12. RATIO AND PROPORTION

IMPORTANT FACTS AND FORMULAE

1. **RATIO** : The ratio of two quantities a and b in the same units, is the fraction $\frac{a}{b}$ and we write it as $a : b$.

   In the ratio $a : b$, we call a as the **first term** or **antecedent** and b, the **second term** or **consequent**.

   Ex. The ratio $5 : 9$ represents $\frac{5}{9}$ with antecedent = 5, consequent = 9.

   Rule : The multiplication or division of each term of a ratio by the same non-zero number does not affect the ratio.

   Ex. $4 : 5 = 8 : 10 = 12 : 15$ etc. Also, $4 : 6 = 2 : 3$.

2. **PROPORTION** : *The equality of two ratios is called proportion.*

   If $a : b = c : d$, we write, $a : b :: c : d$ and we say that a, b, c, d are in proportion.

   Here a and d are called **extremes**, while b and c are called **mean terms**.

   Product of means = Product of extremes.

   Thus, $a : b :: c : d \Leftrightarrow (b \times c) = (a \times d)$.

3. (*i*) **Fourth Proportional** : If $a : b = c : d$, then d is called the fourth proportional to a, b, c.

   (*ii*) **Third Proportional** : If $a : b = b : c$, then c is called the third proportional to a and b.

   (*iii*) **Mean Proportional** : Mean proportional between a and b is $\sqrt{ab}$.

4. (*i*) COMPARISON OF RATIOS :

   We say that $(a : b) > (c : d) \Leftrightarrow \frac{a}{b} > \frac{c}{d}$.

   (*ii*) COMPOUNDED RATIO :

   The compounded ratio of the ratios $(a : b)$, $(c : d)$, $(e : f)$ is $(ace : bdf)$.

5. (*i*) ***Duplicate ratio*** of $(a : b)$ is $(a^2 : b^2)$.

   (*ii*) ***Sub-duplicate ratio*** of $(a : b)$ is $(\sqrt{a} : \sqrt{b})$.

   (*iii*) ***Triplicate ratio*** of $(a : b)$ is $(a^3 : b^3)$.

   (*iv*) **Sub-triplicate ratio** of $(a : b)$ is $\left(a^{\frac{1}{3}} : b^{\frac{1}{3}}\right)$.

   (*v*) If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$. **(componendo and dividendo)**

6. VARIATION :

   (*i*) We say that x is directly proportional to y, if $x = ky$ for some constant k and we write, $x \propto y$.

   (*ii*) We say that x is inversely proportional to y, if $xy = k$ for some constant k and we write, $x \propto \frac{1}{y}$.

SOLVED PROBLEMS

Ex. 1. ***If a : b = 5 : 9 and b : c = 4 : 7, find a : b : c.***

Sol. $a : b = 5 : 9$ and $b : c = 4 : 7 = \left(4 \times \frac{9}{4}\right) : \left(7 \times \frac{9}{4}\right) = 9 : \frac{63}{4}$

$\Rightarrow \quad a : b : c = 5 : 9 : \frac{63}{4} = 20 : 36 : 63.$

Ex. 2. ***Find :***

(i) the fourth proportional to 4, 9, 12;

(ii) the third proportional to 16 and 36;

(iii) the mean proportional between 0.08 and 0.18.

Sol. (*i*) Let the fourth proportional to 4, 9, 12 be x.

Then, $4 : 9 :: 12 : x \Leftrightarrow 4 \times x = 9 \times 12 \Leftrightarrow x = \frac{9 \times 12}{4} = 27.$

$\therefore$ Fourth proportional to 4, 9, 12 is 27.

(*ii*) Let the third proportional to 16 and 36 be x.

Then, $16 : 36 :: 36 : x \Leftrightarrow 16 \times x = 36 \times 36 \Leftrightarrow x = \frac{36 \times 36}{16} = 81.$

$\therefore$ Third proportional to 16 and 36 is 81.

(*iii*) Mean proportional between 0.08 and 0.18

$= \sqrt{0.08 \times 0.18} = \sqrt{\frac{8}{100} \times \frac{18}{100}} = \sqrt{\frac{144}{100 \times 100}} = \frac{12}{100} = 0.12.$

Ex. 3. ***If x : y = 3 : 4, find (4x + 5y) : (5x − 2y).***

Sol. $\frac{x}{y} = \frac{3}{4} \Rightarrow \frac{4x + 5y}{5x - 2y} = \frac{4\left(\frac{x}{y}\right) + 5}{5\left(\frac{x}{y}\right) - 2} = \frac{\left(4 \times \frac{3}{4} + 5\right)}{\left(5 \times \frac{3}{4} - 2\right)} = \frac{(3 + 5)}{\left(\frac{7}{4}\right)} = \frac{32}{7}.$

Ex. 4. ***Divide Rs. 672 in the ratio 5 : 3.***

Sol. Sum of ratio terms = (5 + 3) = 8.

$\therefore$ First part = Rs. $\left(672 \times \frac{5}{8}\right)$ = Rs. 420; Second part = Rs. $\left(672 \times \frac{3}{8}\right)$ = Rs. 252.

Ex. 5. ***Divide Rs. 1162 among A, B, C in the ratio 35 : 28 : 20.***

Sol. Sum of ratio terms = (35 + 28 + 20) = 83.

A's share = Rs. $\left(1162 \times \frac{35}{83}\right)$ = Rs. 490; B's share = Rs. $\left(1162 \times \frac{28}{83}\right)$ = Rs. 392;

C's share = Rs. $\left(1162 \times \frac{20}{83}\right)$ = Rs. 280.

Ex. 6. ***A bag contains 50 p, 25 p and 10 p coins in the ratio 5 : 9 : 4, amounting to Rs. 206. Find the number of coins of each type.***

Sol. Let the number of 50 p, 25 p and 10 p coins be $5x$, $9x$ and $4x$ respectively.

Then, $\frac{5x}{2} + \frac{9x}{4} + \frac{4x}{10} = 206$

$\Leftrightarrow \quad 50x + 45x + 8x = 4120 \Leftrightarrow 103x = 4120 \Leftrightarrow x = 40.$

$\therefore$ Number of 50 p coins = (5 × 40) = 200; Number of 25 p coins = (9 × 40) = 360;

Number of 10 p coins = (4 × 40) = 160.

Ex. 7. ***A mixture contains alcohol and water in the ratio 4 : 3. If 5 litres of water is added to the mixture, the ratio becomes 4 : 5. Find the quantity of alcohol in the given mixture.***

Sol. Let the quantity of alcohol and water be $4x$ litres and $3x$ litres respectively. Then,

$$\frac{4x}{3x+5} = \frac{4}{5} \Leftrightarrow 20x = 4(3x+5) \Leftrightarrow 8x = 20 \Leftrightarrow x = 2.5.$$

$\therefore$ Quantity of alcohol = (4×2.5) litres = 10 litres.

