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Jammu & Kashmir

Class - IV

Jammu and Kashmir Services Selection Board (JKSSB)

Volume - 4

Mathematics, Reasoning & English

SIERRA INNOVATIONS

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1 CHAPTER Percentage

- Percentage means 'Per hundred'.
- The fraction whose denominator is 100, is called percentage and the numerator of that fraction is called percentage rate.
- 5 out of 100 $= \frac{5}{100} = 5\%$
- 10 out of 100 $= \frac{10}{100} = 10\%$
- That is, when an amount is compared with 100, it is called percentage. The basis with which the comparison is made. In the fraction, the base will be called the denominator.

Conversion From Percentage to Fraction

$100\% = 1$	$10\% = \frac{1}{10}$	$5\frac{5}{19}\% = \frac{1}{19}$
$50\% = \frac{1}{2}$	$9\frac{1}{11}\% = \frac{1}{11}$	$5\% = \frac{1}{20}$
$33\frac{1}{3}\% = \frac{1}{3}$	$8\frac{1}{3}\% = \frac{1}{12}$	$4\frac{1}{6}\% = \frac{1}{24}$
$25\% = \frac{1}{4}$	$7\frac{9}{13}\% = \frac{1}{13}$	$4\% = \frac{1}{25}$
$20\% = \frac{1}{5}$	$7\frac{1}{7}\% = \frac{1}{14}$	$2\frac{1}{2}\% = \frac{1}{40}$
$16\frac{2}{3}\% = \frac{1}{6}$	$6\frac{2}{3}\% = \frac{1}{15}$	$37\frac{1}{2}\% = \frac{3}{8}$
$14\frac{2}{7}\% = \frac{1}{7}$	$6\frac{1}{4}\% = \frac{1}{16}$	$62\frac{1}{2}\% = \frac{5}{8}$
$12\frac{1}{2}\% = \frac{1}{8}$	$5\frac{15}{17}\% = \frac{1}{17}$	$57\frac{1}{7}\% = \frac{4}{7}$
$11\frac{1}{9}\% = \frac{1}{9}$	$5\frac{5}{9}\% = \frac{1}{18}$	$66\frac{2}{3}\% = \frac{2}{3}$
$80\% = \frac{4}{5}$	$75\% = \frac{3}{4}$	

Note -

(i) To convert a fraction or a decimal fraction or an integer into a percentage, multiply it by 100.

(ii) To convert a percentage to a fraction, divide it by 100.

- One number is what percent of another number –

$$\%\ \text{Quantity} = \frac{\text{Given number}}{\text{Basic}\left(\text{another number}\right)} \times 100$$

Ex.1 What percent of 48 is 6 ?

Sol. Let x % of 48 = 6

Now, $48 \times \frac{x}{100} = 6$

$\frac{12x}{25} = 6$

$x = \frac{6 \times 25}{12} = 12\frac{1}{2}$

The percent $12\frac{1}{2}\%$ of 48 is 6.

Ex.2 Convert $\frac{9}{16}$ into percentage.

Sol. $\frac{9}{16} = \left(\frac{9}{16} \times 100\right)\% = \frac{225}{4}\% = 56\frac{1}{4}\%$

Ex.3 When 60 is subtracted from 60% of a number, the result is 60. The number is-

(a) 120 (b) 150

(c) 180 (d) 200

Sol. **(b)**

Let the number be x, then –

$X \times 60\% - 60 = 60$

$\Rightarrow 0.60x - 60 = 60$

$\Rightarrow 0.60x = 120$

$\Rightarrow x = \frac{120}{0.60}$

$X = 200$

$\therefore$ The number is 200.

If there is a percentage change

Case I – If there is increase of x_1 % & x_2 % then –

Percentage increase = $x_1 + x_2 + \frac{x_1 . x_2}{100}$

Case II – If there is decrease of x_1 % & x_2 % then –

Percent decrease = $x_1 + x_2 - \frac{x_1 . x_2}{100}$

Case III – If there is increase of x_1 % and decrease of x_2 % then –

Percentage change = $x_1 - x_2 - \frac{x_1 . x_2}{100}$ $\begin{bmatrix} x_1 = \text{ Always percentage increase} \\ x_2 = \text{ Always percentage decrease.} \end{bmatrix}$

Note- If you want to calculate the percentage change in expenses, sales income, revenue, area, etc., then the same rule will be used.

