

10. $(1000)^7 \times 10^{18} = \frac{(1000)^7}{10^{18}} = \frac{(10^3)^7}{10^{18}} = \frac{10^{(3 \times 7)}}{10^{18}} = \frac{10^{21}}{10^{18}} = (10)^{(21-18)} = 10^3 = 1000.$

11. $(256)^{0.16} \times (256)^{0.09} = (256)^{0.16+0.09} = (256)^{0.25} = (256)^{\left(\frac{25}{100}\right)}$
 $= (256)^{\frac{1}{4}} = (4^4)^{\frac{1}{4}} = 4^{\left(4 \times \frac{1}{4}\right)} = 4^1 = 4.$

12. $(0.04)^{-1.5} = \left(\frac{4}{100}\right)^{-1.5} = \left(\frac{1}{25}\right)^{-\frac{3}{2}} = (25)^{\frac{3}{2}} = (5^2)^{\frac{3}{2}} = 5^{\left(2 \times \frac{3}{2}\right)} = 5^3 = 125.$

13. Let $(17)^{3.5} \times (17)^x = 17^8$. Then, $(17)^{3.5+x} = 17^8$.

$\therefore 3.5 + x = 8 \Leftrightarrow x = (8 - 3.5) \Leftrightarrow x = 4.5.$

14. $49 \times 49 \times 49 \times 49 = (7^2 \times 7^2 \times 7^2 \times 7^2) = 7^{(2+2+2+2)} = 7^8.$

So, the correct answer is 8.

15. $8^{-25} - 8^{-26} = \left(\frac{1}{8^{25}} - \frac{1}{8^{26}}\right) = \frac{(8-1)}{8^{26}} = 7 \times 8^{-26}.$

16. $(64)^{-\frac{1}{2}} - (-32)^{-\frac{4}{5}} = (8^2)^{-\frac{1}{2}} - ((-2)^5)^{-\frac{4}{5}} = 8^{2 \times \frac{(-1)}{2}} - (-2)^{5 \times \frac{(-4)}{5}} = 8^{-1} - (-2)^{-4}$
 $= \frac{1}{8} - \frac{1}{(-2)^4} = \left(\frac{1}{8} - \frac{1}{16}\right) = \frac{1}{16}.$

17. $(18)^{3.5} + (27)^{3.5} \times 6^{3.5} = 2^x$

$\Leftrightarrow (18)^{3.5} \times \frac{1}{(27)^{3.5}} \times 6^{3.5} = 2^x \Leftrightarrow (3^2 \times 2)^{3.5} \times \frac{1}{(3^3)^{3.5}} \times (2 \times 3)^{3.5} = 2^x$

$\Leftrightarrow 3^{(2 \times 3.5)} \times 2^{3.5} \times \frac{1}{3^{(3 \times 3.5)}} \times 2^{3.5} \times 3^{3.5} = 2^x$

$\Leftrightarrow 3^7 \times 2^{3.5} \times \frac{1}{3^{10.5}} \times 2^{3.5} \times 3^{3.5} = 2^x \Leftrightarrow 2^7 = 2^x \Leftrightarrow x = 7.$

18. Let $(25)^{7.5} \times (5)^{2.5} + (125)^{1.5} = 5^x$. Then, $\frac{(5^2)^{7.5} \times (5)^{2.5}}{(5^3)^{1.5}} = 5^x \Leftrightarrow \frac{5^{(2 \times 7.5)} \times 5^{2.5}}{5^{(3 \times 1.5)}} = 5^x$

$\Leftrightarrow \frac{5^{15} \times 5^{2.5}}{5^{4.5}} = 5^x \Leftrightarrow 5^x = 5^{(15+2.5-4.5)} = 5^{13} \Leftrightarrow x = 13.$

19. $\frac{(243)^{0.13} \times (243)^{0.07}}{7^{0.25} \times (49)^{0.075} \times (343)^{0.2}} = \frac{(243)^{(0.13+0.07)}}{7^{0.25} \times (7^2)^{0.075} \times (7^3)^{0.2}}$

$= \frac{(243)^{0.2}}{7^{0.25} \times 7^{(2 \times 0.075)} \times 7^{(3 \times 0.2)}} = \frac{(3^5)^{0.2}}{7^{0.25} \times 7^{0.15} \times 7^{0.6}}$

$= \frac{3^{(5 \times 0.2)}}{7^{(0.25+0.15+0.6)}} = \frac{3^1}{7^1} = \frac{3}{7}.$

20. $\left(\frac{a}{b}\right)^{x-1} = \left(\frac{b}{a}\right)^{x-3} \Leftrightarrow \left(\frac{a}{b}\right)^{x-1} = \left(\frac{a}{b}\right)^{-(x-3)} = \left(\frac{a}{b}\right)^{(3-x)}$
 $\Leftrightarrow x-1 = 3-x \Leftrightarrow 2x = 4 \Leftrightarrow x = 2.$

21. $2^{2n-1} = \frac{1}{8^{n-3}} \Leftrightarrow 2^{2n-1} = \frac{1}{(2^3)^{n-3}} = \frac{1}{2^{3(n-3)}} = \frac{1}{2^{(3n-9)}} = 2^{(9-3n)}$
 $\Leftrightarrow 2n-1 = 9-3n \Leftrightarrow 5n = 10 \Leftrightarrow n = 2.$

$$22. 5^a = 3125 \Leftrightarrow 5^a = 5^5 \Leftrightarrow a = 5.$$

$$\therefore 5^{(a-3)} = 5^{(5-3)} = 5^2 = 25.$$

$$23. 5\sqrt{5} \times 5^3 + 5^{-\frac{3}{2}} = 5^{a+2} \Leftrightarrow \frac{5 \times 5^{\frac{1}{2}} \times 5^3}{5^{-\frac{3}{2}}} = 5^{a+2} \Leftrightarrow 5^{\left(1 + \frac{1}{2} + 3 + \frac{3}{2}\right)} = 5^{a+2}$$

$$\Leftrightarrow 5^6 = 5^{a+2} \Leftrightarrow a+2 = 6 \Leftrightarrow a = 4.$$

$$24. \sqrt{2^n} = 64 \Leftrightarrow (2^n)^{\frac{1}{2}} = 2^6 \Leftrightarrow 2^{\frac{n}{2}} = 2^6 \Leftrightarrow \frac{n}{2} = 6 \Leftrightarrow n = 12.$$

$$25. (\sqrt{3})^5 \times 9^2 = 3^n \times 3\sqrt{3} \Leftrightarrow \left(\frac{1}{3^2}\right)^5 \times (3^2)^2 = 3^n \times 3 \times 3^{\frac{1}{2}} \Leftrightarrow 3^{\left(\frac{1}{2} \times 5\right)} \times 3^{(2 \times 2)} = 3^{\left(n + 1 + \frac{1}{2}\right)}$$

$$\Leftrightarrow 3^{\left(\frac{5}{2} + 4\right)} = 3^{\left(n + \frac{3}{2}\right)} \Leftrightarrow n + \frac{3}{2} = \frac{13}{2} \Leftrightarrow n = \left(\frac{13}{2} - \frac{3}{2}\right) = \frac{10}{2} = 5.$$

$$26. \frac{9^n \times 3^5 \times (27)^3}{3 \times (81)^4} = 27 \Leftrightarrow \frac{(3^2)^n \times 3^5 \times (3^3)^3}{3 \times (3^4)^4} = 3^3 \Leftrightarrow \frac{3^{2n} \times 3^5 \times 3^{(3 \times 3)}}{3 \times 3^{(4 \times 4)}} = 3^3$$

$$\Leftrightarrow \frac{3^{2n+5+9}}{3 \times 3^{16}} = 3^3 \Leftrightarrow \frac{3^{2n+14}}{3^{17}} = 3^3 \Leftrightarrow 3^{(2n+14-17)} = 3^3$$

$$\Leftrightarrow 3^{2n-3} = 3^3 \Leftrightarrow 2n-3 = 3 \Leftrightarrow 2n = 6 \Leftrightarrow n = 3.$$

27. $2^{n+4} - 2^{n+2} = 3 \Leftrightarrow 2^{n+2}(2^2 - 1) = 3 \Leftrightarrow 2^{n+2} \times 1 = 2^0 \Leftrightarrow n+2 = 0 \Leftrightarrow n = -2.$

28. $2^{n-1} + 2^{n+1} = 320 \Leftrightarrow 2^{n-1}(1 + 2^2) = 320 \Leftrightarrow 5 \times 2^{n-1} = 320$

$$\Leftrightarrow 2^{n-1} = \frac{320}{5} = 64 = 2^6 \Leftrightarrow n-1 = 6 \Leftrightarrow n = 7.$$

29. $3^x - 3^{x-1} = 18 \Leftrightarrow 3^{x-1}(3 - 1) = 18 \Leftrightarrow 3^{x-1} \times 9 = 3^2 \Leftrightarrow x-1 = 2 \Leftrightarrow x = 3.$
 $\therefore x^x = 3^3 = 27.$

$$30. \frac{2^{n+4} - 2 \times 2^n}{2 \times 2^{n+3}} + 2^{-3} = \frac{2^{n+4} - 2^{n+1}}{2^{n+4}} + \frac{1}{2^3} = \frac{2^{n+1}(2^3 - 1)}{2^{n+4}} + \frac{1}{2^3}$$

$$= \frac{2^{n+1} \times 7}{2^{n+1} \times 2^3} + \frac{1}{2^3} \cdot \left(\frac{7}{8} + \frac{1}{8}\right) = \frac{8}{8} = 1.$$

$$31. \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2 = x + \frac{1}{x} - 2 = (3 + 2\sqrt{2}) + \frac{1}{(3 + 2\sqrt{2})} - 2$$

$$= (3 + 2\sqrt{2}) + \frac{1}{(3 + 2\sqrt{2})} \times \frac{(3 - 2\sqrt{2})}{(3 - 2\sqrt{2})} - 2 = (3 + 2\sqrt{2}) + (3 - 2\sqrt{2}) - 2 = 4.$$

$$\therefore \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right) \approx 2.$$

$$32. x^z = y^2 \Leftrightarrow (10^{0.48})^z = (10^{0.70})^2 \Leftrightarrow 10^{(0.48z)} = 10^{(2 \times 0.70)} = 10^{1.40}$$

$$\Leftrightarrow 0.48z = 1.40 \Leftrightarrow z = \frac{140}{48} = \frac{35}{12} = 2.9 \text{ (approx.)}.$$

33. We know that $11^2 = 121$. Putting $m = 11$ and $n = 2$, we get :

$$(m-1)^{n+1} = (11-1)^{(2+1)} = 10^3 = 1000.$$

34. Given Expression = $\frac{(243)^{\frac{n}{5}} \times 3^{2n+1}}{9^n \times 3^{n-1}} = \frac{(3^5)^{\frac{n}{5}} \times 3^{2n+1}}{(3^2)^n \times 3^{n-1}} = \frac{3^{\left(\frac{5 \times n}{5}\right)} \times 3^{2n+1}}{3^{2n} \times 3^{n-1}}$
 $= \frac{3^n \times 3^{2n+1}}{3^{2n} \times 3^{n-1}} = \frac{3^{(n+2n+1)}}{3^{(2n+n-1)}} = \frac{3^{3n+1}}{3^{3n-1}} = 3^{(3n+1-3n+1)} = 3^2 = 9.$

35. $(216)^{\frac{3}{5}} \times (2500)^{\frac{1}{5}} \times (300)^{\frac{2}{5}} = (3^3 \times 2^3)^{\frac{3}{5}} \times (5^4 \times 2^2)^{\frac{1}{5}} \times (5^2 \times 2^2 \times 3)^{\frac{2}{5}}$
 $= 3^{\left(\frac{3 \times 3}{5}\right)} \times 2^{\left(\frac{3 \times 2}{5}\right)} \times 5^{\left(\frac{4 \times 2}{5}\right)} \times 2^{\left(\frac{2 \times 2}{5}\right)} \times 5^{\left(\frac{2 \times 1}{5}\right)} \times 2^{\left(\frac{2 \times 1}{5}\right)} \times 3^{\frac{2}{5}}$
 $= 3^{\frac{9}{5}} \times 2^{\frac{6}{5}} \times 5^{\frac{8}{5}} \times 5^{\frac{4}{5}} \times 2^{\frac{2}{5}} \times 2^{\frac{2}{5}} \times 3^{\frac{1}{5}}$
 $= 3^{\left(\frac{9}{5} + \frac{1}{5}\right)} \times 2^{\left(\frac{9}{5} + \frac{4}{5} + \frac{2}{5}\right)} \times 5^{\left(\frac{8}{5} + \frac{2}{5}\right)} = 3^2 \times 2^3 \times 5^2.$

Hence, the number of prime factors = $(2 + 3 + 2) = 7.$

36. $\frac{6^{12} \times (35)^{28} \times (15)^{16}}{(14)^{12} \times (21)^{11}} = \frac{(2 \times 3)^{12} \times (5 \times 7)^{28} \times (3 \times 5)^{16}}{(2 \times 7)^{12} \times (3 \times 7)^{11}} = \frac{2^{12} \times 3^{12} \times 5^{28} \times 7^{28} \times 3^{16} \times 5^{16}}{2^{12} \times 7^{12} \times 3^{11} \times 7^{11}}$
 $= 2^{(12-12)} \times 3^{(12+16-11)} \times 5^{(28+16)} \times 7^{(28-12-11)}$
 $= 2^0 \times 3^{17} \times 5^{44} \times 7^{-5} = \frac{3^{17} \times 5^{44}}{7^5}$

Number of prime factors = $17 + 44 + 5 = 66.$

37. $\frac{1}{1+a^{(n-m)}} + \frac{1}{1+a^{(m-n)}} = \frac{1}{\left(1+\frac{a^n}{a^m}\right)} + \frac{1}{\left(1+\frac{a^m}{a^n}\right)}$
 $= \frac{a^m}{(a^m+a^n)} + \frac{a^n}{(a^m+a^n)} = \frac{(a^m+a^n)}{(a^m+a^n)} = 1.$

38. Given Exp. = $\frac{1}{\left(1+\frac{x^b}{x^a}+\frac{x^c}{x^a}\right)} + \frac{1}{\left(1+\frac{x^a}{x^b}+\frac{x^c}{x^b}\right)} + \frac{1}{\left(1+\frac{x^b}{x^c}+\frac{x^a}{x^c}\right)}$
 $= \frac{x^a}{(x^a+x^b+x^c)} + \frac{x^b}{(x^a+x^b+x^c)} + \frac{x^c}{(x^a+x^b+x^c)} = \frac{(x^a+x^b+x^c)}{(x^a+x^b+x^c)} = 1.$

39. Given Exp. = $x^{(b-c)(b+c-a)} \cdot x^{(c-a)(c+a-b)} \cdot x^{(a-b)(a+b-c)}$
 $= x^{(b-c)(b+c)-a(b-c)} \cdot x^{(c-a)(c+a)-b(c-a)} \cdot x^{(a-b)(a+b)-c(a-b)}$
 $= x^{(b^2-c^2+c^2-a^2+a^2-b^2)} \cdot x^{-a(b-c)-b(c-a)-c(a-b)} = (x^0 \times x^0) = (1 \times 1) = 1.$

40. Given Exp. = $x^{(a-b)(a+b)} \cdot x^{(b-c)(b+c)} \cdot x^{(c-a)(c+a)}$
 $= x^{(a^2-b^2)} \cdot x^{(b^2-c^2)} \cdot x^{(c^2-a^2)} = x^{(a^2-b^2+b^2-c^2+c^2-a^2)} = x^0 = 1.$

41. Given Exp. = $\{x^{(a-b)}\}^{\frac{1}{ab}} \cdot \{x^{(b-c)}\}^{\frac{1}{bc}} \cdot \{x^{(c-a)}\}^{\frac{1}{ca}} = x^{\frac{(a-b)}{ab}} \cdot x^{\frac{(b-c)}{bc}} \cdot x^{\frac{(c-a)}{ca}}$
 $= x^{\left\{ \frac{(a-b)}{ab} + \frac{(b-c)}{bc} + \frac{(c-a)}{ca} \right\}} = x^{\left(\frac{1}{b} - \frac{1}{a} \right) + \left(\frac{1}{c} - \frac{1}{b} \right) + \left(\frac{1}{a} - \frac{1}{c} \right)} = x^0 = 1.$

42. Given Exp. = $\frac{1}{1+a+b^{-1}} + \frac{1}{1+b+c^{-1}} + \frac{1}{1+c+a^{-1}}$
 $= \frac{1}{1+a+b^{-1}} + \frac{b^{-1}}{b^{-1}+1+b^{-1}c^{-1}} + \frac{a}{a+ac+1}$
 $= \frac{1}{1+a+b^{-1}} + \frac{b^{-1}}{1+b^{-1}+a} + \frac{a}{a+b^{-1}+1} = \frac{1+a+b^{-1}}{1+a+b^{-1}} = 1.$
 $[\because abc = 1 \Rightarrow (bc)^{-1} = a \Rightarrow b^{-1}c^{-1} = a \text{ and } ac = b^{-1}]$

43. $\sqrt{a^{-1}b} \cdot \sqrt{b^{-1}c} \cdot \sqrt{c^{-1}a} = (a^{-1})^{\frac{1}{2}} \cdot b^{\frac{1}{2}} \cdot (b^{-1})^{\frac{1}{2}} \cdot c^{\frac{1}{2}} \cdot (c^{-1})^{\frac{1}{2}} \cdot a^{\frac{1}{2}}$
 $= (a^{-1}a)^{\frac{1}{2}} \cdot (b \cdot b^{-1})^{\frac{1}{2}} \cdot (c \cdot c^{-1})^{\frac{1}{2}} = (1)^{\frac{1}{2}} \cdot (1)^{\frac{1}{2}} \cdot (1)^{\frac{1}{2}} = (1 \times 1 \times 1) = 1.$

44. $3^x - y = 27 = 3^3 \Leftrightarrow x - y = 3 \quad \dots(i)$

$3^x + y = 243 = 3^5 \Leftrightarrow x + y = 5 \quad \dots(ii)$

On solving (i) and (ii), we get $x = 4$.

