K L E TECHNOLOGICAL UNIVERSITY
DEPARTMENT OF HUMANITIES
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PROFESSIONAL APTITUDE AND LOGICAL REASONING

Ratio, Proportion & Variation

Ration, Proportion and Variation

The basic applications of the concepts involved in this lesson are comparisons of two or more quantities and changes in their magnitudes e.g., comparison of ages, weights, income, savings, heights, volume, density, temperature etc. This lesson comes in handy for doing Data Interpretation.

Ratio
The comparison between two quantities in terms of magnitude is called their ratio. In other words it tells us one quantity is how many times the other quantity.

So if the ratio of two quantities is expressed as $\frac{a}{b}$ or a:b. The numerator 'a' is called the **antecedent** and denominator 'b' is called the **consequent**

Properties of Ratio
1. The value of the ratio does not change when the numerator and denominator both are multiplied by same quantities i.e.
$$\frac{a}{b} = \frac{ka}{kb} = \frac{la}{lb} = \frac{ma}{mb} \ etc.$$
2. The value of a ratio does not alter when the numerator and denominator are both divided by the same quantities
3. When two or more than two ratios are multiplied with each other, then it is called a compounded ratio e.g. $\frac{2}{3} \times \frac{4}{5} \times \frac{6}{7} = \frac{16}{35}$ is compounded ratio of 2/3, 4/5 and 6/7
4. When the ratio is compounded by itself, it is called duplicate, triplicate etc.
$\left(\frac{a}{b}\right)^2$ is called duplicate ratio and $\left(\frac{a}{b}\right)^3$ is called triplicate ratio

    Similarly, $\left(\frac{a}{b}\right)^{1/2}$ is called sub-duplicate and $\left(\frac{a}{b}\right)^{1/3}$ is called sub-triplicate
5. $\frac{a}{b} = \frac{c+am}{d+bm} \ if \ and \ only \ if \ \frac{c}{d} = \frac{a}{b}$ (This property is very useful when we compare two fractions)
6. If a:b and b:c are given, then a:b:c = (axb) : (bxb) : (bxc)

Proportion
An equality of two ratios is called a proportion and we say that the four numbers are in proportion. i.e. if a/b=c/d or a:b = c:d, then we say that a, b, c and d are in proportions and written as a:b :: c:d

Here a and d are called **extremes** and b and c are called **means.** Thus four numbers are said to be in proportion if the ratio of the first and second number is equal to the ratio of the third and the fourth number.

Properties of Proportion
1. If four numbers are proportion then product of extremes is equal to the product of the means. If a:b :: c:d then axd = bxc
2. If a, b and c are three numbers such that a:b = b:c then these numbers a, b and c are said to be in **continued proportion**.

Some Facts About Proportion
a) **Invertendo** if a/b=c/d this implies that b/a=d/c
b) **Alternendo** If a/b=c/d this implies that a/c = b/d
c) **Componendo** If a/b = c/d this implies that $\frac{a+b}{b} = \frac{c+d}{d}$
d) **Dividendo** If a/b = c/d this implies that $\frac{a-b}{b} = \frac{c-d}{d}$

Exercises

01 If 5: 3 = 15: 9 then which of the following is true?
(a)8: 2 = 24:6   (b)5:15 =3:9   (c)6:2= 24:8   (d)All of these

02 If 2A= 3B and 4B = 5C then what is the ratio of A: C?
(a)15: 8   (b)8: 15   (c)23: 8   (d)Can't say

03 If A: B = 2: 1 then what is the value of $(A^2-B^2)/(A^2+B^2)$?
(a)20: 19   (b)5: 3   (c)3: 5   (d)None of these

04 $(2M^2-3N^2)/ (4M^2+N^2)$ = 5: 73 then what is the value of M: N?
(a)9: 16   (b)16: 9   (c)3: 4   (d)4: 3

05 P: Q =6: 5 then what is the value of (5P + 3Q)/ (5P – 3Q)?
(a)1: 3   (b)3: 5   (c)3: 1   (d)5: 3

06 If 7: 14 = 6: J then what is the value of J?
(a)7   (b)6   (c)14   (d)12

07 Current age of father and his son are in the ratio of 7: 3. After 5 years, the same ratio becomes 2: 1. What is current age of father and son, respectively?
(a)70, 35   (b)35, 15   (c)15, 35   (d)None of these

08 50 liters of mixture contains 60% Alcohol and rest is water. If 10 liters of water is added to it then what is the concentration of Alcohol in the mixture?
(a)66.66%   (b)60%   (c)50%   (d)80%

09 Age of two brothers differ by 10 years. Six years ago the elder one was 3 times as old as the other one. What is the current age of younger one?
(a)12   (b)21   (c)11   (d)None of these

10 What number should be subtracted from the terms (Numerator and denominator) in the ratio 15: 19 to make it 3: 4?
(a)6   (b)3   (c)4   (d) Impossible

11 If Rs. 1066 is divided amongst p, q, r and s such that p: q = 3:4; q: r = 5:6 and r: s = 7:5 then who'll get maximum amount?
(a) p   (b) q   (c) r   (d) s

12 Age of two sisters differ by 27 years. Six years ago the elder one was 4 times as old as the other one. What is the current age of elder one?
(a)15 years   (b)9 years   (c) 36 years   (d)42 years

