CHAPTER 05

Simplification

In mathematics, we normally use four mathematical operations + (addition), −(subtraction), × (multiplication) and ÷ (division). Now, we will study about these operations in detail.

Addition

Adding the objects of different sets means finding the total number of objects that are being considered.

e.g., " 2 marbles and 3 marbles make 5 marbles," you can write $2 + 3 = 5$ on the board or on paper. When you say "2 pencils and 3 pencils make 5 pencils", you could again write $2 + 3 = 5$ and so on.

Addition of Fractional Numbers

If any two or more than two fractional numbers are given in the form of $\frac{P}{Q}$, then we can do the sum in the following ways.

(i) $\frac{P}{Q}+\frac{2P}{Q}+\frac{5P}{Q}=\frac{\text{Numerator }=P+2P+5P}{\text{Denominator }=Q}=\frac{8P}{Q}$

(ii) $\frac{P}{Q}+\frac{2P}{R}+\frac{12P}{S}=\frac{P\times\frac{\text{LCM}}{Q}+2P\times\frac{\text{LCM}}{R}+12P\times\frac{\text{LCM}}{S}}{\text{LCM of } Q,R \text{ and } S}$

$$P\frac{Q}{R}+S\frac{T}{U}=(P+S)+\left(\frac{Q}{R}+\frac{T}{U}\right)$$

Subtraction

The process of subtraction is the reverse of addition. In subtraction we take away or remove some number of objects from the given objects to make it smaller.

Subtraction of Fractional Numbers

We subtract the fractional numbers in the following ways

(i) If the fraction $\frac{R}{Q}$ is subtracted from $\frac{P}{Q}$,

then $\frac{P}{Q}-\frac{R}{Q}=\frac{P-R}{Q}$

(ii) $P\frac{Q}{R}-S\frac{T}{R}=(P-S)+\frac{Q-T}{R}$

Multiplication

It is a mathematical concept which indicates that how many times a number is added to itself, e.g., if 2 is added 4 times, then $2 + 2 + 2 + 2 = 8$. This can be done by multiplication also i.e., $2 \times 4 = 8$

In other words, we can say that, the basic idea of multiplication is repeated addition.

The number to be repeated is called the multiplicand and the number which indicates how many times the multiplicand is to be repeated is called the multiplier. The sum of the repetition obtained is called the product.

e.g., (i) $5 \times 3 = 5 + 5 + 5 = 15$

(ii) $649 \times 3 = 649 + 649 + 649 = 1947$

General Method of Multiplication

We all know the general method of multiplication, i.e., how multiplication is done. let us now derive a general formula. The actual multiplication is done in the following way. 48×23 $\frac{96}{1104}$

I.

$$\begin{array}{r} 48 \\ \downarrow \\ 23 \\ \hline \end{array}$$

$8 \times 3 = \overline{24 \text{ we}}$ write ' 4 ' and carry ' 2 '

II.

$$\begin{array}{cc} 4 & 8 \\ \times & \\ 2 & 3 \end{array} (4 \times 3) + (2 \times 8) = 28$$

Add carry ' 2 ' of step I $= 28 + 2 = 30$

We write ' 0 ' at the ten's place and carry ' 3 '.

III.

$$\begin{array}{cc} 4 & 8 \\ \updownarrow & \\ 2 & 3 \\ \hline \multicolumn{2}{c}{4 \times 2 = 8} \end{array}$$

Add carry 3 of step II $= 8 + 3 = 11$

IV. The resultant product is 1104

Multiplying the Fractional Numbers

While multiplying two or more than two fractions, multiply numerator with numerator and multiply denominator with denominator.

