12 months hence, at 6 per cent. per annum. Anſwer 94 £. 6 s. 9½ d.

What is the preſent value of 1 rupee, due 12 months hence, at 12 per cent. per annum. Anſwer 14 an. 3.428.

It is a common cuſtom among thoſe who diſcount bills, to find the intereſt of the principal, from the time the bill is diſcounted to the time when it becomes due, including the days of grace, which intereſt they take as the diſcount, and by that means make it more than it really is; and by the preceding examples it is evident, that he who allows intereſt for diſcount wrongs himſelf conſiderably, for ſo much money ought to be paid, as at intereſt would amount to the ſum due in the time propoſed.

It is not illegal to retain the diſcount, for it has been adjudged, that intereſt may as lawfully be received beforehand for forbearing, as after the term is expired for having forborne: and it ſhall not be reckoned merely as a loan of the balance, otherwiſe every banker, &c. who takes 5l. per cent. for diſcounting bills, would be guilty of uſury: for, if upon diſcounting a 100l. bill at 5l. per cent. he ſhould be conſtrued to lend only 95l. then at the end of the time he would receive 5l. intereſt for the loan of 95l. principal which is above the legal rate. But this doctrine ſeems only to apply to negotiable inſtruments, and not to bonds.

but

But when goods are bought or ſold and diſcount is to be made for preſent or prompt payment, at any rate per cent. without regard to time, the intereſt of the ſum as calculated for a year, is the diſcount.

It is a common practice among many, who deal in diſcounting bills, to take advantage of the neceſſitous, by extorting exceſſive intereſt in various methods, for they not only deduce intereſt from the contents of the bill for the time it hath to run, including three days of grace, but extort a premium of 2, 3, 4, &c. per cent. and when the bill becomes due, if the acceptor cannot conveniently pay it, out of mere lenity the bill is renewed and diſcounted again on the ſame terms, till the man's eyes are open by paying ſuch an exorbitant rate of intereſt, for the uſe of money; there are others who go ſtill more neatly to work in taking advantage of the neceſſitous; the perſon who wants money offers his own promiſſory note for ſale or diſcount at a ſhort date, for inſtance, if the note be for 100 rupees, the monied man perhaps offers him 80 rupees, more or leſs, as he can make his bargain, or as he underſtands, the negociators credit depends, on having the money, and even then, they offer to pay half in money and the remainder in goods at an extraordinary price.

The ſtatute againſt uſury extends to Britiſh ſubjects in India only, not to natives.

The following examples will evince the inevitable ruin which muſt enſue from borrowing money on ſuch exorbitant terms.

Moſes diſcounted my promiſſory note for 500 r. dated 1ſt January, 1803, payable at the expiration of two months from that date at 12 per cent. per annum and took a premium beſides of 4 per cent; I renewed it ſix times on the ſame terms and then paid it when it became due on the 19th January, 1804; at what rate did I pay per cent. per annum. Note, reckon 3 days of grace on each note, that is, 2 mo. 3 days.

1,00) 5,00 Int. per month.
2

500
4

As 5,00 : 183 :: 1,00
Anſwer R. 36 9 .. 7 per cent.

10
3 .. 1/10 0 8
10 8. diſcount or Int.

1,00) 20.00 premium
10 8 diſcount
30 8 whole diſcount.
6 times.

183 0

but ſtill more if we conſider that the diſcounting of each note coſt 30 rs. 8 an. ready money, excepting the firſt.

the

The following running intereſt account is deduced from the foregoing queſtion.

Date.		Principal.				Days.	Intereſt.
Jany. 1	Received	469	8	0	intereſt to 4 March	62 ..	29729
March 4	Paid	500	0	0			
		30	8	0			
	Received	469	8	0			
		439	0	0	intereſt to 7 May ..	64 ..	28096
May 7	Paid	500	0	0			
		61	0	0			
	Received	469	8	0			
		408	8	0	intereſt to 10 July	64 ..	26144
July 10	Paid	500	0	0			
		91	8	0			
	Received	469	8	0			
		378	0	0	intereſt to 13 September	65 ..	24570
Sept. .. 13	Paid	500	0	0			
		122	0	0			
	Received	469	8	0			
		347	8	0	intereſt to 16 November	64 ..	22240
Nov. 16	Paid	500	0	0			
	R.	152	8	0			
	Received	469	8	0			
		317	0	0	intereſt to 19 January ..	64 ..	20288
Jan. . 19	Paid	500	0	0			
		183	0	0		383 ..	151067
							12
	Deduct intereſt	49	10	7			
						36500)	1812804
	Balance .... Rs.	133	5	5		Intereſt Rs.	49 10 7

By the preceding account it is evident, that the proper or legal intereſt amounts to only 49 r. 10 an. 7 p. and that Moſes took 133 r. 5 a. 5 p. more than he was entitled to, making altogether 183 rupees, which is nearly 37 per cent. per annum.

Then

There are numerous very ingenious methods invented by uſurers, for the purpoſe of avoiding the ſtatute againſt uſury, but I believe the foregoing methods do not. I have inſerted them as the moſt common methods uſed in Bengal, and for the purpoſe of elucidating the ruinous conſequences to the borrower and often to the lender.

COMMISSION, BROKERAGE, INSURANCE, AND PURCHASING or STOCKS.

The method of working queſtions in thoſe rules, or any thing elſe, that is rated at ſo much per cent. without regard to time, is the ſame as finding the intereſt of any ſum for one year, by caſe 1, rule 1, in ſimple intereſt.

COMMISSION is an allowance of ſo much per cent. to a factor, &c. for buying and ſelling goods, for his employer.

BROKERAGE is an allowance of ſo much per cent. to a broker, for aſſiſting merchants or factors in procuring, or diſpoſing of goods, &c.

INSURANCE is an allowance of ſo much per cent. given to certain perſons called Underwriters, or to Inſurance companies, who engage to make good the loſs of ſhips, houſes, or merchandizes which may happen, from ſtorms, fire, &c.

PURCHASING and SELLING of STOCKS. STOCKS is the general name for the capitals of our trading companies, and the buying and ſelling certain ſums of money, in thoſe funds.

EXAMPLES.

What is the commiſſion on 500 r. 14 an. 3 p. at 3½ per cent?

	500	34	3
			3
	1502	10	9
½ ... ½	250	7	1.5
100)	1753	1	10.5
	R. 17	8	6 Anſ.

If a broker ſells goods to the amount of 1000 £. what is his demand at ⅛ per cent.
Anſwer 6 £. 5. s.

What is the premium of inſurance on 879 pagodas, at 12½ per cent. Anſ pag. 109 39 30.

What is the purchaſe of a Government certificate for 10,000, at 6 per cent. diſcount.
Anſ. 9400.

EQUATION

EQUATION OF PAYMENTS.

Is the finding a time to pay at once, ſeveral debts due at different times, ſo that no loſs, ſhall be ſuſtained by either party.

NOTE.—Although the following rule may not be minutely correct, yet the difference between it and other operoſe methods, is ſo trifling, that it is always made uſe of as the moſt eligible method in buſineſs.

RULE.—Multiply each payment by the time at which it becomes due. then divide the ſum by the products, by the ſum of the payments, and the quotient will be the time required.

EXAMPLES.

A. owes B. 190 rupees to be paid as follows: 50 r. at the expiration of 6 months; 60 r. at 7 months; and 80 r. at 10 months; what is the equated time to pay the whole?

$$\begin{array}{l} 50 \times 6 = = = 300 \\ 60 \times 7 = = = 420 \\ 80 \times 10 = = = 800 \\ \hline 190) 1520 (8 \text{ Months. Anſ.} \end{array}$$

A. owes B. 52 r. 7 an. 6 p. to be paid in $4\frac{1}{2}$ months; 80 r. 10 an. to be paid in $3\frac{1}{2}$ months, and 76 r. 2 an. 6 p. to be paid in 6 months; what is the equated time to pay the whole? Anſwer 4 months 19 days.

A. owes B. £. 100 to be paid in 9 months and £. 500. to be paid in 18 months, what is the equated time to pay the whole. Anſwer 16 months 15 days.

A debt of 1000 rupees is to be paid as follows, $\frac{1}{2}$ at 8 months; $\frac{1}{3}$ in 12 months and the reſt in 18 months, what is the equated time to pay the whole. Anſ. 11 months.

COMPOUND INTEREST.

Is an allowance or gratuity made by the borrower to the lender, not only for the uſe of the principal, but likewiſe for the uſe of the intereſt, after it becomes due, and is therefore called INTEREST upon INTEREST, ſo that the intereſt being continually added to the principal at the end of the year, the ſum or amount becomes a new principal for the ſucceeding year, and in this caſe, the principal and intereſt always encreaſing. The laws of England do not allow money to be lent at compound intereſt, but the intereſt may be exacted preciſely as it becomes due and lent out again, by which means all the purpoſes of

compound

compound intereſt, may be anſwered to the lender, beſides, in purchaſing annuities, penſions, or leaſes in reverſion, it is ordinary to allow the purchaſer compound intereſt, for his ready money and therefore every dealer in thoſe articles ought to underſtand it.

CASE 1.—Principal, rate and time given, to find the intereſt.

RULE 1.—To the principal, add the intereſt for the firſt year, which becomes a new principal, to which add the intereſt on it for the next year, which becomes the principal for the third year, proceed thus progreſſively, for any number of years, and if there are days, add the intereſt of the laſt amount for that time; the difference between the given principal and this laſt amount gives the intereſt.

2.—Multiply the principal by the amount of one rupee at the given rate for a year, continually for all the years propoſed and add for the days, if any, as before.

The amount of one rupee, for one year, at any given rate is found thus:

'As 100 : is to the given rate added to 100 : : ſo is 1 : to the ratio or to the amount of one rupee, for one year, at the given rate.

As 100 : 108 : : 1 : 1.08 the ratio at 8 per cent.
As 100 . 112 : : 1 : 1.12 the ratio at 12 per cent.

EXAMPLES.

What will 500 ſicca rupees amount to in 3 years and 40 days, at 12 per cent. per annum, compound intereſt.

1ſt METHOD.

500	0	0	1ſt years principal		500
60	0	0	intereſt		60
560	0	0	2d years principal		560
67	3	2.4	intereſt		67.2
627	3	2.4	3d years principal		627.2
75	4	2.4	intereſt		75.264
702	7	5.088	3 years amount		702.464
9	3	9.731	Int. for 40 days		9.238
711	11	2.829	Am. for 3 years, 40 days	Rs.	711.702 Anſwer
500	0	0	Principal		500
211	11	2.829	Compound intereſt	Rs.	211.702=211 an. 2.8 p.

2d

2d. METHOD.		of thum.
500 . . . . Principal		1.12
1.12 . . . . am. of 1 r. for 1 yr.		1.12
560		1.2544
1.12		1.12
627.2	Am. 1 r. for 3 years	1.404928
1.12	Int. on 1 r. for 40 days . .	.018475
702.464	Am. 1 r. for 3 yrs. 40 dys. .	1.423403
9.238	Multiply by principal	500
711.702 Am. for 3 years 40 days.	Answer Rs.	711.7015
500.	or Rs.	711 11 2. &c.
211.702 as before		

What is the compound interest on 100 sicca rupees for 7 years, 96 days, at 10 per cent per annum? Answer 100 rupees.

What is the compound interest on 10,000 pagodas for 12 years, 25 days at 6 per cent. per annum? Answer Pag. 10000.

What is the compound interest of 5 Bombay rupees, 2 qrs. for 8 years, 15 days at 9 per cent. per annum? Answer 5 R. 2 qrs.

What will 1 sicca rupee amount to in 6 years, 40 days, at 12 per cent. per annum, compound interest? Answer R. 2.

CASE 2.—The amount, rate and time given, to find the principal or present worth.

