Of Fractions

A Fraction is that by which some part or parts of an unit are expressed.

Thus if an unit be supposed to be divided into 4 equal parts and 3 of these parts are to be expressed it must be done by the fraction of three fourths or three quarters to be written thus in figures

$\frac{3}{4}$.

The number which shows into how many parts the unit is

supposed to be divided is called the <u>denominator</u> of the fraction. Thus in the foregoing example 4 is the <u>denominator</u> of the fraction $\frac{3}{4}$. The number which shows how many of these parts are considered in the fraction is called the <u>numerator</u> thus 3 is the <u>numerator</u> of the fraction $\frac{3}{4}$.

So likewise in the fractions $\frac{5}{6}\ \frac{3}{8}\ \frac{9}{10}\ \frac{50}{99}$ the denominators are 6. 8. 10. 99. & the Numerators, 5. 3. 9. 60.

Fractions are of two sorts, proper, and improper.

A proper fraction is that whose numerator is less than the denominator as $\frac{1}{2}$.

An improper fraction is that whose numerator is equal to or greater than the denominator as $\frac{2}{2}$. $\frac{3}{2}$. &c.

A mixed number is a whole number or integer & a fraction, such as $8\frac{1}{2}$.

To reduce a whole or mixed number to an improper fraction.

1st If a whole number be propos'd multiply it by any propo=sed denominator and the product

will be the numerator of the improper fraction requir'd

Ex. Let it be requir'd to reduce 8 to an improper fraction whose denominator is 3.

Then $3 \times 8 = 24$ consequently $8 = \frac{24}{3}$

Secondly if a mix'd number be proposed multiply its integer by the denominator of the fraction & to the product add y^e numerator of the fraction y^e sum will be the numerator of the improper fraction requir'd.

Ex. $8\frac{1}{3}$. $3 \times 8 = 24$ & $24 + 1 = 25$.

~~Ex. $8\frac{1}{3}$~~

Therefore $\frac{25}{3} = 8\frac{1}{3}$

To reduce an improper fraction to a whole or mixed number.

Divide the numerator by the denominator the Quotient will be the number required.

Ex. 1. $\frac{50}{7}$ 7)50(7 1/7 7)5•(7 1/7
49
1
49
1

Ergo $\frac{50}{7} = 7\frac{1}{7}$

Ex. 2. $\frac{207}{3}$ 3)207(69
18
27
27
0

Ergo $\frac{207}{3} = 69$.

To reduce a fraction to the lowest terms.

find the greatest common divisor of the numerator & denominator each of which being divided by this divisor the Quotients will be the numerator & denominator of the fraction requir'd.

Ex. $\frac{36}{120}$ the greatest common divisor is 12 Ergo $\frac{36}{12} = 3$

& $\frac{120}{12} = 10$ ergo $\frac{3}{10} = \frac{36}{120}$ is the fraction requir'd.

P. To find the greatest common divisor of two numbers proposed.

Divide the greatest by the least & if there be a remainder divide the least number by that remainder & if there be a second remainder divide the first remainder by it & so on till at last you come to some divisor which will divide the remainder immediately preceding & exactly then will this last divisor be the greatest common divisor of the two given numbers.

Ex. Let 1344 & 582 be the numbers propos'd: then to find their greatest common divisor, divide 1344 by 582, there remains 180; then divide 582 by 180, remains 42; divide 180 by 42, remains 12; divide 42 by 12, remains 6; lastly, divide 12 by 6, & there remains nothing. Therefore 6, is the greatest common divisor of 1344 & 582.

A prime number is that which has no other divisor than unity as, 2, 3, 5, 7, &c.

If two numbers have no other common divisor than unity, they

are said to be prime to each other; such as, 5 & 7; 9 & 14.

P. 4 To reduce different fractions to the same denomination.

1st. If two fractions be given multiply both the terms of the one by the denominator of the other.

Ex. To reduce ~~[illegible]~~ $\frac{2}{3}$ & $\frac{4}{5}$ to the same denomination.