45. $\left(\frac{9}{4}\right)^x \cdot \left(\frac{8}{27}\right)^{x-1} = \frac{2}{3} \Leftrightarrow \frac{9^x}{4^x} \times \frac{8^{x-1}}{(27)^{x-1}} = \frac{2}{3}$
 $\Leftrightarrow \frac{(3^2)^x}{(2^2)^x} \times \frac{(2^3)^{(x-1)}}{(3^3)^{(x-1)}} = \frac{2}{3} \Leftrightarrow \frac{3^{2x} \times 2^{3(x-1)}}{2^{2x} \times 3^{3(x-1)}} = \frac{2}{3}$
 $\Leftrightarrow \frac{2^{(3x-3-2x)}}{3^{(3x-3-2x)}} = \frac{2}{3} \Leftrightarrow \frac{2^{(x-3)}}{3^{(x-3)}} = \frac{2}{3} \Leftrightarrow \left(\frac{2}{3}\right)^{(x-3)} = \left(\frac{2}{3}\right)^1 \Leftrightarrow x-3=1 \Leftrightarrow x=4.$

46. $2^x = \sqrt[3]{32} \Leftrightarrow 2^x = (32)^{\frac{1}{3}} = (2^5)^{\frac{1}{3}} = 2^{\frac{5}{3}} \Leftrightarrow x = \frac{5}{3}.$

47. $2^x \times 8^5 = 2^5 \Leftrightarrow 2^x \times (2^3)^5 = 2^5 \Leftrightarrow 2^x \times 2^5 = 2^5 \Leftrightarrow 2^{(x+5)} = 2^5 \Leftrightarrow x + \frac{3}{5} = \frac{1}{5} \Leftrightarrow x = \left(\frac{1}{5} - \frac{3}{5}\right) = -\frac{2}{5}.$

48. $5^{(x+3)} = 25^{(3x-4)} \Leftrightarrow 5^{(x+3)} = (5^2)^{(3x-4)}$
 $\Leftrightarrow 5^{(x+3)} = 5^2(3x-4) \Leftrightarrow 5^{(x+3)} = 5^{(6x-8)}$
 $\Leftrightarrow x+3 = 6x-8 \Leftrightarrow 5x = 11 \Leftrightarrow x = \frac{11}{5}.$

49. Let $a^x = b^y = c^z = k$. Then, $a = k^{\frac{1}{x}}$, $b = k^{\frac{1}{y}}$ and $c = k^{\frac{1}{z}}$.

$\therefore b^2 = ac \Leftrightarrow \left(\frac{1}{k^y}\right)^2 = k^{\frac{1}{x}} \times k^{\frac{1}{z}} \Leftrightarrow k^{\left(\frac{2}{y}\right)} = k^{\left(\frac{1}{x} + \frac{1}{z}\right)}$
 $\therefore \frac{2}{y} = \frac{(x+z)}{xz} \Leftrightarrow \frac{y}{2} = \frac{xz}{(x+z)} \Leftrightarrow y = \frac{2xz}{(x+z)}.$

50. Let $2^x = 3^y = 6^{-z} = k \Leftrightarrow 2 = k^{\frac{1}{x}}$, $3 = k^{\frac{1}{y}}$ and $6 = k^{-\frac{1}{z}}$.

Now, $2 \times 3 = 6 \Leftrightarrow k^{\frac{1}{x}} \times k^{\frac{1}{y}} = k^{-\frac{1}{z}} \Leftrightarrow k^{\left(\frac{1}{x} + \frac{1}{y}\right)} = k^{-\frac{1}{z}}$

$\therefore \frac{1}{x} + \frac{1}{y} = -\frac{1}{z} \Leftrightarrow \frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 0.$

51. $a^1 - c^x = (b^y)^z = b^{yz} = (a^x)^{yz} = a^{xyz}$. $\therefore xyz = 1$.

52. $2^x = 4^y = 8^z \Leftrightarrow 2^x = 2^{2y} = 2^{3z} \Leftrightarrow x = 2y = 3z$.

$$\therefore \frac{1}{2x} + \frac{1}{4y} + \frac{1}{6z} = \frac{24}{7} \Leftrightarrow \frac{1}{6x} + \frac{1}{6z} + \frac{1}{6z} = \frac{24}{7} \Leftrightarrow \frac{3}{6z} = \frac{24}{7} \text{, so } z = \left(\frac{3}{6} \times \frac{7}{24} \right) = \frac{7}{48}.$$

53. L.C.M. of 2, 3, 4 is 12.

$$\sqrt[12]{2} = 2^{\frac{1}{12}} = 2^{\left(\frac{1}{2} \times \frac{6}{6}\right)} = 2^{\frac{6}{12}} = (2^6)^{\frac{1}{12}} = (64)^{\frac{1}{12}} = \sqrt[12]{64}$$

$$\sqrt[12]{3} = 3^{\frac{1}{12}} = 3^{\left(\frac{1}{3} \times \frac{4}{4}\right)} = 3^{\frac{4}{12}} = (3^4)^{\frac{1}{12}} = (81)^{\frac{1}{12}} = \sqrt[12]{81}$$

$$\sqrt[12]{4} = 4^{\frac{1}{12}} = 4^{\left(\frac{1}{4} \times \frac{3}{3}\right)} = 4^{\frac{3}{12}} = (4^3)^{\frac{1}{12}} = (64)^{\frac{1}{12}} = \sqrt[12]{64}$$

Clearly, $\sqrt[12]{81}$, i.e., $\sqrt[12]{3}$ is the largest.

54. $x = 5 + 2\sqrt{6} = 3 + 2 + 2\sqrt{6} = (\sqrt{3})^2 + (\sqrt{2})^2 + 2 \times \sqrt{3} \times \sqrt{2} = (\sqrt{3} + \sqrt{2})^2$.

Also, $(x - 1) = 4 + 2\sqrt{6} = 2(2 + \sqrt{6}) = 2\sqrt{2}(\sqrt{2} + \sqrt{3})$.

$$\therefore \frac{(x - 1)}{\sqrt{x}} = \frac{2\sqrt{2}(\sqrt{3} + \sqrt{2})}{(\sqrt{3} + \sqrt{2})} = 2\sqrt{2}.$$

10. PERCENTAGE

IMPORTANT FACTS AND FORMULAE

- I. Concept of Percentage : By a certain *percent*, we mean that many hundredths. Thus, x percent means x hundredths, written as $x\%$.

To express $x\%$ as a fraction : We have, $x\% = \frac{x}{100}$.

Thus, $20\% = \frac{20}{100} = \frac{1}{5}$; $48\% = \frac{48}{100} = \frac{12}{25}$, etc.

To express $\frac{a}{b}$ as a percent : We have, $\frac{a}{b} = \left(\frac{a}{b} \times 100\right)\%$.

Thus, $\frac{1}{4} = \left(\frac{1}{4} \times 100\right)\% = 25\%$; $0.6 = \frac{6}{10} = \frac{3}{5} = \left(\frac{3}{5} \times 100\right)\% = 60\%$.

- II. If the price of a commodity increases by $R\%$, then the reduction in consumption so as not to increase the expenditure is

$$\left[\frac{R}{(100+R)} \times 100 \right]\%$$

If the price of a commodity decreases by $R\%$, then the increase in consumption so as not to decrease the expenditure is

$$\left[\frac{R}{(100-R)} \times 100 \right]\%$$

- III. Results on Population : Let the population of a town be P now and suppose it increases at the rate of $R\%$ per annum, then :

1. Population after n years = $P \left(1 + \frac{R}{100}\right)^n$.

2. Population n years ago = $\frac{P}{\left(1 + \frac{R}{100}\right)^n}$.

- IV. Results on Depreciation : Let the present value of a machine be P . Suppose it depreciates at the rate of $R\%$ per annum. Then :

1. Value of the machine after n years = $P \left(1 - \frac{R}{100}\right)^n$.

2. Value of the machine n years ago = $\frac{P}{\left(1 - \frac{R}{100}\right)^n}$.

- V. If A is $R\%$ more than B, then B is less than A by

$$\left[\frac{R}{(100+R)} \times 100 \right]\%.$$

If A is $R\%$ less than B, then B is more than A by

$$\left[\frac{R}{(100-R)} \times 100 \right]\%.$$

SOLVED EXAMPLES

Ex. 1. Express each of the following as a fraction :

$$(i) 56\% \quad (ii) 4\% \quad (iii) 0.6\% \quad (iv) 0.08\%$$

$$\text{Sol. } (i) 56\% = \frac{56}{100} = \frac{14}{25}. \quad (ii) 4\% = \frac{4}{100} = \frac{1}{25}.$$

$$(iii) 0.6\% = \frac{0.6}{100} = \frac{6}{1000} = \frac{3}{500}. \quad (iv) 0.08\% = \frac{0.08}{100} = \frac{8}{10000} = \frac{1}{1250}.$$

Ex. 2. Express each of the following as a decimal :

$$(i) 6\% \quad (ii) 28\% \quad (iii) 0.2\% \quad (iv) 0.04\%$$

$$\text{Sol. } (i) 6\% = \frac{6}{100} = 0.06. \quad (ii) 28\% = \frac{28}{100} = 0.28.$$

$$(iii) 0.2\% = \frac{0.2}{100} = 0.002. \quad (iv) 0.04\% = \frac{0.04}{100} = 0.0004.$$

Ex. 3. Express each of the following as rate percent :

$$(i) \frac{23}{36} \quad (ii) 6\frac{3}{4} \quad (iii) 0.004$$

$$\text{Sol. } (i) \frac{23}{36} = \left(\frac{23}{36} \times 100 \right)\% = \left(\frac{575}{9} \right)\% = 63\frac{8}{9}\%. \quad (ii) 6\frac{3}{4} = \left(\frac{27}{4} \times 100 \right)\% = 675\%.$$

$$(iii) 0.004 = \frac{4}{1000} = \left(\frac{4}{1000} \times 100 \right)\% = 0.4\%.$$

$$(iv) 6\frac{3}{4} = \frac{27}{4} = \left(\frac{27}{4} \times 100 \right)\% = 675\%.$$

Ex. 4. Evaluate :

$$(i) 28\% \text{ of } 450 + 45\% \text{ of } 280 \quad (\text{Bank P.O. 2003})$$

$$(ii) 16\frac{2}{3}\% \text{ of } 600 \text{ gm} - 33\frac{1}{3}\% \text{ of } 180 \text{ gm} \quad (\text{R.R.B. 1998})$$

$$\text{Sol. } (i) 28\% \text{ of } 450 + 45\% \text{ of } 280 = \left(\frac{28}{100} \times 450 + \frac{45}{100} \times 280 \right) = (126 + 126) = 252.$$

$$(ii) 16\frac{2}{3}\% \text{ of } 600 \text{ gm} - 33\frac{1}{3}\% \text{ of } 180 \text{ gm}$$

$$= \left[\left(\frac{50}{3} \times \frac{1}{100} \times 600 \right) - \left(\frac{100}{3} \times \frac{1}{100} \times 180 \right) \right] \text{ gm} = (100 - 60) \text{ gm} = 40 \text{ gm.}$$

Ex. 5. (i) 2 is what percent of 50 ? (S.S.C. 2000)

$$(ii) \frac{1}{2} \text{ is what percent of } \frac{1}{3} ? \quad (\text{S.S.C. 2002})$$

(iii) What percent of 7 is 84 ?

(iv) What percent of 2 metric tonnes is 40 quintals ?

(v) What percent of 6.5 litres is 130 ml ?

$$\text{Sol. } (i) \text{ Required percentage} = \left(\frac{2}{50} \times 100 \right)\% = 4\%.$$

$$(ii) \text{ Required percentage} = \left(\frac{1}{2} \times \frac{3}{1} \times 100 \right)\% = 150\%.$$

$$(iii) \text{ Required percentage} = \left(\frac{84}{7} \times 100 \right)\% = 1200\%.$$

(iv) 1 metric tonne = 10 quintals.

$$\therefore \text{Required percentage} = \left(\frac{40}{2 \times 10} \times 100 \right)\% = 200\%.$$

$$(v) \text{Required percentage} = \left(\frac{130}{6.5 \times 1000} \times 100 \right)\% = 2\%.$$

Ex. 6. Find the missing figures :

$$(i) ?\% \text{ of } 25 = 2.125 \quad (ii) 9\% \text{ of } ? = 63 \quad (iii) 0.25\% \text{ of } ? = 0.04$$

$$\text{Sol. } (i) \text{Let } x\% \text{ of } 25 = 2.125. \text{ Then, } \frac{x}{100} \times 25 = 2.125 \Leftrightarrow x = (2.125 \times 4) = 8.5.$$

$$(ii) \text{Let } 9\% \text{ of } x = 6.3. \text{ Then, } \frac{9}{100} x = 6.3 \Leftrightarrow x = \left(\frac{6.3 \times 100}{9} \right) = 70.$$

$$(iii) \text{Let } 0.25\% \text{ of } x = 0.04. \text{ Then, } \frac{0.25}{100} x = 0.04 \Leftrightarrow x = \left(\frac{0.04 \times 100}{0.25} \right) = 16.$$

Ex. 7. Which is greatest in $16\frac{2}{3}\%$, $\frac{2}{15}$ and 0.17?

$$\text{Sol. } 16\frac{2}{3}\% = \left(\frac{50}{3} \times \frac{1}{100} \right) = \frac{1}{6} = 0.166, \frac{2}{15} = 0.133. \text{ Clearly, } 0.17 \text{ is the greatest.}$$

Ex. 8. If the sales tax be reduced from $3\frac{1}{2}\%$ to $3\frac{1}{3}\%$, then what difference does it make to a person who purchases an article with marked price of Rs. 8400?

(S.S.C. 2002)

$$\begin{aligned} \text{Sol. Required difference} &= \left(3\frac{1}{2}\% \text{ of Rs. 8400} \right) - \left(3\frac{1}{3}\% \text{ of Rs. 8400} \right) \\ &= \left(\frac{7}{2} - \frac{10}{3} \right)\% \text{ of Rs. 8400 = } \frac{1}{6}\% \text{ of Rs. 8400} \\ &= \text{Rs. } \left(\frac{1}{6} \times \frac{1}{100} \times 8400 \right) = \text{Rs. } 14. \end{aligned}$$

Ex. 9. An inspector rejects 0.08% of the meters as defective. How many will he examine to reject 2?

(M.A.T. 2000)

Sol. Let the number of meters to be examined be x .

$$\text{Then, } 0.08\% \text{ of } x = 2 \Leftrightarrow \left(\frac{8}{100} \times \frac{1}{100} \times x \right) = 2 \Leftrightarrow x = \left(\frac{2 \times 100 \times 100}{8} \right) = 2500.$$

Ex. 10. Sixty-five percent of a number is 21 less than four-fifth of that number. What is the number?