Divide the given amount, by the amount of 1. at compound interest at the rate and for the time given, the quotient is the answer.

EXAMPLES.

What ready money will clear a debt due 3 years hence of 578 r. 13 an.; compound interest being allowed at 5 per cent. per annum?

1.05
1.05
1.1025
1.05
1.157625) 578.812500 (500 rupees. Ans.
578 8,25
00

What

What principal or ſum of money may be put out to raiſe the ſum of 1000 rupees in 4 years, at 12 per cent. per annum, compound intereſt? Anſwer 635 8 3.

What ready money will clear a debt due 6 years and 40 days hence of 1000 ſicca rupees, compound intereſt being allowed, at 12 per cent. per annum?

Anſwer Sa. Rs. 500.

CASE 3.—The principal, amount, and rate, given; to find the time.

RULE.—Divide the amount by the principal, and divide the quotient by the amount of 1 for a year, continually, till 1 is the quotient, and the number of diviſions gives the number of years.

EXAMPLES.

In what time will 500 rupees, amount to 578 r. 13 an. at 5 per cent. per annum compound intereſt?

500) 578.8:25
1.05) 1.157625
1.05) 1.1025
1.05) 1.05
1. Anſwer 3 years.

In what time will 225 £. amount to 260 £. 9 s. 3¼, at 5 per cent. per annum compound intereſt? Anſwer 3 years.

Computations by numbers in compound intereſt, annuities, penſions, leaſes, &c. in arrears and in reverſion, are in general ſo very long and operoſe, and ſo liable to error, that tables of compound intereſt, &c. are very uſeful, if not abſolutely neceſſary to thoſe who are engaged in ſuch negociations, and there are a great variety in publication, but correct tables of logarithms, are the beſt and eaſieſt to work by.

MONEY doubles itſelf nearly as follows:

RATE PER CENT.	SIMPLE INTEREST. years	days.	COMPOUND INTEREST. years	days.
5	20	0	14	17
6	16	243	12	325
8	12	182	9	2
9	11	40	8	15
10	10	0	7	96
12	8	121	6	40

COMPARISON

COMPARISON OF WEIGHTS.

IS when the weights of any country, or of different countries, are compared together, and is of great importance to the merchant to be acquainted with.

1. BENGAL, &c.

1 ficca weight is equal to 6.5706 drams, avoirdupois.
80 . . . . . make one Calcutta bazar ſar.
60 . . . . . Serampore ſar.
82 . . . . . Hoogly ſar.
84 . . . . . Benares ſar.
96 . . . . . Allahabad ſar.
84 . . . . . Mirzapoor ſar.
96 . . . . . Lucknow ſar.
72 ſa. wt. 11 an. 2 pn.
10 gund. 3.63 ko. ..... Calcutta factory ſar.

GENERAL RULE.

Multiply the given weight by the number of ficca weight in a ſar of that weight; and divide the product by the number of ficca weight, in a ſar of the required weight.

EXAMPLES.

In 100 factory mons, how many Calcutta bazar mons?

	ſa. wt.		ſa. wt.	an	pn.	gun.	ko.		Fact. mons.
	As 80	:	72	11	2	10	3.63	::	100
	80	:	72.72	.	.	.	.	::	100
CONTRACTIONS.	fact. m.		baz. m.						fact. m.
	11	:	10	.	.	.	.	::	100
	1.1	:	1	.	.	.	.	::	100

100
10

11)1000

Anſ. Baz. mons 90 36 5.8

OR THUS.

1.1)100.0

90.90

or B. M. 90 36 5.8 Anſ.

In 540 fac. mn. 15 s. 6 ck; how many bazar mons?
Anſwer 491 baz. mon 10 s. 5.45 cks.

Change 1 mon factory weight; into bazar weight. Anſwer 26 frs. 5⅓ cks.

In

In 491 baz. mons. 10 fr. 5.45 cks; how many factory mons.

		sa.wt	an.	pn.	gun.	ko.						
	As	72	11	2	10	3.63	:	80	::	491	10	5.45
CONTRACTED.	Or	10.	.	.	.	.	:	11.	::	491	10	5.45
												11

10)5043 33 12.

Anſ. Fact. mons 540 15 6

In 90 baz. mn. 36 ſr. 5.82 ck. how many factory mons? Anſwer 100 fact. mons.

Change 1 ſar bazar weight into factory weight. Anſwer 1 fr. 1 ck.

Reduce 100 bazar mons, to Lucknow mons. Anſwer L. M. 83 13 5.3.

Reduce 83 mons 13 fr. $5\frac{1}{3}$ ck. Lucknow weight; to Calcutta bazar weight.
Anſwer Baz. m. 100.

In 56 Hoogly mons; how many Serampore mons? Anſwer S. M. 76 21 5.3.

In 78 mons, Benares weight, how many factory mons? Anſwer F. M. 90 3 9.

In 100 mons Calcutta bazar weight; how many mons, Benares weight.
Anſwer Ben. m. 95 9 8.4.

2.—To reduce Calcutta factory weight, to Engliſh avoirdupois weight.

1 mon factory weight is equal to 74 lb. 10 oz. 10.6 drams, or 74.6 lb. avoirdupois.

1 mon, 20 fr. or 1.5 mon factory weight is equal to 1 cwt. or 112 lb.

3 mons factory weight, are equal to 2 cwt. or 224 lb.

R U L E.—Multiply the given weight by 2 and divide the product by 3, the quotient is the anſwer.

Or, divide the given weight by 1.5, and the quotient is the anſwer.

EXAMPLES.

Reduce 5 fact. mons, 20 fr. 8 ck.; to avoirdupois weight.

	fact. m.		lb.	oz.	drs.		fact. m.	fr.	ck.
As,	1 . . .	:	74	10	10.6	: : ...	5	20	8
Or,	1 . . .	:	74.6			: : ...	5.5125		
	1 m. 20 s.	:	1 cwt. . .			: : ...	5	20	8
CONTRACTIONS.	1.5 . . .	:	1 cwt. . .			: : ...	5.5125		
			2 cwt.				5	20	8
			2 cwt.				5.5125.		

F. m.

F. m. cwt. F. m. fr. ck.

As 3 . . : . . 2 . . : . . 5 20 8

40 40

120 220

16 16

1920 3528

2

cwt. qrs. lb

1920) 7056 (3 2 19 $\frac{1150}{1920}$ Anſ.

5760

1296

4

1920) 5184 (2 qrs.

3840

1344

28

1920) 37632 (19 $\frac{1150}{1920}$ lb.

Rem. 1150

or thus

5.5125

2

3) 11.0250

cwt. 3.675

4

qrs. 2.70.

28

lb. 19.6

Anſ. or cwt. 3 2 19.6

or thus

1.5)5.5125

Anſ. cwt. 3.675 as before

In 56 factory mons, how many cwt? Anſ. 37 cwt. 1 qr. 9 lb. 5 oz. 5 dr.

In 59 fact. mons, 10 ſ. 4 ck. how many pounds avoirdupois? Anſ. lb. 4424.

3.—To reduce Calcutta bazar weight, to Engliſh avoirdupois weight.

1 mon bazar weight is equal to 82 lb. 2 oz. 2.$\dot{1}\dot{3}$ drams avoirdupois.

15 mons bazar weight is equal to 11 cwt.

1 $\frac{4}{11}$ or 1.$\dot{3}\dot{6}$ mons bazar weight is equal to 1 cwt. or 112 lb.

RULE.—Multiply the given weight by 11 and divide the product by 15, the quotient is the anſwer.

Or, divide the given weight by 1.$\dot{3}\dot{6}$, the quotient will be the anſwer.

Or, multiply the given weight by .$\dot{7}\dot{3}$, the product will be the anſwer.

EXAMPLES.

EXAMPLES.

Reduce 3 mon 10 fr. 4 ck. bazar weight, to avoirdupois weight?

	Baz. m.	lb. oz. drs.	Baz. m. fr. ck.
As,	1 . . : . .	82 2 2.13 . . : : . .	3 10 4
Or,	1 . . : . .	82.13 . . . . . : : . .	3.25625
Contractions	15 . : . .	11 cwt. . . . . : : . .	3 10 4
	15 . : . .	11 cwt. . . . . : : . .	3.25625
	1.36 . : . .	1 cwt. . . . . : : . .	3.25625
	1 . . : . .	73 . . . . . : : . .	3.25625

7

66

66
90

66

9,0) 21491250

cwt. qr. lb.

2.387916 or 2 1 15.4 Anſ.

B. m.	cwt.	B. m. fr. ck.
15 . : .	11 . : : .	3 10 4
40		40
600		130
16		16
9600		2084
		11
		cwt. qr. lb.
		9600)22924(2 1 15 Anſ.
		19200
		3724
		4
		9600)14896(1 qr.
		9600
		5296
		28
		9600)148288(15 lb.
		Rem. 4288

OR THUS.

3.25625
11

15)35.81875

2.38791
or Cwt. 2 1 15.4 Anſ.

OR THUS.

1.36)3.25625
1 325625

135)3.2236875

2.38791
or Cwt. 2 1 15.4 Anſ.

Reduce 555 mons, bazar weight, to avoirdupois weight. Anſ. 407 Cwt.

Reduce 79 mn. 8s. 4ck. bazar wt., to avoirdupo is weight Anſ. Cwt. 58-0-9-7-9.

4.—To change Engliſh avoirdupois weight, into Calcutta factory weight.

RULE.—Multiply the given weight by 3, and divide the product by 2, the quotient will be the anſwer.

Or, Multiply the given weight by 1.5; the product is the anſwer.

EXAMPLES.

1. Reduce 3 cwt. 2 qrs. 19.6 lb. to factory weight.

	lb.	oz.	drms.		F. mon.				cwt.	qr.	lb.
As	74	10	10.6	:	....	1	....	::	....	3	2 19.6
	74.6	.....		:	....	1	....	::	....	3.675	
Contractions	1 cwt.	.....		:	....	1	20 .	::	....	3	2 19.6
	1 cwt.	.....		:	....	1.5	..	::	....	3.675	
	2 cwt.	.....		:	....	3	....	::	....	3	2 19.6

cwt.	mons	cwt.	qr.	lb.
As . 2	. 3	: 3	2	19.6
4		4		
8		14		
28		28		
224		411		
10		10		
2240		4116		
		3		
		12348		
	2240)			
Anſ. Fact.	mons	5	20	8

or thus

3.675	3.675
3	1.5
2)11.025	F. M. 5.5125
F. M. 5.5125	or F. M. 5 20 8 Anſ.

or F. mons 5 20 8 Anſ.

In 575 cwt. 2 qrs. 14 lb. how many factory mons. Anſ. F. m. 863 17 8.32

In 1 ton, how many factory mons. Anſwer F. m. 30 0 0.

5.—To change Engliſh avoirdupois weight into Calcutta bazar weight.

RULE.—Multiply the given weight by 15, and divide the product by 11; the quotient will be the anſwer.

Or, divide the given weight by .73, and the quotient will be the anſwer.

Or, Multiply the given weight by 1.36 and the product will be the anſwer.

EXAMPLES.

Reduce 2 cwt. 1 qr. 15.4 lb., to Calcutta bazar mons.

	lb. oz. drms. mon.		cwt. qr. lb.
As	82 2 2.13	: 1 ..... : :	.... 2 1 15.4
	82.13 ..	: 1 ..... : :	.... 2.38791
Contractions	11	: 15 ..... : :	.... 2 1 15.4
	11	: 15 ..... : :	.... 2.38791
	1 cwt.	: 1.36 .. : :	.... 2.38791
	.73	: 1 ..... : :	.... 2.38791

Cwt.	mon.	Cwt. qr. lb.
11	: .... 15 ...	: : ... 2 1 15.4
4		4
44		9
28		28
132		267
10		10
12320		2674
		15
		12320)40110
		Anſ. Bazar mons 3 10 4

OR THUS.

