PERCENTAGE

Conversion
1) Percentage to Fraction – Divide the value by 100
2) Fraction to Percentage – Multiply the value by 100

Important fraction values:

FRACTION	PERCENT VALUE
1	100%
1/2	50%
1/3	33.33%
1/4	25%
1/5	20%
1/6	16.66%
1/7	14.28%
1/8	12.5%
1/9	11.11%
1/10	10%
1/11	9.09%
1/12	8.33%
1/13	7.69%
1/14	7.14%
1/15	6.66%
1/16	6.25%
1/20	5%
1/24	4.16%
1/25	4%

TEASERS

1. Convert the following percentages into fraction
(i) 58.33%   (ii) 23.33%   (iii) 142.85%   (iv) 53.33%
(v) 18.33%   (vi) 41.25%   (vii) 3.125%   (viii) 18.75%
(ix) 85.72%   (x) 43.33%
2. If 57% of a number is equal to 285 then, find the number.
3. If 72% of a number is equal to 504 then, find the number.
4. Calculate the value of: 25% of 65% of 398.
(i) 66.245   (ii) 65.875   (iii) 64.675   (iv) 67.535
5. Calculate the value of: 14.28% of 45% of 712.
(i) 45.77   (ii) 44.66   (iii) 43.11   (iv) 49.88

EXERCISE

1. Income of A is 25% of the income of B. If the income of A is Rs.240 then, find the income of B.
(a) Rs.60   (b) Rs.120   (c) Rs.300   (d) Rs.960
2. Income of A is 25% more than that of B. If the income of A is Rs.240 then, find the income of B.
(a) Rs.60   (b) Rs.192   (c) Rs.180   (d) Rs.320
3. Income of A is 25% less than that of B. If the income of A is Rs.240 then, find the income of B
(a) Rs.60   (b) Rs.192   (c) Rs.180   (d) Rs.320
4. Income of A is 25% more than that of B. If the income of A is Rs.240 then, find the income of B is what percent less than that of A?
(a) 25%   (b) 33.33%   (c) 20%   (d) 16.66%

5. Income of A is 25% less than that of B. If the income of A is Rs.240 then, the income of B is what percent more than that of A?
(a) 25%   (b) 33.33%   (c) 20%   (d) 16.66%

6. The income of X is 20% more than that of Y. If the income of X is Rs.7560 then, the income of Y is what percent less than that of X?
(a) 16.66%   (b) 25%   (c) 20%   (d) 33.33%

7. The income of X is 20% less than that of Y. If the income of X is Rs.7560 then, the income of Y is what percent more than that of X?
(a) 16.66%   (b) 25%   (c) 20%   (d) 33.33%

8. Side of a square is increased by 10%. What is the percentage change in its area?
(a) 20%   (b) 30%   (c) 25%   (d) 21%

9. Length of a rectangle is increased by 20% and its breadth is decreased by 16.66%. What is the percentage change in its area?
(a) 25%   (c) 33.33%   (c) 30%   (d) No Change

10. The circumference of a circle is increased by 5%. Find the percentage change in its area.
(a) 5.50%   (b) 12.5%   (c) 10.25%   (d) 10%

11. In a village 45% of the population is female and the rest are males. If 55.55% of the females are married and 36.36% of the males are married then, find the percentage of unmarried population with respect to the total population.
(a) 50%   (b) 35%   (c) 20%   (d) 55%

12. In a village 33.33% of the total population is children and the remaining are adults. Out of the total adult population 60% are males and the remaining are females. The no. of females who are adults is what percent of the total population of the village?
(a) 26.66%   (b) 23.33%   (c) 40%   (d) 35%

13. A person spent 25% of his salary on food, 15% of his salary on education, 10% of his salary on transport and 17% of his salary on clothing. If now he is left with Rs.16500 then, find his total salary.
(a) 30000   (b) 40000   (c) 50000   (d) 60000

14. A person spent 22% of his salary on transport, 19% on food, 8% on rent and 11% on medical related expenses. He also spent half of the remaining amount on his education. If now he is left with Rs.14000 then, find his total salary.
(a) 50000   (b) 60000   (c) 70000   (d) 80000

15. In a society an election was conducted for the post of Secretary between two candidates. Out of the total registered voters in the society 10% decided to boycott the elections and hence did not vote. Also, 10% of the casted votes were declared invalid as they violated some rules. The winner got 57% of the valid votes and won by 1134 votes. Find the total no. of registered voters in the society.
(a) 10000   (b) 9000   (c) 8100   (d) 7500