Sol. Let the number be x .

$$\text{Then, } \frac{4}{5}x - (65\% \text{ of } x) = 21 \Leftrightarrow \frac{4}{5}x - \frac{65}{100}x = 21 \Leftrightarrow 15x = 2100 \Leftrightarrow x = 140.$$

Ex. 11. Difference of two numbers is 1660. If 7.5% of one number is 12.5% of the other number, find the two numbers.

Sol. Let the numbers be x and y . Then, 7.5% of $x = 12.5\% \text{ of } y \Leftrightarrow x = \frac{125}{75}y = \frac{5}{3}y$.

$$\text{Now, } x - y = 1660 \Rightarrow \frac{5}{3}y - y = 1660 \Rightarrow \frac{2}{3}y = 1660 \Rightarrow y = \left(\frac{1660 \times 3}{2} \right) = 2490.$$

\therefore One number = 2490, Second number = $\frac{5}{3}y = 4150$.

Ex. 12. In expressing a length 81.472 km as nearly as possible with three significant digits, find the percentage error. (S.S.C. 1997)

$$\text{Sol. Error} = (81.5 - 81.472) \text{ km} = 0.028.$$

$$\therefore \text{Required percentage} = \left(\frac{0.028}{81.472} \times 100 \right)\% = 0.034\%.$$

Ex. 13. In an election between two candidates, 75% of the voters cast their votes, out of which 2% of the votes were declared invalid. A candidate got 9261 votes which were 75% of the total valid votes. Find the total number of votes enrolled in that election. (S.S.C. 2003)

Sol. Let the total number of votes enrolled be x . Then,

Number of votes cast = 75% of x . Valid votes = 98% of (75% of x).

$$\therefore 75\% \text{ of } [98\% \text{ of } (75\% \text{ of } x)] = 9261$$

$$\Leftrightarrow \left(\frac{75}{100} \times \frac{98}{100} \times \frac{75}{100} \times x \right) = 9261 \Leftrightarrow x = \left(\frac{9261 \times 100 \times 100 \times 100}{75 \times 98 \times 75} \right) = 16800.$$

Ex. 14. Shobha's Mathematics Test had 75 problems i.e., 10 arithmetic, 30 algebra and 35 geometry problems. Although she answered 70% of the arithmetic, 40% of the algebra and 60% of the geometry problems correctly, she did not pass the test because she got less than 60% of the problems right. How many more questions she would have needed to answer correctly to earn a 60% passing grade? (C.D.S. 2002)

$$\text{Sol. Number of questions attempted correctly} = (70\% \text{ of } 10 + 40\% \text{ of } 30 + 60\% \text{ of } 35) \\ = (7 + 12 + 21) = 40.$$

Questions to be answered correctly for 60% grade = 60% of 75 = 45.

$$\therefore \text{Required number of questions} = (45 - 40) = 5.$$

Ex. 15. If 50% of $(x - y)$ = 30% of $(x + y)$, then what percent of x is y ? (S.S.C. 2003)

$$\text{Sol. } 50\% \text{ of } (x - y) = 30\% \text{ of } (x + y) \Leftrightarrow \frac{50}{100} (x - y) = \frac{30}{100} (x + y)$$

$$\Leftrightarrow 5(x - y) = 3(x + y) \Leftrightarrow 2x = 8y \Leftrightarrow x = 4y.$$

$$\therefore \text{Required percentage} = \left(\frac{y}{x} \times 100 \right)\% = \left(\frac{y}{4y} \times 100 \right)\% = 25\%.$$

Ex. 16. Mr. Jones gave 40% of the money he had, to his wife. He also gave 20% of the remaining amount to each of his three sons. Half of the amount now left was spent on miscellaneous items and the remaining amount of Rs. 12,000 was deposited in the bank. How much money did Mr. Jones have initially?

Sol. Let the initial amount with Mr. Jones be Rs. x . Then,

$$\text{Money given to wife} = \text{Rs. } \frac{40}{100} x = \text{Rs. } \frac{2x}{5}. \text{ Balance} = \text{Rs. } \left(x - \frac{2x}{5} \right) = \text{Rs. } \frac{3x}{5}.$$

$$\text{Money given to 3 sons} = \text{Rs. } \left[3 \times \left(\frac{20}{100} \times \frac{3x}{5} \right) \right] = \text{Rs. } \frac{9x}{25}.$$

$$\text{Balance} = \text{Rs. } \left(\frac{3x}{5} - \frac{9x}{25} \right) = \text{Rs. } \frac{6x}{25}.$$

$$\text{Amount deposited in bank} = \text{Rs. } \left(\frac{1}{2} \times \frac{6x}{25} \right) = \text{Rs. } \frac{3x}{25}.$$

$$\therefore \frac{3x}{25} = 12000 \Leftrightarrow x = \left(\frac{12000 \times 25}{3} \right) = 100000.$$

So, Mr. Jones initially had Rs. 1,00,000 with him.

Short-cut Method : Let the initial amount with Mr. Jones be Rs. x .

$$\text{Then, } \frac{1}{2} [100 - (3 \times 20)]\% \text{ of } (100 - 40)\% \text{ of } x = 12000.$$

$$\Leftrightarrow \frac{1}{2} \times \frac{40}{100} \times \frac{60}{100} \times x = 12000 \Leftrightarrow \frac{3}{25} x = 12000 \Leftrightarrow x = \left(\frac{12000 \times 25}{3} \right) = 100000.$$

Ex. 17. 10% of the inhabitants of a village having died of cholera, a panic set in, during which 25% of the remaining inhabitants left the village. The population is then reduced to 4050. Find the number of original inhabitants. (S.S.C. 2002)

Sol. Let the total number of original inhabitants be x .

$$\text{Then, } (100 - 25)\% \text{ of } (100 - 10)\% \text{ of } x = 4050$$

$$\Leftrightarrow \left(\frac{75}{100} \times \frac{90}{100} \times x \right) = 4050 \Leftrightarrow \frac{27}{40} x = 4050 \Leftrightarrow x = \left(\frac{4050 \times 40}{27} \right) = 6000.$$

$$\therefore \text{Number of original inhabitants} = 6000.$$

Ex. 18. A salesman's commission is 5% on all sales upto Rs. 10,000 and 4% on all sales exceeding this. He remits Rs. 31,100 to his parent company after deducting his commission. Find the total sales. (R.R.B. 2001)

Sol. Let his total sales be Rs. x . Now, (Total Sales) - (Commission) = Rs. 31,100.

$$\therefore x - [5\% \text{ of } 10000 + 4\% \text{ of } (x - 10000)] = 31100$$

$$\Leftrightarrow x - \left[\frac{5}{100} \times 10000 + \frac{4}{100} (x - 10000) \right] = 31100 \Leftrightarrow x - 500 - \frac{(x - 10000)}{25} = 31100$$

$$\Leftrightarrow x - \frac{x}{25} = 31200 \Leftrightarrow \frac{24x}{25} = 31200 \Leftrightarrow x = \left(\frac{31200 \times 25}{24} \right) = 32500.$$

$$\therefore \text{Total sales} = \text{Rs. } 32,500.$$

Ex. 19. Raman's salary was decreased by 50% and subsequently increased by 50%. How much percent does he lose? (Hotel Management, 2003)

Sol. Let original salary = Rs. 100.

$$\text{New final salary} = 150\% \text{ of } (50\% \text{ of } \text{Rs. } 100) = \text{Rs. } \left(\frac{150}{100} \times \frac{50}{100} \times 100 \right) = \text{Rs. } 75.$$

$$\therefore \text{Decrease} = 25\%.$$

Ex. 20. Paulson spends 75% of his income. His income is increased by 20% and he increased his expenditure by 10%. Find the percentage increase in his savings.

Sol. Let original income = Rs. 100. Then, expenditure = Rs. 75 and savings = Rs. 25.

$$\text{New income} = \text{Rs. } 120, \text{ New expenditure} = \text{Rs. } \left(\frac{110}{100} \times 75 \right) = \text{Rs. } \frac{165}{2}.$$

$$\text{New savings} = \text{Rs. } \left(120 - \frac{165}{2} \right) = \text{Rs. } \frac{75}{2}.$$

$$\text{Increase in savings} = \text{Rs. } \left(\frac{75}{2} - 25 \right) = \text{Rs. } \frac{25}{2}.$$

$$\therefore \text{Increase\%} = \left(\frac{25}{2} \times \frac{1}{25} \times 100 \right)\% = 50\%.$$

Ex. 21. The salary of a person was reduced by 10%. By what percent should his reduced salary be raised so as to bring it at par with his original salary?

(S.S.C. 2004)

Sol. Let the original salary be Rs. 100. New salary = Rs. 90.

$$\text{Increase on } 90 = 10. \text{ Increase on } 100 = \left(\frac{10}{90} \times 100 \right)\% = 11\frac{1}{9}\%.$$

Ex. 22. When the price of a product was decreased by 10%, the number sold increased by 30%. What was the effect on the total revenue? (R.B.I. 2003)

Sol. Let the price of the product be Rs. 100 and let original sale be 100 pieces.

Then, Total Revenue = Rs. (100×100) = Rs. 10000.

New revenue = Rs. (90×130) = Rs. 11700.

$$\therefore \text{Increase in revenue} = \left(\frac{1700}{10000} \times 100 \right)\% = 17\%.$$

Ex. 23. If the numerator of a fraction be increased by 15% and its denominator be diminished by 8%, the value of the fraction is $\frac{15}{16}$. Find the original fraction.

Sol. Let the original fraction be $\frac{x}{y}$.

$$\text{Then, } \frac{115\% \text{ of } x}{92\% \text{ of } y} = \frac{15}{16} \Rightarrow \frac{115x}{92y} = \frac{15}{16} \Rightarrow \frac{x}{y} = \left(\frac{15}{16} \times \frac{92}{115} \right) = \frac{3}{4}.$$

Ex. 24. In the new budget, the price of kerosene oil rose by 25%. By how much percent must a person reduce his consumption so that his expenditure on it does not increase?

$$\text{Sol. Reduction in consumption} = \left[\frac{R}{(100 + R)} \times 100 \right]\% = \left(\frac{25}{125} \times 100 \right)\% = 20\%.$$

Ex. 25. The population of a town is 1,76,400. If it increases at the rate of 5% per annum, what will be its population 2 years hence? What was it 2 years ago?

$$\text{Sol. Population after 2 years} = 176400 \times \left(1 + \frac{5}{100} \right)^2 = \left(176400 \times \frac{21}{20} \times \frac{21}{20} \right) = 194481.$$

$$\text{Population 2 years ago} = \frac{176400}{\left(1 + \frac{5}{100} \right)^2} = \left(176400 \times \frac{20}{21} \times \frac{20}{21} \right) = 160000.$$

Ex. 26. The value of a machine depreciates at the rate of 10% per annum. If its present value is Rs. 1,62,000, what will be its worth after 2 years? What was the value of the machine 2 years ago?

Sol. Value of the machine after 2 years

$$= \text{Rs.} \left[162000 \times \left(1 - \frac{10}{100} \right)^2 \right] = \text{Rs.} \left(162000 \times \frac{9}{10} \times \frac{9}{10} \right) = \text{Rs.} 131220.$$

Value of the machine 2 years ago

$$= \text{Rs.} \left[\frac{162000}{\left(1 - \frac{10}{100} \right)^2} \right] = \text{Rs.} \left(162000 \times \frac{10}{9} \times \frac{10}{9} \right) = \text{Rs.} 200000.$$

Ex. 27. During one year, the population of a town increased by 5% and during the next year, the population decreased by 5%. If the total population is 9975 at the end of the second year, then what was the population size in the beginning of the first year?

(Hotel Management, 2003)

Sol. Population in the beginning of the first year

$$= \frac{9975}{\left(1 + \frac{5}{100} \right) \left(1 - \frac{5}{100} \right)} = \left(9975 \times \frac{20}{21} \times \frac{20}{19} \right) = 10000.$$

Ex. 28. If A earns $33\frac{1}{3}\%$ more than B, how much percent does B earn less than A?

$$\text{Sol. Required percentage} = \left[\frac{\left(\frac{100}{3} \right)}{\left(100 + \frac{100}{3} \right)} \times 100 \right]\% = \left(\frac{100}{400} \times 100 \right)\% = 25\%.$$

Ex. 29. If A's salary is 20% less than B's salary, by how much percent is B's salary more than A's?

$$\text{Sol. Required percentage} = \left[\frac{20}{(100 - 20)} \times 100 \right]\% = 25\%.$$

Ex. 30. How many kg of pure salt must be added to 30 kg of 2% solution of salt and water to increase it to a 10% solution? (M.A.T. 2004)

$$\text{Sol. Amount of salt in } 30 \text{ kg solution} = \left(\frac{2}{100} \times 30 \right) \text{ kg} = 0.6 \text{ kg.}$$

Let x kg of pure salt be added.

$$\text{Then, } \frac{0.6 + x}{30 + x} = \frac{10}{100} \Leftrightarrow 60 + 100x = 300 + 10x \Leftrightarrow 90x = 240 \Leftrightarrow x = \frac{8}{3} = 2\frac{2}{3}.$$

Ex. 31. Due to a reduction of $6\frac{1}{4}\%$ in the price of sugar, a man is able to buy 1 kg more for Rs. 120. Find the original and reduced rate of sugar.

Sol. Let original rate be Rs. x per kg.

$$\text{Reduced rate} = \text{Rs.} \left[\left(100 - \frac{25}{4} \right) \times \frac{1}{100} x \right] = \text{Rs.} \frac{15x}{16} \text{ per kg.}$$

$$\therefore \frac{120}{\frac{15x}{16}} - \frac{120}{x} = 1 \Leftrightarrow \frac{128}{x} - \frac{120}{x} = 1 \Leftrightarrow x = 8.$$

So, original rate = Rs. 8 per kg.

$$\text{Reduced rate} = \text{Rs.} \left(\frac{15}{16} \times 8 \right) \text{ per kg} = \text{Rs.} 7.50 \text{ per kg.}$$

Ex. 32. In an examination, 35% of total students failed in Hindi, 45% failed in English and 20% in both. Find the percentage of those who passed in both the subjects.

Sol. Let A and B be the sets of students who failed in Hindi and English respectively.

Then, $n(A) = 35$, $n(B) = 45$, $n(A \cap B) = 20$.

$$\text{So, } n(A \cup B) = n(A) + n(B) - n(A \cap B) = (35 + 45 - 20) = 60.$$

\therefore Percentage failed in Hindi or English or both = 60%.

Hence, percentage passed = $(100 - 60)\% = 40\%$.

Ex. 33. In an examination, 80% of the students passed in English, 85% in Mathematics and 75% in both English and Mathematics. If 40 students failed in both the subjects, find the total number of students.

Sol. Let the total number of students be x .

Let A and B represent the sets of students who passed in English and Mathematics respectively.

Then, number of students passed in one or both the subjects

$$= n(A \cup B) = n(A) + n(B) - n(A \cap B) = 80\% \text{ of } x + 85\% \text{ of } x - 75\% \text{ of } x$$

$$= \left(\frac{80}{100} x + \frac{85}{100} x - \frac{75}{100} x \right) = \frac{90}{100} x = \frac{9}{10} x.$$

(S.S.C. 2000)

A. Students who failed in both the subjects = $\left(x - \frac{9x}{10}\right) = \frac{x}{10}$.

So, $\frac{x}{10} = 40$ or $x = 400$. Hence, total number of students = 400.