(i) $\frac{P}{Q} \times \frac{R}{S} = \frac{P \times R}{Q \times S}$

(ii) $\frac{P}{Q} \times \frac{R}{S} \times \frac{T}{U} = \frac{PRT}{QSU}$

e.g., (i) $\frac{5}{3} \times \frac{4}{7} = \frac{20}{21}$

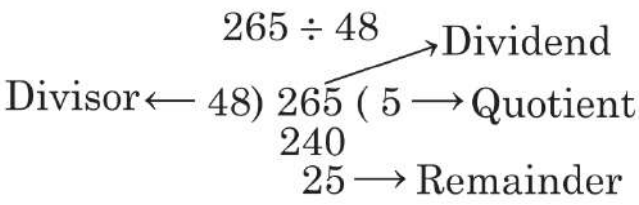
(ii) $2\frac{1}{2} \times 4\frac{1}{3} = \frac{5}{2} \times \frac{13}{3} = \frac{65}{6}$

(iii) $\frac{5}{2} \times \frac{4}{3} \times \frac{9}{7} = \frac{180}{42} = \frac{90}{21} = \frac{30}{7}$

Division

Division is the method of finding how many times one given number called the divisor is contained in another given number called the dividend. The number expressing this, is called the quotient and the excess of the dividend over the product of the divisor and the quotient is called the remainder.

e.g.,



Formulae for Division Based Problems

- Dividend = Divisor × Quotient + Remainder

$$\text{Divisor)}\ \frac{\text{Dividend}}{\text{Remainder}}\ \text{(Quotient}$$

- $\text{Divisor} = \frac{\text{Dividend} - \text{Remainder}}{\text{Quotient}}$
- $\text{Quotient} = \frac{\text{Dividend} - \text{Remainder}}{\text{Divisor}}$

Other Mathematical Operations

Sometime we face some other operations but actually these are not new.

e.g., if we assume the symbol * as +, then

$$5 * 3 = 5 + 3 = 8$$

It means that our basic mathematical operations come in the form of other symbols but questions are solved by taking the original symbols.

The symbols given in the question can be $^*, \delta, \pi, \square$ etc.

How to Solve the Questions?

Following are the steps which are used to solve the questions

Step I First of all read and understand the relation which is given for the symbol properly.

Step II Keeping the given relation in your mind, arrange the numbers according to it.

Step III At last, find the value of the expression using original symbols.

e.g. if $a^*b = a^2 + b^2$, then $5 * 3 = 5^2 + 3^2 = 25 + 9 = 34$

Solved Examples

1. Add the numbers 5936,87569,75.003,7.8753, 7135.990

(a) 100732.8638
(b) 100723.8863
(c) 100723.8683
(d) 100732.8683

Sol. (c)

$$\begin{array}{r} 5936.0000 \\ 87569.0000 \\ 75.0030 \\ +7135.9900 \\ \hline 100723.8683 \end{array}$$

2. Simplify $1856 - 3287 + 5432 - 679$

(a) 3122
(b) 2233
(c) 3322
(d) 4500

Sol. (c) Simplified value

$$= 1856 + 5432 - (3287 + 679)$$
$$= 7288 - 3966 = 3322$$

3. Find the multiplication of the numbers 5384 and 7329.

(a) 39429336
(b) 39459336
(c) 39898736
(d) 38459336

Sol. (b)

$$\begin{array}{r} 5384 \\ \times\ 7329 \\ \hline 48456 \\ 10768\ \times \\ 16152\ \times\times \\ 37688\ \times\times\times \\ \hline 39459336 \end{array}$$

4. If $m \oplus n = m^3 - n^2 + mn$, find $2 \oplus 3$.

(a) 1
(b) -1
(c) 5
(d) -7

Sol. (c) $\because m \oplus n = m^3 - n^2 + mn$

$\therefore\ 2 \oplus 3 = 2^3 - 3^2 + 2 \times 3 = 8 - 9 + 6 = 5$

Practice Questions

1. $\frac{0.04}{0.03}$ **of** $\frac{\left(3\frac{1}{3}-2\frac{1}{2}\right)\div\frac{1}{2}\text{ of }1\frac{1}{4}}{\frac{1}{3}+\frac{1}{5}\text{ of }\frac{1}{9}} =$ **?**

(a) 1
(b) 5
(c) $\frac{1}{5}$
(d) $\frac{1}{2}$

2. The value of

$\frac{1}{\sqrt{2}+1} + \frac{1}{\sqrt{3}+\sqrt{2}} + \frac{1}{\sqrt{4}+\sqrt{3}} + \cdots + \frac{1}{\sqrt{100}+\sqrt{99}}$ is

