

Basic Mathematical Operations

Topics

- ❖ Basic Operations of Mathematics
- ❖ Factors
- ❖ Multiples
- ❖ Divisibility Rules
- ❖ HCF-LCM
- ❖ Fractions
- ❖ Decimals
- ❖ Exponents
- ❖ Square & Cube
- ❖ Square Root, Cube Root

Basic Operation

Addition:

The result is sum or total of some numbers. Eg: $2+5=7$

Subtraction:

Subtract or deduct a number from another number. Eg: $5-3=2$

Product:

When you multiply number together, the result is the product.

Quotient:

When we divide a number by another, the result is quotient.

Reminder:

After dividing a number with another we either get 0 remainder or a positive integer.

Evenly Divided:

After division if we get 0 remainder, then the number which we divide will be evenly divided.


$$\begin{array}{r} 10 \\ 2 \\ \hline 5 \end{array}$$

Factors and Factorization

$$40 \rightarrow 2, 4, 5, 8, 10$$

Factors(উৎপাদক):

When we divide a number into, the multiplication of some other integers then those integers are the factors of that number.

$$40 = 4 \times 10$$

Prime Factors(মৌলিক উৎপাদক):

When we divide a number into, multiplication of some prime integer then those prime integers are the prime factors of that number.

Example:

If we divide 36 into,

$$\begin{aligned} 36 &= 2 \times 18 \\ &= 3 \times 12 \\ &= 4 \times 9 \\ &= 6 \times 6 \end{aligned}$$

Here, 2,3,4,6,9,12, and 18 are the factors of 36, and 2 and 3 are the prime factors.

Multiples(গুণিতক)

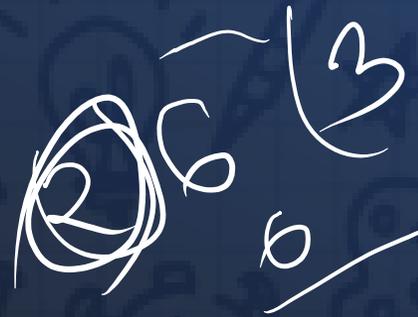
Multiple is the exact opposite of factors. In multiplication, the product is called the multiples of those two number which was multiplied together.

Example:

$$3 \times 2 = 6$$

2

Here, 6 is multiples of both 3 and 2



Divisible:

Divisible are those numbers that can divided an integer and there will be no reminder. In the previous example, 6 is divisible by both 3 and 2.

Divisors:

We can call factors a divisor cause, an integer is always divisible by its factors.

Multiples-Divisor-Divisible

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Divisible(বিভাজ্য): ✍

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Divisors(ভাজক):

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Divisibility Rules



- A number is divisible by 2 if the unit digit of the number is divisible by 2 or if the unit digits are the even number or 0.
- A number is divisible by 3 if the sum of its digits is divisible by 3.
- A number is divisible by 4 if the number formed by the last two digits is divisible by 4.
- A number is divisible by 5 if the last digit is either 0 or 5.
- A number is divisible by 6 if it is divisible by both 2 and 3. We can also say if an even number is divisible by 3 then the number will be divisible by 6.
- If the difference between twice the unit digit of a number and other digits of that number is divisible by 7 then the whole number will be divisible by 7.
- If a number formed by the last three digits is divisible by 8 then the whole number will be divisible by 8.
- A number is divisible by 9 if the sum of its digits is divisible by 9.
- A number is divisible by 10 if the last digit is 0
- A number is divisible by 11 if the sum of its digits in the odd position from the right side and the sum of the digits in the even position from the same side are equal or their difference is 11

~~423~~
 $4+2+3 = \frac{9}{3}$

~~426~~
 $4+2+6 = 12$

~~1811~~
 $16 - 2 = \frac{14}{7}$

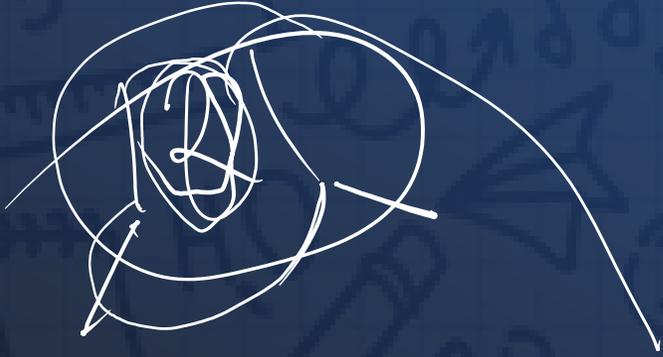
~~656~~
 $4 \overline{) 56} \rightarrow 14$
 $\frac{16}{16} \rightarrow 0$