16. A person spends 40% of his income. If his income is increased by 17% and his expenditure increases by 23% then, find the percentage change in his savings.
(a) 21%   (b) 13%   (c) 40%   (d) 6%

17. A person saves 66.66% of his income. If his income increases by 21% and his savings increases by 25% then, find the percentage change in his expenditure.
(a) 15%   (b) 13%   (c) 19%   (d) 17%

18. A person spends Rs.1870 out of his total income of Rs.2805. If his income increases by 31% and his expenditure increases by 19% then, find the percentage change in his savings.
(a) 40%   (b) 45%   (c) 55%   (d) 50%

19. The price of sugar increases by 10%. Find the percentage change in the consumption if the expenditure remains constant.
(a) 11.11%   (b) 10%   (c) 9.09%   (d) 8.75%

20. The price of sugar decreases by 16.66%. Find the percentage increase in the consumption if the expenditure remains constant.
(a) 15%   (b) 20%   (c) 14.28%   (d) 18.18%
21. If the price of sugar increases by 25%, by what percent consumption should be decreased, so that the expenditure increases by 20%.
(a) 5%   (b) 8%   (c) 10%   (d) 4%
22. If the price of sugar decreases by 30%, by what percent consumption should be increased, so that the expenditure decreases by 10%.
(a) 28.56%   (b) 14.28%   (c) 27.27%   (d) 16.66%
23. If the price of sugar increases by 12.5%. A person decreases his consumption in such a way that his expenditure increases by 10% only. If his original consumption was 45kg, find his current consumption.
(a) 42 kg   (b) 30 kg   (c) 44 kg   (d) 36 kg
24. If the price of sugar increases by 25% then, a person purchases 4kg less sugar at Rs.320. Find the current and original price of sugar.
(a) 16 Rs/kg and 20 Rs/kg   (b) 12 Rs/kg and 15 Rs/kg
(c) 10 Rs/kg and 8 Rs/kg   (d) 20 Rs/kg and 16 Rs/kg
25. Price of sugar increases by 30% then, a person purchases 15kg less for Rs.650. Find the current and original price of the sugar.
(a) Rs.20 and Rs.26   (b) Rs.15 and Rs.18   (c) Rs.30 and Rs.39   (d) Rs.13 and Rs.10

RATIO & PROPORTION

RATIO
• Used for comparing two or more similar quantities.
• <u>Notation</u>- a:b, where a= antecedent, b=consequent
Value of ratio won't change, when we multiply or divide it by a constant number.
Value of ratio will change, when we add or subtract a constant number.
• <u>Commonly used terms</u>:
i) Duplicate and Triplicate Ratio
The duplicate ratio of a:b is (a^2:b^2) and the triplicate ratio of a:b is (a^3:b^3).

ii) Sub-duplicate and Sub-Triplicate Ratio
The Sub-duplicate ratio of a:b is $\sqrt{a}:\sqrt{b}$ and the triplicate ratio of a:b is $\sqrt[3]{a}:\sqrt[3]{b}$

PROPORTION
Four quantities a, b, c, d are said to be in proportion if
a:b = c: d or a:b :: c:d.

<u>Continued proportion</u>:
a:b = b:c = c:d, $\frac{a}{b} = \frac{b}{c} = \frac{c}{d}$

<u>Mean Proportion</u>:
If a:b = b:c
Then b is called mean proportional, if b^2 = ac or b = $\sqrt{ac}$

<u>Third Proportion</u>:
If a:b = b:c
Then c is called Third proportional, if c = $\frac{b^2}{a}$

<u>Fourth Proportion</u>:
If a:b = c:d
Then, d is fourth proportional to numbers a, b, c if, d = $\frac{bc}{a}$

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TEASERS
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1. The ratio of two numbers is 11:19. If the first number is 132 then, find the second number.
2. Two numbers are in the ratio 14:17. If sum of these two numbers is 248 then, find the value of both the numbers.
3. The ratio of two numbers is 13:21. If difference of the two numbers is 576 then, find the value of both the numbers.
4. A and B have a total of Rs.850 with them. They decided to distribute this amount in the ratio 8:9. Find the amount received by A.
5. Two persons X and Y have Rs.1350 with them. They decided to distribute this amount in the ratio 12:13. Find the amount received by Y.
6. If x:y = 2:3 and y:z = 3:4 then, find x:y:z.
7. If x:y = 3:4 and y:z = 9:10 then, find x:y:z.