(S.S.C. 1999)

EXERCISE 10

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer :

- The ratio 5 : 4 expressed as a percent equals : (S.S.C. 2000)
(a) 12.5% (b) 40% (c) 80% (d) 125%
- 3.5 can be expressed in terms of percentage as : (R.R.B. 1998)
(a) 0.35% (b) 3.5% (c) 35% (d) 350%
- Half of 1 percent written as a decimal is : (S.S.C. 1999)
(a) 0.005 (b) 0.05 (c) 0.02 (d) 0.2
- What is 15 percent of Rs. 34 ? (I.M.T. 2002)
(a) Rs. 3.40 (b) Rs. 3.75 (c) Rs. 4.50 (d) Rs. 5.10
- 63% of $3\frac{4}{7}$ is :
(a) 2.25 (b) 2.40 (c) 2.50 (d) 2.75
- 88% of 370 + 24% of 210 = ? = 118 (Bank P.O. 2003)
(a) 256 (b) 258 (c) 268 (d) 358
- 860% of 50 + 50% of 860 = ? (R.B.I. 2003)
(a) 430 (b) 516 (c) 860 (d) 960
- 45% of 750 - 25% of 480 = ? (Bank P.O. 2002)
(a) 216 (b) 217.50 (c) 236.50 (d) 245
- 40% of 1640 + ? = 35% of 980 + 150% of 850 (S.B.I.P.O. 1997)
(a) 372 (b) 842 (c) 962 (d) 1052
- 218% of 1674 = ? \times 1800
(a) 0.5 (b) 4 (c) 6 (d) None of these
- 60% of 264 is the same as : (Hotel Management, 2001)
(a) 10% of 44 (b) 15% of 1056 (c) 30% of 132 (d) None of these
- 270 candidates appeared for an examination, of which 252 passed. The pass percentage is :
(a) 80% (b) $83\frac{1}{2}\%$ (c) $90\frac{1}{3}\%$ (d) $93\frac{1}{3}\%$
- 5 out of 2250 parts of earth is sulphur. What is the percentage of sulphur in earth ?
(a) $\frac{11}{50}$ (b) $\frac{2}{9}$ (c) $\frac{1}{45}$ (d) $\frac{2}{45}$
- What percent of 7.2 kg is 18 gms ?
(a) .025% (b) .25% (c) 2.5% (d) 25%
- 0.01 is what percent of 0.1 ? (S.S.C. 2000)
(a) $\frac{1}{100}$ (b) $\frac{1}{10}$ (c) 10 (d) 100
- What percent of Rs. 2650 is Rs. 1987.50 ? (Hotel Management, 2002)
(a) 60% (b) 75% (c) 80% (d) 90%

17. What percent of a day is 3 hours ? (R.R.B. 2003)
 (a) $12\frac{1}{2}\%$ (b) $16\frac{2}{3}\%$ (c) $18\frac{2}{3}\%$ (d) $22\frac{1}{2}\%$
18. It costs Re. 1 to photocopy a sheet of paper. However, 2% discount is allowed on all photocopies done after first 1000 sheets. How much will it cost to copy 5000 sheets of paper ? (IGNOU, 2003)
 (a) Rs. 3920 (b) Rs. 3980 (c) Rs. 4900 (d) Rs. 4920
19. A housewife saved Rs. 2.50 in buying an item on sale. If she spent Rs. 25 for the item, approximately how much percent she saved in the transaction ?
 (a) 8% (b) 9% (c) 10% (d) 11% (Section Officers', 2003)
20. How many litres of pure acid are there in 8 litres of a 20% solution ?
 (a) 1.4 (b) 1.5 (c) 1.6 (d) 2.4
21. Rajeev buys goods worth Rs. 6650. He gets a rebate of 6% on it. After getting the rebate, he pays sales tax @ 10%. Find the amount he will have to pay for the goods.
 (a) Rs. 6876.10 (b) Rs. 6999.20 (c) Rs. 6654 (d) Rs. 7000 (M.A.T. 2002)
22. Which one of the following shows the best percentage ? (Hotel Management, 1996)
 (a) $\frac{384}{540}$ (b) $\frac{425}{500}$ (c) $\frac{570}{700}$ (d) $\frac{480}{660}$
23. 5% of (25% of Rs. 1800) is
 (a) Rs. 5 (b) Rs. 17.50 (c) Rs. 20 (d) Rs. 25
24. $0.15\% \text{ of } 33\frac{1}{3}\% \text{ of } \text{Rs. } 10,000$ is (S.S.C. 2002)
 (a) Re. 0.05 (b) Rs. 5 (c) Rs. 105 (d) Rs. 150
25. 30% of 28% of 480 is the same as
 (a) 15% of 56% of 240 (b) 60% of 28% of 240
 (c) 60% of 56% of 240 (d) None of these
26. What is 25% of 25% equal to ?
 (a) 0.00625 (b) 0.0625 (c) 0.625 (d) 6.25
27. What percent is 3% of 5% ?
 (a) 15% (b) 30% (c) 50% (d) 60%
28. 4598 is 95% of ?
 (a) 4800 (b) 4840 (c) 4850 (d) 4880
29. $? \% \text{ of } 360 = 129.6$ (Bank P.O. 2002)
 (a) 36 (b) 64 (c) 72 (d) 77
30. $? \% \text{ of } 932 + 30 = 309.6$ (Bank P.O. 2003)
 (a) 25 (b) 30 (c) 35 (d) 40
31. $45\% \text{ of } 1500 + 35\% \text{ of } 1700 = ? \% \text{ of } 3175$ (Bank P.O. 2000)
 (a) 30 (b) 35 (c) 45 (d) None of these
32. $65\% \text{ of } ? = 20\% \text{ of } 422.50$ (Bank P.O. 2003)
 (a) 84.5 (b) 130 (c) 130.425 (d) 200
33. An agent gets a commission of 2.5% on the sales of cloth. If on a certain day, he gets Rs. 12.50 as commission, the cloth sold through him on that day is worth
 (a) Rs. 250 (b) Rs. 500 (c) Rs. 750 (d) Rs. 1250
34. If Rs. 2800 is $\frac{2}{7}$ percent of the value of a house, the worth of the house (in Rs.) is : (L.I.C. 2003)
 (a) 8,00,000 (b) 9,80,000 (c) 10,00,000 (d) 12,00,000

53. If 25% of a number is subtracted from a second number, the second number reduces to its five-sixth. What is the ratio of the first number to the second number ?
 (a) 1 : 3 (b) 2 : 3 (c) 3 : 2 (d) Data inadequate
 (S.B.I.P.O. 1999)
54. The difference of two numbers is 20% of the larger number. If the smaller number is 20, then the larger number is :
 (a) 25 (b) 45 (c) 50 (d) 80
 (S.S.C. 2000)
55. When any number is divided by 12, then dividend becomes $\frac{1}{4}$ th of the other number. By how much percent first number is greater than the second number ?
 (a) 150 (b) 200 (c) 300 (d) Data inadequate
 (Bank P.O. 2000)
56. If one number is 80% of the other and 4 times the sum of their squares is 656, then the numbers are :
 (a) 4, 5 (b) 8, 10 (c) 16, 20 (d) None of these
 (Hotel Management, 1998)
57. Two numbers A and B are such that the sum of 5% of A and 4% of B is two-third of the sum of 6% of A and 8% of B. Find the ratio of A : B.
 (M.B.A. 2002)
 (a) 2 : 3 (b) 1 : 1 (c) 3 : 4 (d) 4 : 3
58. Three candidates contested an election and received 1136, 7636 and 11628 votes respectively. What percentage of the total votes did the winning candidate get ?
 (a) 57% (b) 60% (c) 65% (d) 90%
 (I.M.T. 2002)
59. The population of a town increased from 1,75,000 to 2,62,500 in a decade. The average percent increase of population per year is :
 (C.B.I. 1997)
 (a) 4.37% (b) 5% (c) 6% (d) 8.75%
60. A student multiplied a number by $\frac{3}{5}$ instead of $\frac{5}{3}$. What is the percentage error in the calculation ?
 (S.S.C. 1999)
 (a) 34% (b) 44% (c) 54% (d) 64%
61. A tempo is insured to the extent of $\frac{4}{5}$ of its original value. If the premium on it at the rate of 1.3 percent amounts to Rs. 910, the original value of the tempo is :
 (a) Rs. 78,500 (b) Rs. 80,000 (c) Rs. 82,500 (d) Rs. 87,500
62. When 15% is lost in grinding wheat, a country can export 30 lakh tons of wheat. On the other hand, if 10% is lost in grinding, it can export 40 lakh tons of wheat. The production of wheat in the country is :
 (a) 20 lakh tons (b) 80 lakh tons (c) 200 lakh tons (d) 800 Jakh tons
 (S.B.I.P.O. 2000)
63. In a competitive examination in State A, 6% candidates got selected from the total appeared candidates. State B had an equal number of candidates appeared and 7% candidates got selected with 80 more candidates got selected than A. What was the number of candidates appeared from each State ?
 (S.B.I.P.O. 2000)
 (a) 7600 (b) 8000 (c) 8400 (d) Data inadequate
64. The price of a car is Rs. 3,25,000. It was insured to 85% of its price. The car was damaged completely in an accident and the insurance company paid 90% of the insurance. What was the difference between the price of the car and the amount received ?
 (T.O.G.I. 2003)
 (a) Rs. 32,500 (b) Rs. 48,750 (c) Rs. 76,375 (d) Rs. 81,250
 (Bank P.O. 2003)

65. Gauri went to the stationers and bought things worth Rs. 25, out of which 30 paise went on sales tax on taxable purchases. If the tax rate was 6%, then what was the cost of the tax free items? (M.A.T. 2003)
- (a) Rs. 15 (b) Rs. 15.70 (c) Rs. 19.70 (d) Rs. 20
66. A batsman scored 110 runs which included 3 boundaries and 8 sixes. What percent of his total score did he make by running between the wickets? (S.S.C. 2004)
- (a) 45% (b) $45\frac{5}{11}\%$ (c) $54\frac{6}{11}\%$ (d) 55%
67. After deducting a commission of 5%, a TV set costs Rs. 9595. Its marked price is : (S.S.C. 2003)
- (a) Rs. 10,000 (b) Rs. 10,075 (c) Rs. 10,100 (d) Rs. 10,500
68. A fruit seller had some apples. He sells 40% apples and still has 420 apples. Originally, he had : (S.S.C. 2003)
- (a) 588 apples (b) 600 apples (c) 672 apples (d) 700 apples
69. A person who spends $66\frac{2}{3}\%$ of his income is able to save Rs. 1200 per month. His monthly expenses (in Rs.) are : (S.S.C. 1999)
- (a) Rs. 1200 (b) Rs. 2400 (c) Rs. 3000 (d) Rs. 3200
70. In an examination, 35% of the students passed and 455 failed. How many students appeared for the examination? (S.S.C. 2000)
- (a) 490 (b) 700 (c) 845 (d) 1300
71. In a market survey, 20% opted for product A whereas 60% opted for product B. The remaining individuals were not certain. If the difference between those who opted for product B and those who were uncertain was 720, how many individuals were covered in the survey? (S.S.C. 2002)
- (a) 1440 (b) 1800 (c) 3600 (d) Data inadequate
72. A student has to obtain 33% of the total marks to pass. He got 125 marks and failed by 40 marks. The maximum marks are : (C.B.I. 2003)
- (a) 300 (b) 500 (c) 800 (d) 1000
73. In an election a candidate who gets 84% of the votes is elected by a majority of 476 votes. What is the total number of votes polled? (Hotel Management, 2003)
- (a) 672 (b) 700 (c) 749 (d) 848
74. In an election between two candidates, one got 55% of the total valid votes, 20% of the votes were invalid. If the total number of votes was 7500, the number of valid votes that the other candidate got, was : (R.R.B. 2003)
- (a) 2700 (b) 2900 (c) 3000 (d) 3100
75. At an election involving two candidates, 68 votes were declared invalid. The winning candidate secures 52% and wins by 98 votes. The total number of votes polled is : (S.S.C. 2003)
- (a) 2382 (b) 2450 (c) 2518 (d) None of these
76. 10% of the voters did not cast their vote in an election between two candidates. 10% of the votes polled were found invalid. The successful candidate got 54% of the valid votes and won by a majority of 1620 votes. The number of voters enrolled on the voters' list was : (S.S.C. 2003)
- (a) 25000 (b) 33000 (c) 35000 (d) 40000
77. 8% of the people eligible to vote are between 18 and 21 years of age. In an election, 85% of those eligible to vote, who were between 18 and 21, actually voted. In that election, the number of persons between 18 and 21, who actually voted, was what percent of those eligible to vote? (R.R.B. 1998)
- (a) 4.2 (b) 6.4 (c) 6.8 (d) 8
78. In an election, 30% of the voters voted for candidate A whereas 60% of the remaining voted for candidate B. The remaining voters did not vote. If the difference between

- those who voted for candidate A and those who did not vote was 1200, how many individuals were eligible for casting vote in that election ?
- (a) 10,000 (b) 45,000 (c) 60,000 (d) 72,000
79. Two tailors X and Y are paid a total of Rs. 550 per week by their employer. If X is paid 120 percent of the sum paid to Y, how much is Y paid per week ?
- (a) Rs. 200 (b) Rs. 250 (c) Rs. 300 (d) None of these
(N.I.E.T. 2000)
80. While purchasing one item costing Rs. 400, I had to pay the sales tax at 7% and on another costing Rs. 6400, the sales tax was 9%. What percent of the sales tax I had to pay, taking the two items together on an average ?
- (a) 8% (b) $8\frac{13}{17}\%$ (c) $8\frac{15}{17}\%$ (d) $8\frac{1}{2}\%$
81. A student secures 90%, 60% and 54% marks in test papers with 100, 150 and 200 respectively as maximum marks. The percentage of his aggregate is :
- (a) 64 (b) 68 (c) 70 (d) None of these
(Hotel Management, 1999)
82. 1100 boys and 700 girls are examined in a test; 42% of the boys and 30% of the girls pass. The percentage of the total who failed is :
- (a) 58% (b) $62\frac{2}{3}\%$ (c) 64% (d) 78%
83. In a certain school, 20% of students are below 8 years of age. The number of students above 8 years of age is $\frac{2}{3}$ of the number of students of 8 years age which is 48. What is the total number of students in the school ?
(Bank P.O. 2003)
- (a) 72 (b) 80 (c) 120 (d) 150 (e) None of these
84. In an examination, 5% of the applicants were found ineligible and 85% of the eligible candidates belonged to the general category. If 4275 eligible candidates belonged to other categories, then how many candidates applied for the examination ?
- (a) 30,000 (b) 35,000 (c) 37,000 (d) None of these
(Hotel Management, 1998)
85. Two students appeared at an examination. One of them secured 9 marks more than the other and his marks was 56% of the sum of their marks. The marks obtained by them are :
(S.S.C. 2004)
- (a) 39, 30 (b) 41, 32 (c) 42, 33 (d) 43, 34
86. If x is 90% of y , then what percent of x is y ?
(S.S.C. 1997)
- (a) 90% (b) $101\frac{1}{9}\%$ (c) $111\frac{1}{9}\%$ (d) 190%
87. $x\%$ of y is $y\%$ of :
- (a) x (b) $100x$ (c) $\frac{x}{100}$ (d) $\frac{y}{100}$
88. If 20% of $a = b$, then $b\%$ of 20 is the same as :
(Hotel Management, 1998)
- (a) 4% of a (b) 5% of a (c) 20% of a (d) None of these
89. If $x\%$ of y is the same as $\frac{4}{5}$ of 80, then the value of xy is :
(a) 320 (b) 400 (c) 640 (d) None of these
90. If $x\%$ of y is 100 and $y\%$ of z is 200, then find a relation between x and z .
- (a) $z = \frac{x}{2}$ (b) $z = 2x$ (c) $z = \frac{x}{4}$ (d) $z = 4x$
(S.S.C. 2002)

91. If $p\%$ of p is 36, then p is equal to : (S.S.C. 2000)
- 15
 - 60
 - 600
 - 3600
92. If $x\%$ of y is equal to z , what percent of z is x ? (S.S.C. 1999)
- $\frac{y^2}{100}$
 - $\frac{y}{100^2}$
 - $\frac{100}{y}$
 - $\frac{100^2}{y}$
93. If x is 80% of y , then what percent of $2x$ is y ? (C.B.I. 1998)
- 40%
 - $62\frac{1}{2}\%$
 - $66\frac{2}{3}\%$
 - 80%
94. Subtracting 6% of x from x is equivalent to multiplying x by how much? (S.S.C. 2001)
- 0.094
 - 0.94
 - 9.4
 - 94
95. $(x\% \text{ of } y + y\% \text{ of } x) = ?$
- $x\% \text{ of } y$
 - $y\% \text{ of } x$
 - 2% of xy
 - $xy\% \text{ of } 3$
96. If A is 150 percent of B, then B is what percent of $(A + B)$? (S.S.C. 2000)
- $33\frac{1}{3}\%$
 - 40%
 - $66\frac{2}{3}\%$
 - 75%
97. If 8% of $x = 4\% \text{ of } y$, then 20% of x is : (S.S.C. 2001)
- 10% of y
 - 16% of y
 - 80% of y
 - None of these
98. If 20% of A = B and 40% of B = C, then 60% of $(A + B)$ is : (S.S.C. 2000)
- 30% of C
 - 60% of C
 - 75% of C
 - None of these
99. If $x\%$ of a is the same as $y\%$ of b , then $z\%$ of b is : (S.S.C. 2001)
- $\frac{xy}{z}\% \text{ of } a$
 - $\frac{yz}{x}\% \text{ of } a$
 - $\frac{xz}{y}\% \text{ of } a$
 - None of these
100. If $A = x\% \text{ of } y$ and $B = y\% \text{ of } x$, then which of the following is true? (Bank P.O. 2003)
- A is smaller than B.
 - A is greater than B.
 - Relationship between A and B cannot be determined.
 - If x is smaller than y , then A is greater than B.
 - None of these
101. $33\frac{1}{3}\%$ of a man's daily output is equal to 50% of a second man's daily output. If the second man turns out 1500 screws daily, then the first man's output in terms of making screws is : (S.S.C. 2001)
- 500
 - 1000
 - 2000
 - 2250
- Directions (Questions 102 to 106) : A survey of magazine reading habits of the people living in five cities P, Q, R, S and T is summarised in a table given below. The Column I in the table gives percentage of magazine-readers in each city who read only one magazine a week. The Column II gives the total number of magazine-readers who read two or more magazines a week. Read the table and then answer these questions: (S.S.C. 1999)
- | City | I | II |
|------|----|------|
| P | 75 | 6000 |
| Q | 80 | 3500 |
| R | 60 | 3000 |
| S | 55 | 2700 |
| T | 25 | 4200 |