EXERCISE 12

(OBJECTIVE TYPE QUESTIONS)

Directions : ***Mark (✓) against the correct answer :***

1. If A : B = 5 : 7 and B : C = 6 : 11, then A : B : C is :
(a) 55 : 77 : 66 (b) 30 : 42 : 77 (c) 35 : 49 : 42 (d) None of these

2. If A : B = 3 : 4 and B : C = 8 : 9, then A : C is :
(a) 1 : 3 (b) 3 : 2 (c) 2 : 3 (d) 1 : 2

3. If A : B = 8 : 15, B : C = 5 : 8 and C : D = 4 : 5, then A : D is equal to :
(a) 2 : 7 (b) 4 : 15 (c) 8 : 15 (d) 15 : 4

4. If A : B : C = 2 : 3 : 4, then $\frac{A}{B} : \frac{B}{C} : \frac{C}{A}$ is equal to : **(S.S.C. 2002)**
(a) 4 : 9 : 16 (b) 8 : 9 : 12 (c) 8 : 9 : 16 (d) 8 : 9 : 24

5. If $A : B = \frac{1}{2} : \frac{3}{8}$, $B : C = \frac{1}{3} : \frac{5}{9}$ and $C : D = \frac{5}{6} : \frac{3}{4}$, then the ratio A : B : C : D is :
(a) 4 : 6 : 8 : 10 (b) 6 : 4 : 8 : 10 (c) 6 : 8 : 9 : 10 (d) 8 : 6 : 10 : 9

6. If A : B = 2 : 3, B : C = 4 : 5 and C : D = 6 : 7, then A : B : C : D is :
(a) 16 : 22 : 30 : 35 (b) 16 : 24 : 15 : 35
(c) 16 : 24 : 30 : 35 (d) 18 : 24 : 30 : 35 **(S.S.C. 2002)**

7. If 2A = 3B = 4C, then A : B : C is :
(a) 2 : 3 : 4 (b) 4 : 3 : 2 (c) 6 : 4 : 3 (d) 20 : 15 : 2

8. If $\frac{A}{3} = \frac{B}{4} = \frac{C}{5}$, then A : B : C is :
(a) 4 : 3 : 5 (b) 5 : 4 : 3 (c) 3 : 4 : 5 (d) 20 : 15 : 2

9. If 2A = 3B and 4B = 5C, then A : C is :
(a) 4 : 3 (b) 8 : 15 (c) 15 : 8 (d) 3 : 4

10. The ratio of $4^{3.5} : 2^5$ is same as :
(a) 2 : 1 (b) 4 : 1 (c) 7 : 5 (d) 7 : 10

11. If $\frac{1}{5} : \frac{1}{x} = \frac{1}{x} : \frac{1}{1.25}$, then the value of x is :
(a) 1.5 (b) 2 (c) 2.5 (d) 3.5

12. If 0.75 : x :: 5 : 8, then x is equal to : **(L.I.C. 2003)**
(a) 1.12 (b) 1.20 (c) 1.25 (d) 1.30

13. If $x : y = 5 : 2$, then $(8x + 9y) : (8x + 2y)$ is : **(S.S.C. 2001)**
(a) 22 : 29 (b) 26 : 61 (c) 29 : 22 (d) 61 : 26

14. If 15% of x = 20% of y, then $x : y$ is :
(a) 3 : 4 (b) 4 : 3 (c) 17 : 16 (d) 16 : 17

15. If $(x : y) = 2 : 1$, then $(x^2 - y^2) : (x^2 + y^2)$ is :
(a) 3 : 5 (b) 5 : 3 (c) 1 : 3 (d) 3 : 1

16. If $(4x^2 - 3y^2) : (2x^2 + 5y^2) = 12 : 19$, then $(x : y)$ is :
(a) 2 : 3 (b) 1 : 2 (c) 3 : 2 (d) 2 : 1

17. If $x^2 + 4y^2 = 4xy$, then $x : y$ is :
(a) 2 : 1 (b) 1 : 2 (c) 1 : 1 (d) 1 : 4

18. If $5x^2 - 13xy + 6y^2 = 0$, then $x : y$ is :
(a) (2 : 1) only (b) (3 : 5) only
(c) (5 : 3) or (1 : 2) (d) (3 : 5) or (2 : 1)

19. If $\frac{x}{5} = \frac{y}{8}$, then $(x + 5) : (y + 8)$ is equal to :
(a) 3 : 5 (b) 13 : 8 (c) 8 : 5 (d) 5 : 8

20. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{7}$, then $\frac{a + b + c}{c}$ is equal to :
(a) 7 (b) 2 (c) $\frac{1}{2}$ (d) $\frac{1}{7}$

21. If $(a + b) : (b + c) : (c + a) = 6 : 7 : 8$ and $(a + b + c) = 14$, then the value of c is :
(a) 6 (b) 7 (c) 8 (d) 14

22. The salaries of A, B, C are in the ratio 2 : 3 : 5. If the increments of 15%, 10% and 20% are allowed respectively in their salaries, then what will be the new ratio of their salaries ? **(Bank P.O. 2002)**
(a) 3 : 3 : 10 (b) 10 : 11 : 20
(c) 23 : 33 : 60 (d) Cannot be determined

23. If Rs. 782 be divided into three parts, proportional to $\frac{1}{2} : \frac{2}{3} : \frac{3}{4}$, then the first part is : **(C.B.I. 2003)**
(a) Rs. 182 (b) Rs. 190 (c) Rs. 196 (d) Rs. 204

24. If 76 is divided into four parts proportional to 7, 5, 3, 4, then the smallest part is :
(a) 12 (b) 15 (c) 16 (d) 19

25. Two numbers are in the ratio 3 : 5. If 9 is subtracted from each, the new numbers are in the ratio 12 : 23. The smaller number is : **(S.S.C. 2003)**
(a) 27 (b) 33 (c) 49 (d) 55

26. Two numbers are in the ratio 1 : 2. If 7 is added to both, their ratio changes to 3 : 5. The greatest number is : **(Hotel Management, 2003)**
(a) 24 (b) 26 (c) 28 (d) 32

27. Rs. 1210 were divided among A, B, C so that A : B = 5 : 4 and B : C = 9 : 10. Then, C gets :
(a) Rs. 340 (b) Rs. 400 (c) Rs. 450 (d) Rs. 475

28. In a bag, there are coins of 25 p, 10 p and 5 p in the ratio of 1 : 2 : 3. If there are Rs. 30 in all, how many 5 p coins are there ? **(Hotel Management, 2003)**
(a) 50 (b) 100 (c) 150 (d) 200

29. The ratio of three numbers is 3 : 4 : 5 and the sum of their squares is 1250. The sum of the numbers is :
(a) 30 (b) 50 (c) 60 (d) 90

30. The ratio of three numbers is 3 : 4 : 7 and their product is 18144. The numbers are :
(a) 9, 12, 21 (b) 15, 20, 25 (c) 18, 24, 42 (d) None of these

31. Salaries of Ravi and Sumit are in the ratio 2 : 3. If the salary of each is increased by Rs. 4000, the new ratio becomes 40 : 57. What is Sumit's present salary ?
(a) Rs. 17,000 (b) Rs. 20,000 (c) Rs. 25,500 (d) None of these
(Bank P.O. 2003)

32. If Rs. 510 be divided among A, B, C in such a way that A gets $\frac{2}{3}$ of what B gets and B gets $\frac{1}{4}$ of what C gets, then their shares are respectively : (I.M.T. 2002)

(*a*) Rs. 120, Rs. 240, Rs. 150 (*b*) Rs. 60, Rs. 90, Rs. 360
(*c*) Rs. 150, Rs. 300, Rs. 60 (*d*) None of these

33. The sum of three numbers is 98. If the ratio of the first to the second is 2 : 3 and that of the second to the third is 5 : 8, then the second number is : (S.S.C. 2001)

(*a*) 20 (*b*) 30 (*c*) 48 (*d*) 58

34. A fraction which bears the same ratio to $\frac{1}{27}$ that $\frac{3}{11}$ does to $\frac{5}{9}$, is equal to :

(*a*) $\frac{1}{55}$ (*b*) $\frac{1}{11}$ (*c*) $\frac{3}{11}$ (*d*) 55

(S.S.C. 2001)

35. Rs. 366 are divided amongst A, B and C so that A may get $\frac{1}{2}$ as much as B and C together, B may get $\frac{2}{3}$ as much as A and C together, then the share of A is :