(a) 1
(b) 9
(c) $\sqrt{99}$
(d) $\sqrt{99} - 1$

3. Simplify $\frac{\frac{1}{3}+\frac{1}{4}\left[\frac{2}{5}-\frac{1}{2}\right]}{1\frac{2}{3}\text{ of }\frac{3}{4}-\frac{3}{4}\text{ of }\frac{4}{5}}$

(a) $\frac{37}{78}$
(b) $\frac{37}{13}$
(c) $\frac{74}{78}$
(d) $\frac{74}{13}$

4. Ram went to a market and bought one copy of a Mathematics book and two pencils for ₹ 165. Rahim went to the same market and bought another copy of the same book and ten pencils of the same brand for ₹169.The price of each pencil was

(a) ₹ 0.50
(b) ₹ 1
(c) ₹ 0.75
(d) ₹ 2

5. A man has some hens and cows. If the number of head : number of feet $= 12:35$, find out the number of hens, if the number of heads alone is 48

(a) 28
(b) 26
(c) 24
(d) 22

6. $1 + \frac{1}{1+\frac{1}{5}}$ **is equal to**

(a) $11/6$
(b) $13/6$
(c) $15/6$
(d) None of these

7. In the following, which is the greatest number?

(a) $[(2+2)^2]^2$
(b) $(2+2+2)^2$
(c) $(4)^2$
(d) $(2 \times 2 \times 2)^2$

8. Which of the following will come in place of both the questions marks (?) in the following equation?

$$\frac{128 \div 16 \times ? - 7 \times 2}{7^2 - 8 \times 6 + ?^2} = 1$$

(a) 17
(b) 16
(c) 18
(d) 3

9. If a number is decreased by 4 and divided by 6 the result is 8. What would be the result if 2 is subtracted from the number and then it is divided by 5?

(a) $9\frac{2}{3}$
(b) $10\frac{1}{5}$
(c) $11\frac{2}{5}$
(d) 10

10. If 567567567 is divided by 567, the quotient is

(a) 111
(b) 10101
(c) 1001001
(d) 3

11. How many $\frac{1}{8}$ are in $\frac{1}{2}$?

(a) 8
(b) 4
(c) 2
(d) 16

12. The difference of the place value and the face value of the number 3 in 12345 is

(a) 299
(b) 297
(c) 298
(d) None of the above

13. When 121012 is divided by 12, the remainder is

(a) 0
(b) 2
(c) 3
(d) 4

14. A chocolate has 12 equal pieces. Manju gave $\frac{1}{4}$ th of it to Anju, $\frac{1}{3}$ rd of it to Sujata and $\frac{1}{6}$ th of it to Fiza. The number of pieces of chocolate left with Manju is

(a) 1
(b) 2
(c) 3
(d) 4

ANSWERS

1. (b)	**2.** (b)	**3.** (a)	**4.** (a)	**5.** (b)	**6.** (a)	**7.** (a)	**8.** (d)	**9.** (d)	**10.** (c)
11.(b)	**12.**(b)	**13.**(d)	**14.**(**c**)						

Hints & Solutions

1. $\frac{0.04}{0.03}$ of $\frac{\left(3\frac{1}{3}-2\frac{1}{2}\right)\div\frac{1}{2}\text{ of }1\frac{1}{4}}{\frac{1}{3}+\frac{1}{5}\text{ of }\frac{1}{9}}$

$$=\frac{0.04}{0.03}\times\frac{\left(\frac{10}{3}-\frac{5}{2}\right)\div\frac{5}{8}}{\frac{1}{3}+\frac{1}{45}}$$

$$=\frac{4}{3}\times\frac{\frac{5}{6}\times\frac{8}{5}}{\frac{1}{3}+\frac{1}{45}}$$

$$=\frac{4}{3}\times\frac{\frac{4}{3}}{16}$$

$$=\frac{4}{3}\times\frac{4}{3}\times\frac{45}{16}=5$$

2. $\because \frac{1}{\sqrt{2}+1}\times\frac{\sqrt{2}-1}{\sqrt{2}-1}=\sqrt{2}-1$

Similarly,

$$\frac{1}{\sqrt{2}+1}+\frac{1}{\sqrt{3}+\sqrt{2}}+\cdots+\frac{1}{\sqrt{100}+\sqrt{99}}$$