102. The city with the lowest number of magazine-readers is : (a) Q (b) R (c) S (d) T

103. Which city has the highest number of magazine-readers who read only one magazine a week ?
 (a) P (b) Q (c) R (d) S

104. The highest number of magazine-readers in any given city is :
 (a) 17500 (b) 18000 (c) 24000 (d) 30000

105. How many magazine-readers in city Q read only one magazine a week ?
 (a) 14000 (b) 18000 (c) 12500 (d) 16500

106. The total number of all the magazine-readers in the five cities who read only one magazine a week is :
 (a) 19400 (b) 24000 (c) 41200 (d) 42000

107. Rohit spends 40% of his salary on food, 20% on house rent, 10% on entertainment and 10% on conveyance. If his savings at the end of a month are Rs. 1500, then his monthly salary is : (S.S.C. 2003)
 (a) Rs. 6000 (b) Rs. 7500 (c) Rs. 8000 (d) Rs. 10,000

108. Kunal spent Rs. 35,000 in buying raw materials, Rs. 40,000 in buying machinery and 20% of the total amount he had as cash with him. What was the total amount ?
 (a) Rs. 80,000 (b) Rs. 85,750 (c) Rs. 90,000 (d) Rs. 93,750

109. Gaurav spends 30% of his monthly income on food articles, 40% of the remaining on conveyance and clothes and saves 50% of the remaining. If his monthly salary is Rs. 18,400, how much money does he save every month ?
 (a) Rs. 3624 (b) Rs. 3864 (c) Rs. 4264 (d) Rs. 5888

110. A spider climbed $62\frac{1}{2}\%$ of the height of the pole in one hour and in the next hour it covered $12\frac{1}{2}\%$ of the remaining height. If the height of the pole is 192 m, then distance climbed in second hour is : (Section Officers', 2003)
 (a) 3 m (b) 5 m (c) 7 m (d) 9 m

111. A man spends 35% of his income on food, 25% on children's education and 80% of the remaining on house rent. What percent of his income he is left with ?
 (a) 8% (b) 10% (c) 12% (d) 14%

112. From the salary of an officer, 10% is deducted as house rent, 20% of the rest, he spends on conveyance, 20% of the rest he pays as income tax and 10% of the balance, he spends on clothes. Then, he is left with Rs. 15,552. Find his total salary.
 (a) Rs. 25,000 (b) Rs. 30,000 (c) Rs. 35,000 (d) Rs. 40,000 (L.I.C.A.A.O. 2003)

113. Aman gave 40% of the amount he had to Rohan. Rohan in turn gave one-fourth of what he received from Aman to Sahil. After paying Rs. 200 to the taxi driver out of the amount he got from Rohan, Sahil now has Rs. 600 left with him. How much amount did Aman have ? (Bank P.O. 2000)
 (a) Rs. 4000 (b) Rs. 8000 (c) Rs. 12,000 (d) Data inadequate

114. Sameer spends 24% of his monthly income on food and 15% on the education of his children. Of the remaining salary, he spends 25% on entertainment and 20% on conveyance. He is now left with Rs. 10,736. What is the monthly salary of Sameer ?
 (a) Rs. 27,600 (b) Rs. 28,000 (c) Rs. 31,200 (d) Rs. 32,000 (Bank P.O. 2004)

115. 405 sweets were distributed equally among children in such a way that the number of sweets received by each child is 20% of the total number of children. How many sweets did each child receive ? (Bank P.O. 2003)
 (a) 9 (b) 15 (c) 18 (d) 45

116. The sum of the number of boys and girls in a school is 150. If the number of boys is x , then the number of girls becomes $x\%$ of the total number of students. The number of boys is : (S.S.C. 2002)
- (a) 40 (b) 50 (c) 60 (d) 90
117. In an examination of n questions, a student replied 15 out of the first 20 questions correctly. Of the remaining questions, he answered one-third correctly. All the questions have the same credit. If the student gets 50% marks, the value of n is : (S.S.C. 2002)
- (a) 20 (b) 40 (c) 50 (d) 100
118. The salaries of A and B together amount to Rs. 2000. A spends 95% of his salary and B, 85% of his. If now, their savings are the same, what is A's salary ? (S.S.C. 2002)
- (a) Rs. 750 (b) Rs. 1250 (c) Rs. 1500 (d) Rs. 1600
119. A's marks in Biology are 20 less than 25% of the total marks obtained by him in Biology, Maths and Drawing. If his marks in Drawing be 50, what are his marks in Maths ? (S.S.C. 2002)
- (a) 40 (b) 45 (c) 50 (d) Cannot be determined
120. A salesman is allowed $5\frac{1}{2}\%$ discount on the total sales made by him plus a bonus of $\frac{1}{2}\%$ on the sales over Rs. 10,000. If his total earnings were Rs. 1990, then his total sales (in Rs.) were : (C.B.I. 2003)
- (a) 30,000 (b) 32,000 (c) 34,000 (d) 35,000
121. In an examination, there are three papers and a candidate has to get 35% of the total to pass. In one paper, he gets 62 out of 150 and in the second 35 out of 150. How much must he get, out of 180, in the third paper to just qualify for a pass ? (R.R.B. 2002)
- (a) 60.5 (b) 68 (c) 70 (d) 71
122. In a History examination, the average for the entire class was 80 marks. If 10% of the students scored 95 marks and 20% scored 90 marks, what was the average marks of the remaining students of the class ? (D.M.R.C. 2003)
- (a) 65.5 (b) 72.5 (c) 75 (d) 85
123. A scored 30% marks and failed by 15 marks. B scored 40% marks and obtained 35 marks more than those required to pass. The pass percentage is : (S.S.C. 2003)
- (a) 33% (b) 38% (c) 43% (d) 46%
124. The price of a table is Rs. 400 more than that of a chair. If 6 tables and 6 chairs together cost Rs. 4800, by what percent is the price of the chair less than that of the table ? (S.S.C. 2003)
- (a) $33\frac{1}{3}\%$ (b) 50% (c) $66\frac{2}{3}\%$ (d) None of these
125. In a recent survey, 40% houses contained two or more people. Of those houses containing only one person, 25% were having only a male. What is the percentage of all houses, which contain exactly one female and no males ? (S.B.I.P.O. 2000)
- (a) 15 (b) 40 (c) 75 (d) Can't be determined (e) None of these
126. In a city, 40% of the people are illiterate and 60% are poor. Among the rich, 10% are illiterate. What percentage of the poor population is illiterate ? (S.S.C. 2003)
- (a) 36% (b) 40% (c) 60% (d) None of these
127. Of the 1000 inhabitants of a town, 60% are males of whom 20% are literate. If, of all the inhabitants, 25% are literate, then what percent of the females of the town are literate ? (M.A.T. 2003)
- (a) 22.5 (b) 27.5 (c) 32.5 (d) 37.5

128. $37\frac{1}{2}\%$ of the candidates in an examination were girls, 75% of the boys and $62\frac{1}{2}\%$ of the girls passed and 342 girls failed. The number of boys failed was :
 (a) 350 (b) 360 (c) 370 (d) 380
 (S.S.C. 2003)
129. $\frac{5}{9}$ part of the population in a village are males. If 30% of the males are married, the percentage of unmarried females in the total population is :
 (a) 20% (b) $27\frac{7}{9}\%$ (c) 40% (d) 70%
130. In a city, 35% of the population is composed of migrants, 20% of whom are from rural areas. Of the local population, 48% is female while this figure for rural and urban migrants is 30% and 40% respectively. If the total population of the city is 728400, what is its female population ?
 (a) 324138 (b) 349680 (c) 509940 (d) None of these
131. The boys and girls in a college are in the ratio 3 : 2. If 20% of the boys and 25% of the girls are adults, the percentage of students who are not adults is :
 (a) 58% (b) 67.5% (c) 78% (d) 82.5%
132. A man bought a house for Rs. 5 lakhs and rents it. He puts $12\frac{1}{2}\%$ of each month's rent aside for repairs, pays Rs. 1660 as annual taxes and realises 10% on his investment thereafter. The monthly rent of the house is :
 (a) Rs. 2460 (b) Rs. 2500 (c) Rs. 4920 (d) Rs. 5000
133. A debtor can pay 87 paise in the rupee, but if his creditors would take 20% of his debts, he could pay them and have Rs. 42 left. His debts and assets respectively are :
 (a) Rs. 400, Rs. 520 (b) Rs. 500, Rs. 521 (c) Rs. 600, Rs. 522 (d) Rs. 1000, Rs. 525
134. If the price of a book is first decreased by 25% and then increased by 20%, then the net change in the price will be :
 (a) No change (b) 5% increase (c) 5% decrease (d) 10% decrease
 (S.S.C. 2003)
135. The price of a shirt is increased by 15% and then reduced by 15%. The final price of the shirt :
 (a) does not change (b) increases by 2.25%
 (c) decreases by 2.25% (d) None of these
 (Hotel Management, 2002)
136. A number is decreased by 10% and then increased by 10%. The number so obtained is 10 less than the original number. What was the original number ?
 (S.S.C. 1999)
 (a) 1000 (b) 1050 (c) 1500 (d) 2000
137. The price of an article was increased by $r\%$. Later the new price was decreased by $r\%$. If the latest price was Re. 1, then the original price was :
 (S.S.C. 2004)
 (a) Re. 1 (b) $\text{Rs. } \left(\frac{1 - r^2}{100} \right)$
 (c) $\text{Rs. } \frac{\sqrt{1 - r^2}}{100}$ (d) $\text{Rs. } \left(\frac{10000}{10000 - r^2} \right)$
138. Peter could save 10% of his income. But two years later when his income is increased by 20%, he could save the same amount only as before. By how much percent has his expenditure increased ?
 (R.R.B. 2003)
 (a) 22% (b) $22\frac{2}{9}\%$ (c) $23\frac{1}{3}\%$ (d) 24%

139. Madan pays income tax at the rate of 10%. If his income increased by 10% and his tax rate increases to 15%, his net income would increase by Rs. 350. What is Madan's income ?
 (a) Rs. 8000 (b) Rs. 10,000 (c) Rs. 12,000 (d) Rs. 14,000
140. Mr. X, a businessman had the income in the year 2000, such that he earned a profit of 20% on his investment in the business. In the year 2001, his investment was less by Rs. 5000 but still had the same income (Income = Investment + Profit) as that in 2000. Thus, the percent profit earned in 2001 increased by 6%. What was his investment in 2000 ?
 (S.B.I.P.O. 2001)
 (a) Rs. 1,02,000 (b) Rs. 1,05,000 (c) Rs. 1,50,500
 (d) Data inadequate (e) None of these
141. What percent decrease in salaries would exactly cancel out the 20 percent increase ?
 (a) $16\frac{2}{3}\%$ (b) 18% (c) 20% (d) $33\frac{1}{3}\%$
 (S.S.C. 2000)
142. A number is increased by 20% and then again by 20%. By what percent should the increased number be reduced so as to get back the original number ? (S.S.C. 2004)
 (a) $19\frac{11}{31}\%$ (b) $30\frac{5}{9}\%$ (c) 40% (d) 44%
143. The price of a T.V. set is decreased by 25% as a result of which the sale increased by 20%. What will be the effect on the total revenue of the shop ? (Bank P.O. 2003)
 (a) No effect (b) 5% decrease (c) 5% increase
 (d) 10% increase (e) None of these
144. The price of tea being increased by 20%, a man reduces his consumption by 20%. By how much percent will his expenses for tea be decreased ? (S.S.C. 2003)
 (a) 2% (b) 4% (c) 6% (d) 8%
145. Entry fee in an exhibition was Re. 1. Later, this was reduced by 25% which increased the sale by 20%. The percentage increase in the number of visitors is
 (a) 54% (b) 57% (c) 60% (d) 66%
146. The income of a broker remains unchanged though the rate of commission is increased from 4% to 5%. The percentage of slump in business is :
 (a) 1% (b) 8% (c) 20% (d) 80%
147. In a fraction, if numerator is increased by 40% and denominator is increased by 80%, then what fraction of the original is the new fraction ? (S.B.I.P.O. 2000)
 (a) $\frac{1}{2}$ (b) $\frac{7}{9}$ (c) $\frac{7}{18}$ (d) Data inadequate
148. If the price of petrol is increased by 30%, by how much percent a car owner must reduce his consumption in order to maintain the same budget ? (S.S.C. 2000)
 (a) 21% (b) $21\frac{1}{3}\%$ (c) $23\frac{1}{13}\%$ (d) 33%
149. The price of wheat falls by 16%. By what percentage a person can increase the consumption of wheat so that his overall budget does not change ? (M.B.A. 2002)
 (a) 16% (b) 18% (c) 18.5% (d) 19%
150. The price of oil is increased by 25%. If the expenditure is not allowed to increase, the ratio between the reduction in consumption and the original consumption is
 (a) 1 : 3 (b) 1 : 4 (c) 1 : 5 (d) 1 : 6
151. If the price of sugar rises from Rs. 6 per kg to Rs. 7.50 per kg, a person, to have no increase in his expenditure on sugar, will have to reduce his consumption of sugar by
 (a) 15% (b) 20% (c) 25% (d) 30%

152. Prices register an increase of 10% on foodgrains and 15% on other items of expenditure. If the ratio of an employee's expenditure on foodgrains and other items be 2 : 5, by how much should his salary be increased in order that he may maintain the same level of consumption as before, his present salary being Rs. 2590 ? (Bank P.O. 1999)
- (a) Rs. 323.75 (b) Rs. 350 (c) Rs. 360.50 (d) None of these
153. A district has 64000 inhabitants. If the population increases at the rate of $2\frac{1}{2}\%$ per annum, then the number of inhabitants at the end of 3 years will be (S.S.C. 2003)
- (a) 68911 (b) 68921 (c) 69200 (d) 70000
154. If inflation increases at a rate of 8% p.a., what will a Rs. 20 article cost at the end of two years ? (Bank P.O. 1999)
- (a) Between Rs. 20 and Rs. 21 (b) Between Rs. 21 and Rs. 22
 (c) Between Rs. 22 and Rs. 23 (d) Between Rs. 23 and Rs. 24
155. The population of a town was 1,60,000 three years ago. If it increased by 3%, 2.5% and 5% respectively in the last three years, then the present population is : (IGNOU, 2003)
- (a) 1,77,000 (b) 1,77,366 (c) 1,77,461 (d) 1,77,596
156. The population of a town 2 years ago was 62,500. Due to migration to big cities, it decreases every year at the rate of 4%. The present population of the town is : (S.S.C. 2004)
- (a) 56,700 (b) 57,600 (c) 58,800 (d) 60,000
157. Depreciation applicable to an equipment is 20%. The value of the equipment 3 years from now will be less by : (M.B.A. 2002)
- (a) 45% (b) 48.8% (c) 51.2% (d) 60%
158. The population of a town increases by 5% annually. If its population in 2001 was 1,38,915, what it was in 1998 ? (R.R.B. 2001)
- (a) 1,00,000 (b) 1,08,000 (c) 1,10,000 (d) 1,20,000
159. The value of a machine depreciates at the rate of 10% every year. It was purchased 3 years ago. If its present value is Rs. 8748, its purchase price was : (A.A.O. Exam, 2003)
- (a) Rs. 10,000 (b) Rs. 11,372 (c) Rs. 12,000 (d) Rs. 12,500
160. In the month of January, the Railway Police caught 4000 ticketless travellers. In February, the number rose by 5%. However, due to constant vigil by the Police and the Railway staff, the number reduced by 5% and in April it further reduced by 10%. The total number of ticketless travellers caught in the month of April was : (M.B.A. 1999)
- (a) 3125 (b) 3255 (c) 3575 (d) 3591
161. The population of a variety of tiny bush in an experimental field increased by 10% in the first year, increased by 8% in the second year but decreased by 10% in the third year. If the present number of bushes in the experimental field is 26730, then the number of bushes in the beginning was : (M.A.T. 2002)
- (a) 25000 (b) 27000 (c) 28000 (d) 24600
162. The production of a company has ups and downs every year. The production increases for two consecutive years consistently by 15% and in the third year it decreases by 10%. Again in the next two years it increases by 15% each year and decreases by 10% in the third year. If we start counting from the year 1996, approximately what will be the effect on production of the company in 2002 ? (Bank P.O. 2002)
- (a) 27% increase (b) 32% increase (c) 37% increase
 (d) 42% increase (e) 52% increase