(*a*) Rs. 122 (*b*) Rs. 129.60 (*c*) Rs. 146.60 (*d*) Rs. 183

36. A sum of Rs. 1300 is divided amongst P, Q, R and S such that $\frac{\text{P's share}}{\text{Q's share}} = \frac{\text{Q's share}}{\text{R's share}} = \frac{\text{R's share}}{\text{S's share}} = \frac{2}{3}$. Then, P's share is : (L.I.C. 2003)

(*a*) Rs. 140 (*b*) Rs. 160 (*c*) Rs. 240 (*d*) Rs. 320

37. A and B together have Rs. 1210. If $\frac{4}{15}$ of A's amount is equal to $\frac{2}{5}$ of B's amount, how much amount does B have ? (A.A.O. 2003)

(*a*) Rs. 460 (*b*) Rs. 484 (*c*) Rs. 550 (*d*) Rs. 664

38. Two numbers are respectively 20% and 50% more than a third number. The ratio of the two numbers is : (S.S.C. 2003)

(*a*) 2 : 5 (*b*) 3 : 5 (*c*) 4 : 5 (*d*) 6 : 7

39. Two whole numbers whose sum is 72 cannot be in the ratio :

(*a*) 5 : 7 (*b*) 3 : 5 (*c*) 3 : 4 (*d*) 4 : 5

40. If a carton containing a dozen mirrors is dropped, which of the following cannot be the ratio of broken mirrors to unbroken mirrors ?

(*a*) 2 : 1 (*b*) 3 : 1 (*c*) 3 : 2 (*d*) 7 : 5

41. Seats for Mathematics, Physics and Biology in a school are in the ratio 5 : 7 : 8. There is a proposal to increase these seats by 40%, 50% and 75% respectively. What will be the ratio of increased seats ? (Bank P.O. 2003)

(*a*) 2 : 3 : 4 (*b*) 6 : 7 : 8 (*c*) 6 : 8 : 9 (*d*) None of these

42. The ratio of the number of boys and girls in a college is 7 : 8. If the percentage increase in the number of boys and girls be 20% and 10% respectively, what will be the new ratio ? (R.B.I. 2003)

(*a*) 8 : 9 (*b*) 17 : 18
(*c*) 21 : 22 (*d*) Cannot be determined

43. A sum of money is to be distributed among A, B, C, D in the proportion of 5 : 2 : 4 : 3. If C gets Rs. 1000 more than D, what is B's share ? (R.B.I. 2003)

(*a*) Rs. 500 (*b*) Rs. 1500 (*c*) Rs. 2000 (*d*) None of these

44. If 40% of a number is equal to two-third of another number, what is the ratio of first number to the second number ? (Bank P.O. 2002)

(*a*) 2 : 5 (*b*) 3 : 7 (*c*) 5 : 3 (*d*) 7 : 3

45. Ratio of the earnings of A and B is 4 : 7. If the earnings of A increase by 50% and those of B decrease by 25%, the new ratio of their earnings becomes 8 : 7. What are A's earnings ? **(Bank P.O. 2002)**
(a) Rs. 21,000 (b) Rs. 26,000 (c) Rs. 28,000 (d) Data inadequate

46. What least number must be subtracted from each of the numbers 14, 17, 34 and 42 so that the remainders may be proportional ?
(a) 0 (b) 1 (c) 2 (d) 7

47. In a mixture of 60 litres, the ratio of milk and water is 2 : 1. If this ratio is to be 1 : 2, then the quantity of water to be further added is :
(a) 20 litres (b) 30 litres (c) 40 litres (d) 60 litres

48. The fourth proportional to 5, 8, 15 is : **(R.R.B. 2002)**
(a) 18 (b) 24 (c) 19 (d) 20 (e) 21

49. The mean proportional between 234 and 104 is :
(a) 12 (b) 39 (c) 54 (d) None of these

50. The third proportional to 0.36 and 0.48 is :
(a) 0.64 (b) 0.1728 (c) 0.42 (d) 0.94

51. The third proportional to $(x^2 - y^2)$ and $(x - y)$ is :
(a) $(x + y)$ (b) $(x - y)$ (c) $\frac{x+y}{x-y}$ (d) $\frac{x-y}{x+y}$

52. The ratio of third proportional to 12 and 30 and the mean proportional between 9 and 25 is :
(a) 2 : 1 (b) 5 : 1 (c) 7 : 15 (d) 9 : 14

53. In a ratio, which is equal to 3 : 4, if the antecedent is 12, then the consequent is :
(a) 9 (b) 16 (c) 20 (d) 24

54. The prices of a scooter and a T.V. are in the ratio 7 : 5. If the scooter costs Rs. 8000 more than a T.V. set, then the price of a T.V. set is :
(a) Rs. 20,000 (b) Rs. 24,000 (c) Rs. 28,000 (d) Rs. 32,000

55. An amount of Rs. 735 was divided between A, B and C. If each of them had received Rs. 25 less, their shares would have been in the ratio of 1 : 3 : 2. The money received by C was :
(a) Rs. 195 (b) Rs. 200 (c) Rs. 225 (d) Rs. 245

56. An amount of Rs. 2430 is divided among A, B and C such that if their shares be reduced by Rs. 5, Rs. 10 and Rs. 15 respectively, the remainders shall be in the ratio of 3 : 4 : 5. Then, B's share was :
(a) Rs. 605 (b) Rs. 790 (c) Rs. 800 (d) Rs. 810

57. The ratio between two numbers is 3 : 4 and their L.C.M. is 180. The first number is :
(a) 60 (b) 45 (c) 20 (d) 15

58. An alloy is to contain copper and zinc in the ratio 9 : 4. The zinc required to be melted with 24 kg of copper is :
(a) $10\frac{2}{3}$ kg (b) $10\frac{1}{3}$ kg (c) $9\frac{2}{3}$ kg (d) 9 kg

59. 60 kg of an alloy A is mixed with 100 kg of alloy B. If alloy A has lead and tin in the ratio 3 : 2 and alloy B has tin and copper in the ratio 1 : 4, then the amount of tin in the new alloy is :
(a) 36 kg (b) 44 kg (c) 53 kg (d) 80 kg

60. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio should these be mixed to get an alloy 15 times as heavy as water ?
(a) 1 : 1 (b) 2 : 3 (c) 1 : 2 (d) 3 : 2

61. 15 litres of mixture contains 20% alcohol and the rest water. If 3 litres of water be mixed with it, the percentage of alcohol in the new mixture would be :
(a) 15% (b) $16\frac{2}{3}\%$ (c) 17% (d) $18\frac{1}{2}\%$

62. 20 litres of a mixture contains milk and water in the ratio 5 : 3. If 4 litres of this mixture be replaced by 4 litres of milk, the ratio of milk to water in the new mixture would be :
(a) 2 : 1 (b) 7 : 3 (c) 8 : 3 (d) 4 : 3

63. 85 kg of a mixture contains milk and water in the ratio 27 : 7. How much more water is to be added to get a new mixture containing milk and water in the ratio 3 : 1 ?
(a) 5 kg (b) 6.5 kg (c) 7.25 kg (d) 8 kg

64. The ages of A and B are in the ratio 3 : 1. Fifteen years hence, the ratio will be 2 : 1. Their present ages are :
(a) 30 years, 10 years (b) 45 years, 15 years
(c) 21 years, 7 years (d) 60 years, 20 years

65. The average age of three boys is 25 years and their ages are in the proportion 3 : 5 : 7. The age of the youngest boy is :
(a) 21 years (b) 18 years (c) 15 years (d) 9 years

66. The speeds of three cars are in the ratio 5 : 4 : 6. The ratio between the time taken by them to travel the same distance is :
(a) 5 : 4 : 6 (b) 6 : 4 : 5 (c) 10 : 12 : 15 (d) 12 : 15 : 10