6) ~~426~~ (7)
 $\frac{42}{6} \rightarrow 0$

8) ~~949~~ (11)
 $\frac{8}{8} \rightarrow 11$
 $\frac{8}{8} \rightarrow 0$

9) ~~123~~
 $\frac{36}{63}$
 $\frac{63}{63} \rightarrow 0$

~~6949~~



$$1 + 1 = 2$$

$$\frac{2}{0/11}$$



$$1 + 1$$

$$2$$

$$121$$

$$1 + 1$$





HCF-LCM

HCF:

HCF refers to the Highest Common Factor. HCF is the highest common factor of two or multiple numbers that can divide those numbers evenly.

Example:

❖ Identify the HCF of 12, 16, 24

The factors of 12 are 1, 2, 3, 4, 6, 12

The factors of 16 are 1, 2, 4, 8, 16

The factors of 24 are 1, 2, 3, 4, 6, 12, 24

∴ The highest common factor / HCF is 4

1, 2, 4

4

HCF-LCM

$$\boxed{HCF \times LCM = 16 \times 12}$$

LCM:

LCM of any two is the value that is evenly divisible by the two given numbers.

Example:

❖ Identify the LCM of 12, 16

The Multiples of 12 are 12, 24, 36, 48, 60,

The ~~factors~~ of 16 are 16, 32, 48, 64, 80,

Multiple

∴ The Least Common Multiple / LCM is 48

✓ The product of HCF and LCM of any group of numbers is equal to the product of those numbers.



Problem 1

HCF

The greatest common factor of two positive integers is A. The least common multiple of the two integers is B. If one of the integers is C, What is the other number?

- a) AB/C
- b) BC/A
- c) $A/C + B$
- d) $A + B/C$
- e) None of these

$$\begin{aligned} & \textcircled{x} \\ & \textcircled{x} \times \textcircled{C} = \underline{A} \times \underline{B} \\ & \underline{x} = \frac{AB}{C} \end{aligned}$$

Problem 2

When x is divided by 13, the answer is y with a remainder of 3. When x is divided by 7, the answer is z with a remainder of 3. If x , y , and z are all possible integers, what is the remainder of $yz/13$?

a) 0

b) 3

c) 4

d) 7

e) None of these

$$x = 13y + 3$$

$$x = 7z + 3$$



A handwritten diagram showing a division of yz by 13. The expression is written as $yz \div 13$ with a horizontal line above yz and a vertical line to the left of 13 . The result is 3 with a horizontal line above it. The entire diagram is circled and has a large 'X' drawn over it, indicating it is incorrect.

$$\begin{array}{r} 3 \overline{) 10} \\ \underline{9} \\ 1 \\ \underline{0} \\ 0 \end{array}$$