Ex.1 Two successive price increases of 10% and 10% of an article are equal to which one single price increase?

(a) 19% (b) 20%

(c) 21% (d) 22%

Sol. **(c)**

Let the initial price of any item = 100

New price = 110 % of 100 of 110%.

$\left(100 \times \frac{110}{100} \times \frac{110}{100}\right) = 121 = 21\%$

Hence, the single price increase is equal to 21 percent.

Ex.2 The price of laptop is increased by 25%. Now by what percent is the price increased for the second time so that the total increase becomes 35%?

(a) 7.5 (b) 9

(c) 8 (d) 10

Sol. **(c)**

Given that –

Price increased by 25% = x

The overall increase was 35%.

Formula:

Total Increment = x + y +xy/100

Calculation:

$\Rightarrow$ 35 = 25 + y + (25 × y/100)

$\Rightarrow$ 35 = 25 + y + y/4

$\Rightarrow$ 140 = 100 + 4y + y

$\Rightarrow$ 140 – 100 = 5y

$\Rightarrow$ 40 = 5y

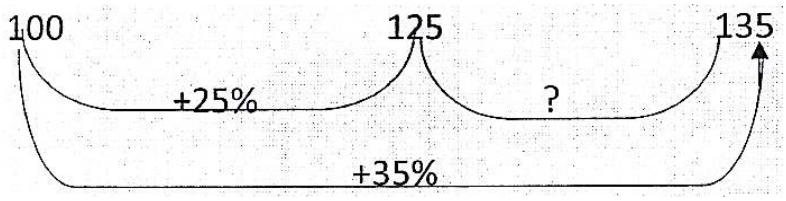
$\Rightarrow$ y = 8

Hence, the second time increase is 8%.

Method II

Let the price of laptop = 100

Price First Increase Second Increase



Percent increase $= \frac{135-125}{125} \times 100$

$= \frac{10}{125} \times 100 = 8\%$

Ex.3 The value of a tool decreases by 20% every year. What will be the cost of that tool after 3 years?

(a) 48.8% (b) 51.2% (c) 54% (d) 60%

Sol. (a)

20% = 1/5

Initial	Final
5	4
5	4
5	4
125	64

Required Percentage = $\frac{61}{125} \times 100 = 48.8\%$

Method II

Let the price of tool = x

According to question,

Price after 8 years $= x \times \frac{80}{100} \times \frac{80}{100} \times \frac{80}{100}$

$= \frac{64}{125} x$

Decrease in price $= x - \frac{64}{125}x = \frac{61}{125}x$

Percentage decrease $= \frac{\frac{61}{125}x}{x} \times 100 = 48.8\%$

Formula Related to Population

- If the population of a city is P and it is increasing at the rate of x% per annum, then the population after n years –

$$= P\left(1 + \frac{x}{100}\right)^n$$

- If it is decreasing, then the population

$$= P\left(1 - \frac{x}{100}\right)^n$$

Ex.1 If the population of a city is increasing at the rate of 4% per annum and the present number of people is 15625, then what will be the population after 3 years?

Sol. Required Population $= 15625\left(1 + \frac{4}{100}\right)^3$

$$= 15625 \times \frac{26}{25} \times \frac{26}{25} \times \frac{26}{25} = 17576$$

Ex.2 The population of a city is 8000. If the number of males increases at the rate of 6 percent and the rate of increase in the number of females is 10 percent, then the population will become 8600. Find the number of females in the city.

Sol. Let the number of females = x

Then, 110 % of x + 106% of (8000 + x) = 8600

$$\frac{110x}{100} + \frac{106(8000 - x)}{100} = 8600$$

x (110 – 106) = 8600 × 100 – 8000 × 106

$$\therefore x = \frac{8600 \times 100 - 8000 \times 106}{110 - 106}$$

$$= \frac{12000}{4} = 3000$$

Ex.3 In 1988 the population of a city decreased by 12%. In 1989 it increased by 15%. What was the overall impact on the city's population in the early 1990s?