67. In a college, the ratio of the number of boys to girls is 8 : 5. If there are 160 girls, the total number of students in the college is :
(a) 100 (b) 250 (c) 260 (d) 416

68. The sides of a triangle are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$ and its perimeter is 104 cm. The length of the longest side is :
(a) 52 cm (b) 48 cm (c) 32 cm (d) 26 cm

69. The ratio of the number of boys and girls in a school is 3 : 2. If 20% of the boys and 25% of the girls are scholarship holders, what percentage of the students does not get the scholarship ?
(a) 56 (b) 70 (c) 78 (d) 80

70. In a school, 10% of the boys are same in number as $\frac{1}{4}$th of the girls. What is the ratio of boys to girls in that school ?
(a) 3 : 2 (b) 5 : 2 (c) 2 : 1 (d) 4 : 3

71. Three containers have their volumes in the ratio 3 : 4 : 5. They are full of mixtures of milk and water. The mixtures contain milk and water in the ratio of (4 : 1), (3 : 1) and (5 : 2) respectively. The contents of all these three containers are poured into a fourth container. The ratio of milk and water in the fourth container is :
(a) 4 : 1 (b) 151 : 48 (c) 157 : 53 (d) 5 : 2

72. x varies inversely as square of y. Given that $y = 2$ for $x = 1$. The value of x for $y = 6$ will be equal to : (C.D.S. 2003)
(a) 3 (b) 9 (c) $\frac{1}{3}$ (d) $\frac{1}{9}$

73. If 10% of x = 20% of y, then $x : y$ is equal to : (C.D.S. 2003)
(a) 1 : 2 (b) 2 : 1 (c) 5 : 1 (d) 10 : 1

74. The electricity bill of a certain establishment is partly fixed and partly varies as the number of units of electricity consumed. When in a certain month 540 units are consumed, the bill is Rs. 1800. In another month 620 units are consumed and the bill is Rs. 2040. In yet another month 500 units are consumed. The bill for that month would be :
(*a*) Rs. 1560 (*b*) Rs. 1680 (*c*) Rs. 1840 (*d*) Rs. 1950

75. The ratio of the incomes of A and B is 5 : 4 and the ratio of their expenditures is 3 : 2. If at the end of the year, each saves Rs. 1600, then the income of A is :
(*a*) Rs. 3400 (*b*) Rs. 3600 (*c*) Rs. 4000 (*d*) Rs. 4400

76. Zinc and copper are melted together in the ratio 9 : 11. What is the weight of melted mixture, if 28.8 kg of zinc has been consumed in it ?
(*a*) 58 kg (*b*) 60 kg (*c*) 64 kg (*d*) 70 kg

77. The compounded ratio of (2 : 3), (6 : 11) and (11 : 2) is :
(*a*) 1 : 2 (*b*) 2 : 1 (*c*) 11 : 24 (*d*) 36 : 121

78. If 0.4 of a number is equal to 0.06 of another number, the ratio of the numbers is :
(*a*) 2 : 3 (*b*) 3 : 4 (*c*) 3 : 20 (*d*) 20 : 3

79. The least whole number which when subtracted from both the terms of the ratio 6 : 7 gives a ratio less than 16 : 21 is :
(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 6

80. A and B are two alloys of gold and copper prepared by mixing metals in the ratio 7 : 2 and 7 : 11 respectively. If equal quantities of the alloys are melted to form a third alloy C, the ratio of gold and copper in C will be :
(*a*) 5 : 7 (*b*) 5 : 9 (*c*) 7 : 5 (*d*) 9 : 5

81. Which of the following ratios is greatest ?
(*a*) 7 : 15 (*b*) 15 : 23 (*c*) 17 : 25 (*d*) 21 : 29

82. A certain amount was divided between A and B in the ratio 4 : 3. If B's share was Rs. 4800, the total amount was :
(*a*) Rs. 11,200 (*b*) Rs. 6400 (*c*) Rs. 19,200 (*d*) Rs. 39,200

83. A sum of Rs. 53 is divided among A, B, C in such a way that A gets Rs. 7 more than what B gets and B gets Rs. 8 more than what C gets. The ratio of their shares is :
(*a*) 16 : 9 : 18 (*b*) 25 : 18 : 10 (*c*) 18 : 25 : 10 (*d*) 15 : 8 : 30

84. What is the ratio whose terms differ by 40 and the measure of which is $\frac{2}{7}$?
(*a*) 16 : 56 (*b*) 14 : 56 (*c*) 15 : 56 (*d*) 16 : 72

ANSWERS

1. (*b*)	2. (*c*)	3. (*b*)	4. (*d*)	5. (*d*)	6. (*c*)	7. (*c*)	8. (*c*)
9. (*c*)	10. (*b*)	11. (*c*)	12. (*b*)	13. (*c*)	14. (*b*)	15. (*a*)	16. (*c*)
17. (*a*)	18. (*d*)	19. (*d*)	20. (*b*)	21. (*a*)	22. (*c*)	23. (*d*)	24. (*a*)
25. (*b*)	26. (*c*)	27. (*b*)	28. (*c*)	29. (*c*)	30. (*c*)	31. (*d*)	32. (*b*)
33. (*b*)	34. (*a*)	35. (*a*)	36. (*b*)	37. (*b*)	38. (*c*)	39. (*c*)	40. (*c*)
41. (*a*)	42. (*c*)	43. (*c*)	44. (*c*)	45. (*d*)	46. (*c*)	47. (*d*)	48. (*b*)
49. (*d*)	50. (*a*)	51. (*d*)	52. (*b*)	53. (*b*)	54. (*c*)	55. (*c*)	56. (*d*)
57. (*b*)	58. (*a*)	59. (*b*)	60. (*d*)	61. (*b*)	62. (*b*)	63. (*a*)	64. (*b*)
65. (*c*)	66. (*d*)	67. (*d*)	68. (*b*)	69. (*c*)	70. (*b*)	71. (*c*)	72. (*d*)
73. (*b*)	74. (*b*)	75. (*c*)	76. (*c*)	77. (*b*)	78. (*c*)	79. (*b*)	80. (*c*)
81. (*d*)	82. (*a*)	83. (*b*)	84. (*a*)				

SOLUTIONS

1. $A : B = 5 : 7$, $B : C = 6 : 11 = \left(6 \times \frac{7}{6}\right) : \left(11 \times \frac{7}{6}\right) = 7 : \frac{77}{6}$.

   $\therefore$ $A : B : C = 5 : 7 : \frac{77}{6} = 30 : 42 : 77$.

2. $\left(\frac{A}{B} = \frac{3}{4}, \frac{B}{C} = \frac{8}{9}\right) \Rightarrow \frac{A}{C} = \left(\frac{A}{B} \times \frac{B}{C}\right) = \left(\frac{3}{4} \times \frac{8}{9}\right) = \frac{2}{3} \Rightarrow A : C = 2 : 3$.

3. $\frac{A}{B} = \frac{8}{15}, \frac{B}{C} = \frac{5}{8}$ and $\frac{C}{D} = \frac{4}{5} \Rightarrow \frac{A}{D} = \left(\frac{A}{B} \times \frac{B}{C} \times \frac{C}{D}\right) = \left(\frac{8}{15} \times \frac{5}{8} \times \frac{4}{5}\right) = \frac{4}{15}$

   $\Rightarrow A : D = 4 : 15$.

