

SET - I

SECTION - A

1. Simplify :

$$8\frac{1}{2} - \left[ 3\frac{1}{5} \div 4\frac{1}{2} \text{ of } 5\frac{1}{3} + \left\{ 11 - \left( 3 - \left( 1\frac{1}{4} - \frac{5}{8} \right) \right) \right\} \right]$$

**Sol:**

Given expression

$$= \frac{17}{2} - \left[ \frac{16}{5} \div \frac{9}{2} \text{ of } \frac{16}{3} + \left\{ 11 - \left( 3 - \left( \frac{5}{4} - \frac{5}{8} \right) \right) \right\} \right]$$

$$= \frac{17}{2} - \left[ \frac{16}{5} \div \frac{9}{2} \text{ of } \frac{16}{3} + \left\{ 11 - \left( 3 - \frac{5}{8} \right) \right\} \right]$$

$$= \frac{17}{2} - \left[ \frac{16}{5} \div \frac{9}{2} \text{ of } \frac{16}{3} + \left\{ 11 - \frac{19}{8} \right\} \right]$$

$$= \frac{17}{2} - \left[ \frac{16}{5} \div \frac{9}{2} \text{ of } \frac{16}{3} + \frac{69}{8} \right]$$

$$= \frac{17}{2} - \left[ \frac{16}{5} \div \frac{9}{2} \times \frac{16}{3} + \frac{69}{8} \right]$$

$$= \frac{17}{2} - \left[ \frac{16}{5} \div \frac{24}{1} + \frac{69}{8} \right]$$

$$= \frac{17}{2} - \left[ \frac{16}{5} \times \frac{1}{24} + \frac{69}{8} \right] = \frac{17}{2} - \left[ \frac{16}{120} + \frac{69}{8} \right]$$

$$= \frac{1020 - 1051}{120} = -\frac{31}{120}$$

[4 marks]

2. Find the average of first 31 consecutive even numbers.

**Sol:**

The Average of first n consecutive even numbers is  $(n+1)$

The required average =  $(n + 1) = 31 + 1 = 32$ .

[4 marks]

3. If the selling price of 12 articles is equal to the cost price of 18 articles, what is the profit %?

**Sol :**

Here,  $m = 18, n = 12$

$$\therefore \text{Profit}\% = \left( \frac{m-n}{n} \right) \times 100$$

$$= \left( \frac{18-12}{12} \right) \times 100$$

$$= \frac{6}{12} \times 100 = 50\%.$$

[4 marks]

4. Two trains of length 110 meters and 90 meters are running on parallel lines in the same direction with a speed of 35 km/hr and 40 km/hr, respectively. In what time will they pass each other?

**Sol:**

Here,  $L_1 = 110 \text{ m}, L_2 = 90 \text{ m}, s_1 = 35 \text{ km/hr}$  and  $s_2 = 40 \text{ km/hr}$

$$\therefore s_2 - s_1 = 40 - 35 = 5 \text{ km/hr} = 5 \times \frac{5}{18} \text{ m/s}$$

$$\therefore \text{Time taken} = \frac{L_1 + L_2}{s_2 - s_1}$$

$$= \frac{110+90}{5 \times \frac{5}{18}} = \frac{200 \times 18}{5 \times 5} = 144 \text{ sec.}$$

[4 marks]

5. A man can row 7 km/hr in still water. If the river is running at 3 km/hr, it takes 6 hours more in upstream than to go downstream for the same distance. How far is the place?

**Sol :**

Downstream speed =  $(x + y)$  km/hr

Upstream speed =  $(x - y)$  km/hr.

Let the distance between the two places be  $d$  km.

We have,

Total time = Sum of time taken downstream and upstream

$$\begin{aligned} \Rightarrow t &= \frac{d}{x+y} + \frac{d}{x-y} \\ &= d \left[ \frac{(x-y) + (x+y)}{(x-y)(x+y)} \right] \\ &= d \left[ \frac{2x}{x^2 - y^2} \right] \\ &= d = \frac{t(x^2 - y^2)}{2x} \text{ km.} \end{aligned}$$

The required distance

$$\begin{aligned} &= \frac{(x^2 - y^2)t}{2y} \\ &= \frac{(49-9)6}{2 \times 3} = 40 \text{ km.} \end{aligned}$$

[4 marks]

6. 'A' can run 100 m in 27 sec and 'B' in 30 sec. By what distance 'A' beats 'B'?