$$=(\sqrt{2}-1)+(\sqrt{3}-\sqrt{2})+\ldots+(\sqrt{100}-\sqrt{99})$$

$$=\sqrt{100}-1=10-1=9$$

3. $\frac{\frac{1}{3}+\frac{1}{4}\left[\frac{2}{5}-\frac{1}{2}\right]}{1\frac{2}{3}\text{ of }\frac{3}{4}-\frac{3}{4}\text{ of }\frac{4}{5}}$

$$=\frac{\frac{1}{3}+\frac{1}{4}\left[\frac{4-5}{10}\right]}{\frac{3}{4}\times\frac{5}{3}-\frac{4}{5}\times\frac{3}{4}}$$

$$=\frac{\frac{1}{3}+\frac{1}{4}\left[-\frac{1}{10}\right]}{\frac{5}{4}-\frac{3}{5}}$$

$$=\frac{\frac{1}{3}-\frac{1}{40}}{\frac{13}{20}}=\frac{37}{120}\times\frac{20}{13}=\frac{37}{78}$$

4. According to the question,

Cost price of → (1 book +2 pencils) = ₹165

Cost price of → (1 book +10 pencils) = ₹169 .....(ii)

On subtracting Eq. (i) from Eq.

(ii) we get, 8 pencils = ₹4

∴ 1 pencil = $₹\frac{4}{8} = ₹0.50$

5. Suppose, number of heads = $12K$ and number of feet = $35K$

Then, $12K = 48 \Rightarrow K = 4$

∴ Number of feet = $35 \times 4 = 140$

Again, suppose number of hens

$= x$

and number of cows = y

∴ $x + y = 48$ ... (i)

and $2x + 4y = 140$

$\Rightarrow 2x + 4(48 - x) = 140$

[from Eq. (i)]

$\Rightarrow 2x + 192 - 4x = 140$

$\Rightarrow 2x = 52$

$\Rightarrow x = 26$

6. Expression = $1 + \frac{1}{1+\frac{1}{5}}$

$= 1 + \frac{1}{\frac{5+1}{5}} = 1 + \frac{5}{6}$

$= \frac{6+5}{6} = \frac{11}{6}$

7. $[(2+2)^2]^2 = (16)^2 = 256$

$(2+2+2)^2 = (6)^2 = 36$

$(4)^2 = 16$

$(2 \times 2 \times 2)^2 = (8)^2 = 64$

Therefore, $256 > 64 > 36 > 16$

∴ $[(2+2)^2]^2$ is the greatest.

8. $\frac{128\div16\times?-7\times2}{7^2-8\times6+?^2}=1$

$\Rightarrow \frac{8\times?-14}{49-48+?^2}=1$

$\Rightarrow\ 1+?^2=8\times?-14$

$\Rightarrow ?^2-8\times?+15=0$

On putting ' x ' in place of question mark '?', we get

$x^2-8x+15=0$

$(x-3)(x-5)=0$

$\therefore\ x=3$ or 5

9. Let the number be N.

According to the question,

$$\frac{N-4}{6}=8$$

$$\Rightarrow\ N=(8\times6)+4$$

$$\Rightarrow\ N=52$$

Now, $\frac{N-2}{5}=\frac{52-2}{5}=\frac{50}{5}=10$

10. Clearly, $\frac{567567567}{567}=1001001$

11. Required number of $\frac{1}{8}$ in $\frac{1}{2}=\frac{\frac{1}{2}}{\frac{1}{8}}=\frac{8}{2}=4$

12. The place value of the given number is 300 and the face value of that number is 3. So, the required difference is $300-3=297$

13. 4 Hence, when 121012 is divided by 12, then remainder is 4.

14. The number of pieces of chocolate left with Manju

$=1-\left(\frac{1}{4}+\frac{1}{3}+\frac{1}{6}\right)$

$=1-\left(\frac{3+4+2}{12}\right)$

$=1-\frac{9}{12}=\frac{12-9}{12}=\frac{3}{12}$

Hence, number of pieces of chocolate left with Manju is 3.