4. Let $A = 2x$, $B = 3x$ and $C = 4x$. Then, $\frac{A}{B} = \frac{2x}{3x} = \frac{2}{3}, \frac{B}{C} = \frac{3x}{4x} = \frac{3}{4}$ and $\frac{C}{A} = \frac{4x}{2x} = \frac{2}{1}$

   $\Rightarrow \frac{A}{B} : \frac{B}{C} : \frac{C}{A} = \frac{2}{3} : \frac{3}{4} : \frac{2}{1} = 8 : 9 : 24$.

5. $A : B = \frac{1}{2} : \frac{3}{8} = 4 : 3$, $B : C = \frac{1}{3} : \frac{5}{9} = 3 : 5$, $C : D = \frac{5}{6} : \frac{3}{4} = 10 : 9$

   $\Rightarrow A : B = 4 : 3$, $B : C = 3 : 5$ and $C : D = 5 : \frac{9}{2}$

   $\Rightarrow A : B : C : D = 4 : 3 : 5 : \frac{9}{2} = 8 : 6 : 10 : 9$.

6. $A : B = 2 : 3$, $B : C = 4 : 5 = \left(4 \times \frac{3}{4}\right) : \left(5 \times \frac{3}{4}\right) = 3 : \frac{15}{4}$

   and $C : D = 6 : 7 = \left(6 \times \frac{15}{24}\right) : \left(7 \times \frac{15}{24}\right) = \frac{15}{4} : \frac{35}{8}$

   $\Rightarrow A : B : C : D = 2 : 3 : \frac{15}{4} : \frac{35}{8} = 16 : 24 : 30 : 35$.

7. Let $2A = 3B = 4C = k$. Then, $A = \frac{k}{2}$, $B = \frac{k}{3}$ and $C = \frac{k}{4}$

   $\Rightarrow A : B : C = \frac{k}{2} : \frac{k}{3} : \frac{k}{4} = 6 : 4 : 3$.

8. Let $\frac{A}{3} = \frac{B}{4} = \frac{C}{5} = k$. Then, $A = 3k$, $B = 4k$ and $C = 5k$

   $\Rightarrow A : B : C = 3k : 4k : 5k = 3 : 4 : 5$.

9. $2A = 3B$ and $4B = 5C \Rightarrow \frac{A}{B} = \frac{3}{2}$ and $\frac{B}{C} = \frac{5}{4}$

   $\Rightarrow \frac{A}{C} = \left(\frac{A}{B} \times \frac{B}{C}\right) = \left(\frac{3}{2} \times \frac{5}{4}\right) = \frac{15}{8} \Rightarrow A : C = 15 : 8$.

10. $\frac{4^{3.5}}{2^5} = \frac{(2^2)^{3.5}}{2^5} = \frac{2^{(2 \times 3.5)}}{2^5} = \frac{2^7}{2^5} = 2^2 = 4$.

    $\therefore$ Required ratio is $4 : 1$.

11. $\frac{1}{5} : \frac{1}{x} = \frac{1}{x} : \frac{100}{125} \Rightarrow \left(\frac{1}{x} \times \frac{1}{x}\right) = \left(\frac{1}{5} \times \frac{100}{125}\right) = \frac{4}{25}$

    $\Rightarrow \frac{1}{x^2} = \frac{4}{25} \Rightarrow x^2 = \frac{25}{4} \Rightarrow x = \frac{5}{2} = 2.5$.

12. $(x \times 5) = (0.75 \times 8) \Rightarrow x = \frac{6}{5} = 1.20.$

13. Let $x = 5k$ and $y = 2k$. Then, $\frac{8x + 9y}{8x + 2y} = \frac{(8 \times 5k) + (9 \times 2k)}{(8 \times 5k) + (2 \times 2k)} = \frac{58k}{44k} = \frac{29}{22}$.

$\Rightarrow (8x + 9y) : (8x + 2y) = 29 : 22.$

14. 15% of x = 20% of $y \Rightarrow \frac{15x}{100} = \frac{20y}{100} \Rightarrow \frac{x}{y} = \left(\frac{20}{100} \times \frac{100}{15}\right) = \frac{4}{3}$

$\Rightarrow x : y = 4 : 3.$

15. $\frac{x}{y} = \frac{2}{1} \Leftrightarrow \frac{x^2}{y^2} = \frac{4}{1} \Leftrightarrow \frac{x^2 + y^2}{x^2 - y^2} = \frac{4 + 1}{4 - 1}$ *[By componendo and dividendo]*

$\Leftrightarrow \frac{x^2 - y^2}{x^2 + y^2} = \frac{3}{5} \Leftrightarrow (x^2 - y^2) : (x^2 + y^2) = 3 : 5.$

16. $\frac{4x^2 - 3y^2}{2x^2 + 5y^2} = \frac{12}{19} \Leftrightarrow 19(4x^2 - 3y^2) = 12(2x^2 + 5y^2)$

$\Leftrightarrow 52x^2 = 117y^2 \Leftrightarrow 4x^2 = 9y^2 \Leftrightarrow \frac{x^2}{y^2} = \frac{9}{4} \Leftrightarrow \frac{x}{y} = \frac{3}{2}.$

$\therefore$ Required ratio is 3 : 2.

17. $x^2 + 4y^2 = 4xy \Leftrightarrow x^2 - 4xy + 4y^2 = 0 \Leftrightarrow (x - 2y)^2 = 0$

$\Leftrightarrow (x - 2y) = 0 \Leftrightarrow x = 2y \Leftrightarrow \frac{x}{y} = \frac{2}{1}.$

$\therefore x : y = 2 : 1.$

18. $5x^2 - 13xy + 6y^2 = 0 \Leftrightarrow 5x^2 - 10xy - 3xy + 6y^2 = 0$

$\Leftrightarrow 5x(x - 2y) - 3y(x - 2y) = 0 \Leftrightarrow (x - 2y)(5x - 3y) = 0$

$\Leftrightarrow x = 2y \text{ or } 5x = 3y \Leftrightarrow \frac{x}{y} = \frac{2}{1} \text{ or } \frac{x}{y} = \frac{3}{5}$

$\therefore (x : y) = (2 : 1) \text{ or } (3 : 5).$

19. Let $\frac{x}{5} = \frac{y}{8} = k$. Then, $x = 5k$ and $y = 8k$.

$\therefore \frac{x + 5}{y + 8} = \frac{5k + 5}{8k + 8} = \frac{5(k + 1)}{8(k + 1)} = \frac{5}{8} \Rightarrow (x + 5) : (y + 8) = 5 : 8.$

20. Let $\frac{a}{3} = \frac{b}{4} = \frac{c}{7} = k$. Then, $a = 3k, b = 4k, c = 7k$.

$\therefore \frac{a + b + c}{c} = \frac{3k + 4k + 7k}{7k} = \frac{14k}{7k} = 2.$

21. Let $(a + b) = 6k$, $(b + c) = 7k$ and $(c + a) = 8k$.

Then, $2(a + b + c) = 21k \Leftrightarrow 2 \times 14 = 21k \Leftrightarrow k = \frac{28}{21} = \frac{4}{3}$.

$\therefore (a + b) = \left(6 \times \frac{4}{3}\right) = 8 \Rightarrow c = (a + b + c) - (a + b) = (14 - 8) = 6.$

22. Let A = $2k$, B = $3k$ and C = $5k$.

A's new salary = $\frac{115}{100}$ of $2k = \left(\frac{115}{100} \times 2k\right) = \frac{23}{10}k$

B's new salary = $\frac{110}{100}$ of $3k = \left(\frac{110}{100} \times 3k\right) = \frac{33}{10}k$

C's new salary = $\frac{120}{100}$ of $5k = \left(\frac{120}{100} \times 5k\right) = 6k$.

$\therefore$ New ratio = $\frac{23k}{10} : \frac{33k}{10} : 6k = 23 : 33 : 60$.