2.38791
15

11)35.81865

Br. m. 3.25624
or Br. m. 3 10 4 Anſwer.

OR THUS.

$1.36 = \frac{135}{99}$ 2.38791
135

99)322.36785

Baz. m. 3.25624
or Bazar mons 3 10 4 Anſ.

OR THUS.

73)2.38791
7 238791

66)2149119

Anſwer ... B. m. 3.25624 as before.

In 777 cwt. how many bazar mons? Anſwer 1059 21 13.

In 1 ton, how many bags of rice, weighing each 2 bazar mons.
Anſwer 13 bags and 1 m. 10 fr. 14 ck.

6.—

6.—To reduce Calcutta weights to Bombay weights See Tables of Bombay and Surat weights.

1 mon Calcutta bazar weight is equal to 82 lb. 2 oz. 2.13̇ drms. or 82.13 lb.
1 mon . . . ditto . . . . . 2 mon. 37 s. 10 p. or 2.93̇ Bom. wt.
6 bazar mons, 32 sr. 11.63̇ ck., or 6.81̇ . 1 Bombay candy of 560 lb.
1 mon Calcutta factory weight . . . 74 lb. 10 oz. 10.6̇ drs., or 74.6̇ lb.
1 . . . ditto . . . . . 2 mon. 26 sr. 20 p. or 2.6̇ Bom. wt.
7 fact. mons, 20 sr., or 7.5 . . . . 1 Bombay candy of 560 lb.

RULE 1.—As 1 bazar mon : is to 2 Bom. mn. 37 s. 10 p. or 2.93̇ :: so is the given weight : to the answer in Bombay weight.

2.—As 6 baz. mons; 32 s. 11.63̇ p. or 6.81̇ : are to 1 candy :: so is the given weight : to the answer in candys.

3.—As 1 fact. mn. : is to 2 Bom. mn. 26 sr. 20 p., or 2.6̇ :: so is the given weight : to the answer in Bombay mons.

4.—As 7 fact. mons, 20 s. or 7.5. : are to 1 candy :: so is the given weight : to the answer in candys.

EXAMPLES.

Reduce 50 bazar mons, to Bombay mons.

Br. m.	By. m.	sr.	p.		RULE 1	or thus
As 1 .... :	2	37	10	.... ::	50	2.93̇
			5×10=50			50
	14	26	20			146.6̇ or Bombay mons 146 26 2
			10			40
Bombay mons	146	26	20	Answer		26.6̇
						30
						20.0

Or See. General rule in comparison of Madras weights ; case 8.

In 50 bazar mons, how many candies?

Br. m.	fr.	ck.
6	32	11.63
40		
272		
16		
1363		
100		
436363		

candy Br. m.
.. 1 :: 50
40
2000
16
32000
100
c. m. f. p.
436363)3200000(7 6 26 20 Anſ.
rem. 145459
20
436363)2909180(6 mons
rem. 291002
40
436363)11640080(26 far
rem. 294642
30
436363)8839260(20 pauys

or thus
6.81)50.00
6 50
675)4950.(7.3 Anſ.
20
Rem. 225
mon 6.6
40
fars 26.6
30
pa. 20.0

In 50 factory mons, how many Bombay Mons?

RULE 3.

Fact. mon Bz. m. fr. p. F. m.
As ... 1 .... : .... 2 26 20 .. :: .. 50
5×10=50
13 13 10
10
Bombay mons 133 13 10 Anſwer.

OR THUS.
2.6
50
B.m. fr. p.
133.3 or 133 13 10 Anſ.
40
13.3
30
10.0

In 50 mons factory weight how many candies?

BY RULE 4.

F.m.	fr.	ck.		can.		F. m.
As 7	20	0	.. : ..	1	.. : : ..	50
40						40
3000				3,00)2000		

7.5)50.0

6.6

or B. C. 6 13 13 10 Anſwer.

Bombay candy 6 13 13 10 Anſ.

In 59 bazar mon, 10 s. 8 ck. how many Bombay mons? Anſ. Bom. m. 173 33 14

Reduce 59 baz. mons, 10 s. 8 ck., to Bombay candies. Anſ. Can. 8 13 33 14.

Reduce 59 factory mons, 10 s. 8 ck., to Bombay mons. Anſ. Bom. m. 158 1 10.

Reduce 59 fact. mons, 10 s. 8 ck., to Bombay candies. Anſ. Can. 7 18 1 10.

7.—To reduce Bombay weights to Calcutta weights.

RULE 1.—As 2 Bom. mons, 37 s. 10 p., or 2.93 : are to 1 bazar mon : : ſo is the given weight; to the anſwer in bazar mons.

Or, multiply the given weight by .03409, and the product is the anſwer.

2.—As 1 candy : is to 6 baz. mons, 32 ſr. 11.63 ck. or 6.81 : : ſo is the given weight : to the anſwer in bazar mons.

Or, divide the given weight by .146, and the quotient is the anſwer.

3.—As 2 Bom. mons, 26 s. 20 p. or 2.6 : are to 1 factory mon : : ſo is the given weight : to the anſwer in factory mons.

Or, multiply the given weight by .0375, and the product is the anſwer, as before.

4.—As 1 candy; is to 7 fact. mons, 20 ſr., or 7.5 : : ſo is the given weight : to the anſwer in factory mons.

Or, divide the given weight by .13.

EXAMPLES

EXAMPLES.

Reduce 146 Bom. mons, 26 fr. 20 p., to Calcutta bazar mons.

BY RULE 1.

Bom. fr. p. Baz. m. B. m. fr. p.

As 37 20 : 1 :: 146 26 20

40 40

217 5866

30 30

3520 3520)176000(50 Anf.

17600

0

OR THUS.

2.93 146.66

29 1466

264) 13200(50 Anf.

OR THUS.

146 6 .03409

146 1320

1320 9)449.9

9

49.9 or 50 Anf.

In 7 Bom. can. 6 mn. 26 fr. 20 p., how many bazar mons?

RULE 2.

can. Baz m. fi. ck. c. m. fr.

As 1 ..... : ..... 6 32 11.63 ..... : 7 6 26

20 40 20

20 272 146

40 16 40

800 4363 5866

30 100 30

24000 4.6353 176000

176000

24,000)76799888,000

Bazar mons 49 39 13⅓ Anf.

OR THUS.

7.3 6.8i

7 66

66 4090

9 4090

9)449.90

49.9 or 50 Anf.

OR THUS.

.146) 7.333

14 733

132) 6600(50 Anfwer.

660

In 133 Bombay mn. 13 fr. 10 p., how many factory mons

RULE 3.

B. m.	fr.	p.		F. m		B. m.	fr.	p.
As 2	26	20	:	1	::	133	13	10
40						40		
106						5333		
30						30		
3200						32,00)1600,00		

Anſwer Factory mons 50

OR THUS.

2.6) 133.3
2 133
24) 1200
Anſ. F. m. 50

OR THUS.

133.3
.0375
0666
93333
400000
F. m. 50 Anſ.

In 6 Bom. can. 13 mn. 13 s. 10 p., how many factory mons?

RULE 4.

	Can.	F.m.	sr.		Can.	m.	sr.	p.
As	1	7	20	.:	6	13	13	10
	20	40			20			
	20	300			133			
	40				40			
	800				5333			
	30				40			
	24000				160000			
					300			
					24,000)48000,000			
					4,0)200,0			
				Anſ. Fact. mons	50			

or thus

6.6
7.5
333
4666
50. Anſ.

or thus

.13)6.66
1 66
12)600
Anſ. 50

Reduce 796 Bombay mons, to bazar mons. Anſ. Bazar m. 271 14 8 .256

Reduce 50 Bombay candies, to bazar mons. Anſ. Bazar m. 340 36 5

Reduce 150 Bombay mons, to factory mons. Anſ. Fy. m. 56 10

Reduce 150 Bombay candies, to factory mons. Anſ. Fy. m. 1125

8.—To reduce Calcutta weights to Madras weights.

	lb.	oz.	drms.	
2 Calcutta bazar mon .... is equal to	82	2	2.13	avoirdupois, or 82.13 lb.
1 ditto .. factory mon	74	10	10.6	, or 74.6 lb.
1 Madras mon	25	0	0	
1 ditto . candy	500	0	0	
1 ditto . garce	9256	8	0	, or 9256.5 lb.

	Mad. mn.	v.	pol.	p.w.	
1 Calcutta bazar mon .... is equal to ...	3	2	11	3	or 3.2853
1 ditto .. factory mon	2	7	37	7.3	or 2.986
375 ditto .. bazar mons	1.232	0	0	0	
75 ditto .. factory mons	224	0	0	0	

370 Madras mons, 2 vis, 3 pol. 2 p. w., or 370.26 equal to 1 garce.

Fac. m.	s.	ck	Fac. mon	
6	27	3.7	or 6.09643 .. is equal to ..	1 Madras candy
Bzr. m.	**s.**	**ck**	**Bzr. mon**	
6	3	8.1	or 6.087	1 ..... ditto.
112	28	0	or 112.7	1 garce.
1127	0	0	.....	10 ..... ditto.

GENERAL RULE.

Reduce the given weight to avoirdupois weight; and divide it by as many pounds, as are equal to 1 or an integer of the required weight.

To reduce bazar mons to Madras mons.

1.—As 1 bazar mon : is to 3 Mad. mn. 2 v. 11 pol. 3 p. wt., or 3.2853 ſo is the given weight : to the anſwer.

2.—As 375 bazar mons : is to 1232 Madras mons :: ſo is the given weight : to the anſwer as before. Or divide the given weight, by .30438 and the quotient will be the anſwer.

EXAMPLES.

In 50 bazar mons, how many Madras mons.

BY GENERAL RULE.

lb. oz. drs.
82 2 2.13
5 × 10 = 50
410 10 10.65
10
As 25 .. : 1 .. :: .. 4106 10 10.5
16
65706
16
1051306
10
)10513065(Mad. mn. v. pol. p. w.
Rem. 17065
8
6,000)136520(2 viss
Rem. 8520
40
64000)340800(5 pollam
Rem. 20800
10
64000)208000(3 pag. wt
Rem. 6000

Mad. mn. 164 2 5 3 Anſwer

OR THUS.

821.3
50
25)4106.66
164.26

or 164 Mad. mn. 20. 5 pol. 3 p. w.

BY RULE I.

As 1 : 3 2 11 3 :: 50
5
16 3 15 5
10
Mad. mn. 164 2 5 0 Anſ.

BY RULE 2.

As 375 : 1232 :: 50
50
375)61600
Anſ. Mad. mn. 164 2 5 3

or thus
BY RULE 1.

3.2853
50
———
64.266 or 164 2 5 3 Anſ.
8
———
2.13
40
———
5.3
10
———
3.
———

or thus

.30438)50.00000
———
164.26 &c. or 164 2 5 3

	M.	mn.	v.	p.	p. w.
Reduce 5 baz. mns. 2 far. 5 ck., to Madras mons. Anſ.	16		4	37	2
Reduce 10 bazar mons, to Madras mons. Anſ.	32		6	33	

TO REDUCE BAZAR MONS, TO MADRAS CANDIES.

RULE 1.—As 6 baz. mons, 3 sr. 8.1 ck. . or 6.087 : is to 1 candy :: ſo is the given weight: to the Anſwer. Or, multiply the given weight by .16426 and the product is the anſwer.

EXAMPLES.

EXAMPLES.

If 50 bazar mons, how many candies?