13 Ratio M: N is 25 times N: M then what is the value of M: N?
(a)1: 25   (b)25:1   (c)1: 5   (d)5: 1

14 What minimum number should be added to the terms in the ratio 8: 17 to make it 2: 3?
(a)10   (b)5   (c)3   (d)13

15 500 liters of mixture contains 40% milk and rest is water. If 100 liters of water is added to it then what is the ratio of milk and water in the new mixture?
(a)12 : 17   (b)7 : 5   (c)5: 6   (d)None of these

16 300 liters of mixture contains 55% spirit and rest is water. If 50 liters of water is added to it then what is the ratio of spirit and water in the new mixture?
(a)37 : 33   (b)23 : 42   (c)55: 101   (d)33 : 37

17 2520 liters of mixture contains 45% Soda and rest is water. If 880 liters of water is added to it then what is the ratio of Soda and water in the new mixture?
(a)9 : 17   (b) 9: 19   (c)13 : 22   (d)1 : 2

18   M: N = 2: 5 and N: O = 10: 11 then M: O =?
    (a) 11: 4   (b)4: 11   (c) 15: 4   (d)None of these.

19   What is mean proportional between 289 and 361?
    (a)173   (b)325   (c)253   (d)323

20   If 2X= 9Y and 4Y = 5Z then what is the ratio of Z: X?
    (a)2: 5   (b)8 : 45   (c)45: 8   (d)5: 2

21   A box is having 7 pieces of glass. If that box falls then which of the following **CAN'T** be the ratio of broken to unbroken glasses?
    (a)1: 6   (b)2: 5   (c)3: 4   (d)8: 9

22   If P: Q = 3: 1 then what is the value of $(P^2+Q^2)/(P^2-Q^2)$?
    (a)4: 5   (b)5: 4   (c)1: 3   (d) Indeterminable

23    $(3A^2-B^2)/ (2A^2+5B^2)$ = 138: 143 then what is the value of A: B?
    (a)7: 3   (b)3: 7   (c)143: 138   (d)None of these

24   X: Y =6: 5 then what is the value of (10X + 3Y)/ (10X – 3Y)?
    (a)5: 6   (b)3: 5   (c)9: 10   (d)5: 3

25   3 % of X = 5% of Y then X: Y =?
    (a)5: 3   (b)3: 5   (c)1: 1   (d)None of these

26   20 liters of mixture contains 30% soda and rest is water. If 5 liters of soda is added to it then what is the concentration of water in new mixture?
    (a)76 %   (b)56 %   (c)24%   (d)30 %

27   What number should be subtracted from the terms in the ratio   61: 70 to make it 5: 6?
    (a)3   (b)4   (c)5   (d)16

28   If Rs. 370 is divided amongst P, Q and R such that P: Q = 3:4;   Q: R = 6:8 then who'll get minimum amount?
    (a)P   (b)Q   (c)R   (d)All equal

29   What number should be added to the terms (Numerator and denominator) in the ratio 7: 15 to make it 1: 3?
    (a)15   (b)1   (c)–3   (d)8

30   If 3A= 7B and 4B = 8C then what is the ratio of A: C?
    (a)3: 14   (b)8: 3   (c)3: 8   (d)14: 3

31   Divide 1162 in the ratio of 35: 28: 20.
    (a) 490: 392: 280   (b)392: 490: 280   (c)490: 280: 392   (d)280: 490: 392

32   A box is having 2 dozen pieces of glass. If that box falls then which of the following **CAN'T** be the ratio of broken to unbroken glasses?
    (a)5: 1   (b)5: 3   (c)5: 7   (d)3: 2

33    $(4Y^2-3Z^2)/ (2Y^2+5Z^2)$ = 12: 19 then what is the value of Y: Z?
    (a)2: 7   (b)5: 2   (c)2: 3   (d)3: 2

34   Current age of mother and her daughter are in the ratio of 11: 7. After 15 years, the same ratio becomes 7: 5. What is current age of daughter and mother, respectively?
    (a)50, 70   (b)70,50   (c)55, 35   (d)35, 55

35   200 liters of mixture contains 35% wine and rest is water. If 10 liters of water is added to it then what is the ratio of wine and water in the new mixture?
    (a)7: 2   (b)2: 1   (c)1: 2   (d)None of these

36   Current age of uncle and nephew are in the ratio of 4: 1, but after 5 years it will become 3: 1

then what is the age of uncle, if alive, after 35 years, henceforth?

(a) 40 years   (b)75 years   (c)45 years   (d)None of these

37   The expenses of a girl's hostel are partly constant and partly vary as the number of girls in the hostel. The expenses were 10000 for 150 girls and 8400 for 120 girls. Find the expenses for 330 girls.

(a) 19600   (b) 16900   (c) 22500   (d)28900

38   A lump of two metals weighing 18 grams is Rs. 90 but if weights are interchanged, it would worth 72 Rs. If price of a metal is Rs. 6 / gram then find the price of other metal in the mixture.

(a)Rs. 4 / gram   (b) Rs. 3.25 / gram   (c) Rs. 5 / gram   (d) Rs. 3 / gram

39   If 10 liters are drawn from a cask full of alcohol and replaced by soda, and this process is repeated, the ratio of alcohol to soda becomes 16:9. Find the capacity of the cask.

(a)50 liters   (b) 48 liters   (c) 40 liters   (d) 46 liters

40   If 20 liters are drawn from a container full of alcohol and replaced by water, and this process is repeated, the ratio of alcohol to water becomes 16:9. Find the capacity of the container.

(a)100 liters   (b) 96 liters   (c) 80 liters   (d) 92 liters