23. Given ratio = $\frac{1}{2} : \frac{2}{3} : \frac{3}{4} = 6 : 8 : 9$.

$\therefore$ 1st part = Rs. $\left(782 \times \frac{6}{23}\right)$ = Rs. 204.

24. Given ratio = 7 : 5 : 3 : 4, Sum of ratio terms = 19.

$\therefore$ Smallest part = $\left(76 \times \frac{3}{19}\right) = 12$.

25. Let the numbers be $3x$ and $5x$. Then, $\frac{3x-9}{5x-9} = \frac{12}{23} \Leftrightarrow 23(3x-9) = 12(5x-9)$

$\Leftrightarrow 9x = 99 \Leftrightarrow x = 11$.

$\therefore$ The smaller number = $(3 \times 11) = 33$.

26. Let the numbers be x and $2x$. Then, $\frac{x+7}{2x+7} = \frac{3}{5} \Leftrightarrow 5(x+7) = 3(2x+7) \Leftrightarrow x = 14$.

$\therefore$ Greatest number = 28.

27. A : B = 5 : 4, B : C = 9 : 10 = $\left(9 \times \frac{4}{9}\right) : \left(10 \times \frac{4}{9}\right) = 4 : \frac{40}{9}$.

$\therefore$ A : B : C = $5 : 4 : \frac{40}{9} = 45 : 36 : 40$.

Sum of ratio terms = (45 + 36 + 40) = 121.

$\therefore$ C's share = Rs. $\left(1210 \times \frac{40}{121}\right)$ = Rs. 400.

28. Let the number of 25 p, 10 p and 5 p coins be x, $2x$ and $3x$ respectively.

Then, sum of their values = Rs. $\left(\frac{25x}{100} + \frac{10 \times 2x}{100} + \frac{5 \times 3x}{100}\right)$ = Rs. $\frac{60x}{100}$.

$\therefore \frac{60x}{100} = 30 \Leftrightarrow x = \frac{30 \times 100}{60} = 50$.

Hence, the number of 5 p coins = $(3 \times 50) = 150$.

29. Let the numbers be $3x$, $4x$ and $5x$. Then,

$9x^2 + 16x^2 + 25x^2 = 1250 \Leftrightarrow 50x^2 = 1250 \Leftrightarrow x^2 = 25 \Leftrightarrow x = 5$.

$\therefore$ Sum of numbers = $(3x + 4x + 5x) = 12x = (12 \times 5) = 60$.

30. Let the numbers be $3x$, $4x$ and $7x$. Then,

$3x \times 4x \times 7x = 18144 \Leftrightarrow x^3 = 216 \Leftrightarrow x^3 = 6^3 \Leftrightarrow x = 6$.

$\therefore$ The numbers are 18, 24 and 42.

31. Let the original salaries of Ravi and Sumit be Rs. $2x$ and Rs. $3x$ respectively. Then,

$\frac{2x + 4000}{3x + 4000} = \frac{40}{57} \Leftrightarrow 57(2x + 4000) = 40(3x + 4000) \Leftrightarrow 6x = 68000 \Leftrightarrow 3x = 34000$.

Sumit's present salary = $(3x + 4000)$ = Rs. (34000 + 4000) = Rs. 38,000.

32. $\left(A = \frac{2}{3}B \text{ and } B = \frac{1}{4}C\right) \Leftrightarrow \frac{A}{B} = \frac{2}{3}$ and $\frac{B}{C} = \frac{1}{4}$

$\Rightarrow$ A : B = 2 : 3 and B : C = 1 : 4 = 3 : 12 $\Rightarrow$ A : B : C = 2 : 3 : 12.

$\therefore$ A's share = Rs. $\left(510 \times \frac{2}{17}\right)$ = Rs. 60; B's share = Rs. $\left(510 \times \frac{3}{17}\right)$ = Rs. 90;

C's share = Rs. $\left(510 \times \frac{12}{17}\right)$ = Rs. 360.

33. Let the three parts be A, B, C. Then,

$A : B = 2 : 3$ and $B : C = 5 : 8 = \left(5 \times \frac{3}{5}\right) : \left(8 \times \frac{3}{5}\right) = 3 : \frac{24}{5}$

$\Rightarrow$ $A : B : C = 2 : 3 : \frac{24}{5} = 10 : 15 : 24$ $\Rightarrow$ $B = \left(98 \times \frac{15}{49}\right) = 30.$

34. Let $x : \frac{1}{27} :: \frac{3}{11} : \frac{5}{9}$. Then, $x \times \frac{5}{9} = \frac{1}{27} \times \frac{3}{11}$ $\Leftrightarrow$ $x = \left(\frac{1}{27} \times \frac{3}{11} \times \frac{9}{5}\right) = \frac{1}{55}$.

35. $A : (B + C) = 1 : 2$ $\Rightarrow$ A's share = Rs. $\left(366 \times \frac{1}{3}\right)$ = Rs. 122.

36. Let $P = 2x$ and $Q = 3x$. Then, $\frac{Q}{R} = \frac{2}{3}$ $\Rightarrow$ $R = \frac{3}{2}Q = \left(\frac{3}{2} \times 3x\right) = \frac{9x}{2}$.

Also, $\frac{R}{S} = \frac{2}{3}$ $\Rightarrow$ $S = \frac{3}{2}R = \left(\frac{3}{2} \times \frac{9x}{2}\right) = \frac{27x}{4}$.

Thus, $P = 2x$, $Q = 3x$, $R = \frac{9x}{2}$ and $S = \frac{27x}{4}$.

Now, $P + Q + R + S = 1300$ $\Leftrightarrow$ $\left(2x + 3x + \frac{9x}{2} + \frac{27x}{4}\right) = 1300$

$\Leftrightarrow$ $(8x + 12x + 18x + 27x) = 5200$

$\Leftrightarrow$ $65x = 5200$ $\Leftrightarrow$ $x = \frac{5200}{65} = 80.$

$\therefore$ P's share = Rs. (2×80) = Rs. 160.

37. $\frac{4}{15}A = \frac{2}{5}B$ $\Leftrightarrow$ $A = \left(\frac{2}{5} \times \frac{15}{4}\right)B$ $\Leftrightarrow$ $A = \frac{3}{2}B$ $\Leftrightarrow$ $\frac{A}{B} = \frac{3}{2}$ $\Leftrightarrow$ $A : B = 3 : 2$

$\therefore$ B's share = Rs. $\left(1210 \times \frac{2}{5}\right)$ = Rs. 484.

38. Let the third number be x.

Then, first number = 120% of $x = \frac{120x}{100} = \frac{6x}{5}$;

second number = 150% of $x = \frac{150x}{100} = \frac{3x}{2}$.

$\therefore$ Ratio of first two numbers = $\frac{6x}{5} : \frac{3x}{2} = 12x : 15x = 4 : 5$.

39. The sum of the ratio terms must divide 72. So, the ratio cannot be 3 : 4.

40. For dividing 12 into two whole numbers, the sum of the ratio terms must be a factor of 12. So, they cannot be in the ratio 3 : 2.

41. Originally, let the number of seats for Mathematics, Physics and Biology be $5x$, $7x$ and $8x$ respectively.

Number of increased seats are (140% of $5x$), (150% of $7x$) and (175% of $8x$)

i.e. $\left(\frac{140}{100} \times 5x\right)$, $\left(\frac{150}{100} \times 7x\right)$ and $\left(\frac{175}{100} \times 8x\right)$ *i.e.* $7x$, $\frac{21x}{2}$ and $14x$.

$\therefore$ Required ratio = $7x : \frac{21x}{2} : 14x = 14x : 21x : 28x = 2 : 3 : 4$.