$\frac{2}{3}$ $\frac{4}{5}$

$\frac{10}{15}$ $\frac{12}{15}$

2d. If three or more fractions be given multiply the terms of each by the product of the denominators of the rest.

Ex. $\frac{2}{3}, \frac{1}{6}, \frac{3}{4}$

18 12 36

72 72 72

Ex. 3d. $\frac{1}{3}, \frac{1}{5}, \frac{3}{7}, \frac{2}{9}$

315, 189, 405, 210

945, 945, 945, 945.

Add Fractions.

Reduce them to the same denomination & add the numerators.

Ex. 1st $\frac{2}{5} + \frac{4}{3} = \frac{10}{15} + \frac{12}{15} = \frac{22}{15} = 1\frac{7}{15}$

Ex. 2. $\frac{2}{3} + \frac{1}{6} + \frac{3}{4} = \frac{48}{72} + \frac{12}{72} + \frac{54}{72}$

$= \frac{114}{72} = 1\frac{42}{72} = 1\frac{7}{12}$

To subtract one fraction from another

Reduce them to the same denomination & subtract one numerator from the other.

Ex. 1st $\frac{2}{3} - \frac{3}{7} = \frac{14}{21} - \frac{9}{21} = \frac{5}{21}$

Ex. 2d $\frac{13}{21} - \frac{11}{42} = \frac{26}{42} - \frac{11}{42} = \frac{15}{42} = \frac{5}{14}$

Ex. 3d $1\frac{7}{15} - \frac{4}{5} = 1\frac{7}{15} - \frac{12}{15} = \frac{22}{15} + \frac{22}{15} - \frac{12}{15} = \frac{10}{15} = \frac{2}{3}$

To Multiply one Fraction by another.

Multiply the numerator of the one by the numerator of the other which will give the numerator of the product & then multiply the denominator of one Fraction by the denominator of the other which will give the denominator of the

product.

Ex. 1st. Multiply $\frac{1}{2}$ by $\frac{2}{3} = \frac{8}{15}$ the product is $= \frac{1}{4}$.

Ex. 2d. $\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$.

Ex. 3d. $6 \times \frac{2}{3} = \frac{12}{3} = 4$.

Ex. 4th. $\frac{2}{3} \times \frac{7}{8} = \frac{14}{24} = \frac{7}{12}$

Ex. 5th. $\frac{2}{3} \times \frac{5}{6} \times \frac{9}{10} = \frac{90}{180} = \frac{1}{2}$.

Ex. 6th. $\frac{8}{4} \times \frac{3}{4} \times \frac{3}{4} = \frac{27}{64}$.

Ex. 7th. $6\frac{3}{4} \times 7 = 47\frac{1}{4}$.

Ex. 8th. $3\frac{3}{4} \times 2\frac{2}{3} = \frac{15}{4} \times \frac{8}{3} = \frac{120}{12} = 10$

Ex. 9th. $96\frac{1}{2} \times 24\frac{1}{3} = 193\frac{1}{2} \times \frac{73}{3} =$

$= \frac{14089}{6} = 2348\frac{1}{6}$

Ex. 10th. $\frac{4}{2} \times \frac{12}{3} = \frac{48}{6}$. $\frac{4}{2} = 2$. $\frac{12}{3} = 4$

$= \frac{4}{2} \times \frac{12}{3} = 2 \times 4 = 8 = \frac{48}{6}$

Divison of Fractions

Rule.

Multiply the numerator of the dividend into the denominator of the divisor for a new numerator & multiply the other numerator & denominator together for a new denominator.

Ex. 1st. Let $\frac{6}{35}$ be divided by $\frac{3}{7}$

$\frac{3}{7}) \frac{6}{35} (\frac{42}{105} = \frac{2}{5}$. P. $\frac{3}{7} \times \frac{2}{5} = \frac{6}{35}$

Ex. 2d. $\frac{5}{12}) \frac{20}{27} (\frac{240}{135} = 1\frac{7}{9}$.