BY GENERAL RULE.

lb. oz. drs.
82 2 2.13
5
410 10 10.65
10
4106 10 10.5

As 500 . : . 1 . :: 4106 10 10.5

16 16
8000 65706
16 16
128000 1051306
10 10
1280000) 10513065 (8 4 2 5 3 Anf.
can. m. v. pol. p. w.

rem. 273065
20
1280000) 5461300 (4 mons.
rem. 341300
8
1280,00) 2730400 (2 vis.
rem. 1704
40
128,0) 6816,0 (5 pol.
6400
rem. 416
10
128,0) 4160 (3 p. w.
384
32

or thus

82.13
50
500) 410.6
8.213

or can. 8 4 2 5 3 as be

BY ABOVE RULE.

6.087) 50.000 (8.213 as before

5479) 45000 (8

cap.

.16426
50
8.213 as before.

In 25 bazar mons; how many candies? Answer 4c. 2m. 1v. 2p. 6½p. w.

In 25 bazar mon 20 fr.; how many candies? Answer 4c. 3m. 6v. 8p. 3p. w.

TO REDUCE FACTORY WEIGHT TO MADRAS MONS.

RULE 1.—As 1 factory mon: is to 2 Mad. mons 7v. 35 pol. 7 3 p. wt. or 2.986 :: so is the given weight: to the answer.

2.—As 75 factory mons: are to 224 Madras mons :: so is the given weight: to the answer as before. Or divide the given weight by .33482 and the quotient will be the answer.

EXAMPLES.

In 50 factory mons; how many Madras mons?

BY GENERAL RULE.

lb. oz. drams
7 4 1 10.65
5×10=50
373 5 5.33
10

As .25 : 1 :: 3735 5 5.3
16 16
400 5973
16 16
6400 95573
10 10
64000) 957333 (149 2 26 6.6 Anf. Mad. m. v. pol. p. wt.

or thus
74 6
50
25)373.3
Mad. mn. 149.3
8
vis 2.6
40
pol. 26.6
10
p. wt. 6.6

Mad. mn. 149 2 26.6

BY

BY RULE 1.

F. m. M. m. v. pol. p. wt. F. m.

As .. 1 .. : .. 2 7 35 7 33 .. :: .. 50

5 × 10 = 50

14 7 18 6 66

10

Mad. mn. 149 2 26 6.6 Anſwer

OR THUS

2.9166

50

Mad. mn. 149.3 as before

OR THUS

.31482)50.00000

Mad. mn. 149.3 as before

or Mad. mn. 149 2 26 6

BY RULE 2.

F. m. M. m. F. m.

As .. 75 .. : .. 224 .. :: .. 50

50

75) 11200

Mad. m. 149 2 26 6 Anſwer.

In 10 factory mons, how many Madras mons. Anſ. 29 M. m. 6 v. 37 p. 3⅓ f. w.

In 10 factory mons, 10 ſr.; how many Mad. mons. Anſ. 30 M. m. 4 v. 36 p. 2.430 p. w.

TO REDUCE FACTORY WEIGHT, TO MADRAS CANDIES.

RULE. — As 6 factory mons, 27 f. 3 7 ck. or 6 69643 : are to 1 candy :: ſo is the given weight : to the anſwer. Or multiply the given weight by .1493 and the product is the anſwer.

EXAMPLES

EXAMPLES.

In 50 factory mons, how many Madras candies?

BY GENERAL RULE.

74 10 10.65
5

373 5 5.33
10

As 500 : : 1 : 3733 5 5.3
16 16

8000 59733
16 16

128000 955733
10 10

1280000) 9557333 (7 9 2 26 6 Anf.
can. m. v. pol. p. wt.

OR THUS

74.66
50

500)373.33

can. 7.46
20

mn. 9.3
8

vis. 2.6
40

pol. 26.66

or can. 7 9 2 26 6

BY ABOVE RULE.

6.69643) 50.0000

7.46 as before

.1493
50

candies 7.46 as before.

In 29 factory mons, how many Madras candies? Anf. 3 c. 14 m. 5 v. 13 p. 3 p. wt.
In 25 factory mons, 5 fr. 8 ck. how many candies? Anf. 3 c. 15 m. 2 v. 6 p. 6 p. wt.

TO REDUCE BAZAR MONS TO GARCE.

RULE 1.—As 112 bazar mons, 28 fr. or 112.7 : is to 1 garce : ſo is the given weight : to the anſwer.

2.—As 1127 bazar mons : is to 10 garce : : ſo is the given weight to the anſwer. Or multiply the given weight by .008873. and the product is the anſwer.

EXAMPLES.

EXAMPLES.

In 500 bazar mons, how many garce.

BY GENERAL RULE.

lb. oz. drs.

82 2 2.13

5 × 10 × 10 = 500

410 10 10.66

10

4106 10 10.66

10

As 9256 8 0 ... : 1 ... :: 41066 10 10.6

16 10

148 04 657066

16 16

2309664 10510306

10 10

23096640)105130660(4 $\frac{123}{2,3}$ &c. or about 4 $\frac{2}{5}$ garce.

10,44106

OR THUS.

9256.5)41066.6

Anſ. Garce 4.43 &c.

or about 4 $\frac{2}{5}$ garce.

BY RULE 2.

As 1127 . 10 :: 500

10

1127) 5000

Anſ. 4 $\frac{2}{5}$

OR THUS.

.008873

500

Garce 4.4365

Reduce 579 bazar mons, to garce. Anſwer 5 garce 11 p.

TO REDUCE MADRAS WEIGHTS TO CALCUTTA WEIGHTS.

1 Madras mon	is equal to	Bazar mons	0	12	2.8 or .30438
1232 ditto	———	———	375	0	0
1 Madras candy	———	———	6	3	8.1 or 6.087
16420 candy	———	———	1	0	0
1 Garce	———	———	112	28	0 or 112.7
10 ditto	———	———	1127	0	0
.008873 garce	———	———	1	0	0
1 Madras mon	———	Fact. mons	0	13	6.3 or .33432
224 ditto	———	———	75	0	0
1 Madras candy	———	———	6	27	3.7 or 6.69645

GENERAL

GENERAL RULE.

As one of the given weight : is to its weight in avoirdupois : : ſo is the given weight : to its weight in avoirdupois.

Then as 1 of the required weight in avoirdupois : is to 1 :: ſo is the given weight reduced to avoirdupois : to the anſwer.

TO REDUCE MADRAS MONS TO BAZAR MONS.

RULE 1.—As 1 Madras mon : is equal to 12 ſars, 2.8 ck. or 82438 bazar weight :: ſo is the given weight : to the anſwer.

2.—As 1232 Madras mons : is to 375 bazar mons :: ſo is the given weight : to the anſwer.

EXAMPLES.

Reduce 154 Madras mons, 2 vis., 5 pol. 3 p. wt., to bazar mons.

BY GENERAL RULE.

Mad. m.	lb.	Mad. m.	v.	pol.	pw.		lb.	oz.	drs.	baz. m.	lb.	oz.
1	: 25	: 164	2	5	3	then As	82	2	2.13	: 1 : :	4106	10
8		8					16				16	
8		1314					1314				65706	
40		40					16				16	
320		52565					21026				1051296	
10		10					100				100	
3200		525653					2102613				) 105129600	
		25										
		lb. oz.										
3200)1314:325(4106 10												
Rem. 2125												
16												
3200)34000(10 oz.												
3200												

Anſwer Bazar mons 49 39 15 $\frac{141}{215}$

OR THUS.

As 82.13 : 25 :: 164.26

25

82133

328533

82.13) 4106.66

821 41066

7392) 369600

Anſwer Bazar mons 50

Mad.

BY RULE 1.

Mad. m.	ſir.	ck.	Mad. m. v pl.pw.
As 1 :	12	2.8 :	.: 164 2 5 3
—	16		
3200	—		52,653
	194		1948
	10		
	1948		4705224
			2102612
			4730877
			525653

3200)1023972044(10)319991

16) 31999

40) 1999 15

B. m. 49 39 15 Anſwer.

OR THUS.

164 26
30438

131413
492800
6570666
4928000000

Anſwer 49 9 or 50 B. m.

BY RULE 2.

Mad m.	B. m.	B. m. v. pl pw.
As 1232 .	375 :.	164 2 5 3
3942400		525653
		375

B m s. ck..

3942400)197119875(49 39 15.9 Anſ.

164 26
375

1232)61600000

Anſwer Bazar mon 50

Reduce 505 Madras mons, to Calcutta bazar mons.

Anſwer Bazar mons 153 28 8.748

Reduce 95 Madras mons, to bazar mons. Anſwer Bazar mons 28 36 10.608

N O T E.—When the weight is given in Candies, reduce them to mons, and proceed as before.

To change Madras garce, into bazar mons.

RU L E.—As 10 garce : is to 1127 bazar mons :: ſo is the given weight to the anſwer. Or divide the given weight by .00887, and the quotient is the anſwer.

EXAMPLES.

In 4 garce, 34 parah . 4.6 mar., how many bazar mons?

Work by either of the following proportions:

BY GENERAL RULE.

lb. oz. drs.

As 1 garce ..... : 9256 lb. 8 oz. :: 4 garce, 34 par, 4.6 mar. : 41066 10 10.6
Then 82 lb. 2 oz. 2.13 : 1 bazar mon . :: 41056 lb. 10 oz. 10.6 drs. : 500 Anſ.
Or 82.13 lb. ..... : 9256.5 lb. ... :: 4.4365 garce ..... : 500

BY ABOVE RULE.

As 10 garce .... : 1127 baz. m. :: 4 garce, 34 par., 4.6 mar. : 500 Anſ.
Or 10 ditto ..... : 1127 ditto :: 4.4365 garce ..... : 500
Or .008873 garce .. : 1 bazar mon :: 4.4365 ..... : 500

.008873) 4.436500 (500 bazar mons. Anſwer.
44365
—
00
—

In 40 garce, how many bazar mons. Anſwer 4503 bazar mons.

In 1 garce, how many bags of rice, containing each 2 bazar mons?
Anſ. 56 bags & 23 ſars.

TO REDUCE MADRAS MONS INTO FACTORY MONS.

EXAMPLES.

Reduce 149 Madras mons 2 vis . 26.6 pol., to factory mons.

BY GENERAL RULE.

As .. 1 Madras mon . . . : 25 lb. . . . . :: 149 2 26.6 : 3733 5 5.3
Then 74 lb. 10 oz. 10.6 drs. : 1 fact. mon . . . :: 3735 5 5.3 : 50 Anſ.
Or .. 74.6 lb. . . . . : 1 do. . . . . :: 3733 3 . . . : 50

OR THUS.

As .. 1 Madras mon . . . . : 13 ſars. 6.3 ck. fact. wt. :: 149 2 26.6 : 50
Or .. 1 Madras mon . . . . : .33382 . . . . . :: 149.3 . . . : 50

OR THUS.

As .. 224 Madras mons . . : 75 fact. mons . . . . :: 149 2 26.6 : 50
Or .. 224 ditto . . . . . : 75 do. . . . . :: 149.3
75
—
746.6
104533
—
224) 11200.0 (50 fact. mons. Anſ.
1120
—
0
—

In

In 50 Madras mons, how many factory mons. Anſwer 16 F. m. 29 f. 10 c.

In 75 Madras mons, how many factory mons. Anſwer 25 F. m. 4 f. 7 c.

NOTE.—When the given weight is in Candies, reduce them to Madras mons, and work as before.

To reduce Calcutta weights to China pecul.

GENERAL RULE.

As 1 mon of the given weight : is to its weight in avoirdupois :: ſo is 1 the given weight :: to its weight in avoirdupois. Then as 133 lb. 5 oz. 5 3 drs. : is to 1 pecul :: ſo is the given weight reduced to avoirdupois : to the anſwer.

OR THUS,

Multiply the given weight, if in [illegible] mons, by 56 and divide the laſt by 100; the quotient is the anſwer.

OR THUS.

If the given weight, is in bazar mons, multiply it by .616 and the product is the anſwer.

EXAMPLES.

[illegible] factory mons, how many China [illegible].