Sol. % Impact = % Increase – % Decrease – $\frac{(\%\text{Increase})(\%\text{ Decrease})}{100}$

$$= 15 - 12 - \frac{15 \times 12}{100} = 15 - 13.8 = 12$$

$\therefore$ The population increased by 1.2%.

- If x percent of any amount is taken by the first person, y percent of the balance is taken by the second person and after taking z percent of the remaining amount by the third person, if A is left, then the total amount initially –

$$= \frac{A \times 100 \times 100 \times 100}{(100 - x)(100 - y)(100 - z)}$$

- An increase or decrease in the price of a commodity, a decrease or increase in it consumption –

(a) % Increase in consumption $= \frac{100 \times \text{decrease}}{100 - \text{decrease}}$

(b) % Decrease in consumption $= \frac{100 \times \text{increase}}{100 + \text{increase}}$

Ex.1 If the price of sugar is increased by 40%, by what percent should a family reduce it annual consumption of sugar so that the expenditure of the family does not increase?

(a) $24\frac{4}{7}\%$ (b) $28\frac{4}{7}\%$

(c) $29\frac{4}{7}\%$ (d) $30\frac{4}{7}\%$

Sol. **(b)**

Let , the consumption initially was = 100 units and price per unit = ₹100.

Initially total expenditure = ₹ (100 × 100) = ₹ 10000

New price = 140 per units and let the new consumption ¾ (100 – X) units.

Now, expenditure = 140 × (100 – x) × (14000 – 140 x)

$14000 - 140x = 10000$

$\Rightarrow 140x = 4000$

$\Rightarrow x = \frac{4000}{140} = \frac{200}{7}\% = 28\frac{4}{7}\%$

Decrease in consumption = $28\frac{4}{7}\%$

Method II

Decrease in comsumption

$$\%\,\text{Decrease} = \frac{100 \times \text{Increase}}{100 + \text{Increase}}$$

$$\%\,\text{Decrease} = \frac{100 \times 40}{100 + 40} = \frac{4000}{140} = \frac{200}{7} = 28\frac{4}{7}\%$$

Ex.2 A 10% reduction in the price of sugar allows a housewife to buy 6.2 kg more sugar for ₹ 1116. What is the reduced price of sugar per kg?

(a) ₹ 12 (b) ₹ 14

(c) ₹ 16 (d) ₹ 18

Sol. **(d)**

Let the price initially = X per kg.

New price $= \frac{90x}{100}$ Rs./kg. $= \frac{9x}{10} =$ Per kg.

$$\frac{116}{(9x/10)} - \frac{1116}{x} = 6.2$$

$$\Rightarrow \frac{1240}{x} - \frac{1116}{x} = 6.2$$

$6.2x = (1240 - 1116) = 124$

$\Rightarrow x = \frac{124}{6.2} = \frac{1240}{62} = 20$

Reduced price = $\left(\frac{90}{100} \times 20\right)$ per kg. = ₹ 18 per kg.

Method II

For the current price –

Rs. × % change = Weight (Less/More)

$1116 \times \frac{10}{100} = 6.2$

$\Rightarrow \frac{1162}{62} = 18$ ₹ $\Rightarrow$ Current price.

Ex.3 If the price of petrol is reduced by 10%, by how much will a consumer have to increase the consumption of petrol so that his expenditure on petrol does not decrease?

(a) $11\frac{1}{9}\%$ (b) $12\frac{1}{3}\%$

(c) $10\frac{1}{2}\%$ (d) 14%

Sol. **(a)**

Let the initial consumption of petrol = 100 Units and it's price = ₹100 per unit.

Total price = ₹ (100 x 100) =₹ 10000

New price = ₹90 per unit.

Let, new consumption = (100 + X) units.