Ex. 3d. $\frac{2}{11} : \frac{2}{5} \times \frac{5}{7}$

$\frac{10}{35}) \frac{2}{11} (\frac{70}{110} = \frac{7}{11}$

Ex. 4th. $20\frac{2}{5} : 2\frac{2}{5} =$

$\frac{17}{5}) \frac{102}{5} (\frac{10}{17} \frac{2}{7} = 6$

Ex. 5th. $10\frac{26}{63} : 5\frac{3}{7}$ Then $40\frac{26}{63} = \frac{2546}{63}$.

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and $5\frac{3}{7} = \frac{38}{7}$. Then $\frac{38}{7}) \frac{2546}{63} (\frac{17822}{2394} = 7\frac{1064}{2394} = 7\frac{4}{9}$

Ex. 6th ~ 13 : $\frac{5}{7}$: $\frac{5}{7}) \frac{13}{1} (\frac{91}{5}$

$5) 91 (18\frac{1}{5}$

3

41

40

1

Ex. 7th ~ $\frac{5}{7} : \frac{5}{42}$.

Ex. 8th ~ $\frac{1}{2} = \frac{21}{24} = \frac{7}{8}$.

Ex. 9th ~ $\frac{5}{4} : \frac{1}{2} = 2\frac{1}{2} = \frac{10}{4}$

$\frac{5}{4} = 1\frac{1}{4}$. $1\frac{1}{4} : \frac{1}{2} = 1\frac{1}{4} \times 2 = 2\frac{1}{2}$.

Ex. 10th ~ $\frac{7}{9} : \frac{3}{4} = \frac{28}{27} = 1\frac{1}{27}$.

Ex. 11th ~ $\frac{9}{10} : \frac{2}{3} = \frac{27}{20} = 1\frac{7}{20}$.

Ex 12th ~ $\frac{9}{10} : 1\frac{1}{2} = \frac{9}{10} : \frac{3}{2} = \frac{18}{30} = \frac{9}{5}$.

Suppose a boat with eleven men & a boy sails upon a cruize, & takes a prize worth 136 L. the boy's share is to be $\frac{1}{3}$ of a man's share Q. how much each got.

$136 : \frac{11}{3} = 136 : \frac{34}{3} = \frac{4081}{34} = 12$.

Answ. each man had 12 L & the boy 4.

Of decimal Fractions.
Not of Notation

In decimal fractions an integer is supposed to be divided into ten equal parts and every one of those ten parts are supposed to be subdivided into other ten equal parts &c.

The integer being thus divided into 0, 10, 100, 1000, 10000, &c.

equal parts thus become the de-
-nominators to decimal fractions.
-ts for instance $\frac{2}{10}$ $\frac{3}{100}$ $\frac{7}{0000}$ &c.
But these denominators need not
be set down; but only the nume-
-rators; & are distinguished or sepa-
-rated from whole numbers by a point
or comma. Thus $5\frac{4}{10}$ is written
5.4 or 5,4 & $\frac{7}{10}$ is 0.7 & $35\frac{5}{100}$ is 35.05.

II Addition of Decimals.

Rule

Having placed the numbers to
be added under one another so
that the commas or separating
points may all stand in a dere-
-line add the numbers as if they
were intigers & from the sum cut off
so many decimals as are the most in
any of the given numbers.

&c. 45.07
50.758
123.0057
74.702
24.8
318.3357

III. Subtraction of Decimals

Rule

To find the difference between

45.300756 & 74.284.
45.375
28.909

437.5	75.0034	562.
89.657	57.875	93.5784
347.843	17.1284	468.4216

IIII. Multiplication of Decimals

Rule

Multiply them as if they were whole numbers then cut off or separate with a point or comma so many places of Decimal parts in the product as there are in both the factors together.

Ex.

3.024	32.12
2.23	24.3
9072	9636
6048	12848
6048	6424
6.743352	780.516

78.546	5745.
436	.0675
471276	28725
235638	40205
314184	34470
32847656	387.7775

If there be not so many figures in the product as there ought to be decimals by the rule, the defect must be supplied by prefixing cyphers to the product.