50 — 50
56 — 56
— —
1800 100 — 2800 Anſwer.
— —
Anſwer 28 Pecul

50 bazar mons how many pecul.
.616
50
—
Pecul . . 30.8 Anſwer.
—

[illegible] factory mons, 2 [illegible], how many pecul? Anſwer 52 p. 12 catties.
[illegible] bazar mons, 2 [illegible], how many pecul? Anſwer 51 p. 10 catties.

To reduce China pecul to Calcutta weights.

RULE 1.—Reduce the given weight to avoirdupois, and divide it by 1 mon of the required weight in avoirdupois.

2.—

2.—If the required weight is factory mons, multiply the given weight by 100, and divide the product by 56; or divide the given weight by .56, and the quotient is the answer.

3.—If the required weight is bazar mons, divide the given weight by .616, the quotient is the answer.

EXAMPLES.

In 28 pecul how many factory mons?

28

56) [illegible] (50 factory mons. Ans.

[illegible]

In 30 pecul, 8 catties, how many bazar mons?

.616) 30 [illegible] (5 bazar mons. Ans.

[illegible]

0

NOTE.—Reduce pecul to lbs. avoirdupois, by multiplying by 4, and dividing the product by 3.

Reduce avoirdupois weight to pecul, by multiplying by 3, and dividing the product by 400.

Reduce 1 pecul, to factory weight. Answer 1 m. 31 f. 6 c. $\frac{55}{40}$.

Reduce 1 pecul, to bazar weight. Answer 1 m. 35 f. 3 c.

TARE AND TRETT.

TARE allowances made among merchants, in such goods as are sold by weight.

GROSS WEIGHT, is the whole weight including package

TARE, is the weight of the bag, box, &c. wherein the goods are packed.

TRETT, is an allowance for dust, waste, &c. made by the seller to the buyer.

SUTTLE,

SUTTLE, is when the tare, is deducted from the groſs weight.

CLOFF, is an allowance on every draught, on ſome ſorts of goods.

NETT WEIGHT, is when all allowances are deducted from the groſs weight.

When the tare is at ſo much in the groſs weight to find the Nett weight.

RULE.—Subtract the Tare from the groſs weight, and the remainder is the nett weight.

EXAMPLES.

What is the nett weight of 100 dubbers of Ghee, each weighing 2 bazar mons 5 ſars, tare on the whole 6 baz. mons, 10 ſars, 5 ck.

		100			
		2			
		200			
ſar					
5 . . .	1/8	12	20	0	
		212	20	0	Groſs weight.
		6	10	5	Tare.
Bazar mons		205	9	11	Nett weight.

What is the nett weight of 3 hogſheads of Sugar, weighing as follows.

No.		Baz. m.	ſ.	ck		Tare	ſ.	ck.
1	4		15	2				
2	3		5	0			8	2
3	2		30	4			7	0
Groſs weight	10		10	6			25	5
Tare	0		25	5				
Nett weight	9		25	1				

What is the nett weight of 5000 bags of rice, weighing 2 mons 6 ſars each, allowing 50 mons 6 ſ. for tare and trett. Anſwer 10699 m. 34 ſ.

When the tare is at ſo much per box, bag, &c. to find the nett weight.

RULE.—Multiply the tare of each box, or bag, &c., by the number of boxes, &c., ſubtract the product from the groſs as before, and the remainder will be the nett weight.

EXAMPLES.

What is the nett weight of 8 frails of raiſins, each weighing 2 cwt. 3 qrs. groſs; tare at 2 lb. per frail.

	cwt.	qrs.			
	2	3		22	
		8		8	
Groſs . .	22	0	lb.	176 or 1 cwt. 2 qrs. 8 lb.	
Tare . .	1	2	8		
Nett . .	20	1	20		

What is the nett weight of 40 bales of ſilk, each weighing 4 fact. mons, 20 ſars groſs; tare at 9 ſars per bale. Anſwer 171 mn. nett.

When the tare is at ſo much per cwt., mon, &c. to find the nett weight.

RULE.—Divide the whole groſs weight, by ſaid part or parts, that the tare is of the integer of the given weight, and the quotient will be the tare, which ſubtracted from the groſs, as before, gives the nett weight.

EXAMPLES.

What is the nett weight of 22 boxes of ſugar, each weighing 2 mons 15 ſars groſs, tare at 5 ſars per mon.

		22			
		2			
ſar		44			
10 . .	½	5	20		
5 . .	¼	2	30		
ſar		52	10	0	Groſs.
5 . .	⅛	6	21	4	Tare.
Mons		45	28	12	nett weight.

What is the nett weight of 9 hogſheads of ſugar, each weighing 6 cwt. 2 qrs. 12 lb. groſs, tare 17 lb. per cwt. Anſwer 50 cwt. 1 qr. 21 lb.

BARTER.

IS the changing of one commodity for another and informs us how to proportion the value of any goods, ſo that neither party may ſuſtain any loſs; and if the commodities exchanged are not of equal value the defect is ſupplied with money.

RULE.

RULE 1.—Find the value of that commodity whoſe quantity is given, then find the quantity of the other at the given rate, you can have for the aforeſaid value, which quantity will be the anſwer.

2.—When one has goods at a certain price ready money, but in bartering advances it to ſomething more; ſay, as the ready money price of the one: is to its bartering price :: ſo is the ready money price of the other: to its bartering price; then the quantity of the latter commodity may be found either from the ready money or the bartering price.

EXAMPLES.

How much Sugar at 8 ſr. r. 8 an. per bazar mon, muſt be given in barter for 4 cheſts of Tea, at 180 ſicca rupees per cheſt?

180 then, As 8 8 0 : 1 :: 720
4 16 16
720 136 136)11520(84 28 3.7 Anſ.
rem. 96
40
136)3840(28 ſars.
rem 32
16
136)512(3.7 ck.
408
104

OR THUS

8.5) 720.0(84.705
40
ſars 28.232
16
ck. 3.7 &c.

How many yards of cloth, at 9 ſicca rupees per yard, muſt I give for 1000 yards of muſlin at 2 an. per yard? Anſwer 13 yards 3 qrs. $2\frac{2}{9}$ nails.

RULE 2.

A. and B. barter. A. hath 30 cwt. of prunes at 6d. per lb. ready money, but in barter will have $7\frac{1}{2}$ d. per lb.; B. hath ſugar worth 36 ſhillings per cwt. ready money; what ought B. to rate his ſugar at, in barter, and what quantity muſt be given for the 30 cwt. of prunes?

cwt.		a.	a.	ſh.	ſh.	cwt.	ſh.
30	then	6 :	7½ ::	36	again 45	: 1 . . : . .	2100
112				7			1
3360 lb.			d	252			45)2100
7½			½	18			
25200 pence, or 2100 ſh.				6)270		Anſwer Cwt.	46 2 18.6 lb.
			Rate	45 ſh.			

A. hath tea at 8 ſ. 6 d. per lb. ready money, but in barter will have 10 ſ. per lb.; B. hath tobacco worth 18 d. per lb. ready money; how muſt B. rate his tobacco per lb. that his profit may be equivalent with A.'s. Anſwer 1 ſ. 9 $\frac{3}{17}$ d. per lb.

LOSS AND GAIN.

IS the rule by which we diſcover the gain or loſs, by any parcel of goods, and ſo inſtructs us, how to raiſe or fall the price of any commodity in ſuch proportions, that neither our gain may be ſo exorbitant as to injure our cuſtomers, nor our loſs ſo great as to impoveriſh ourſelves, which is generally at ſo much per cent.

In this rule there are great varieties, all of which may be eaſily ſolved by the following proportions:

When the buying and ſelling prices are known; and the rate per cent. gain or loſs required.

RULE.—As the whole quantity of the goods; is to the whole coſt and propoſed gain :: ſo is any part of ſaid goods :: to the price they muſt be ſold for.

When the propoſed gain or loſs is at ſo much per cent., make 100 with the gain or loſs added to it, your ſecond term.

EXAMPLES.

Bought 300 yards of cloth at 7 r. 8 an. per yard; and ſold it again for 9 r. 4 an. per yard; what did I gain by the whole?

	300 at 7 r. 8 a.			300 at 9 r. 4 an.	
	7			9	
a.	2100		a.	2700	
8	½	150	4 ...	¼	75
Coſt .... R.		2250	Rs.		2775 ſold for
					2250 coſt.
				Rs.	525 gained. Anſ.

Suppoſe I give £. 46 for 9 cwt. 2 qrs. 18 lb. of ſugar, at what rate muſt I ſell it per lb. to gain 12 £. 12 s. by the whole?

	£	s.	d.	
	46	0	0	coſt.
	12	12	0	gain.
Cwt. qrs. lb.				lb.
As 9 2 18 . . : . . .	58	12	0	. . . :: 1
4	20			
38	1082)1172 (1 s. 0¾ $\frac{1074}{1082}$ per lb. Anſwer.			
28				
1082	rem. 90			
	12			
	1080			
	4			
	1082)4320(¾			
	rem. 1074			

If I buy Tea at 8 r. 8 an. per lb. and ſell it again for 10 r. 8 a. per lb.; what is the gain per cent.?

	R. A.		
	10 8		100
	8 8		16
R. A.			
As 8 8 . . . . : . . . 2 0 . . .	::	. . .	1600
16			2
136		136)3200(	R. 23 $\frac{40}{136}$ or 23 $\frac{5}{17}$ per cent.
		rem. 40	

I purchaſed an invoice of Europe Goods amounting to £. 500 at 50 per cent. advance, allowing 2s. 3d. per current rupee; I ſold the whole at the rate of 1 ſicca rupee for

every

every ſhilling on the original amount £. 500; what did my gain amount to and how much per cent.? Anſwer Gain ſr. 4252 14 0. and 74 per cent.

MIXTURES.

WHEN the price and quantity of ſeveral commodities are given to be mixed, to find the mean price of that mixture; this is called ALLIGATION MEDIAL.

RULE.—As the whole compoſition : is to its total value :: ſo is any part thereof; to its mean price.

EXAMPLES.

A wine merchant mixes 50 gallons of Madeira, at 4 rupees per gallon, with 30 gallons, at 3 rupees per gallon, 30 gallons at 2 rupees per gallon, 20 gallons of Teneriffe Wine, at 12 annas per gallon, and 10 gallons of Vin de Grave at 8 annas per gallon; how may he ſell this mixture per gallon?

Galls.	R. A.	R.
50 at	4 ...	200
30 ..	3 ...	90
30 ..	2 ...	60
20 ..	0 12 ..	15
10 ..	0 8 .	5
140	140)370	

Rs. 2 10 3.4 Anſ.

I purchaſed 63 gallons of Brandy at 4 rupees per gallon, 63 gallons at 3 r. 8 a. per gallon, 63 gallons, at 3 rupees per gallon; I want to reduce the price by mixing it with 40 gallons of Bengal Rum, at 12 annas per gallon, and wiſh to know what I can ſell it for per gallon, to gain 25 per cent.?

Galls,

Galls.	R.	A.	R.	A.
63	at 4	0	252	0
63	.. 3	8	220	8
63	.. 3	0	189	0
40	.. 0	12	30	0
229			691	8

As 100 .. : 125 ... : : 691 8
125
864 6

	Gall.	R.	A.	Gall.
Then, as	229 ...	864	6 ...	1
		15		

229)13830

16)60 an. 4 p.

R. 3 12 4 Anſwer.

I have 5 pipes of Madeira Wine of different qualities and prices, but have no proſpect of being able to ſell the inferior qualities; thus, 1 pipe at 700 rupees, 1 pipe 500, 1 pipe 300, 1 pipe 200, and 1 pipe at 150 rupees; ſuppoſe I mix them together, what can I afford to ſell them at per pipe? Anſwer 370 rupees per pipe.

When the rates of ſeveral commodities are given, to find ſuch quantities of them, as being mixed together, ſhall bear a propoſed price; this is called ALLIGATION ALTERNATE.