Now, the total price = (₹100 + x) × 90]
= ₹ (9000 + 90x)
∴ 9000 + 90x = 10000 = 90x = 1000

$\Rightarrow x = \frac{1000}{90} = \frac{100}{9} = 11\frac{1}{9}$

Increase in consumption = $11\frac{1}{9}\%$

Method II

Increase in consumption

$= \frac{100 \times \text{Decrease}}{100 - \text{Decrease}}$

$\%\ \text{Increase} = \frac{100 \times 10}{100 - 10}$

$= \frac{1000}{90} = \frac{100}{9}$

$= 11\frac{1}{9}\%$

- If each side or vertices of an equilateral triangle, each side or diagonal or perimeter of a square, the radius, diameter or circumference of a circle, each side of a cube or a cuboid, the radius or diameter of a sphere or a hemisphere, etc., increase or decrease by x percent then the percentage decrease or increase in it's area is –

$= 2x \pm \frac{x^2}{100}$ $\quad \begin{bmatrix} +\text{Increase} \\ -\text{Decrease} \end{bmatrix}$

Ex.1 When the radius is increased by 25%, then find the percentage increase in the area of the circle.

(a) 50% (b) 56.25%
(c) 56% (d) 56.15%

Sol. Gradual increase = A + B + (AB/100)
= 25 + 25 + (25 × 25/100)
= 50 + 6.25 = 56.25%
∴ % increase in the area = 56.25%

Ex.2 By what percent will the surface area of a cube increase when each of it's time is doubled?

(a) 200% (b) 300%
(c) 150% (d) 50%

Sol. **(b)**

We know that -
Total surface area of the cube = $6a^2$
If both the sides are multiplied, then –

$1 \rightarrow 2$
$1 \rightarrow 2$
Total surface area $\rightarrow \underbrace{1}_{3}$ $\quad 4 \leftarrow$ New surface area

∴ The surface area of the cube will increase = $\left(\frac{3}{1} \times 100\%\right)$ = 300%

Ex.3 If the radius and height of the base of a right circular cylinder are increased by 20% each, then by how much will the volume of the cylinder increase?

(a) 40% (b) 60%
(c) 72.80% (d) 96%

Sol. **(c)**

Let the radius and height of the cylinder be r and h respectively.
It's volume, $v = \pi r^2 h$

New radius = $r + \frac{20}{100}r = \frac{6}{5}r$

New height = $h + \frac{20}{100}h = \frac{6}{5}h$

So, new volume

$V_1 = \pi\left(\frac{6}{5}r\right)^2 \times \left(\frac{6}{5}h\right) = \frac{216}{125}\pi r^2 h$

Hence, increase in volume = $\frac{216}{125}\pi r^2 h - \pi r^2 h = \frac{91}{125}\pi r^2 h$

Hence, % increase = $\frac{\frac{91}{125}\pi r^2 h}{\pi r^2 h} \times 100$

$= \frac{91}{125} \times 100$

$= \frac{364}{5} = 72.8$

Method II

Volume of cylinder $= \pi r^2 h$

$= \pi.r.rh$

Here we will use permutation formula twice

First time $= 20 + 20 + \frac{20 \times 20}{100}$

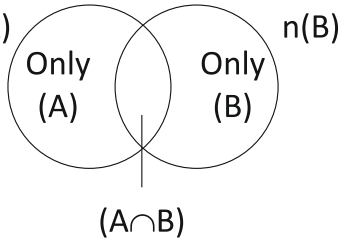
$= 44\%$

Second time $= 44 + 20 + \frac{44 \times 20}{100}$

$= 64 + 8.8 = 72.8\%$

Question Based On Sets

- $n(A \cup B)$ = A and B together or at least one.
- $n(A \cap B)$ = Includes both.



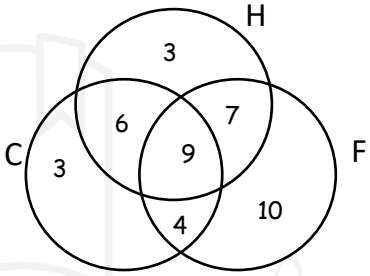
- $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
- Only $A = n(A) - n(A \cap B)$
- Only $B = n(B) - n(A \cap B)$

Ex.1 In a school there are 22 boys in cricket team, 25 in hockey team and 30 in football team. Now if 15 boys play hockey and cricket, 16 boys play hockey and football, 13 boys play football and cricket and 9 boys play hockey, football and cricket, then find the total number of boys who play?

Sol. Let C, H and F be the set of boys playing Cricket, Hockey and Football respectively.