**Sol :**

A beats B by a distance

$$\begin{aligned} &= \frac{x}{t_2} \times (t_2 - t_1) \\ &= \frac{100}{30}(30 - 27) = \frac{300}{30} = 10 \text{ m.} \end{aligned}$$

[4 marks]

7. Mohan deposits Rs. 5000 in NSC at 2% per annum and Rs. 2000 in mutual funds at 4% per annum. Find the rate of interest for the whole sum.

**Sol :**

Here,  $P_1 = 5000$ ,  $R_1 = 2$ ,  $P_2 = 2000$ ,  $R_2 = 4$ .

Using the formula

$$R = \left( \frac{P_1 R_1 + P_2 R_2}{P_1 + P_2} \right)$$

$$\text{We get, } R = \frac{5000 \times 2 + 2000 \times 4}{5000 + 2000} = 2\frac{4}{7}\%$$

[4 marks]

8. Mahatma Gandhi was born on 2 October 1869, what was the day on this date?

**Sol :**

2 October 1869 means

1868 complete years + 9 months + 2 days

1600 years give 0 odd days

200 years give 3 odd days

No. of leap years in 68 years = largest integer less than  $\frac{68}{4} = 17$

$\therefore$  68 years contain 17 leap years and 51 non-leap years.

$\therefore$  68 years have  $2 \times 17 + 51 = 85$ , i.e. 1 odd day Also count no. of days from 1 Jan. 1869 to 2 Oct. 1869

Jan.	Feb.	March	April	May	June
31	+28	+31	+30	+31	+30
July	Aug.	Sept.	Oct.		
31	+31	+30	+2 = 275		

= 39 weeks + 2 days

$\therefore$  This gives 2 odd days

$\therefore$  Total no. of odd days =  $0 + 3 + 1 + 2 = 6$

$\therefore$  Day on 2 Oct. 1869 was Saturday

[4 marks]

9. How many times the hands of a clock are in a straight line in a day?

**Sol :**

We know that, any relative position of the hands of a clock is repeated 11 times in every 12 hrs.

$\therefore$  In every 12 hrs, hands coincide 11 times and are opposite to each other 11 times.

$\therefore$  In every 12 hrs, hands are in a straight line  $11 + 11 = 22$  times.

$\therefore$  In every 24 hrs hands are in a straight line 44 times.

[4 marks]

10. If  $\sqrt{24} = 4.899$ , then find the value of  $\sqrt{\frac{8}{3}}$

**Sol :**

$$\sqrt{\frac{8}{3}} = \sqrt{\frac{8}{3}} \times \sqrt{\frac{3}{3}} = \frac{\sqrt{24}}{3} = \frac{4.899}{3} = 1.633.$$

[4 marks]

## SECTION - B

11. If salary of a person is first increased by 15% and thereafter decreased by 12%, what is the net change in his salary?

**Sol:**

Here,  $x = 15$  and  $y = -12$ .

∴ The net % change in the salary

$$\begin{aligned} &= \left( x + y + \frac{xy}{100} \right) \% \\ &= \left( 15 - 12 - \frac{15 \times 12}{100} \right) \% \text{ or } 1.2\%. \end{aligned}$$

Since the sign is +ve, the salary of the person increases by 1.2%

[6 marks]

12. The incomes of Mohan and Sohan are in the ratio 7 : 2 and their expenditures are in the ratio 4 : 1. If each saves Rs. 1000, find their expenditures.

**Sol:**

We have,  $a : b = 7 : 2$ ,  $c : d = 4 : 1$  and  $S = 1000$ .

$$\begin{aligned} \therefore \text{A's expenditure} &= \frac{cS(b-a)}{ad-bc} = \frac{4 \times 1000 \times (2-7)}{(7 \times 1 - 2 \times 4)} \\ &= \text{Rs. } 20000 \end{aligned}$$

$$\begin{aligned} \text{and, B's expenditure} &= \frac{dS(b-a)}{ad-bc} = \frac{1 \times 1000 \times (2-7)}{(7 \times 1 - 2 \times 4)} \\ &= \text{Rs. } 5000 \end{aligned}$$

[6 marks]

13. 'A' sells a horse to 'B' at a profit of 5% and 'B' sells it to 'C' at a profit of 10%.  
Find the resultant profit per cent.