RULE.—Write down the different, rates reduced to the ſame denomination, the higheſt uppermoſt, the next higher below that, and the reſt in the ſame order; and ſet down the mean rate on the left hand of theſe.

Connect or link together, the ſeveral rates thus ranked, one with another in ſuch a manner, that every one leſs than the mean, be linked with ſome one or more greater, or with as many as you pleaſe that are greater; and every greater with one leſs, or as many leſs as you pleaſe, than the given mean.

Take the difference between each of the rates and the mean rate, and write it down againſt that with which it is linked, and if only one difference ſtand againſt any rate, it will be the quantity belonging to that rate, but if there are ſeveral, then their ſum will be the quantity, which quantities are the anſwer for that rate, againſt which they ſtand.

Add up all the differences, and their ſum will be the ſum of the mixtures, at the given or mean rate, and the ſeveral differences will aſ-

certain

certain the quantity of each ingredient to be taken in compounding the mixtures.

EXAMPLES.

A Perſon hath brandy, which he values as follows; ſome at 5, ſome at 4, ſome at 3, and ſome at 2 rupees per gallon; but as the higheſt price was ſeldom called for, and the loweſt complained of, he propoſes to make a mixture out of the whole, which will ſtand him at 3 rupees per gallon; how many gallons of each muſt he take to anſwer his purpoſe?

R.	GAL.	R.	R.
5	1	at 5	5
	0		0
3	1		3
	2		4
			12

OR THUS.

5	0	at 5	0
			4
			6
			2

I would mix a quantity of ſugar at 10 rupees per mon, with other ſugar, at 7 r. 8 an. 5 r. 8 an., and 4 r. 8 an. p r mon, in ſuch proportions as to make the mixture worth 6 rupees per maund; what quantity of each muſt I take? Anſwer $1\frac{1}{2}$ mon at 10, 1 mon at $7\frac{1}{2}$, $1\frac{1}{2}$ mon at 5, and 4 mons at $4\frac{1}{2}$ rupees per mon.

I wiſh to mix ſugar at 10 d., 5 d., and 4 d. per pound, ſo that the compoſition may be worth 6 d. per pound, what quantity of each muſt I take? Anſwer 3 lb. at 10 d. 4 lb. at 5 d. and 4 lb. at 4 d.

NOTE.—Examples of this nature will admit of as many anſwers, as there are different ways of linking together, a larger price and a leſſer, than the mean rate propoſed; the compounder may therefore take choice of either, as may beſt ſuit his convenience.

When the price of each ſimple is given, alſo the quantity of one of them, and the mean rate and price; to find the ſeveral quantities of the reſt in proportion; this is called ALLIGATION PARTIAL.

RULE.—Take the difference between each rate and the mean rate, as in the laſt rule.

Then, as, the difference belonging to that price whoſe quantity is given: is to the given quantity :: ſo is each of the other differences: to its reſpective quantity ſought.

EXAMPLES.

With 10 ſars of tea at 10 rupees per ſar, I would mix ſorts at 4, 5 and 8 rupees per ſar, in order to ſell the mixture at 7 rupees per ſar, what quantity muſt I take of each ſort?

10	.. 3	Then as	3	: 10 ::	3	: 10	at	4	..	40
4	.. 3		3	: 10 ::	1	: 3 1/3	at	5	..	16 2/3
7 5	.. 1		3	: 10 ::	2	: 6 2/3	at	8	..	53 1/3
8	.. 2			and		10	at	10	..	100
						30	at	7	..	210

How much tea at 6s. 6d.; 7s. 6d.; and 9s. per lb. must be taken to be mixed with 36lb. at 12s. per lb., that the mixture may be worth 8s. per lb.? Anſ. 108lb. at 9s. 288lb. at 7s. 6d. and 72 lb. at 6s. 6d.

When the particular prices of each ſimple and the quantity of the whole mixture, alſo the mean price are given: to find the particular quantity of each ſort in the mixture; this is called ALLGATION TOTAL.

RULE.—Take the difference of each price, and the mean rate, as before.

Then, as the ſum of all the differences: is to the whole quantity given :: ſo is each particular difference: to its particular quantity ſought.

EXAMPLES.

I have by me four ſorts of ſugar, viz.; of 5, 6, 8, and 9 rupees per mon, and I am inclined to mix up a quantity of 168 mons, ſo as to make it worth 7 rupees the mon; in what proportion muſt the ſugar be taken.

			SUM.	MON.	DIFF.	MON.		
5	 2	then, as	6 :	168 ::	2 :	56	at 5	280
7 6	 1		6 :	168 ::	1 :	28	at 6	168
8	 1		6 :	168 ::	1 :	28	at 8	224
9	 2		6 :	168 ::	2 .	56	at 9	504
	Sum. 6					168	at 7	1176

How much gold of 16, of 18, and 23 carats fine, muſt be mixed together to form a compoſition of 60 oz. of 20 carats fine? Ans. 15 oz. of 16; 15 oz. of 18; and 30 of 23 carats fine.

NOTE.—An ounce divided into 24 equal parts are called carats, and when any compoſition or coin conſiſts of 22 carats of gold and 2 of copper or alloy, it is ſaid to be 22 carats fine, &c.

PARTNERSHIP.

WHEN two or more perſons join together in buſineſs, they are ſaid to be in *Partnerſhip*, or *Company*, and the perſons ſo engaged are called the *Firm*.

To determine each perſons particular ſhare of the gain or loſs, in proportion to the principal or ſhare, he may have in the firm or concern.

WITHOUT TIME.

RULE.—As the ſum of the ſeveral ſtocks: is to the gain or loſs:: ſo is each perſons ſhare in the ſtock:: to his ſhare in the gain or loſs.

PROOF.—Add all the ſhares together, and that ſum, if right, will be equal to the whole gain or loſs.

EXAMPLES.

A. and B. join in partnerſhip; A. advances 8000 rupees, B. advances 6000 rupees, when they balanced their books, they found there was a clear profit of 5000 rupees, how much is each partner's ſhare.

8000	then, as, 14000	: 5000 ::	8000	: 2857	2	$3\frac{1}{7}$ A's ſhare.
6000						
14000	14000	: 5000 ::	6000	: 2142	13	$8\frac{4}{7}$ B's ſhare.
				Proof ..	5000	

A. B. C. and D. were concerned in a ſhip, whereof A. had $\frac{1}{2}$, B. C. and D. $\frac{1}{6}$ each; when ſhe was ſold off and all accounts ſettled, there remained 55466 rupees, how much was each perſons dividend or ſhare? Anſ. A. ſhare 27733 B. C. and D. ſhare each 9244 5 4.

WITH TIME.

Is when each perſons ſtock continues unequal time in company ſo that a conſideration may be made of the time, as well as of the ſtock.

RULE.—Multiply each perſon's ſtock by the time, it has continued in the concern, and proceed with the products, as with the particular ſtocks without time.

EXAMPLES.

Four merchants A. B. C. and D. enter into partnerſhip, thus:

A. put in 6000 rupees for 4 months.
B. .... 5000 ... for 6 months.
C. .... 4000 ... for 8 months.
D. .... 3000 ... for 12 months.

They

They gain 10,000, what is due to each proportionably to ſtock and time

A's ſtock	6000 × 4	24000
B	5000 × 6	30000
C	4000 × 8	32000
D	3000 × 12	36000
	ſum . . .	122000

Then, as 122000 : . . . 10000 :: 24000 : 1967 3 $4\frac{112}{122}$ to A.

122000 : 10000 :: 30000 : 2459 0 $3\frac{18}{122}$ to B.

122000 : 10000 :: 32000 : 2622 15 $2\frac{68}{122}$ to C.

122000 : 10000 :: 36000 : 2950 13 $1\frac{46}{122}$ to D.

Proof . . . 10000 0 0

NOTE.—Queſtions of this kind ſeldom or never occur in buſineſs; all difference in point of time, in computations of partnerſhip, are adjuſted by an intereſt account, therefore farther examples would be uſeleſs.

POSITION.

THE RULE OF POSITION, or trial and error, is ſo called becauſe we ſuppoſe ſome uncertain number or numbers; and by reaſoning from them according to the nature of the queſtion, and paying proper attention to the error, or errors, obtain a true anſwer.

SINGLE POSITION.

BY SINGLE POSITION, or a ſingle ſuppoſition, are ſolved thoſe queſtions, wherein the reſults are proportional to their ſuppoſitions.

RULE.—Suppoſe ſome convenient number, and proceed with it according to the nature of the queſtion; then, if the reſult be either too much or too little; ſay, as the falſe number reſulting: is to the true number given :: ſo is the given or ſuppoſed number; to the number required.

EXAMPLES

EXAMPLES.

A perſon being aſked how many ſheep he had got, replied, if you add $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{6}$ of the number together, the ſum will be 18. How many had he?

Suppoſe he had 12

Then $\frac{1}{3}$ of 12 .. is ... 4
$\frac{1}{4}$. ditto 3
$\frac{1}{6}$. ditto 2

The ſum is 9 but ſhould be 12.

Hence, as 9 : . 18 . : : 12 : 24 ſheep. Anſwer.

Proof.

24

$\frac{1}{3}$ 8
$\frac{1}{4}$ 6
$\frac{1}{6}$ 4

18

What ſum is that, of which the half, third and fourth, make 520 £. Anſwer 480.

A. B. and C. buy a parcel of timber, which coſt £. 48, and it is agreed, that B. ſhould pay a third part more than A., and C.; and a fourth part more than B.; what ſum muſt each pay? Anſwer A 12 £. B. 16 £. C. 20 £.

A Schoolmaſter being aſked how many ſcholars he had, anſwered, if I had as many, and one fourth as many, I ſhould have 198; how many had he?

Anſwer 72 ſcholars.

DOUBLE POSITION.

BY DOUBLE POSITION, or two ſuppoſitions, are ſolved thoſe queſtions wherein the reſults are diſproportional to their ſuppoſitions.

RULE.—Suppoſe any two convenient numbers, and proceed with them according to the nature of the queſtion, marking the errors, with + or —, according as they exceed or fall ſhort of the truth.

THEN

Multiply the firſt ſuppoſition by the 2d error, and the ſecond ſuppoſition by the firſt error, and divide the ſum of the products, by the ſum of the errors, if they are differently marked, or the difference of the products, by the difference of the errors if they are marked alike, and the quotient will be the number ſought.

OR

Multiply the difference between the two ſuppoſed numbers, by the

leſs

leſs error, and divide the product by the ſum of the errors, if they are differently marked; or by the difference if they are marked alike; and the quotient will be a correction of the number belonging to the leſs error, and muſt be added to it, if that error be leſs than the truth, or ſubtracted, if it be greater.

EXAMPLES.

What number is that, which being multiplied by 3, the product increaſed by 4, and that ſum divided by 8, the quotient may be 32.?

				ITS ERROR.
Suppoſe 12	Again, ſuppoſe 108	1ſt. ſuppoſition 12	X	—27
3	3	2d. ditto 108	X	+ 9
36	324	27 its error 12		
4	4	2916		108
8)40	8)328	108		
quotient . 5	quotient 41	27+9=36)3024		
ſhould be 32	ſhould be 32	84 Anſwer.		
Error — 27	Error ..... + 9			

A Gentleman finding ſeveral beggars at his door, gave them 3d. each, and had 5d. remaining; he would have given them 4d. each, but wanted 7d. to do it; how many beggars were there? Anſwer 12 beggars.

When firſt the marriage knot was tied
Betwixt my wife and me,
My age did her's as far exceed
As three times three, doth three;
But when ten years and half ten years,
We man and wife had been,
Her age came up as near to mine.
As eight is to 16.
What both our ages was, I pray
Now tell me, on the wedding day? Anſwer. His age when married 45 years;
Her age when married 15 years.