163. The present population of a country estimated to be 10 crores is expected to increase to 13.31 crores during the next three years. The uniform rate of growth is :
 (a) 8% (b) 10% (c) 12.7% (d) 15%
164. A building worth Rs. 1,33,100 is constructed on land worth Rs. 72,900. After how many years will the value of both be the same if land appreciates at 10% p.a. and building depreciates at 10% p.a.?
 (a) $1\frac{1}{2}$ (b) 2 (c) $2\frac{1}{2}$ (d) 3
165. The population of a town increases 4% annually but is decreased by emigration annually to the extent of $(1/2)\%$. What will be the increase percent in 3 years?
 (a) 9.8 (b) 10 (c) 10.5 (d) 10.8
166. The current birth rate per thousand is 32, whereas corresponding death rate is 11 per thousand. The net growth rate in terms of population increase in percent is given by:
 (a) 0.0021% (b) 0.021% (c) 2.1% (d) 21%
167. The total population of a village is 5000. The number of males and females increases by 10% and 15% respectively and consequently the population of the village becomes 5600. What was the number of males in the village? (Bank P.O. 2003)
 (a) 2000 (b) 2500 (c) 3000 (d) 4000
168. A's income is 25% more than B's income. B's income in terms of A's income is :
 (a) 75% (b) 80% (c) 90% (d) 96%
169. A's salary is 50% more than B's. How much percent is B's salary less than A's?
 (a) $33\frac{1}{3}\%$ (b) $33\frac{1}{4}\%$ (c) $33\frac{1}{3}\%$ (d) $33\frac{1}{2}\%$
 (S.S.C. 2002)
170. If A's height is 40% less than that of B, how much percent B's height is more than that of A?
 (a) $33\frac{1}{3}\%$ (b) 40% (c) 60% (d) $66\frac{2}{3}\%$
 (S.S.C. 2000)
171. p is six times as large as q. The percent that q is less than p, is :
 (a) $16\frac{2}{3}\%$ (b) 60 (c) $83\frac{1}{3}\%$ (d) 90
172. Two numbers are less than a third number by 30% and 37% respectively. How much percent is the second number less than the first? (S.S.C. 2002)
 (a) 3% (b) 4% (c) 7% (d) 10%
173. Two numbers are respectively $12\frac{1}{2}\%$ and 25% more than a third number. The first number as a percentage of the second number is : (C.B.I. 2003)
 (a) 50 (b) 60 (c) 75 (d) 90
174. A's salary is 40% of B's salary which is 25% of C's salary. What percentage of C's salary is A's salary? (M.B.A. 2003)
 (a) 5% (b) 10% (c) 15% (d) 20%
175. 5% of income of A is equal to 15% of income of B and 10% of income of B is equal to 20% of income of C. If C's income is Rs. 2000, then the total income of A, B and C is :
 (a) Rs. 6000 (b) Rs. 14,000 (c) Rs. 18,000 (d) Rs. 20,000
176. Peter earned 40% more money than Albert. Albert earned 20% less than Michael. Peter earned more than Michael by : (S.S.C. 2003)
 (a) 10% (b) 12% (c) 20% (d) 25%

177. Amit's monthly income is 30% more than that of Raunaq. Raunaq's monthly income is 20% less than that of Deepak. If the difference between the monthly incomes of Amit and Deepak is Rs. 800, what is the monthly income of Raunaq ? (Bank P.O. 1999)
- (a) Rs. 12,000 (b) Rs. 16,000 (c) Rs. 20,000
 (d) Data inadequate (e) None of these
178. In an examination in which full marks were 800, A gets 20% more than B, B gets 20% more than C, and C gets 15% less than D. If A got 576, what percentage of full marks did D get (approximately) ? (R.R.B. 1998)
- (a) 45.7 (b) 51.2 (c) 58.8 (d) 61.7
179. In an examination, the percentage of students qualified to the number of students appeared from school A is 70%. In school B, the number of students appeared is 20% more than the students appeared from school A and the number of students qualified from school B is 50% more than the students qualified from school A. What is the percentage of students qualified to the number of students appeared from school B ? (Bank P.O. 1999)
- (a) 30% (b) 70% (c) 78.5% (d) 87.5%
180. Fresh fruit contains 68% water and dry fruit contains 20% water. How much dry fruit can be obtained from 100 kg of fresh fruits ? (S.S.C. 2004)
- (a) 32 kg (b) 40 kg (c) 52 kg (d) 80 kg
181. A large watermelon weighs 20 kg with 96% of its weight being water. It is allowed to stand in the sun and some of the water evaporates so that only 95% of its weight is water. Its reduced weight will be :
- (a) 16 kg (b) 16.5 kg (c) 17 kg (d) 18 kg
182. How much pure alcohol has to be added to 400 ml of a solution containing 15% alcohol to change the concentration of alcohol in the mixture to 32% ? (S.S.C. 2003)
- (a) 60 ml (b) 68 ml (c) 100 ml (d) 128 ml
183. Milk contains 5% water. What quantity of pure milk should be added to 10 litres of milk to reduce this to 2% ? (Bank P.O. 2003)
- (a) 5 litres (b) 7 litres (c) 15 litres
 (d) Cannot be determined (e) None of these
184. The quantity of water (in ml) needed to reduce 9 ml shaving lotion containing 50% alcohol to a lotion containing 30% alcohol, is : (a) 4 (b) 5 (c) 6 (d) 7
185. To a sugar solution of 3 litres containing 40% sugar, one litre of water is added. The percentage of sugar in the new solution is : (a) $13\frac{1}{3}\%$ (b) 15% (c) 30% (d) 33%
186. One type of liquid contains 20% water and the second type of liquid contains 35% of water. A glass is filled with 10 parts of first liquid and 4 parts of second liquid. The percentage of water in the new mixture in the glass is : (C.B.I. 1997)
- (a) 20% (b) $24\frac{2}{7}\%$ (c) 37% (d) 40%
187. In some quantity of ghee, 60% is pure ghee and 40% is vanaspati. If 10 kg of pure ghee is added, then the strength of vanaspati ghee becomes 20%. The original quantity was : (Hotel Management, 2003)
- (a) 10 kg (b) 15 kg (c) 20 kg (d) 25 kg
188. The weight of the container alone is 25% of the container filled with a certain fluid. When some fluid is removed, the weight of the container and remaining fluid is 50% of the original total weight. What fractional part of the liquid has been removed ? (D.M.R.C. 2003)
- (a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{2}{3}$ (d) $\frac{3}{4}$

189. From a container having pure milk, 20% is replaced by water and the process is repeated thrice. At the end of the third operation, the milk is : (S.S.C. 2003)
 (a) 40% pure (b) 50% pure (c) 51.2% pure (d) 58.8% pure
190. An empty fuel tank of a car was filled with A type petrol. When the tank was half-empty, it was filled with B type petrol. Again when the tank was half-empty, it was filled with A type petrol. When the tank was half-empty again, it was filled with B type petrol. What is the percentage of A type petrol at present in the tank ?
 (a) 33.5% (b) 37.5% (c) 40% (d) 50%
 (Bank P.O. 2003)
191. A bag contains 600 coins of 25 p denomination and 1200 coins of 50 p denomination. If 12% of 25 p coins and 24% of 50 p coins are removed, the percentage of money removed from the bag is nearly :
 (a) 15.6% (b) 17.8% (c) 21.6% (d) 30%
192. The price of rice is reduced by 2%. How many kilograms of rice can now be bought for the money which was sufficient to buy 49 kg of rice earlier ? (S.S.C. 2004)
 (a) 48 kg (b) 49 kg (c) 50 kg (d) 51 kg
193. A reduction of 21% in the price of wheat enables a person to buy 10.5 kg more for Rs. 100. What is the reduced price per kg ?
 (a) Rs. 2 (b) Rs. 2.25 (c) Rs. 2.30 (d) Rs. 2.50
194. Due to an increase of 30% in the price of eggs, 3 eggs less are available for Rs. 7.80. The present rate of eggs per dozen is : (N.I.E.T. 1997)
 (a) Rs. 8.64 (b) Rs. 8.88 (c) Rs. 9.36 (d) Rs. 10.40
195. The price of sugar having gone down by 10%, Sharad can buy 6.2 kg more for Rs. 279. The difference between the original and the reduced price (per kg) is :
 (a) Re. 0.50 (b) Re. 1 (c) Rs. 1.50 (d) Rs. 4.50
196. In an examination, 34% of the students failed in Mathematics and 42% failed in English. If 20% of the students failed in both the subjects, then the percentage of students who passed in both the subjects was : (S.S.C. 2003)
 (a) 44 (b) 50 (c) 54 (d) 56
197. 40% of the people read newspaper X, 50% read newspaper Y and 10% read both the papers. What percentage of the people read neither newspaper ?
 (a) 10% (b) 15% (c) 20% (d) 25%
198. Out of 450 students of a school, 325 play football, 175 play cricket and 50 neither play football nor cricket. How many students play both football and cricket ?
 (a) 50 (b) 75 (c) 100 (d) 225
 (S.S.C. 2004)
199. In a hotel, 60% had vegetarian lunch while 30% had non-vegetarian lunch and 15% had both types of lunch. If 96 people were present, how many did not eat either type of lunch ? (S.S.C. 2000)
 (a) 20 (b) 24 (c) 26 (d) 28
200. There are 600 boys in a hostel. Each plays either hockey or football or both. If 75% play hockey and 45% play football, how many play both ?
 (a) 48 (b) 60 (c) 80 (d) 120
201. In a certain office, 72% of the workers prefer tea and 44% prefer coffee. If each of them prefers tea or coffee and 40 like both, the total number of workers in the office is :
 (a) 200 (b) 240 (c) 250 (d) 320
202. In an examination, 65% students passed in Civics and 60% in History, 40% passed in both of these subjects. If 90 students failed in History and Civics both, then what is the total number of students ? (R.R.B. 2003)
 (a) 600 (b) 650 (c) 700 (d) 750

203. In an examination, 35% candidates failed in one subject and 42% failed in another subject while 15% failed in both the subjects. If 2500 candidates appeared at the examination, how many passed in either subject but not in both?

(a) 325 (b) 1175 (c) 2125 (d) None of these

ANSWERS

1. (d) 2. (d) 3. (a) 4. (d) 5. (a) 6. (b) 7. (c) 8. (b) 9. (c)
10. (d) 11. (b) 12. (d) 13. (b) 14. (d) 15. (c) 16. (b) 17. (a) 18. (d)
19. (b) 20. (c) 21. (a) 22. (b) 23. (c) 24. (b) 25. (b) 26. (b) 27. (d)
28. (b) 29. (a) 30. (b) 31. (d) 32. (b) 33. (b) 34. (b) 35. (c) 36. (c)
37. (d) 38. (d) 39. (e) 40. (b) 41. (b) 42. (b) 43. (d) 44. (a) 45. (c)
46. (b) 47. (a) 48. (c) 49. (d) 50. (a) 51. (d) 52. (a) 53. (b) 54. (a)
55. (b) 56. (b) 57. (d) 58. (a) 59. (b) 60. (b) 61. (d) 62. (c) 63. (b)
64. (c) 65. (c) 66. (b) 67. (c) 68. (d) 69. (b) 70. (b) 71. (b) 72. (b)
73. (b) 74. (a) 75. (c) 76. (a) 77. (c) 78. (c) 79. (b) 80. (c) 81. (a)
82. (b) 83. (e) 84. (a) 85. (c) 86. (c) 87. (a) 88. (a) 89. (d) 90. (b)
91. (b) 92. (d) 93. (b) 94. (b) 95. (c) 96. (b) 97. (a) 98. (d) 99. (c)
100. (c) 101. (d) 102. (d) 103. (a) 104. (c) 105. (a) 106. (c) 107. (b) 108. (d)
109. (b) 110. (d) 111. (a) 112. (b) 113. (b) 114. (d) 115. (a) 116. (c) 117. (c)
118. (c) 119. (d) 120. (c) 121. (d) 122. (c) 123. (a) 124. (c) 125. (e) 126. (c)
127. (c) 128. (d) 129. (b) 130. (d) 131. (c) 132. (c) 133. (c) 134. (d) 135. (c)
136. (a) 137. (d) 138. (b) 139. (b) 140. (b) 141. (a) 142. (b) 143. (e) 144. (b)
145. (c) 146. (c) 147. (b) 148. (c) 149. (d) 150. (c) 151. (b) 152. (d) 153. (b)
154. (d) 155. (b) 156. (b) 157. (b) 158. (d) 159. (c) 160. (d) 161. (a) 162. (c)
163. (b) 164. (d) 165. (d) 166. (c) 167. (c) 168. (b) 169. (c) 170. (d) 171. (c)
172. (d) 173. (d) 174. (b) 175. (c) 176. (b) 177. (b) 178. (c) 179. (d) 180. (b)
181. (a) 182. (c) 183. (c) 184. (c) 185. (c) 186. (b) 187. (a) 188. (c) 189. (c)
190. (b) 191. (c) 192. (c) 193. (a) 194. (a) 195. (a) 196. (a) 197. (c) 198. (c)
199. (b) 200. (d) 201. (c) 202. (a) 203. (b)

SOLUTIONS

1. $5 : 4 = \frac{5}{4} = \left(\frac{5}{4} \times 100 \right)\% = 125\%$.
2. $3.5 = \frac{35}{10} = \left(\frac{35}{10} \times 100 \right)\% = 350\%$.
3. $\frac{1}{2}\% = \left(\frac{1}{2} \times \frac{1}{100} \right) = \frac{0.5}{100} = 0.005$.
4. 15% of Rs. 34 = Rs. $\left(\frac{15}{100} \times 34 \right) = \text{Rs. } 5.10$.
5. $63\% \text{ of } 3\frac{4}{7} = \left(\frac{63}{100} \times \frac{25}{7} \right) = \frac{4}{9} = 2.25$.
6. Let 88% of 370 + 24% of 210 = $x = 118$.
Then, $x = \left(\frac{88}{100} \times 370 \right) + \left(\frac{24}{100} \times 210 \right) - 118 = 325.60 + 50.40 - 118 = 376 - 118 = 258$.