Given that = n(C) = 22, n(H) = 25, n(F) = 30, $n(C \cap H \cap F) = 9$

$n(C \cap H) = 15$, $n(H \cap F) = 16$, $n(C \cap F) = 13$



Now, the number of players playing only C and H = $n(C \cap H) - n(C \cap H \cap F)$

$= 15 - 9 = 6$

Number of players playing only H and F = $n(H \cap F) - n(C \cap H \cap F)$

Number of players playing only C and F = $n(C \cap F) - n(C \cap H \cap F)$

$= 13 - 9 = 4$

Number of players playing only C = 22 – 6 – 9 – 4 = 3

Number of players playing only H = 25 – 6 – 9 – 4 = 6

And, number of players playing only F = 30 – 7 – 9 – 4 = 10

Hence, the total number of players = 3 + 6 + 3 + 9 + 7 + 10 + 4 = 42

Ex.2 In an office 72% of employees like to drink tea and 44% like to drink coffee. If each employee must like one of the two and 40 like both, then what is the total number of employees in the office?

(a) 200 (b) 240

(c) 250 (d) 320

Sol. **(c)**

Let, the total number of employees = x

Now,

$$n(A) = \left(\frac{72}{100} \times x\right) = \frac{18x}{25}, n(B) = \left(\frac{44}{100} \times x\right) = \frac{11x}{25}$$

And, $n(A \cap B) = 40$

$\therefore$ $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$$x = \left(\frac{18x}{25} + \frac{11x}{25} - 40\right) \Rightarrow \left(\frac{29x}{25} - x\right) = 40$$

$4x = (40 \times 25) \Rightarrow x = 250$

Hence, the total number of employees in the office = 250

Method II

Tea = 72%

Coffee = 44%

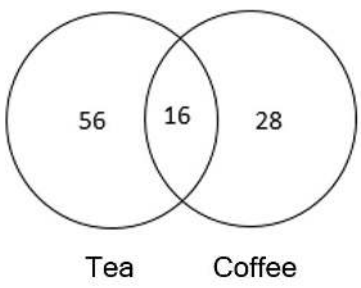
Both (Tea + Coffee) = 72 + 44 + 100

= 116 – 100

= 16%

Total employees $= \frac{40}{16} \times 100$

= 250



Ex.3 In an examination 34% of the students failed in Mathematics and 41% failed in English. If 20% of the students failed in both the subjects, then what is the percentage of students passed in both the subjects?

(a) 44% (b) 50%

(c) 54% (d) 56%

Sol. **(a)**

Let A = set of failed students of Mathematics and B = set of failed students of English

Then, n(A) = 34, n(B) = 42, $n(A \cap B) = 20$

$\therefore$ $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

= (34 + 42 - 20) = 56

Hence, the number of people who failed in one or both the subjects = 56

Percentage of students who passed = (100 – 56)% = 44%

2 CHAPTER Average

Average = Sum of Trials / Number of Trials

Number Based Average (Formula)

1. Average of first n natural numbers $= \frac{n+1}{2}$
2. Average of first n consecutive even numbers = (n + 1)
3. Average of first n consecutive odd numbers = n
4. Average of squares of first n natural numbers $= \frac{n+1\ \ 2n+1}{6}$
5. Average of cubes of first n natural numbers $= \frac{n\ n+1^{\ 2}}{4}$
6. Average of odd numbers from 1 to $n = \frac{n+1}{2}$, (where n = last odd number)
7. Average of even numbers from 1 to $n = \frac{n+2}{2}$, (where n = last even number)
8. If the speed in covering the same distance is a km/hr and b km/hr respectively, then the average speed will be $= \frac{2ab}{a+b}$
9. If the speed for the same distance is a km/hr, b km/hr and c km/hr, then
   The average speed will be $= \frac{3abc}{ad+bc+ca}$ km/hr
10. One of the P persons, whose average weight is x kg, leaves, a new person comes in his place, due to which the average weight of the persons is increased by y kg, then the weight of the new person = (x + P × y) kg
11. The average age of P persons is X years. When Q persons join, the average age becomes y years, then the average age of the new persons $= x + \ y-x\ \times\frac{P+Q}{Q}$ years
12. The average age of P persons is x years. When Q persons leaves the average age of the person decreased by y years, then the average age of the persons who went out $= x-\left[\ y-x\ \times\frac{P-Q}{Q}\right]$ years
13. The average age of x children is y years. If the age of the father is added to the ages of the children, then their average age becomes z years. Father's age = z × (x + 1) – y × x years
14. The average age of P students is x years. The average age of the students when one student left out becomes y years, then the average age of the outgoing student becomes = P × x – (P – 1)y years
15. If the average value of salary of total P employees and officers in an institution is ₹ x per month and the average value of salary of officers is ₹ y per month and the average value of salary of employees is ₹ z per month, then the total number of employees in the organization $= \frac{x-y\ \times P}{z-y}$
16. If each amount is multiplied by x, then the average also becomes x times.
17. Finding bowler's average
    Bowler's average = Total runs / Numbers of wickets
    Total runs = A × x, x = Numbers of wicket