ARITHMETICAL PROGRESSION.

WHEN a ſeries of numbers increaſes, or decreaſes, by an equal exceſs, or difference, thoſe numbers are ſaid to be in ARITHMETICAL PROGRESSION, ſuch

ſuch as, 2, 4, 6, 8, 10, &c. or, 15, 14, 13, 12, &c. and the numbers which form ſuch ſeries are called the terms of the progreſſion. The firſt and laſt terms are uſually called the *extremes*; and any two equally diſtant from them, *means*.

NOTE.—If three numbers are in arithmetical progreſſion, the ſum of the *extremes*, will be equal to double the *mean*;

When the number of terms are even, as 1, 3, 5, 7, 9, 11, the ſum of the *two extremes*, will be equal to the ſum of any *two means* that are equally diſtant from the extremes, viz. 1, 3, 5, 7, 9, 11.

$$1+11=12. \quad 5+7=12. \quad 3+9=12$$

When the numbers of terms are odd, as, 4, 10, 16, 22, 28, the double of the middle figure or term will be equal to the ſum of the extremes, or to any two means equally diſtant from the middle term; viz. 4, 10, 16, 22, 28.

$$16+16. \quad 22+10=32.$$

In this rule there are five things to be conſidered, viz.

1.—The firſt term, commonly the leaſt.

2.—The laſt term, commonly the greateſt.

3.—The number of terms.

4.—The common exceſs, or difference.

5.—The aggregate, or ſum of all the terms.

Any three of which being given, the other two may be eaſily found.

1.——When the two extremes, and the number of terms are given, to find the ſum of all the ſeries or terms.

RULE.—Multiply the ſum of the two extremes, by half the number of terms; or multiply the ſum of the two extremes into the number of terms, and divide the product by 2; the quotient will be the ſum of all the ſeries, or terms.

EXAMPLES.

How many ſtrokes does the hammer of a clock ſtrike in 12 hours?

$1+12=13$ the ſum of the extremes
6 half the number of terms

Anſwer 78 ſtrokes

OR THUS

$1+12=13$ ſum of the extremes
12 the number of terms

2)156

Anſwer 78

Suppoſe

Suppoſe 100 ſtones were placed in a right line, a yard diſtant from one another, and the firſt ſtone was a yard from the baſket, I demand how many miles he muſt travel that gathers them ſingly into the baſket? Ans. 5 miles 1300 yards.

If the leaſt term of a ſeries of numbers in arithmetical progreſſion be 3, the greateſt 100, and the number of terms 17, what is the ſum of the terms? Ans. 884?

2.—When the two extremes and number of terms are given, to find the common difference.

RULE.—The difference between the two extremes, divided by the number of terms leſs 1, the quotient will be the common difference.

EXAMPLES.

A perſon had 12 children that differed alike in their ages; the youngeſt was 5 years old, the eldeſt 27, what was the difference of their ages, and the age of each?

27—5=22 the difference of the extremes.

12—1=11 the number of terms leſs 1.

Then 22÷11=2 the common difference, which added to the age of the youngeſt, and ſo on to the reſt, will give their ſeveral ages, viz. 5+2=7 the age of the ſecond, and ſo on for the reſt.

If the leaſt term of a ſeries of numbers in arithmetical progreſſion be 4, the greateſt 100, and the numbers of terms 17, what is the common difference between each term; Ans. 6, the common difference.

A debt is to be diſcharged at 10 different payments in arithmetical progreſſion; the firſt payment is to be 5 l. and the laſt 50 £; what is the whole debt, and what muſt each payment be? Ans. 275 £. the whole debt; the common difference 5, therefore each payment, thus, 5,10,15,20 &c. to 50.

3. When the two extremes and common difference are given to find the number of terms.

RULE.—Divide the difference of the two extremes by the common exceſs; add 1 to the quotient, and the ſum will be the number of terms.

EXAMPLES.

The leaſt term of a ſeries in arithmetical progreſſion is 4, the greateſt 100, and the common difference between each term is 6, what is the number of terms?

100—4=96÷6=16+1=17 the number of terms.

A man going a journey, travelled the firſt day 2 leagues and the laſt day 23; he increaſed his journey every day 3 leagues, how many days did he travel. Ans. 8 days.

A man being aſked how many children he had, anſwered, my youngeſt child is 5 years old, and the eldeſt 27, and that he had increaſed one in his family every two years, how many children had he? Ans. 12 children.

4.—When the laſt term, the common difference, and the number of terms are given, to find the firſt term.

RULE.—Multiply the number of terms leſs 1, by the common difference; the product ſubtracted from the laſt term leaves the firſt.

EXAMPLES.

The greateſt term in a ſeries of numbers in arithmetical progreſſion is 100, the number of terms 17, and the common difference between each term 6; what is the leaſt term?

$17-1\times 6=96$; then $100-96=4$ Anſwer.

A man in 6 days went from Calcutta to a certain place, every day's journey was greater than the preceding one by four miles, his laſt day's journey was 40 miles; what was his firſt. Anſwer 20 miles.

5.—When the number of terms, common difference, and ſum of all the terms are given, to find the firſt term.

RULE.—Divide the ſum of the terms, by the number of terms; and from that quotient ſubtract half the product of the common difference or exceſs, by the number of terms leſs 1, the remainder will be the firſt term.

EXAMPLES.

The number of terms is 17, the common difference 6, and the ſum of the terms, of a ſeries of numbers in arithmetical progreſſion is 884; what is the leaſt term?

$884\div 17=52$ and $17-1\times 6=96$, then $52-\frac{96}{2}=4$ the leaſt term.

If the number of terms be 22, the common difference 5, and the ſum of the terms 1221; what is the leaſt term? Anſwer 3.

6.—When the firſt term, number of terms, and the common difference are given, to find the laſt term.

RULE.—Subtract the common difference from the product of the number of terms, multiplied by the common difference, the remainder added to the firſt term, will give the laſt.

EXAMPLES.

What is the laſt term of an arithmetical progreſſion, beginning at 6, and continuing by the increaſe of 3 to 21 places?

Firſt $21\times 3=63$, and $63-3=60$; then $60+6=66$ the laſt term.

If,

If the leaſt term of a ſervice of numbers in arithmetical progreſſion be 4, the number of terms 17, and the common difference 6, what is the greateſt term? Anſwer 100.

7.—The firſt term, common difference, and number of terms given, to find the ſum of all the terms.

RULE.—From the product of the number of terms in the common difference, ſubtract the common difference, and to the remainder add, the double of the firſt term; half the product of that ſum multiplied by the number of terms, gives the ſum of all the terms or ſeries.

EXAMPLES.

Suppoſe I agree to ſink a well 30 yards deep upon theſe terms, viz. to pay 3 ſhillings for the firſt yard, 5 for the ſecond, 7 for the third, &c. raiſing two ſhillings per yard, what will the whole amount to?

First $30 \times 2 = 60$; alſo $60 - 2 = 58$

Again $58 + 6 = 64$, and $64 \times 30 = 1920$

Then $1920 \div 2 = 960$ s. $= £48$ the Anſwer.

8.—The firſt term, the number of terms, and ſum of all the terms given, to find the common difference.

RULE.—Divide the double ſum of all the ſeries, by the number of terms, and from the quotient ſubtract double the firſt term; divide the remainder, by the number of terms leſſened by unity, and the quotient will be the common difference.

EXAMPLE.

A perſon travelled from Calcutta to Berhampore, being 180 miles in 6 days, and every day travelled equally further than the preceding day; it is known that the firſt day he travelled 6 miles; how many miles did he travel each of the other days?

First $360 \div 6 = 60$, and $60 - 12 = 48$, alſo $6 - 1 = 5$.

Then $48 \div 5 = 9\frac{3}{5}$ miles, the common difference required.

And $9\frac{3}{5}$ added to 6 and every other term reſpectively gives, as follows, viz.

6	for the firſt	Days Journey.
19 $\frac{1}{5}$	..... ſecond	
25 $\frac{2}{5}$	..... third	
34 $\frac{4}{5}$	..... fourth	
44 $\frac{2}{5}$	..... fifth	
54	..... ſixth	
Proof 180		

GEOMETRICAL PROGRESSION.

IS, when any rank or ſeries of numbers increaſe by one common multiplier, or decreaſe by one common diviſor.

As 4, 8, 16, 32, 64, 128, here the common multiplier or ratio is 2.
Alſo 729, 243, 81, 27, 9, 3, here the common diviſor or ratio is 3.

In any ſeries of numbers in geometrical progreſſion, the product of the two extremes are equal to the product of any two means, that are equally diſtant from the extremes.

As 3, 9, 27, 81, 243,, 729
Here $3 \times 279 = 9 \times 243 = 27 \times 81 = 2187$

When the number of terms are odd, the middle term, multiplied into itſelf will be equal to the product of the two extremes, or any two means equally diſtant from the ſaid mean or middle term.

As 3, 6, 12, 24, 48. $12 \times 12 = 6 \times 24 = 48 \times 3 = 144$

In geometrical progreſſion, five things are to be obſerved, as in arithmetical progreſſion, viz.

1.—The firſt term. 2.—The laſt term. 3.—The number of terms. 4.—The ratio. 5.—The ſum of the terms.

Any three of theſe being given, the reſt may be eaſily found.

If over any rank of geometrical numbers, you place a ſeries of arithmetical ones beginning with 0, the addition and ſubtraction of the indices

anſwer

anſwer to the multiplication and diviſion of the numbers they ſtand over,

thus { 0, 1, 2, 3, 4, 5, 6, 7 Indies.
1, 2, 4, 8, 16, 32, 64, 128 numbers in geometrical progreſſion.

that is { As 2+3=5 which is the indice of 32.
So 4×8=32 the 5th term in geometrical progreſſion.

again { As 2+4=6.
So 4×16=64. the 6th term.

Now by theſe indices and a few of the firſt terms, the laſt term, or any diſtant one, may be ſpeedily found, without producing the whole ſeries.

1.—When the firſt term is unity, the ratio and number of terms being known to find the laſt of any remote term.

RULE.—Find a few of the leading terms, over which place their indices, as before directed; then find what figures of the indices, when added together will give the index of the term wanted, multiply the numbers ſtanding under ſuch indices into each other, the laſt product will be the term required.

NOTE.—When the indices begin with a cipher, the ſum of the indices, made choice of muſt be always one leſs, than the number of terms given, in the queſtion, becauſe 1 in the indices, ſtands over the ſecond term.

EXAMPLES.

The firſt or leaſt term of a ſeries of numbers in geometrical progreſſion is 3, the ratio 3, and the number of terms 14, what is the greateſt or laſt term?

1, 2, 3, 4, 5, &c. indices.
3, 9, 27, 81, 243, &c. leading terms.
5+5+4=14 index to the 14th term.
243×243×81=4782969, laſt or 14th. term.

A boy agrees for 14 oranges, to pay only the price of the laſt, reckoning a farthing for the firſt, half penny for the ſecond, &c. doubling the price to the laſt; how much did he give for them;

Firſt { 0, 1, 2, 3, 4, 5, 6, indices.
1, 2, 4, 8, 16, 32, 64, terms.

then { 2+5=7.
4×32=128.

alſo { 7+6=13.
128×64=8192 which is the 14th. term, becauſe the indices are leſs than the terms by 1, and 8192 qrs.=8 £. 10 s. 8 Anſwer.

If the firſt term be 2, the ratio 2, and the numbers of terms 19, what is the laſt or greateſt term? Ans. 524288.

A man bought a horſe, and by agreement was to give, what the laſt nail would come to, at a farthing for the firſt nail, two for the ſecond, four for the third, &c. There were four ſhoes, and 8 nails in each ſhoe; I demand the price of the horſe? Ans. 2236962 £. 2 s. 8 d.