Ex.

$$\begin{array}{r} 0.2365 \\ 0.2435 \\ \hline 11825 \\ 7095 \\ 9460 \\ 4730 \\ \hline 0.057\,58775 \end{array}$$

$$\begin{array}{r} 0.0347 \\ 0.0236 \\ \hline 2082 \\ 1041 \\ 694 \\ \hline 0.000818\,92 \end{array}$$

$$\begin{array}{r} 57.056 \\ .378 \\ \hline 456448 \\ 399392 \\ 285280 \\ \hline 21.57\,8368 \end{array}$$

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V. Division of Decimals

Rule

Divide as if they were integers, then observe that the places of decimal parts of the divisor & quotiant counted together must always be equal in number to those in the dividend.

Case 1. When the places of parts in the divisor & dividend are equal the quotiant will be whole numbers.

Ex. I. 8.45)295.75(35
2535
4225
4225

Ex. II. .0078)0.4368(56
390
468
468
0

Case 2d. When the places of parts of the dividend exceed those in the divisor cut off the excess for decimal parts in the quotient.

Ex. I. 243)780.516(32.12

729

515

486

291

243

486

486

000

Ex. II. 436)34246.056(78.546

3052

3726

3488

2380

2180

2005

1744

2616

2616

0000

1782

Case 3d: When there are not so many places of parts in the dividend as in the divisor annex cyphers to the dividend to make them equal. Then will the quotient be whole numbers as in case 1.

Ex. I. 7. 604) 192. 10.0 (25
15360
38420
38420
00000

Ex. II 0. 7875) 441. 0000 (560
39375
47250
47250
00000

Case 4th. If after the division is finish
there are not so many figures in the
quotient as there ought to be places
of parts by the general rule; supply
their defect by prefixing cyphers
to it.

Ex. I

```
957)7.25406(0.00758
    6699
    -----
     5550
     4785
     -----
      7656
      7656
      ----
         0000
```

Ex. II

```
0.575)0.0007475(0.0013
      575
      ---
       1725
       1725
       ----
          0000
```

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To Reduce Vulgar fractions into Decimals & the contrary

Rule

A vulgar fraction may be reduce into Decimals thus.

Annex cyphers to the numerator & then divide it by the denominator, the quotient will be the decimal parts equivalent to the given fraction or so near it as may be thought necessary to approach.

Exp. 1 $\frac{3}{4}$. 4) 300 (0.75
28
20
20
00

Ex. 11 $\frac{4}{7}$

7)4 0 0 0 0 0 0 0 (0.5 7 1 4 2 8 5 7 1 4 2

35
50
49
10
7
30
28
20
14
60
56
40
35
50
49
10
7
30
28
20
14
60
56
40
6c.

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Ex. III

$\frac{1}{13}$

13) 1000000 (0.076923076923

91

90

78

120

117

30

26

40

39

10

91

90

78

120

117

30

26

40

39

10

&c.

Ex. IIII $\frac{1}{7}$

7)10000000(0.142857 142857

1
30
28
20
14
60
56
40
35
50
49
10
7
30
28
20
14
60
56
40
35
50
49
10

&c.

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To Reduce a Decimal to a Vulgar fraction of a proposed denomination

Rule

Multiply the decimal by the proposed denominator & from the product cut off as many figures as are contained in the propsed decimal & you will have the numerator corresponding to the proposed denominator.

Ex. 1 0.75 proposed denominator 4

$$0.75 = \frac{3}{4}$$

3|00

What is the value of 0.025 of one pound sterling

$$0.025 = 16^{s}.6^{d}$$

20

16|500

To reduce .571428571428571 &c.
to 7ths answ. 4/7

	7
3	999999999999999 &c
	= 4

To find the vallue of 0.74722
of a pound troy.

8 oz 19 pwt 82 gr nearly.

	0.74722
	12
	149444
	74722
	8.96664
	20
19	3.33280
	24
	133312
	66656
7	.98.72