8. If x:y = 7:8 and y:z = 5:3 then, find x:y:z.

9. If a:b = 3:2, b:c = 5:3, c:d = 4:7 then, find a:b:c:d.

10. Find the Mean Proportion of 4 and 16.

11. Find the Mean Proportion of 7 and 28.

12. Find the Third Proportion of 18 and 24.

13. Find the Third Proportion of 25 and 45.

14. Find the Fourth Proportion of 9, 36 and 12.

15. Find the Fourth Proportion of 7, 11 and 35.

EXERCISE

1. The income of A and B is in the ratio 5:3 while the ratio of their expenditure is 3:1. If at the end of the year each saves Rs.800 then, find the income of A.

(a) 4000   (b) 2000   (c) 3000   (d) 2800

2. The income of A and B is in the ratio 3:2 and the ratio of their expenditure is 4:3. If their savings are Rs.2000 and Rs.1000 then, what is the income of B?

(a) 6000   (b) 5000   (c) 4000   (d) 3000

3. A planet is divided into two parts Land and Water and the ratio of Land and Water on that planet is 3:7 while the ratio of Land and Water in its Northern Hemisphere is 2:3. What is the ratio of Land and Water in the Southern Hemisphere?

(a) 3:4   (b) 1:4   (c) 3:2   (d) 2:5

4. A planet is divided into two parts Land and Water and the ratio of Land and Water on that planet is 2:3 while the ratio of land and water in its Northern Hemisphere is 3:4. Find the ratio of Land and Water in the Southern Hemisphere.

(a) 13:22   (b) 11:17   (c) 12:19   (d) 14:23

5. A bag contains Rs.2240 in the form of Rs.5, Rs.2 and Rs.1. The coins are in the ratio 3:4:5. Find the no. of Rs.5 coins.

(a) 300   (b) 240   (c) 320   (d) 400

6. A box contains Rs.1450 in the form of Rs.1, 50paise and 25paise coins. The coins are in the ratio 9:5:12. What is the no. of 50paise coins?

(a) 400   (b) 500   (c) 900   (d) 600

7. A bag contains 250 coins of the denomination Rs.1, 50p and 25p. The ratio of their amount is 10:6:7. Find the number of Rs.1 coins.

(a) 60   (b) 50   (c) 80   (d) 100

8. A bag contains 585 coins of denomination Rs.5, Rs.2 and Rs.1. The amount is in the ratio 50:28:15. Find the no. of Rs.1 coins.

(a) 120   (b) 150   (c) 180   (d) 225

9. A person broke a Pencil into two parts such that the ratio of length of these two parts is same as the ratio of length of the whole pencil to the larger part. Find the ratio in which the pencil was broken.

(a) $\frac{\sqrt{5}+1}{2}$ (b) $\frac{\sqrt{3}+3}{5}$ (c) $\frac{\sqrt{5}+3}{4}$ (d) $\frac{\sqrt{7}+3}{2}$

10. If $\frac{a}{b+c}=\frac{b}{c+a}=\frac{c}{a+b}$ then, which of the following statements is correct?

(a) Each fraction is equal to $\frac{1}{2}$ only.   (b) Each faction is equal to 1 or -1

(c) Each faction is equal to 1 or $\frac{1}{2}$ (d) Each faction is equal to $\frac{1}{2}$ or -1

AVERAGE

$$\text{Average} = \frac{\text{Sum of Observations}}{\text{No. of Observations}}$$

Average of an Arithmetic Progression
i) Middle term
ii) (First term + Last term)/2

Arithmetic Mean of 'a' and 'b' = $\frac{a+b}{2}$

Geometric Mean of 'a' and 'b' = $\sqrt{a*b}$

Harmonic Mean of 'a' and 'b' = $\frac{2ab}{(a+b)}$

Sum of Series:

$$1 + 2 + 3 + 4 \ldots\ldots\ldots\ldots + n = \frac{n(n+1)}{2}$$

$$1^2 + 2^2 + 3^2 + \ldots\ldots\ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

$$1^3 + 2^3 + 3^3 + \ldots\ldots\ldots\ldots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$$

TEASERS

1. Find the average of: 8, 12, 16, 20, and 24.
2. Find the average of: 12, 17, 22, 27, and 32.
3. Find the average of: 11, 13, 15, 17, 19, and 21.
4. Find the average of: 24, 28, 32 and 36
5. Find the average of: 37, 50, 63, 76 and 89
6. Find the average of: 32, 37, 39, 43, 47 and 54.
7. Find the average of: 56, 61, 63, 69, 78, 81 and 82.
8. Find the average of: 29, 33, 38, 42, 47, 50 and 57.
9. Find the average of 20, 27, 35, 37, 40, 45.
10. The average of the numbers 8, 10, 11, 15, 16, x and 12 is 11 then, the value of x is?