2.—In any ſeries not proceeding from unity, the ratio and firſt term being given, to find any remote term, without producing all the intermediate terms.

RULE.—Proceed as in the laſt caſe, only obſerve to divide every product by the firſt term, and the quotient will be the term required.

EXAMPLE.

A perſon dying left 11 children, to whom, and to his executor, he bequeathed in manner following, viz. to his executor for ſeeing his will performed £. 10, the youngeſt child to have £. 30. and ſo on every child to exceed the next younger in triple proportion, what will be the ſhare of the eldeſt?

0 1 2 3 4 5 6 Indices.
10 30 90 270 810 2430 7290 Terms.

4+6=10 number terms leſs one.

Then 810×7290=5904900 which÷10 the firſt term gives £. 590490 the eldeſt child's fortune.

3.—When the firſt term, ratio and number of terms are given, to find the ſum of all the terms.

RULE.—Find the laſt term as before, from which take the firſt, divide the remainder by the ratio, leſs one, and to that quotient add the laſt term and you have the ſum required.

EXAMPLES.

A gentleman married and received of his Father in Law one guinea, on condition that he was to have a preſent, every month for the firſt year, which ſhould be double ſtill to what he had the month before; what was the young lady's portion?

0 1 2 3 4 5 6 Indices.
1 2 4 8 16 32 64 Terms.

6×5=11 number of terms leſs one.

64×32=2048 the laſt term.

2048—1÷2—1=2047.

2048—2048=4095 Guineas, or 4299 £. 15 s. Anſwer.

VARIATIONS.

VARIATIONS.

BY Variations, are meant the different ways any number of things may be altered or changed, with reſpect to their places. Theſe are ſometimes called CHANCES, PERMUTATION, ALTERNATION, &c.

To find the number of changes that can be made of any given number of things, all different from each other.

R U L E.—Multiply continually together the numbers 1, 2, 3, 4, 5, &c. to the number of terms and the laſt product will be the anſwer.

EXAMPLES.

How many changes may be rung by 8 bells.

$1\times2\times3\times4\times5\times6\times7\times8=40320$ Anſwer.

How many changes may be rung on 9 bells? Anſwer 362880.

How many days can 7 perſons be placed in a different poſition at dinner?
Anſwer 5040 days.

An accomptant told a gentleman, who had conſtantly 8 perſons at his table, that he would gladly make a ninth and was willing to give 20 guineas for his board, ſo long as he could place the ſaid company at dinner, differently from any one day before; this being accepted what did his entertainment coſt him per year. Anſwer 5 $\frac{5}{12}$ d.

INVOLUTION
OR
THE RAISING OF POWERS.

A POWER is the product ariſing from multiplying any given number into itſelf continually a certain number of times, thus,

$2\times2=4$ is the 2d power, or ſquare of 2.

$2\times2\times2=8$ is the 3d power, or the cube 2.

$2\times2\times2\times2=16$ is the 4th power of 2;

The number denoting the power is called the index, or the exponent of that power.

If two or more powers are multiplied together, their product is that power whoſe index is the ſum of the exponents of the factors: thus,

$2\times2=4$ the ſquare of 2; $4\times4=16=4$th power of 2; and $16\times16=256=8$th power of 2, &c.

TABLE

TABLE OF THE FIRST NINE POWERS OF NUMBERS.

1st.	2d.	3d.	4th.	5th.	6th	7th.	8th.	9th.
1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512
3	9	27	81	243	729	2187	6561	19683
4	16	64	256	1024	4096	16384	65536	262144
5	25	125	625	3125	15625	78125	390625	1953125
6	36	216	1296	7776	46656	279936	1679616	10077696
7	49	343	2401	16807	117649	823543	5764801	40353607
8.	64.	512	4096	32768	262144	2097152	16777216	134217728
9..	81.	720.	6561.	59049.	531441.	4782969.	43046721.	387420489.

EXAMPLES.

What is 5th. powef of 7 ?

7
7

49=2d. power
7

343=3d. power
7

2401=4th. power
7

16807=5th. power.

What is the 3d. power of 35? Anſwer 42875.
What is the 4th. power of $\frac{3}{4}$? Anſwer $\frac{81}{256}$.
What is the 5th. power of .029? Anſwer .000000020511149.

EVOLUTION

EVOLUTION

OR

THE EXTRACTION OF ROOTS.

THE root of any number, or power, is ſuch a number, as being multiplied into itſelf a certain number of times, will produce that power. Thus 2 is the ſquare root of 4, becauſe $2\times2=4$; and 4 is the cube root of 64 becauſe $4\times4\times4=64$; and ſo on.

Any power of a given number may be found exactly, but there are many numbers of which a given root can never be preciſely determined although by the help of decimals, we can approximate towards it, to any aſſigned degree of exactneſs.

The roots which approximate are called SURD ROOTS, and thoſe which are perfectly accurate are called RATIONAL ROOTS: thus the ſquare root of 2 is a ſurd root; and the cube root of 27 is a rational root, being exactly equal to 3.

Roots are ſometimes denoted by writing the character $\surd$ before the power, with the index of the root againſt it: thus the third root of 70 is expreſſed $\sqrt[3]{70}$, and the ſecond root of it is $\surd 70$, the index 2 being always omitted, when the ſquare root is deſigned.

If the power be expreſſed by ſeveral numbers with the ſign + or — between them a line is drawn from the top of the ſign over all the parts of it; thus, the third root of $28-13$ is $\sqrt[3]{\overline{28-13}}$.

But all the roots are now generally deſigned like powers with fractional indices: thus, the ſquare root of 5 is denoted by $5^{\frac{1}{2}}$ the cube root of 19 by $19^{\frac{1}{3}}$ and the fourth root of $40-12$ by $\overline{40-12}^{\frac{1}{4}}$ &c.

TO EXTRACT THE SQUARE ROOT.

THE extraction of the ſquare root is by having a number given, to find out another number, which being multiplied by itſelf, produces that given number.

RULE

RULE. 1.—Divide the given number into periods of two figures each by putting a point over the place of units, another over the place of hundreds, and ſo on.

2.—Find the greateſt ſquare in the firſt period, and ſet its root on the right hand of the given number, after the manner of a quotient figure in diviſion.

3.—Subtract the ſquare thus found, from the ſaid period, and to the remainder annex the following period for a dividend.

4.—Double the root abovementioned for a diviſor; and find how often it is contained in the dividend, excluſive of the place of units; and ſet the reſult both in the quotient and the diviſor.

5.—Subtract the product of this quotient figure and the diviſor, thus augmented, from the dividend, and to the remainder bring down the next period, for a new dividend.

6.—Find a diviſor as before, by doubling the figures already in the root; and from theſe find the next figure of the root, as in the laſt article; and ſo through all the periods to the laſt.

NOTE.—If there be decimals in the given number, it muſt be pointed both ways from unity, and the root be made to conſiſt of as many whole numbers and decimals, as there are periods belonging to each, and when the figures belonging to the given number are exhauſted, the operation may be continued at pleaſure by adding cyphers.

It may be alſo obſerved, that the beſt way of doubling the root, is by adding the laſt figure of it to the laſt diviſor.

PROOF.—Square the root found, and to that product, add the remainder, if any; and that ſum will be the ſame as the number given to be extracted.

Squares	1.	4.	9.	16.	25.	36.	49.	64.	81.
Roots	1.	2.	3.	4.	5.	6.	7.	8.	9.

Hence we may obſerve that if any number end with 2, 3, 7 or 8 the ſquare root of that number can never exactly found.

EXAMPLES.

Required the ſquare root of 393129?

393129(627 Root
36
---
122)3331
244

1247) 8729
8729

What

What is the ſquare root of 436.5?

```
436.50000000(20 89:5, &c. Root.
4
-
408) 3650
     3264
     ----
4169 )38600
      37521
      -----
41782 )107900
       83564
       -----
417845 )2433600
        2089225
        -------
Remains 314375
```

NOTE.—In a mixed number make the number of decimal places even, by annexing ciphers to the right hand of the given ſquare, that a point may fall on the units place of the whole number.

What is the ſquare root of 2?

```
2.000000000000(1.414213 Root.
1
-
24)100
   96
   --
281)400
    281
    ---
2824)11900
     11296
     -----
28282)60400
      56564
      -----
282841)383600
       282841
       ------
2828423)10075900
        8485269
        -------
Remains 1590631
```

What is the ſquare root of 814602573? Ans. 28541.24, &c.

To extract the ſquare root of VULGAR FRACTIONS.

RULE.—Reduce the fraction or fractional parts to their lowest terms, and if it be a mixed number, to an improper fraction; then extract

[illegible] root of the numerator and for a new numerator, and the ſquare [illegible] denominator for a new denominator. But if the fraction be [illegible] power, then reduce it to a decimal, and proceed as before.

EXAMPLES.

[illegible] the ſquare root of $\frac{288}{646}$?

[illegible] in its loweſt terms is $=\frac{4}{9}$; the $\sqrt{\frac{4}{9}}=\frac{2}{3}$ the root required.

What is the ſquare root of $\frac{2704}{4225}$? Anſwer $\frac{4}{5}$.

What is the ſquare root of $6\frac{2}{5}$? Anſwer 2.5298, &c.

TO EXTRACT THE CUBE ROOT.

TO extract the cube root, is to find out a number, which being multiplied into itſelf, and then again into the product, produceth the given number.

Cube. 1. 8. 27. 64. 125. 216. 343. 512. 729

Roots. 1. 2. 3. 4. 5. 6. 7. 8. 9

To extract the cube root of any whole number, or a pure or mixed decimal.

RULE 1.—Put a point over the units place, and alſo upon every third figure, from the right hand to the left, in whole numbers, and from the left hand to the right in decimals.

2.—Find the neareſt leſs cube to the left hand period and ſubtract it from: put the root in the quotient and bring down the figures in the next period for a RESOLVEND.

3.—Find a diviſor by multiplying the ſquare of the quotient by 300, and how often it is contained in the RESOLVEND, and put the anſwer in the quotient.

4. Cube the laſt figure in the quotient, multiply all the figures in the [illegible] by 30, except the laſt and that product by the ſquare of the [illegible] multiply the diviſor by the laſt figure, and the ſum of theſe

products

products will give the ſubtrahend, which take from the reſolvend, to the remainder bring down the next period, and repeat the work.

PROOF.—Cube the root found, and to the product add the remainder, if any, and that ſum will be the ſame as the number given to be extracted.

EXAMPLES.

Extract the cube root of 48627.125

48627.125(36.5 Root
3 cubed=27

3 ſquared×300=2700)21627 reſolvend

6 cubed===216

×30×6 ſquared=3240
Diviſor 27..×laſt figure 6=16200

19656 ſubtrahend

36 ſquared×300=388800)1971125 reſolvend

5 cubed =125
36×30×5 ſquared=27000
Diviſor 388800×laſt figure 5=1944000

1971125 ſubtrahend

Required the cube root of 122615327232. Anſ. 4968.

To extract the cube root of any vulgar fraction.

RULE. 1.—Reduce the given fraction to its loweſt terms, then extract the cube root of numerator, for a new numerator, and the cube root of the denominator, for a new denominator.

2.—If the fraction will not extract even, reduce it to a decimal, and then extract the cube root.

When the number to be extracted is a mixed fraction, reduce the fraction part to a decimal, and annex it to the whole number, then extract the cube root.

EXAMPLES.

Extract the cube root of $\frac{243}{576}$?

First $\frac{243}{576} = \frac{27}{64}$; the cube root of 27 is 3, and that of 64 is 4; therefore the cube root of $\frac{27}{64}$ is $\frac{3}{4}$

Extract the cube root of $\frac{2}{3}$?

$\frac{2}{3} = .66666$, &c. the cube root of which is .87358, &c.

What is the cube root of $\frac{175}{470}$? Anſ. .71638.