$3 \times 3 = 9$
 $\Rightarrow 9 + 1 = 10$

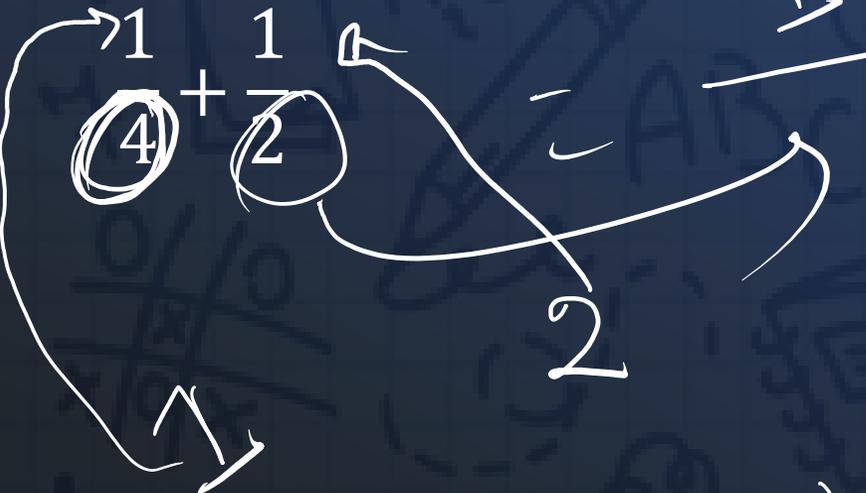
$$13y + 3 = 7z + 3$$

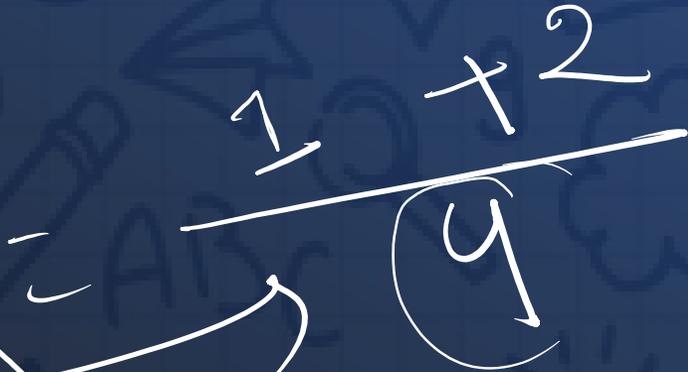
$$\Rightarrow 13y = 7z$$

$$\Rightarrow y = \frac{7z}{13}$$

Fractions & Decimals

Addition:

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


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


$$\frac{3}{4}$$




Study Mate

Fractions & Decimals

Addition:

$$3.985 + 4.6 =$$

A handwritten addition problem on a dark blue background. The numbers 3.985 and 4.6 are written in white, with a horizontal line drawn below them. The sum 8.585 is written below the line. A curved arrow points from the 5 in the thousandths place of the sum back to the 5 in the hundredths place of the second addend, indicating a carry-over. The numbers are written in a cursive, hand-drawn style.

$$\begin{array}{r} 3.985 \\ + 4.600 \\ \hline 8.585 \end{array}$$



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Fractions & Decimals

Subtraction:

$$3.985 - 4.6 =$$

$$\begin{array}{r} 4.600 \\ 3.985 \\ \hline 0.675 \end{array}$$

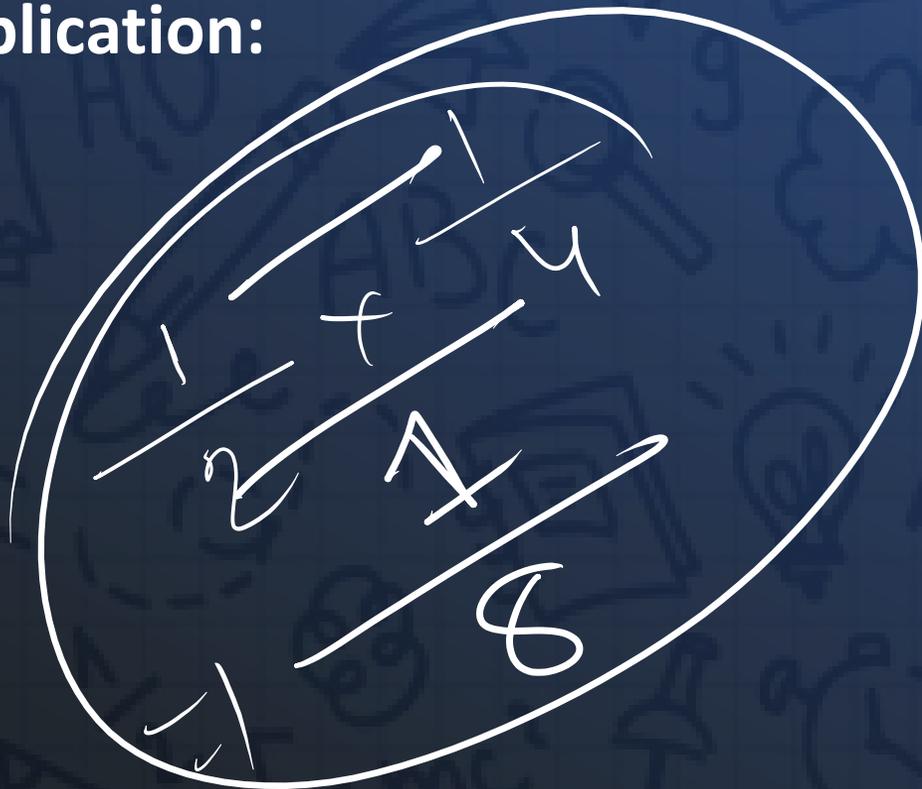


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Fractions & Decimals

Multiplication:

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





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Fractions & Decimals

Multiplication:

$$\underline{3.985} \times \underline{4.6} =$$

A handwritten multiplication problem on a dark blue background. The numbers 3.985 and 4.6 are written in white, with their decimal points clearly marked. The numbers are aligned to the right. Two horizontal lines are drawn below the numbers to separate the multiplicand and multiplier from the product. The product, 18.333, is written below the lines. The digits of the product are aligned with the corresponding digits of the multiplier. The decimal point in the product is placed directly below the decimal point in the multiplier. The entire calculation is written in a cursive, handwritten style.