EXERCISE

1. Find the average of first 30 natural numbers.
(a) 30　　　　　　　(b) 31　　　　　　　(c) 15　　　　　　　(d) 15.5
2. Find the average of first 30 even numbers.
(a) 30　　　　　　　(b) 31　　　　　　　(c) 15　　　　　　　(d) 15.5
3. Find the average of first 30 odd numbers.
(a) 30　　　　　　　(b) 31　　　　　　　(c) 15　　　　　　　(d) 15.5
4. The average of 9 consecutive numbers is 40. The largest of these numbers is?
(a) 43　　　　　　　(b) 42　　　　　　　(c) 44　　　　　　　(d) 41
5. 14 consecutive numbers are given. If the average of the two numbers that appear in the middle is 8 then, the sum of these given numbers is?
(a) 108　　　　　　(b) 84　　　　　　　(c) 98　　　　　　　(d) 112
6. Average weight of 17 students is 16 kg. A new student joins and the average becomes 21 kg. Find the weight of the new player.
(a) 100kg　　　　　(b) 102kg　　　　　(c) 104kg　　　　　(d) 106kg
7. Average weight of 25 students of a class is 50 kg. If the weight of the class teacher is included, the average is increased by 1 kg. The weight of the teacher is
(a) 76 kg　　　　　(b) 75 kg　　　　　(c) 77 kg　　　　　(d) 74 kg
8. Average age of 17 students of a class is 23 years. One student left the class, now the average becomes 24 years. Find the age of that student.
(a) 41 years　　　　(b) 17 years　　　　(c) 7 years　　　　(d) 8 years

9. A player scores 92 runs in his 21st innings after that his average increases by 2 runs. Find the average of player before 21st innings.
(a) 52   (b) 50   (c) 48   (d) 46

10. The average of nine numbers is 20. One of the numbers is 21 and if it is replaced by 30 then, the average becomes?
(a) 21.5   (b) 19.5   (c) 21   (d) 20

11. The average weight of the 10 people in a boat is increased by 1.2 kg when one of the crew members who weigh 65kg is replaced by a new man. The weight of the new man (in kg) is?
(a) 70 kg   (b) 68 kg   (c) 71 kg   (d) 77 kg

12. The average of ten numbers is calculated as 17. It was discovered later on that while calculating the average one number namely 49 was wrongly read as 39. Find the correct average.
(a) 16   (b) 18   (c) 26   (d) 20

13. The average marks of 45 students was found out to be 72. If the marks of two students were incorrectly entered as 58 and 62 instead of 85 and 26 respectively then what is the correct average?
(a) 72.2   (b) 67.9   (c) 68.4   (d) 71.8

14. The average of 19 numbers is 71. The average of first 10 numbers is 69. The average of last 10 is 74. Find the 10th no.
(a) 61   (b) 81   (c) 83   (d) 85

15. The average of 15 numbers is 53. The average of first 8 numbers is 49. The average of last 8 is 58. Find the 8th no.
(a) 44   (b) 60   (c) 61   (d) 63

16. The average of nine numbers is 50. The average of first five numbers is 54 and that of last three numbers is 52. What is the value of 6th number?
(a) 26   (b) 76   (c) 24   (d) None of these

17. 9 people go to a restaurant, 8 out of them spent Rs.25 each. 9th person spends Rs.40 more than the average of all the 9 persons. Find the total expense of the dinner.
(a) 300   (b) 245   (c) 270   (d) 450

18. There are 35 students in a hostel. 7 new students join the hostel. Now, per day expenditure of mess was increased by Rs.42 but per head expenditure of mess decreases by Rs.1 find the original expenditure of mess.
(a) 420   (b) 450   (c) 360   (d) 540

19. Average weight of 57 boys is 90kg. Average weight of 76 girls is 97kg. Find the average weight of the class.
(a) 92   (b) 93   (c) 94   (d) 95

20. The average weight of a class of 40 students is 30kg and the average weight of another class with 20 students is 15kg. Find the average weight of both the classes combined.
(a) 35Kg   (b) 20kg   (c) 30kg   (d) 25kg