7. Given expression = $\left(\frac{860}{100} \times 50 + \frac{50}{100} \times 860 \right) = 430 + 430 = 860.$
8. Given expression = $\left(\frac{45}{100} \times 750 \right) - \left(\frac{25}{100} \times 480 \right) = (337.50 - 120) = 217.50.$
9. Let 40% of 1640 + x = 35% of 980 + 150% of 850
 Then, $x = 35\% \text{ of } 980 + 150\% \text{ of } 850 - 40\% \text{ of } 1640$
 $= \left(\frac{35}{100} \times 980 + \frac{150}{100} \times 850 \right) - \left(\frac{40}{100} \times 1640 \right) = (343 + 1275 - 656)$
 $= (1618 - 656) = 962.$
10. Let 218% of 1674 = $x \times 1800$. Then, $x = \left(\frac{218}{100} \times 1674 \times \frac{1}{1800} \right) = 2.0274.$
11. 60% of 264 = $\left(\frac{60}{100} \times 264 \right) = 158.40$; 10% of 44 = $\left(\frac{10}{100} \times 44 \right) = 4.40$;
 15% of 1056 = $\left(\frac{15}{100} \times 1056 \right) = 158.40$; 30% of 132 = $\left(\frac{30}{100} \times 132 \right) = 39.60$.
 $\therefore 60\% \text{ of } 264 = 15\% \text{ of } 1056.$
12. Pass percentage = $\left(\frac{252}{270} \times 100 \right)\% = \frac{280}{3}\% = 93\frac{1}{3}\%.$
13. Required percentage = $\left(\frac{5}{2250} \times 100 \right)\% = \frac{2}{9}\%.$
14. Required percentage = $\left(\frac{18}{7200} \times 100 \right)\% = \frac{1}{4}\% = 0.25\%.$
15. Required percentage = $\left(\frac{0.01}{0.1} \times 100 \right)\% = \left(\frac{1}{10} \times 100 \right)\% = 10\%.$
16. Required percentage = $\left(\frac{1987.50}{2650} \times 100 \right)\% = \left(\frac{19875}{265} \times \frac{1}{100} \times 100 \right)\% = 75\%.$
17. Required percentage = $\left(\frac{3}{24} \times 100 \right)\% = \frac{25}{2}\% = 12\frac{1}{2}\%.$
18. Total cost = Rs. [1 × 1000 + (100 - 2)% of 1 × 4000]
 $= \text{Rs. } (1000 + 0.98 \times 4000) = \text{Rs. } (1000 + 3920) = \text{Rs. } 4920.$
19. Actual price = Rs. (25 + 2.50) = Rs. 27.50.
 $\therefore \text{Saving} = \left(\frac{2.50}{27.50} \times 100 \right)\% = \frac{100}{11}\% = 9\frac{1}{11}\% = 9\%$.
20. Quantity of pure acid = 20% of 8 litres = $\left(\frac{20}{100} \times 8 \right) \text{ litres} = 1.6 \text{ litres.}$
21. Rebate = 6% of Rs. 6650 = Rs. $\left(\frac{6}{100} \times 6650 \right) = \text{Rs. } 399.$
 Sales tax = 10% of Rs. (6650 - 399) = Rs. $\left(\frac{10}{100} \times 6251 \right) = \text{Rs. } 625.10.$
 $\therefore \text{Final amount} = \text{Rs. } (6251 + 625.10) = \text{Rs. } 6876.10.$

22. $\frac{384}{540} = \left(\frac{384}{540} \times 100 \right)\% = 71\frac{1}{9}\%$; $\frac{425}{500} = \left(\frac{425}{500} \times 100 \right)\% = 85\%$;
 $\frac{570}{700} = \left(\frac{570}{700} \times 100 \right)\% = 81\frac{3}{7}\%$; $\frac{480}{660} = \left(\frac{480}{660} \times 100 \right)\% = 72\frac{8}{11}\%$.
 $\therefore \frac{425}{500}$ shows the best percentage.
23. 5% of (25% of Rs. 1600) = Rs. $\left[\frac{5}{100} \times \left(\frac{25}{100} \times 1600 \right) \right] = \text{Rs. } 20$.
24. 0.15% of $33\frac{1}{3}\%$ of Rs. 10,000 = Rs. $\left[\frac{15}{100} \times \frac{1}{100} \times \left(\frac{100}{3} \times \frac{1}{100} \times 10000 \right) \right] = \text{Rs. } 5$.
25. Clearly, 60% of 28% of 240 = $\left(\frac{60}{100} \times \frac{28}{100} \times 240 \right) = \left(\frac{30}{100} \times \frac{28}{100} \times 2 \times 240 \right)$
 $= \left(\frac{30}{100} \times \frac{28}{100} \times 480 \right) = 30\%$ of 28% of 480.
26. 25% of 25% = $\frac{25}{100} \times \frac{25}{100} = \frac{1}{16} = 0.0625$.
27. Required percentage = $\left(\frac{3\%}{5\%} \times 100 \right)\% = \left[\frac{(3/100)}{(5/100)} \times 100 \right]\% = 60\%$.
28. Let 95% of $x = 4598$. Then, $\frac{95}{100} \times x = 4598$ or $x = \left(4598 \times \frac{100}{95} \right) = 4840$.
29. Let $x\%$ of 360 = 129.6. Then, $\frac{x}{100} \times 360 = \frac{1296}{10}$ or $x = \left(\frac{1296}{10} \times \frac{100}{360} \right) = 36$.
30. Let $x\%$ of 932 + 30 = 309.6. Then, $\left(\frac{x}{100} \times 932 \right) = 279.6$ or $x = \left(\frac{2796}{10} \times \frac{100}{932} \right) = 30$.
31. Let $x\%$ of 3175 = 45% of 1500 + 35% of 1700.
Then, $\frac{x}{100} \times 3175 = \left(\frac{45}{100} \times 1500 + \frac{35}{100} \times 1700 \right) = 675 + 595 = 1270$.
 $\Leftrightarrow x = \left(\frac{1270 \times 100}{3175} \right) = 40$.
32. Let 65% of $x = 20\%$ of 422.50.
Then, $\frac{65}{100} \times x = \left(\frac{20}{100} \times \frac{4225}{10} \right) \Leftrightarrow x = \left(\frac{845}{10} \times \frac{100}{65} \right) = 130$.
33. Let the total sale be Rs. x .
Then, 2.5% of $x = 12.50 \Leftrightarrow \left(\frac{25}{100} \times \frac{1}{100} \times x \right) = \frac{125}{10} \Leftrightarrow x = \left(\frac{125}{10} \times \frac{100 \times 10}{25} \right) = 500$.
34. Let the worth of the house be Rs. x .
Then, $\frac{2}{7}\%$ of $x = 2800 \Leftrightarrow \left(\frac{2}{7} \times \frac{1}{100} \times x \right) = 2800 \Leftrightarrow x = \left(\frac{2800 \times 100 \times 7}{2} \right) = 9,80,000$.
35. Let 15% of $x\%$ of 582 = 17.46.
Then, $\frac{15}{100} \times \frac{x}{100} \times 582 = \frac{1746}{100} \Leftrightarrow x = \left[\frac{1746}{100} \times \frac{100 \times 100}{15 \times 582} \right] = 20$.

36. Let $\sqrt{784} + x = 78\%$ of 500. Then, $x = \left(\frac{78}{100} \times 500\right) - \sqrt{784} = (390 - 28) = 362$.

37. Let the number be x .

$$\text{Then, } 20\% \text{ of } x = 120 \Leftrightarrow \left(\frac{20}{100} \times x\right) = 120 \Leftrightarrow x = \left(\frac{120 \times 100}{20}\right) = 600.$$

$$\therefore 120\% \text{ of } x = \left(\frac{120}{100} \times 600\right) = 720.$$

38. Let the number be x .

$$\text{Then, } 35\% \text{ of } x = 175 \Leftrightarrow \left(\frac{35}{100} \times x\right) = 175 \Leftrightarrow x = \left(\frac{175 \times 100}{35}\right) = 500.$$

Now, let $y\% \text{ of } 175 = 500$.

$$\text{Then, } \left(\frac{y}{100} \times 175\right) = 500 \Leftrightarrow y = \left(\frac{500 \times 100}{175}\right) = \frac{2000}{7} = 285\frac{5}{7}.$$

39. Let the number be x . Then, $\frac{2}{5}$ of $\frac{1}{3}$ of $\frac{3}{7}$ of $x = 15 \Leftrightarrow x = \left(15 \times \frac{7}{3} \times 3 \times \frac{5}{2}\right) = \frac{525}{2}$.

$$\therefore 40\% \text{ of } \frac{525}{2} = \left(\frac{40}{100} \times \frac{525}{2}\right) = 105.$$

40. Let the number be x . Then, $x - \frac{2}{5}x = 510 \Leftrightarrow \frac{3}{5}x = 510 \Leftrightarrow x = \left(\frac{510 \times 5}{3}\right) = 850$.

$\therefore 10\% \text{ of } 850 = 85$.

41. Let the number be x . Then,

$$15\% \text{ of } 40 - 25\% \text{ of } x = 2 \Leftrightarrow \left(\frac{15}{100} \times 40\right) - 2 \Leftrightarrow \frac{x}{4} = 4 \Leftrightarrow x = 16.$$

42. Let the number be x . Then, $x - 40\% \text{ of } x = 30$

$$\Leftrightarrow x - \frac{40}{100}x = 30 \Leftrightarrow x - \frac{2}{5}x = 30 \Leftrightarrow \frac{3x}{5} = 30 \Leftrightarrow x = \left(\frac{30 \times 5}{3}\right) = 50.$$

43. Let the number be x . Then, $50\% \text{ of } x - 35\% \text{ of } x = 12$

$$\Leftrightarrow \frac{50}{100}x - \frac{35}{100}x = 12 \Leftrightarrow \frac{15}{100}x = 12 \Leftrightarrow x = \left(\frac{12 \times 100}{15}\right) = 80.$$

44. Let the number be x . Then, $x - 16\% \text{ of } x = 42$

$$\Leftrightarrow x - \frac{16}{100}x = 42 \Leftrightarrow x - \frac{4}{25}x = 42 \Leftrightarrow \frac{21}{25}x = 42 \Leftrightarrow x = \left(\frac{42 \times 25}{21}\right) = 50.$$

45. Clearly, the numbers which have 1 or 9 in the unit's digit, have squares that end in the digit 1. Such numbers from 1 to 70 are 1, 9, 11, 19, 21, 29, 31, 39, 41, 49, 51, 59, 61, 69.

Number of such numbers = 14.

$$\therefore \text{Required percentage} = \left(\frac{14}{70} \times 100\right)\% = 20\%.$$

46. $\frac{4}{5} \times 70 = 56$ and $\frac{5}{7} \times 112 = 80$.

$$\therefore \text{Required percentage} = \left(\frac{80 - 56}{80} \times 100\right)\% = \left(\frac{24}{80} \times 100\right)\% = 30\%.$$

47. $y = 125 + 10\% \text{ of } 125 = 125 + 12.50 = 137.50$.

$$\therefore x = 137.50 - 10\% \text{ of } 137.50 = 137.50 - 13.75 = 123.75.$$

48. Let the number be x . Then,

$$75\% \text{ of } x + 75 = x \Leftrightarrow x - \frac{75}{100}x = 75 \Leftrightarrow x - \frac{3}{4}x = 75 \Leftrightarrow \frac{x}{4} = 75 \Leftrightarrow x = 300.$$

49. Let the number be x .

$$\text{Then, } x - 35 = \frac{80}{100}x \Leftrightarrow x - \frac{80}{100}x = 35 \Leftrightarrow x = \frac{35 \times 100}{20} = 175 \Leftrightarrow \frac{4}{5}x = 140.$$

50. Let the number be 100 and required multiplier be y .

$$\text{Then, } 100y = 129.7 \text{ or } y = \frac{129.7}{100} = 1.297.$$

51. Let the numbers be x and y . Then, 6.5% of x = 8.5% of y $\Leftrightarrow x = \frac{85}{65}y = \frac{17}{13}y$.

$$\text{Now, } x + y = 2490 \Rightarrow \frac{17}{13}y + y = 2490 \Rightarrow \frac{30}{13}y = 2490 \Rightarrow y = \left(\frac{2490 \times 13}{30} \right) = 1079.$$

$$\therefore \text{One number} = y = 1079, \text{other number} = \frac{17}{13}y = 1411.$$

52. Let the numbers be x and y . Then,

$$x + y = \frac{28}{25}x \Leftrightarrow y = \frac{28}{25}x - x \Leftrightarrow y = \frac{3}{25}x \Leftrightarrow \frac{y}{x} = \left(\frac{3}{25} \times 100 \right)\% = 12\%.$$

53. Let the numbers be x and y .

$$\text{Then, } y - 25\% \text{ of } x = \frac{5}{6}y \Leftrightarrow y - \frac{5}{6}y = \frac{25}{100}x \Leftrightarrow \frac{y}{6} = \frac{x}{4} \Leftrightarrow \frac{x}{y} = \frac{4}{6} = \frac{2}{3}.$$

54. Let the larger number be x .

$$\text{Then, } x - 20 = \frac{20}{100}x \Leftrightarrow x - \frac{1}{5}x = 20 \Leftrightarrow \frac{4}{5}x = 20 \Leftrightarrow x = \left(20 \times \frac{5}{4} \right) = 25.$$

55. Let the numbers be x and y . Then, $\frac{x}{12} = \frac{y}{4} \Leftrightarrow x = 3y$.

$$\therefore \text{Required percentage} = \left(\frac{x-y}{y} \times 100 \right)\% = \left(\frac{2y}{y} \times 100 \right)\% = 200\%.$$

56. Let one number = x . Then, other number = 80% of $x = \frac{4}{5}x$.

$$\therefore 4 \left[x^2 + \left(\frac{4}{5}x \right)^2 \right] = 656 \Leftrightarrow x^2 + \frac{16}{25}x^2 = 164 \Leftrightarrow \frac{41}{25}x^2 = 164 \Leftrightarrow x^2 = \frac{164 \times 25}{41} = 100 \Leftrightarrow x = 10.$$

So, the numbers are 10 and 8.

$$57. 5\% \text{ of } A + 4\% \text{ of } B = \frac{2}{3} (6\% \text{ of } A + 8\% \text{ of } B)$$

$$\Leftrightarrow \frac{5}{100}A + \frac{4}{100}B = \frac{2}{3} \left(\frac{6}{100}A + \frac{8}{100}B \right)$$

$$\Leftrightarrow \frac{1}{20}A + \frac{1}{25}B = \frac{1}{25}A + \frac{4}{75}B \Leftrightarrow \left(\frac{1}{20} - \frac{1}{25} \right)A = \left(\frac{4}{75} - \frac{1}{25} \right)B$$

$$\Leftrightarrow \frac{1}{100}A = \frac{1}{75}B \Leftrightarrow \frac{A}{B} = \frac{100}{75} = \frac{4}{3}$$

58. Total number of votes polled = $(1136 + 7636 + 11628) = 20400$.
- $$\therefore \text{Required percentage} = \left(\frac{11628}{20400} \times 100 \right)\% = 57\%$$
59. Increase in 10 years = $(262500 - 175000) = 87500$.
- $$\text{Increase}\% = \left(\frac{87500}{175000} \times 100 \right)\% = 50\%$$
- $$\therefore \text{Required average} = \left(\frac{50}{10} \right)\% = 5\%$$
60. Let the number be x . Then, error = $\frac{5}{3}x - \frac{3}{5}x = \frac{16}{15}x$.
- $$\text{Error}\% = \left(\frac{16x}{15} \times \frac{3}{5x} \times 100 \right)\% = 64\%$$
61. Let the original value of the tempo be Rs. x . Then,
- $$1.3\% \text{ of } \frac{4}{5} \text{ of } x = 910 \Leftrightarrow \frac{13}{10} \times \frac{1}{100} \times \frac{4}{5} \times x = 910$$
- $$\text{NOTE: } \left[\frac{13}{10} \times \frac{1}{100} \times \frac{4}{5} \right] = \frac{13 \times 10 \times 100 \times 4}{1000} \Leftrightarrow x = \left(\frac{910 \times 10 \times 100 \times 5}{13 \times 4} \right) = 87500.$$
62. Let the total production be x lakh tons. Then, $15\% \text{ of } x - 10\% \text{ of } x = (40 - 30)$ lakh tons
- $$\Leftrightarrow 5\% \text{ of } x = 10 \text{ lakh tons} \Leftrightarrow x = \left(\frac{10 \times 100}{5} \right) = 200 \text{ lakh tons.}$$
63. Let the number of candidates appeared from each state be x .
Then, $7\% \text{ of } x - 6\% \text{ of } x = 80 \Leftrightarrow 1\% \text{ of } x = 80 \Leftrightarrow x = 80 \times 100 = 8000$.
64. Amount paid to car owner = $90\% \text{ of } 85\% \text{ of } \text{Rs. } 3,25,000$
- $$\text{NOTE: } \left[\frac{90}{100} \times \frac{85}{100} \times 325000 \right] = \text{Rs. } 2,48,625.$$
- $$\therefore \text{Required difference} = \text{Rs. } (325000 - 248625) = \text{Rs. } 76,375.$$
65. Let the amount of taxable purchases be Rs. x .
- $$\text{Then, } 6\% \text{ of } x = \frac{30}{100} \Leftrightarrow x = \left(\frac{30}{100} \times \frac{100}{6} \right) = 5.$$
- $$\therefore \text{Cost of tax free items} = \text{Rs. } [25 - (5 + 0.30)] = \text{Rs. } 19.70.$$
66. Number of runs made by running = $110 - (3 \times 4 + 8 \times 6) = 50$.
- $$\therefore \text{Required percentage} = \left(\frac{50}{110} \times 100 \right)\% = 45\frac{5}{11}\%$$
67. Let the marked price be x.
- $$\text{Then, } x - 5\% \text{ of } x = 9595 \Leftrightarrow 95\% \text{ of } x = 9595 \Leftrightarrow x = \left(\frac{9595 \times 100}{95} \right) = 10100.$$
68. Suppose originally he had x apples.
- $$\text{Then, } (100 - 40)\% \text{ of } x = 420 \Leftrightarrow \frac{60}{100} \times x = 420 \Leftrightarrow x = \left(\frac{420 \times 100}{60} \right) = 700.$$
69. Let the monthly income be Rs. x .
- $$\text{Then, } \left(100 - 66\frac{2}{3} \right)\% \text{ of } x = 1200 \Leftrightarrow 33\frac{1}{3}\% \text{ of } x = 1200$$
- $$\Leftrightarrow \frac{100}{3} \times \frac{1}{100} \times x = 1200 \Leftrightarrow x = 1200 \times 3 = 3600.$$
- $$\therefore \text{Monthly expenses} = \text{Rs. } (3600 - 1200) = \text{Rs. } 2400.$$