42. Originally, let the number of boys and girls in the college be $7x$ and $8x$ respectively.
Their increased number is (120% of $7x$) and (110% of $8x$)

i.e. $\left(\frac{120}{100}\times 7x\right)$ and $\left(\frac{110}{100}\times 8x\right)$ *i.e.* $\frac{42x}{5}$ and $\frac{44x}{5}$.

$\therefore$ Required ratio $= \frac{42x}{5} : \frac{44x}{5} = 21 : 22.$

43. Let the shares of A, B, C and D be Rs. $5x$, Rs. $2x$, Rs. $4x$ and Rs. $3x$ respectively.
Then, $4x - 3x = 1000 \Leftrightarrow x = 1000.$

$\therefore$ B's share = Rs. $2x$ = Rs. (2×1000) = Rs. 2000.

44. Let 40% of A $= \frac{2}{3}$B. Then, $\frac{40A}{100} = \frac{2B}{3} \Leftrightarrow \frac{2A}{5} = \frac{2B}{3} \Leftrightarrow \frac{A}{B} = \left(\frac{2}{3}\times\frac{5}{2}\right) = \frac{5}{3}.$

$\therefore$ A : B = 5 : 3.

45. Let the original earnings of A and B be Rs. $4x$ and Rs. $7x$.

New earnings of A = 150% of Rs. $4x$ = Rs. $\left(\frac{150}{100}\times 4x\right)$ = Rs. $6x$.

New earnings of B = 75% of Rs. $7x$ = Rs. $\left(\frac{75}{100}\times 7x\right)$ = Rs. $\frac{21x}{4}$.

$\therefore \quad 6x : \frac{21x}{4} = 8 : 7 \Leftrightarrow \frac{6x\times 4}{21x} = \frac{8}{7}.$

This does not give x. So, the given data is inadequate.

46. Let the required number be x. Then, $(14 - x) : (17 - x) :: (34 - x) : (42 - x)$.

$\therefore \quad \frac{14-x}{17-x} = \frac{34-x}{42-x} \Leftrightarrow (14-x)(42-x) = (17-x)(34-x)$

$\Leftrightarrow x^2 - 56x + 588 = x^2 - 51x + 578 \Leftrightarrow 5x = 10 \Leftrightarrow x = 2.$

$\therefore$ Required number = 2.

47. Quantity of milk $= \left(60\times\frac{2}{3}\right)$ litres = 40 litres.

Quantity of water in it = (60 − 40) litres = 20 litres.
New Ratio required = 1 : 2.

Let quantity of water to be added further be x litres. Then, milk : water $= \frac{40}{(20+x)}$.

Now, $\frac{40}{(20+x)} = \frac{1}{2} \Leftrightarrow 20 + x = 80 \Leftrightarrow x = 60.$

Quantity of water to be further added = 60 litres.

48. Let the fourth proportional to 5, 8, 15 be x.

Then, $5 : 8 :: 15 : x \Leftrightarrow 5x = (8\times 15) \Leftrightarrow x = \frac{(8\times 15)}{5} = 24.$

49. Required mean proportional $= \sqrt{234\times 104} = \sqrt{13\times 9\times 2\times 13\times 8} = (13\times 3\times 4) = 156.$

50. Let the third proportional to 0.36 and 0.48 be x.

Then, $0.36 : 0.48 :: 0.48 : x \Leftrightarrow x = \left(\frac{0.48\times 0.48}{0.36}\right) = 0.64.$

51. Let the third proportional to $(x^2 - y^2)$ and $(x - y)$ be z. Then,

$(x^2-y^2) : (x-y) :: (x-y) : z \Leftrightarrow (x^2-y^2)\times z = (x-y)^2 \Leftrightarrow z = \frac{(x-y)^2}{(x^2-y^2)} = \frac{(x-y)}{(x+y)}.$

52. Let the third proportional to 12 and 30 be x.

Then, $12 : 30 :: 30 : x \Leftrightarrow 12x = 30 \times 30 \Leftrightarrow x = \frac{(30 \times 30)}{12} = 75$.

$\therefore$ Third proportional to 12 and 30 = 75.

Mean proportional between 9 and 25 = $\sqrt{9 \times 25} = 15$.

$\therefore$ Required ratio = 75 : 15 = 5 : 1.

53. We have $\frac{3}{4} = \frac{12}{x} \Leftrightarrow 3x = 48 \Leftrightarrow x = 16$.

$\therefore$ Consequent = 16.

54. Let the prices of a scooter and a T.V. set be Rs. $7x$ and Rs. $5x$ respectively. Then,

$7x - 5x = 8000 \Leftrightarrow 2x = 8000 \Leftrightarrow x = 4000$.

$\therefore$ Price of a T.V. set = Rs. (7×4000) = Rs. 28000.

55. Remainder = Rs. $[735 - (25 \times 3)]$ = Rs. 660.

$\therefore$ Money received by C = Rs. $\left[\left(660 \times \frac{2}{6}\right) + 25\right]$ = Rs. 225.

56. Remainder = Rs. $[2430 - (5 + 10 + 15)]$ = Rs. 2400.

$\therefore$ B's share = Rs. $\left[\left(2400 \times \frac{4}{12}\right) + 10\right]$ = Rs. 810.

57. Let the required numbers be $3x$ and $4x$. Then, their L.C.M. is $12x$.

$\therefore$ $12x = 180 \Leftrightarrow x = 15$. Hence, the first number is 45.

58. Let the required quantity of copper be x kg.

Then, $9 : 4 :: 24 : x \Leftrightarrow 9x = 4 \times 24 \Leftrightarrow x = \frac{4 \times 24}{9} = 10\frac{2}{3}$.

Hence, the required quantity of copper is $10\frac{2}{3}$ kg.

59. Quantity of tin in 60 kg of A = $\left(60 \times \frac{2}{5}\right)$ kg = 24 kg.

Quantity of tin in 100 kg of B = $\left(100 \times \frac{1}{5}\right)$ kg = 20 kg.

Quantity of tin in the new alloy = (24 + 20) kg = 44 kg.

60. G = 19W and C = 9W.

Let 1 gm of gold be mixed with x gm of copper to get $(1 + x)$ gm of the alloy.

(1 gm gold) + (x gm copper) = $(x + 1)$ gm of alloy

$\Leftrightarrow 19W + 9Wx = (x + 1) \times 15W \Leftrightarrow 19 + 9x = 15(x + 1) \Leftrightarrow 6x = 4 \Leftrightarrow x = \frac{2}{3}$.

$\therefore$ Ratio of gold with copper = $1 : \frac{2}{3} = 3 : 2$.

61. Alcohol in 15 litres of mix. = 20% of 15 litres = $\left(\frac{20}{100} \times 15\right)$ litres = 3 litres.

Water in it = (15 – 3) litres = 12 litres.

New quantity of mix. = (15 + 3) litres = 18 litres.

Quantity of alcohol in it = 3 litres.

Percentage of alcohol in new mix. = $\left(\frac{3}{18} \times 100\right)\% = 16\frac{2}{3}\%$.

62. Quantity of milk in 16 litres of mix. $= \left(16 \times \frac{5}{8}\right)$ litres $= 10$ litres.

Quantity of milk in 20 litres of new mix. $= (10 + 4)$ litres.

Quantity of water in it $= (20 - 14)$ litres $= 6$ litres.

$\therefore$ Ratio of milk and water in the new mix. $= 14 : 6 = 7 : 3$.

63. Milk in 85 kg of mix. $= \left(85 \times \frac{27}{34}\right)$ kg $= \frac{135}{2}$ kg.

Water in it $= \left(85 - \frac{135}{2}\right)$ kg $= \frac{35}{2}$ kg.

Let x kg of water be added to it.