Practice Question

Q.1 The average of 18 numbers is 42. If each is multiplied by $1\frac{1}{2}$ what will be the average of the resulting number?

Q.2 What is the average of the first 50 natural numbers ?

Q.3 What is the average of the squares of the first 10 natural numbers ?

(a) 35.5 (b) 36

(c) 37.5 (d) 38.5

Q.4 The sum of 5 numbers is 240. Out of these, the average of the first two numbers is 30 and that of the last two numbers is 70, what is the third number ?

(a) 40

(b) 60

(c) 75

(d) Cannot be determined

Q.5 The average of two numbers A and B is 20, that of B and C is 19 and that of C and A is 21, what is the value of A ?

(a) 24 (b) 22

(c) 20 (d) 18

Q.6 A batsman scored 63 runs in the twelfth innings which increases his average of runs by 2 runs, what is the average of his runs after the twelfth innings ?

(a) 41 (b) 42

(c) 34 (d) 35

Q.7 In a cricket match, the run rate in the first 10 overs was only 3.2. What should be the run rate for the remaining 40 overs to complete the target of 282 runs ?

(a) 6.25 (b) 6.50

(c) 6.75 (d) 7.0

Q.8 The average speed of a motorcycle from a place A to B was 65 km/h and from B to A its average speed was 60 km/h. What was the average speed of the motorcycle for the whole journey?

(a) 62.5 km/h (b) 72.2 km/h

(c) 62.4 km/h (d) 60.8 km/h

Q.9 A car travels at V_1 km/hr for t_1 hour and travels at V_2 km/hr for t_2 hour. What is the average speed of the car during the whole journey ?

(a) $\frac{t_1 + t_2}{v_1 t_1 + v_2 t_2}$ km/h

(b) $\frac{v_1 t_1 + v_2 t_2}{t_1 + t_2}$ km/h

(c) $\frac{v_1 t_2 + v_2 t_1}{v + v_2}$ km/h

(d) $\frac{v_1 + v_2}{v_1 t_1 + v_2 t_2}$ km/h

Q.10 An airplane travels at a speed of 200, 400, 600 and 800 km/hr over the four sides of a square field. Then find the average speed of the airplane for the whole journey ? (in km/h)

(a) 600 km/h (b) 400 km/h

(c) 500 km/h (d) 384 km/h

Q.11 The average height of 25 boys is 1.4 m. After 5 boys from this group leave the camp, the average height of the remaining boys increases by 0.15 m. What is the average height of the 5 boys who left ?

(a) 0.8 m (b) 0.9 m

(c) 0.95 m (d) 1.05 m

Q.12 Out of 9 persons, 8 persons spent ₹ 30 each for their meals. The ninth one spent ₹ 20 more than the average expenditure of all the nine. The total money spent by all of them was ?

(a) ₹ 260 (b) ₹ 290

(c) ₹ 292.50 (d) ₹ 400.50

Q.13 Three years ago, the average age of a family of 5 members was 17 years. A baby having been born the present average age of the family is the same as the average age 3 years ago. Find the present age of the baby ?

(a) 2 years (b) 2.4 years

(c) 3 years (d) 1.5 years

Q.14 The present age of Ram is thrice the present age of his son and that of his father is $\frac{2}{5}$. The average age of all three is 46 years. What is the difference between the present ages of Ram and his father ?