**Sol :**

We have,  $m = 5$  and  $n = 10$

$$\therefore \text{Resultant profit \%} = \left( m + n + \frac{mn}{100} \right)$$

$$= \left( 5 + 10 + \frac{5 \times 10}{100} \right)$$

$$= \frac{31}{2} \% \text{ or } 15 \frac{1}{2} \%$$

[6 marks]

14. Find a single discount equivalent to three successive discounts of 10%, 20% and 30%.

**Sol :**

The equivalent single discount is given by

$$\left( 10 + 20 + 30 - \frac{(10 \times 20 + 10 \times 30 + 20 \times 30)}{100} + \frac{10 \times 20 \times 30}{100^2} \right) \% \text{ i.e.}$$

$$\left( 60 - 11 + \frac{6}{10} \right) \% = \frac{496}{10} \% \text{ or } 49.6\%$$

[6 marks]

15. 'A' and 'B' can do a piece of work in 12 days, 'B' and 'C' in 15 days, 'C' and 'A' in 20 days. How long would each take separately to do the same work?

**Sol :**

Here,  $X = 12$ ,  $Y = 15$  and  $Z = 20$ .

$\therefore$  A alone can do the work in

$$= \frac{2XYZ}{XY + YZ - ZX}$$

$$= \frac{2 \times 12 \times 15 \times 20}{12 \times 15 + 15 \times 20 - 20 \times 12} \text{ days}$$

or,  $\frac{7200}{360}$ , i.e. 30 days.

B alone can do the work in

$$= \frac{2XYZ}{YZ+ZX-XY} \text{ days}$$
$$= \frac{2 \times 12 \times 15 \times 20}{15 \times 20 + 20 \times 12 - 12 \times 15} \text{ days}$$

or,  $\frac{7200}{360}$ , i.e. 20 days.

C alone can do the work in

$$= \frac{2XYZ}{ZX+XY-YZ} \text{ days}$$
$$= \frac{2 \times 12 \times 15 \times 20}{20 \times 12 + 12 \times 15 - 15 \times 20} \text{ days}$$

or,  $\frac{7200}{120}$ , i.e. 60 days.

[6 marks]

16. The sum of the ages of John and Marry is 42 years. 3 years back, the age of John was 5 times the age of Marry. Find the difference the present ages of John and Marry.

**Sol:**

Here,  $S = 42$ ,  $n = 5$  and  $t = 3$

$\therefore$  Present age of John

$$= \frac{Sn - t(n-1)}{n+1} = \frac{42 \times 5 - 3(5-1)}{5+1}$$
$$= \frac{198}{6} = 33 \text{ years}$$

and, present age of Marry



$$\frac{5+t(n+1)}{n+1} = \frac{42+3(5-1)}{5+1}$$

$$= \frac{54}{6} = 9 \text{ years.}$$

∴ Difference between the present ages of John and Marry = 33 - 9 = 24 years.

[6 marks]

- 17.** A square field is surrounded by a path 2m wide on its outside. The area of the path is 72 sq m. what is the area of the field?

**Sol :**

Area of the field

$$= \left( \frac{A - 4w^2}{4w} \right)^2$$

$$= \left( \frac{72 - 4 \times 2^2}{4 \times 2} \right)^2 = 49 \text{ Sq m}$$

[6 marks]

- 18.** The quotient arising from the division of 24446 by a certain Quotient is 79 and the remainder is 35, what is the divisor?

**Sol :**

$$\text{Divisor} = \frac{(\text{Divison} - \text{Re mainder})}{\text{Quotient}}$$

$$\text{Divisor} = \frac{24446 - 35}{79} = 309$$

[6 marks]

19. The product of two numbers is 120. The sum of their squares is 289. The sum of the two numbers is

**Sol:**

Let the numbers be a and b. Then,

$$(a + b)^2 = (a^2 + b^2) + 2ab$$

$$= 289 + 2 \times 120 = 289 + 240 = 529$$

$$\therefore a + b = \sqrt{529} \Rightarrow a + b = 23.$$

20.  $\sqrt{12 + \sqrt{12 + \sqrt{12 + \dots}}} = ?$

**Sol:**

Let, given expression = x

$$\text{Then, } \sqrt{12 + x} = x \Rightarrow 12 + x = x^2$$

$$\therefore x^2 - x - 12 = 0 \text{ or, } (x - 4)(x + 3) = 0$$

So, x = 4 (neglecting x = -3)

[6 marks]