Then, $\frac{\left(\frac{135}{2}\right)}{\left(\frac{35}{2} + x\right)} = \frac{3}{1} \Leftrightarrow \frac{135}{35 + 2x} = \frac{3}{1} \Leftrightarrow 105 + 6x = 135 \Leftrightarrow 6x = 30 \Leftrightarrow x = 5.$

$\therefore$ Quantity of water to be added $= 5$ kg.

64. Let the ages of A and B be $3x$ years and x years respectively.

Then, $\frac{3x + 15}{x + 15} = \frac{2}{1} \Leftrightarrow 2x + 30 = 3x + 15 \Leftrightarrow x = 15.$

So, A's age $= (3 \times 15)$ years $= 45$ years and B's age $= 15$ years.

65. Total age of 3 boys $= (25 \times 3)$ years $= 75$ years. Ratio of their ages $= 3 : 5 : 7$.

Age of the youngest $= \left(75 \times \frac{3}{15}\right)$ years $= 15$ years.

66. Ratio of time taken $= \frac{1}{5} : \frac{1}{4} : \frac{1}{6} = 12 : 15 : 10.$

67. Let the number of boys and girls be $8x$ and $5x$ respectively. Then, $5x = 160 \Leftrightarrow x = 32$.

$\therefore$ Total number of students $= 13x = (13 \times 32) = 416$.

68. Ratio of sides $= \frac{1}{2} : \frac{1}{3} : \frac{1}{4} = 6 : 4 : 3.$

Largest side $= \left(104 \times \frac{6}{13}\right)$ cm $= 48$ cm.

69. Let boys $= 3x$ and girls $= 2x$.

Number of those who do not get scholarship

$$= (80\% \text{ of } 3x) + (75\% \text{ of } 2x) = \left(\frac{80}{100} \times 3x\right) + \left(\frac{75}{100} \times 2x\right) = \frac{39x}{10}.$$

Required percentage $= \left(\frac{39x}{10} \times \frac{1}{5x} \times 100\right)\% = 78\%.$

70. 10% of $B = \frac{1}{4}G \Leftrightarrow \frac{10B}{100} = \frac{1}{4}G \Leftrightarrow B = \frac{5}{2}G$

$\therefore \frac{B}{G} = \frac{5}{2} \Leftrightarrow B : G = 5 : 2.$

71. Let the three containers contain $3x$, $4x$ and $5x$ litres of mixtures respectively.

Milk in 1st mix. $= \left(3x \times \frac{4}{5}\right)$ litres $= \frac{12x}{5}$ litres.

Water in 1st mix. $= \left(3x - \frac{12x}{5}\right)$ litres $= \frac{3x}{5}$ litres.

Milk in 2nd mix. $= \left(4x \times \frac{3}{4}\right)$ litres $= 3x$ litres.

Water in 2nd mix. $= (4x - 3x)$ litres $= x$ litres.

Milk in 3rd mix. $= \left(5x \times \frac{5}{7}\right)$ litres $= \frac{25x}{7}$ litres.

Water in 3rd mix. $= \left(5x - \frac{25x}{7}\right)$ litres $= \frac{10x}{7}$ litres.

Total milk in final mix. $= \left(\frac{12x}{5} + 3x + \frac{25x}{7}\right)$ litres $= \frac{314x}{35}$ litres.

Total water in final mix. $= \left(\frac{3x}{5} + x + \frac{10x}{7}\right)$ litres $= \frac{106x}{35}$ litres.

Required ratio of milk and water $= \frac{314x}{35} : \frac{106x}{35} = 157 : 53.$

72. Given $x = \frac{k}{y^2}$, where k is a constant.

Now, $y = 2$ and $x = 1$ gives $k = 4$.

$\therefore \quad x = \frac{4}{y^2} \Rightarrow x = \frac{4}{6^2}$, when $y = 6 \Rightarrow x = \frac{4}{36} = \frac{1}{9}$.

73. 10% of x = 20% of $y \Leftrightarrow \frac{10x}{100} = \frac{20y}{100} \Leftrightarrow \frac{x}{10} = \frac{y}{5} \Leftrightarrow \frac{x}{y} = \frac{10}{5} = \frac{2}{1}$.

$\therefore \quad x : y = 2 : 1.$

74. Let the fixed amount be Rs. x and the cost of each unit be Rs. y. Then,

$540y + x = 1800$ ...(*i*) and $620y + x = 2040$ ...(*ii*)

On subtracting (*i*) from (*ii*), we get $80y = 240 \Leftrightarrow y = 3$.

Putting $y = 3$ in (*i*), we get :

$540 \times 3 + x = 1800 \Leftrightarrow x = (1800 - 1620) = 180.$

$\therefore$ Fixed charges = Rs. 180, Charge per unit = Rs. 3.

Total charges for consuming 500 units = Rs. $(180 + 500 \times 3)$ = Rs. 1680.

75. Let the incomes of A and B be Rs. $5x$ and Rs. $4x$ respectively and let their expenditures be Rs. $3y$ and Rs. $2y$ respectively.

Then, $5x - 3y = 1600$ ...(*i*) and $4x - 2y = 1600$ ...(*ii*)

On multiplying (*i*) by 2, (*ii*) by 3 and subtracting, we get : $2x = 1600 \Leftrightarrow x = 800.$

$\therefore$ A's income = Rs. $5x$ = Rs. (5×800) = Rs. 4000.

76. For 9 kg zinc, mixture melted = (9 + 11) kg.

For 28.8 kg zinc, mixture melted $= \left(\frac{20}{9} \times 28.8\right)$ kg = 64 kg.

77. Required ratio $= \left(\frac{2}{3} \times \frac{6}{11} \times \frac{11}{2}\right) = \frac{2}{1} = 2 : 1.$

78. $0.4A = 0.06B \Leftrightarrow \frac{A}{B} = \frac{0.06}{0.40} = \frac{6}{40} = \frac{3}{20}$.

$\therefore \quad A : B = 3 : 20.$

79. Let x be subtracted. Then,

$$\frac{6-x}{7-x} < \frac{16}{21} \Leftrightarrow 21(6-x) < 16(7-x) \Leftrightarrow 5x > 14 \Leftrightarrow x > 2.8.$$

$\therefore$ Least such whole number is 3.

80. Gold in C $= \left(\frac{7}{9} + \frac{7}{18}\right)$ units $= \frac{7}{6}$ units. Copper in C $= \left(\frac{2}{9} + \frac{11}{18}\right)$ units $= \frac{5}{6}$ units.

$\therefore$ Gold : Copper $= \frac{7}{6} : \frac{5}{6} = 7 : 5.$

81. $\frac{7}{15} = 0.466$, $\frac{15}{23} = 0.652$, $\frac{17}{25} = 0.68$ and $\frac{21}{29} = 0.724$.

Clearly, 0.724 is greatest and therefore, 21 : 29 is greatest.

82. If B's share is Rs. 3, total amount = Rs. 7.

If B's share is Rs. 4800, total amount = Rs. $\left(\frac{7}{3} \times 4800\right)$ = Rs. 11200.

83. Suppose C gets Rs. x. Then, B gets Rs. $(x + 8)$ and A gets Rs. $(x + 15)$.

Then, $x + (x + 8) + (x + 15) = 53 \Leftrightarrow x = 10.$

$\therefore$ A : B : C = (10 + 15) : (10 + 8) : 10 = 25 : 18 : 10.

84. Let the ratio be $x : (x + 40)$. Then,

$$\frac{x}{(x+40)} = \frac{2}{7} \Leftrightarrow 7x = 2x + 80 \Leftrightarrow 5x = 80 \Leftrightarrow x = 16.$$

$\therefore$ Required ratio = 16 : 56.