(a) 68 years

(b) 58 years

(c) 54 years

(d) Cannot be determined

Q.15 In a primary school, the average age of the students is 8 years and the average age of 12 teachers is 45 years. If the average age of all is 9 years, then what are the number of students?

(a) 432 (b) 540

(c) 408 (d) 416

Q.16 The average number of printing errors in a book of 512 pages is 4 per page. If the number of these errors in the first 302 pages is 998, then what is the average number of errors per page in the remaining pages ?

(a) 4 (b) 5

(c) 5.5 (d) 6.5

Q.17 The arithmetic mean of the scores of a group of students in an examination was 52. Among them, the best 20% students got an average of 80 marks and the worst 25% students got an average of 31 marks, then what was the average of the marks of the remaining 55% students?

(a) 45 (b) 50

(c) 51.4 approx. (d) 54.6 approx.

Q.18 The average marks of the students in a group is 63. Out of these the marks of 3 are 78, 69 and 48, what is the average marks of the remaining 6 students?

(a) 63.5 (b) 64

(c) 63 (d) 62

Answer Key

Q.1 $42 \times \frac{3}{2} = 63$

Q.2 We know that, $1+2+3+\cdots\cdots+n = \frac{1}{2}n\ n+1$

$\therefore\ 1+2+3+\cdots\cdots+50 = \left(\frac{1}{2}\times 50\times 51\right) = 1275$

So, the required average $= \frac{1275}{50} = \frac{51}{2} = 25.5$

Q.3 We know that, $1^2+2^2+3^2+\cdots\cdots+n^2 = \frac{1}{6}n\ n+1\ \ 2n+1$

$\therefore\ 1^2+2^2+3^2+\cdots\cdots+10^2 = \left(\frac{1}{6}\times 10\times 11\times 21\right) = 385$

So, the required average $= \frac{385}{10} = 38.5$

Q.4 Sum of 5 numbers = 240

Sum of first 2 numbers = (30 × 2) = 60

Sum of last two numbers = (70 × 2) = 140

$\therefore$ Third number = 240 – (60 + 140) = 40

Q.5 (A + B) = (20 × 2) = 40

(B + C) = (19 × 2) = 38 and (C + A) = (21 × 2) = 42

On adding: 2 (A + B + C) = (40 + 38 + 42) = 120

$\Rightarrow$ (A + B + C) = 60

$\therefore$ A = (A + B + C) – (B + C) = (60 – 38) = 22

Q.6 Let the average number of runs after 11 innings = x

Then, average number of runs after 12 innings = (x + 2)

$\therefore$ 12 (x + 2) – 11x = 63

$\Rightarrow$ 12x – 11x = 63 – 24 $\Rightarrow$ x = 39

Average run count after 12 innings = (x + 2) = (39 + 2) = 41

Short Approach:

Average after twelfth innings = Runs of last innings - (Number of innings - 1) × Increase in average

= 63 – (12 – 1) 2

= 63 – 22 = 41

Q.7 Number of runs scored in 10 overs = (3.2 × 10) = 32

Number of runs to be scored in next 40 overs = 282 – 32 = 250

Run-rate for next 40 overs $= \frac{250}{40} = 6.25$

Q.8 Here, x = 65 and y = 60

$\therefore$ Average speed $= \frac{2xy}{x+y}$ km/h

$= \frac{2\times65\times60}{65+60}$ km/h

$= \frac{2\times65\times60}{125}$ km/h

$= \frac{312}{5}$ km/h = 62.4 km/h

Q.9 Distance covered in t_1 hours = t_1v_1 km

Distance covered in t_2 hours = t_2v_2 km

Total Distance = $t_1v_1 + t_2v_2$

Total Time = $t_1 + t_2$

$\therefore$ Average Speed $= \frac{v_1t_1+v_2t_2}{t_1+t_2}$ km/h

Q.10 Let one side of the square be x km long.