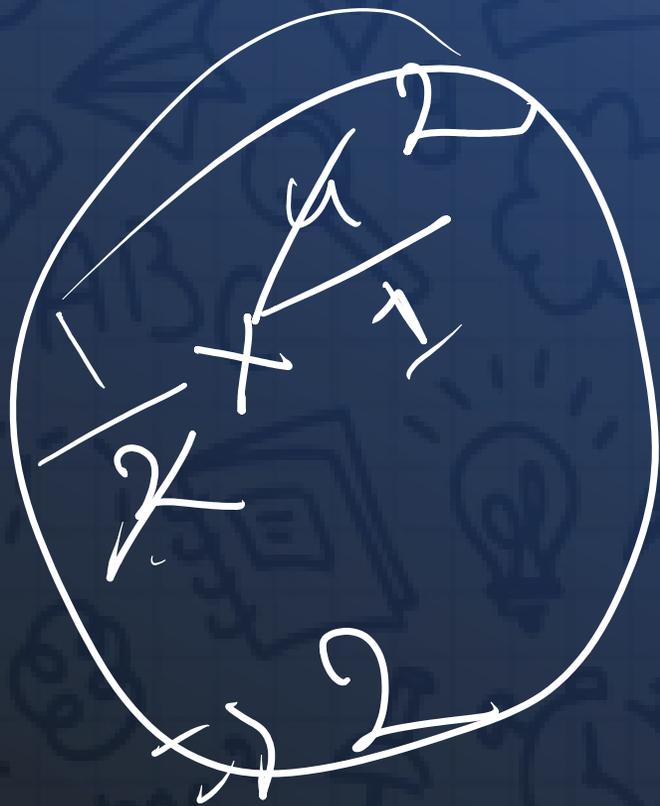


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Fractions & Decimals

Division:

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





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Fractions & Decimals

Division:

$$3.985 \div 4.6 =$$

A handwritten long division problem on a blue background. The dividend is 3985 and the divisor is 46. A horizontal line is drawn above the dividend. The quotient is written as 86.630. The numbers 100 and 1000 are written next to the 0 and 0 in the quotient, respectively, indicating the decimal places. The numbers 316 and 915 are written below the dividend, representing the products of the divisor and the quotient digits. The numbers 82 and 235 are written below the products, representing the remainders at each step. The final remainder is 5.

$$\begin{array}{r} 86.630 \\ 46 \overline{) 3985} \\ \underline{316} \\ 82 \\ \underline{82} \\ 0 \\ \underline{0} \\ 5 \end{array}$$





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Fractions & Decimals

Rising & Reducing:

$$\frac{25}{100}$$

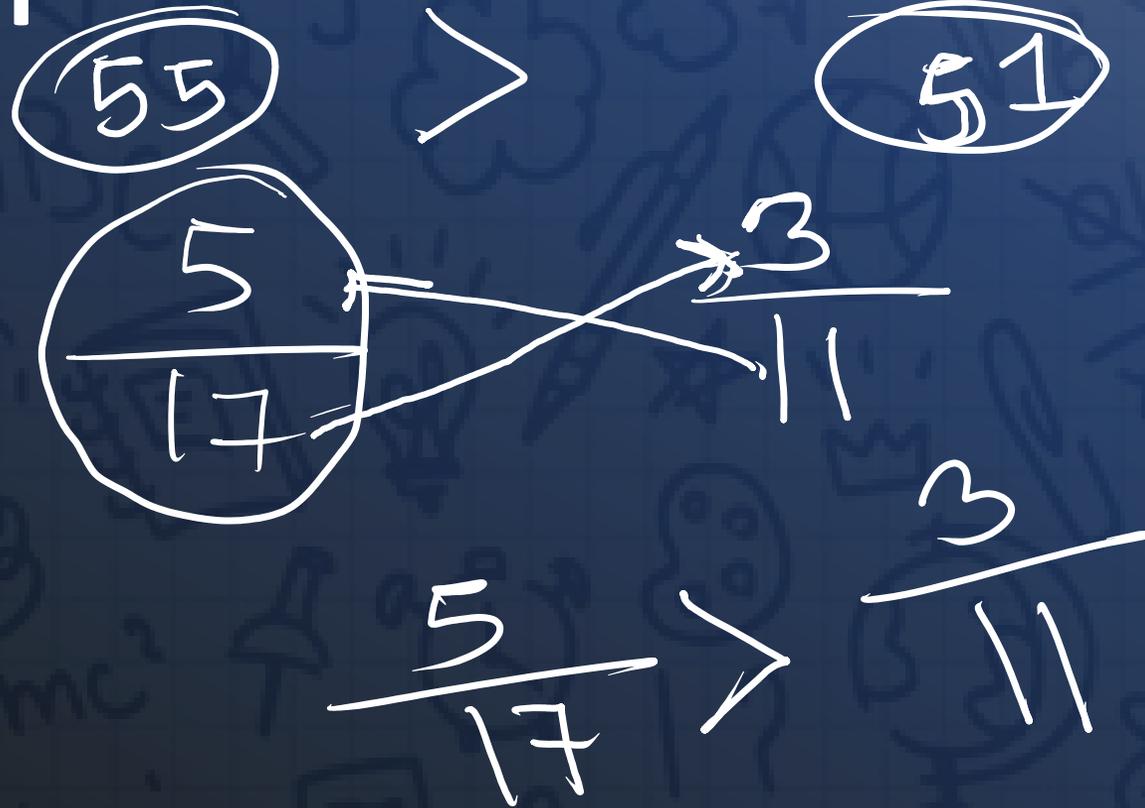
Handwritten diagram illustrating the process of rising and reducing the fraction $\frac{25}{100}$:

- Starting with $\frac{25}{100}$, it is multiplied by 4 to rise to $\frac{100}{400}$.
- Then, $\frac{100}{400}$ is divided by 4 to reduce it back to $\frac{25}{100}$.

Comparison of Fraction

For 2 fraction

$$\frac{5}{17} \quad \frac{3}{11}$$



For 3 or more fraction

$$\frac{5}{16} \quad \frac{3}{14} \quad \frac{8}{19} \quad \frac{13}{24}$$

$$\frac{\textcircled{5}}{16} \rightarrow 11$$

$$\frac{3}{\textcircled{14}} \rightarrow 11$$

$$\frac{13}{24} \rightarrow \frac{8}{19} \rightarrow \frac{5}{16} \rightarrow \frac{3}{14}$$

$$\frac{\textcircled{8}}{19} \rightarrow 11$$

$$\frac{\textcircled{13}}{24} \rightarrow 11$$

For 3 or more fraction

$$\frac{25}{27} \quad \frac{31}{37} \quad \frac{81}{89} \quad \frac{21}{25}$$

$$\frac{25}{27} \rightarrow 2$$

$$12.5$$

$$\frac{31}{37} \rightarrow 8$$

$$5.16 \dots$$

$$\frac{21}{25} \rightarrow 4$$

$$5.2 \dots$$

$$\frac{25}{27}$$

$$\frac{81}{89}$$

$$\frac{21}{25}$$

$$\frac{31}{37}$$

$$5.2$$

$$5.5$$

$$\frac{81}{89}$$

$$8$$

$$10.2$$

$$x^2 = x \times x$$

Exponents

$$x^a \times y^b \quad 10^3 \quad 5^2$$

Exponents or power provide a shortcut notation for repeated multiplication of a number by itself.

Example:

$$4^3 = \underline{4} \times \underline{4} \times \underline{4}$$

❖ When the exponent is 2 we call it square.

❖ When the exponent is 3 we call it cube.

Some Rules of Exponents:

$$❖ (x)^a \times (x)^b = x^{a+b}$$

$$❖ x^a / x^b = x^{a-b}$$

$$❖ (x^a)^b = x^{ab}$$

$$❖ (xy)^a = x^a \times y^a$$

$$❖ \left(\frac{x}{y}\right)^a = x^a / y^a$$

$$❖ x^{-a} = \frac{1}{x^a}$$

$$❖ x^0 = 1$$

$$❖ x^1 = x$$

Root

$(64)^{\frac{1}{3}}$ $(4^3)^{\frac{1}{3}}$ $4^{2+\frac{1}{3}}$ $4^1 = 4$ $(-2)^2 = 4$ $(2)^2 = 4$

Root is opposite of exponents.

Example:

$$4^3 = 4 \times 4 \times 4 = 64$$

$$\sqrt[3]{64} = 4$$

$$\sqrt[3]{64} = 4$$

- ❖ We can't identify the square root of a negative number.
- ❖ Square of a negative number is always positive.

Some Rules of Root:

❖ $\sqrt{(a \times b)} = \sqrt{a} \times \sqrt{b}$

❖ $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

❖ $\sqrt[n]{a} = a^{\frac{1}{n}}$

$64^{\frac{1}{3}}$

$\sqrt{36} = 36^{\frac{1}{2}}$