$\therefore$ Total distance = 4x km

Total time

$= \frac{x}{200}+\frac{x}{400}+\frac{x}{600}+\frac{x}{800}=\frac{x}{96}$ hr

$\therefore$ Average Speed $= \frac{4x\times96}{x}=384$ km/h

Short Approach:

A — 200 — 12

B — 400 — –6

C — 600 — –4

D — 800 — 3

2400

$\frac{2400}{\frac{25}{4}}=\frac{2400\times4}{25}$

= 96 × 4 = 384 km/hr

Q.11 Sum of height of 25 boys = (1.4 × 25) m = 35 m

Average height of 20 boys = (1.4 + 0.15) m = 1.55 m

Sum of height of 20 boys = (1.55 × 20) m = 31 m

Sum of height of 5 boys = (35 – 31) meters = 4 meters

Average height of 5 boys $= \frac{4}{5}$ meter = 0.8 meter

Q.12 Let the average expenditure of 9 persons be = x

According to the question, $\frac{30\times8+x+20}{9}=x$

$240 + 20 + x = 9x$

$\Rightarrow 260 = 8x$

$x = \frac{260}{8} = x = 32.5$

Total expenditure = 32.5 × 9 = ₹ 292.50

Q.13 Let the age of the child be = x years.

Total age of family 3 years ago = 85 years

Presently the total age of the family = 85 + 15 = 100 years

According to question,

$\frac{100+x}{6} = 17$

$\Rightarrow 100 + x = 102$

$\Rightarrow x = 2$ years

Short Approach:			
Family	3 years ago	Present	
	85	100	2 yrs
Family + Child	–	102	
	Present age of child = 2 years		

Q.14 Let Ram's son age be = x years

Then, Age of Ram = 3x years

Age of Ram $= \frac{2}{5}$ × (Age of Ram's father)

$\therefore$ Age of Ram's father $= \frac{5}{2}$ × (Age of Ram) $= \left(\frac{5}{2} \times 3x\right)$ yrs $= \frac{15x}{2}$ yrs

Sum of ages of three = (46 × 3) years = 138 years

$\therefore x + 3x + \frac{15x}{2} = 138 \Rightarrow 2x + 6x + 15x = 276$

$\Rightarrow 23x = 276 \Rightarrow x = \frac{276}{23} = 12$

The difference between the present ages of Ram and his father $= \left(\frac{15x}{2} - 3x\right)$ yrs $= \frac{9x}{2}$ yrs

$= \left(\frac{9}{2} \times 12\right)$ yrs = 54 yrs

Short Approach:	Ram's father	:	Ram	:	Ram's son
Ratio	15	:	6	:	2
	Sum of ratios = 15 + 6 + 2 = 23				
	Sum of ages of three = 46 × 3 yrs				

The difference between the present ages of Ram and Ram's father $= \frac{46 \times 3}{23} \times (15 - 6)$

$= 6 \times 9$

$= 54$ yrs

Q.15 Let the number of students be 'x'.

$\Rightarrow$ The sum of the average ages of all the students / x = 8

$\Rightarrow$ Sum of ages of all students = 8x

Now, sum of age of teachers / 12 = 45

$\Rightarrow$ Sum of ages of teachers = 540

Average of all

$\Rightarrow$ (Sum of ages of students + Sum of ages of teachers) / (x + 12) = 9

$\Rightarrow$ 8x + 540 = 9x + 108

$\Rightarrow$ 9x – 8x = 540 – 108

$\Rightarrow$ x = 432

$\therefore$ Total number of Students = x = 432

Q.16 Total number of errors in the whole book = (512 × 4) = 2048

Number of errors in 302 pages = 998

Number of errors in the remaining 210 pages = (2048 – 998) = 1050

Average number of these errors per page $= \frac{1050}{210} = 5$

Q.17 Let the total number of students = 100

And average marks of remaining 55% students = x

100 × 52 = 20 × 80 + 25 × 31 + 55 × x $\Rightarrow$ 5200 = 1600 + 775 + 55x

$\Rightarrow$ 5200 = 2375 + 55x $\Rightarrow$ 55x = 2825

x = 51.3636 $\Rightarrow$ x = 51.4 approx.

Q.18 Total number of students in the group = (3 + 6) = 9

Sum of marks of 9 students = (63 x 9) = 567

The sum of the marks of 3 students = (78 + 69 + 48) = 195

The sum of the marks of 6 students = (567 – 195) = 372

Their average marks $= \frac{372}{6} = 62$