70. Let the number of students appeared be x .

$$\text{Then, } 65\% \text{ of } x = 455 \Leftrightarrow \frac{65}{100}x = 455 \Leftrightarrow x = \left(\frac{455 \times 100}{65}\right) = 700.$$

71. Percentage of uncertain individuals = $[100 - (20 + 60)]\% = 20\%$.

$$\therefore 60\% \text{ of } x = 20\% \text{ of } x = 720 \Leftrightarrow 40\% \text{ of } x = 720$$

$$\Leftrightarrow \frac{40}{100}x = 720 \Leftrightarrow x = \left(\frac{720 \times 100}{40}\right) = 1800.$$

72. Let the maximum marks be x .

$$\text{Then, } 33\% \text{ of } x = 125 + 40 \Leftrightarrow \frac{33}{100}x = 165 \Leftrightarrow x = \left(\frac{165 \times 100}{33}\right) = 500.$$

73. Let the total number of votes polled be x .

$$\text{Then, votes polled by other candidate} = (100 - 84)\% \text{ of } x = 16\% \text{ of } x$$

$$\therefore 84\% \text{ of } x = 16\% \text{ of } x = 476 \Leftrightarrow \frac{84}{100}x = 476 \Leftrightarrow x = \left(\frac{476 \times 100}{84}\right) = 700.$$

74. Number of valid votes = 80% of 7500 = 6000.

$$\text{Valid votes polled by other candidate} = 45\% \text{ of } 6000 = \left(\frac{45}{100} \times 6000\right) = 2700.$$

75. Let the number of valid votes be x .

$$\text{Then, } 52\% \text{ of } x = 48\% \text{ of } x = 98 \Leftrightarrow 4\% \text{ of } x = 98$$

$$\Leftrightarrow \frac{4}{100}x = 98 \Leftrightarrow x = 98 \times 25 = 2450.$$

$$\therefore \text{Total number of votes polled} = (2450 + 68) = 2518.$$

76. Let the total number of voters be x . Then, Votes polled = 90% of x .

$$\text{Valid votes} = 90\% \text{ of } (90\% \text{ of } x).$$

$$\therefore 54\% \text{ of } [90\% \text{ of } (90\% \text{ of } x)] = 46\% \text{ of } [90\% \text{ of } (90\% \text{ of } x)] = 1620$$

$$\Leftrightarrow 8\% \text{ of } [90\% \text{ of } (90\% \text{ of } x)] = 1620$$

$$\Leftrightarrow \frac{8}{100} \times \frac{90}{100} \times \frac{90}{100} \times x = 1620 \Leftrightarrow x = \left(\frac{1620 \times 100 \times 100 \times 100}{8 \times 90 \times 90}\right) = 25000.$$

77. Let the number of persons eligible to vote be x . Then,

$$\text{Number of eligible persons between 18 and 21} = 8\% \text{ of } x$$

$$\text{Number of persons between 18 and 21, who voted} = 85\% \text{ of } (8\% \text{ of } x)$$

$$= \left(\frac{85}{100} \times \frac{8}{100} \times x\right) = \frac{68}{1000}x.$$

$$\therefore \text{Required percentage} = \left(\frac{68x}{1000} \times \frac{1}{x} \times 100\right)\% = 6.8\%.$$

78. Let the number of persons eligible to vote be x .

$$\text{Then, voters who voted for A} = 30\% \text{ of } x.$$

$$\text{Voters who voted for B} = 60\% \text{ of } (70\% \text{ of } x).$$

$$= \left(\frac{60}{100} \times \frac{70}{100} \times 100\right)\% \text{ of } x = 42\% \text{ of } x.$$

$$\text{Voters who did not vote} = [100 - (30 + 42)]\% \text{ of } x = 28\% \text{ of } x.$$

$$\therefore 30\% \text{ of } x = 28\% \text{ of } x = 1200 \Leftrightarrow 2\% \text{ of } x = 1200 \Leftrightarrow x = \left(\frac{1200 \times 100}{2}\right) = 60000.$$

79. Let the sum paid to Y per week be Rs. z . Then, $z + 120\% \text{ of } z = 550$

$$\Leftrightarrow z + \frac{120}{100} z = 550 \Leftrightarrow \frac{11}{5} z = 550 \Leftrightarrow z = \left(\frac{550 \times 5}{11} \right) = 250.$$

80. Total sales tax paid = 7% of Rs. 400 + 9% of Rs. 6400

$$= \text{Rs.} \left(\frac{7}{100} \times 400 + \frac{9}{100} \times 6400 \right) = \text{Rs.} (28 + 576) = \text{Rs.} 604.$$

Total cost of the items = Rs. $(400 + 6400) = \text{Rs.} 6800$.

$$\therefore \text{Required percentage} = \left(\frac{604}{6800} \times 100 \right)\% = 8 \frac{15}{17}\%.$$

81. Total marks secured = (90% of 100 + 60% of 150 + 54% of 200)

$$= \left(\frac{90}{100} \times 100 + \frac{60}{100} \times 150 + \frac{54}{100} \times 200 \right) = (90 + 90 + 108) = 288.$$

Total maximum marks = $(100 + 150 + 200) = 450$.

$$\therefore \text{Aggregate percentage} = \left(\frac{288}{450} \times 100 \right)\% = 64\%.$$

82. Total number of students = $1100 + 700 = 1800$.

Number of students passed = (42% of 1100 + 30% of 700) = $(462 + 210) = 672$.

Number of failures = $1800 - 672 = 1128$.

$$\therefore \text{Percentage failure} = \left(\frac{1128}{1800} \times 100 \right)\% = 62 \frac{2}{3}\%.$$

83. Let the number of students be x . Then,

Number of students of or above 8 years = $(100 - 20)\% \text{ of } x = 80\% \text{ of } x$.

$$\therefore 80\% \text{ of } x = 48 + \frac{2}{3} \text{ of } 48 \Leftrightarrow \frac{80}{100} x = 80 \Leftrightarrow x = 100.$$

84. Let the total number of applicants be x . Number of eligible candidates = 95% of x .

Eligible candidates of other categories = 15% of (95% of x)

$$= \left(\frac{15}{100} \times \frac{95}{100} \times x \right) = \frac{57}{400} x.$$

$$\therefore \frac{57}{400} x = 4275 \Leftrightarrow x = \left(\frac{4275 \times 400}{57} \right) = 30000.$$

85. Let their marks be $(x + 9)$ and x .

$$\text{Then, } x + 9 = \frac{56}{100} (x + 9 + x) \Leftrightarrow 25(x + 9) = 14(2x + 9) \Leftrightarrow 3x = 99 \Leftrightarrow x = 33.$$

So, their marks are 42 and 33.

$$86. X = \frac{90}{100} Y \Rightarrow X = \frac{9}{10} Y \Rightarrow Y = \frac{10}{9} X \Rightarrow \frac{Y}{X} = \frac{10}{9}.$$

$$\therefore \text{Required percentage} = \left(\frac{Y}{X} \times 100 \right)\% = \left(\frac{10}{9} \times 100 \right)\% = 111 \frac{1}{9}\%.$$

$$87. x\% \text{ of } y = \left(\frac{x}{100} \times y \right) = \left(\frac{y}{100} \times x \right) = y\% \text{ of } x.$$

$$88. 20\% \text{ of } a = b \Rightarrow \frac{20}{100} a = b.$$

$$\therefore b\% \text{ of } 20 = \left(\frac{b}{100} \times 20 \right) = \left(\frac{20}{100} a \times \frac{1}{100} \times 20 \right) = \frac{4}{100} a = 4\% \text{ of } a.$$

89. $\frac{x}{100} \times y = \frac{4}{5} \times 80 \Rightarrow xy = 64 \times 100 = 6400.$

90. Clearly, $y\% \text{ of } z = 2(x\% \text{ of } y) \Rightarrow \frac{yz}{100} = \frac{2xy}{100} \Rightarrow z = 2x.$

91. $p\% \text{ of } p = 36 \Leftrightarrow \left(\frac{p}{100} \times p\right) = 36 \Leftrightarrow p^2 = 3600 \Leftrightarrow p = 60.$

92. $x\% \text{ of } y = z \Rightarrow \frac{x}{100}y = z \Rightarrow \frac{x}{z} = \frac{100}{y}.$

$\therefore \text{Required percentage} = \left(\frac{x}{z} \times 100\right)\% = \left(\frac{100}{y} \times 100\right)\% = \left(\frac{100^2}{y}\right)\%.$

93. $x = 80\% \text{ of } y \Leftrightarrow x = \frac{80}{100}y \Leftrightarrow \frac{y}{x} = \frac{5}{4} \Leftrightarrow \frac{y}{2x} = \frac{5}{8}.$

$\therefore \text{Required percentage} = \left(\frac{y}{2x} \times 100\right)\% = \left(\frac{5}{8} \times 100\right)\% = 62\frac{1}{2}\%.$

94. Let $x = 6\% \text{ of } x = xz.$ Then, $94\% \text{ of } x = xz \Leftrightarrow \frac{94}{100}x \times \frac{1}{x} = z \Leftrightarrow z = 0.94.$

95. $x\% \text{ of } y + y\% \text{ of } x = \frac{x}{100}y + \frac{y}{100}x = \frac{2xy}{100} = 2\% \text{ of } xy.$

96. $A = 150\% \text{ of } B \Rightarrow A = \frac{150}{100}B \Rightarrow \frac{A}{B} = \frac{3}{2} \Rightarrow \frac{A}{B} + 1 = \frac{3}{2} + 1$

$$\Rightarrow \frac{A+B}{B} = \frac{5}{2} \Rightarrow \frac{B}{A+B} = \frac{2}{5}.$$

$\therefore \text{Required percentage} = \left(\frac{B}{A+B} \times 100\right)\% = \left(\frac{2}{5} \times 100\right)\% = 40\%.$

97. $8\% \text{ of } x = 4\% \text{ of } y \Rightarrow \frac{8}{100}x = \frac{4}{100}y \Rightarrow x = \frac{1}{2}y.$

$\therefore 20\% \text{ of } x = 20\% \text{ of } \frac{1}{2}y = 10\% \text{ of } y.$

98. $\frac{20}{100}A = B$ and $\frac{40}{100}B = C \Rightarrow \frac{1}{5}A = B$ and $\frac{2}{5}B = C \Rightarrow A = 5B$ and $B = \frac{5}{2}C$

$$\Rightarrow A = \frac{25}{2}C \text{ and } B = \frac{5}{2}C.$$

$\therefore 60\% \text{ of } (A+B) = \frac{60}{100} \left(\frac{25}{2}C + \frac{5}{2}C \right) = \frac{60 \times 15}{100}C = \frac{900}{100}C = 900\% \text{ of } C.$

99. $x\% \text{ of } a = y\% \text{ of } b \Rightarrow \frac{x}{100}a = \frac{y}{100}b \Rightarrow b = \left(\frac{x}{y}\right)a = Y\frac{100}{100} = X.$

$\therefore x\% \text{ of } b = \left(x\% \text{ of } \frac{x}{y}\right)a = \left(\frac{xx}{y \times 100}\right)a = \left(\frac{xx}{y}\right)\% \text{ of } a.$

100. $x\% \text{ of } y = \left(\frac{x}{100} \times y\right) = \left(\frac{y}{100} \times x\right) = y\% \text{ of } x \Rightarrow A = B.$

101. Let the first man's output be $x.$

Then, $33\frac{1}{3}\% \text{ of } x = 50\% \text{ of } 1500 \Leftrightarrow \left(\frac{100}{3} \times \frac{1}{100} \times x\right) = 750 \Leftrightarrow x = 750 \times 3 = 2250.$

Questions 102-106

Let the number of magazine-readers in city P be x .

$$\text{Then, } (100 - 75)\% \text{ of } x = 6000 \Leftrightarrow \frac{25}{100}x = 6000 \Leftrightarrow x = \left(\frac{6000 \times 100}{25}\right) = 24000.$$

Number of readers in P, reading only one magazine a week = $(24000 - 6000) = 18000$.

Similarly, we can find these values in other cases. Thus, we have the following table :

City	No. of magazine-readers	No. of readers reading only one magazine a week
P	24000	18000
Q	17500	14000
R	7500	4500
S	6000	3300
T	5600	1400

102. The lowest number of magazine-readers is 5600 and this is in the case of city T.
 103. The highest number of magazine-readers who read only one magazine a week is 18000 and this is in the case of city P.
 104. The highest number of magazine-readers is 24000.
 105. Number of magazine-readers in city Q reading only one magazine a week = 14000.
 106. Total number of magazine-readers reading only one magazine a week
 $= (18000 + 14000 + 4500 + 3300 + 1400) = 41200$.

107. Saving = $[100 - (40 + 20 + 10 + 10)]\% = 20\%$. Let the monthly salary be Rs. x .

$$\text{Then, } 20\% \text{ of } x = 1500 \Leftrightarrow \frac{20}{100}x = 1500 \Leftrightarrow x = 1500 \times 5 = 7500.$$

108. Let the total amount be Rs. x . Then, $(100 - 20)\% \text{ of } x = 35000 + 40000$

$$\Leftrightarrow 80\% \text{ of } x = 75000 \Leftrightarrow \frac{80}{100}x = 75000 \Leftrightarrow x = \left(\frac{75000 \times 5}{4}\right) = 93750.$$

109. Saving = $50\% \text{ of } (100 - 40)\% \text{ of } (100 - 30)\% \text{ of } \text{Rs. } 18,400$
 $= \text{Rs. } \left(\frac{50}{100} \times \frac{60}{100} \times \frac{70}{100} \times 18400\right) = \text{Rs. } 3864.$

110. Height climbed in second hour = $12\frac{1}{2}\% \text{ of } \left(100 - 62\frac{1}{2}\%\right) \text{ of } 192 \text{ m}$
 $= \left(\frac{25}{2} \times \frac{1}{100} \times \frac{75}{2} \times \frac{1}{100} \times 192\right) \text{ m} = 9 \text{ m.}$

111. Let the total income be x .
 Then, income left = $(100 - 80)\% \text{ of } [100 - (35 + 25)]\% \text{ of } x = 20\% \text{ of } 40\% \text{ of } x$
 $= \left(\frac{20}{100} \times \frac{40}{100} \times 100\right)\% \text{ of } x = 8\% \text{ of } x.$

112. Let the total salary be Rs. x .
 Then, $(100 - 10)\% \text{ of } (100 - 20)\% \text{ of } (100 - 20)\% \text{ of } (100 - 10)\% \text{ of } x = 15552$
 $\Leftrightarrow \left(\frac{90}{100} \times \frac{80}{100} \times \frac{80}{100} \times \frac{90}{100} \times x\right) = 15552 \Leftrightarrow x = \left(\frac{15552 \times 10000}{64 \times 81}\right) = 30000.$

113. Let the amount with Aman be Rs. x .
 Then, amount received by Sahil = $\frac{1}{4}$ of 40% of Rs. $x = 10\% \text{ of } \text{Rs. } x$.

$$\therefore 10\% \text{ of } x = 600 + 200 \Leftrightarrow \frac{10}{100}x = 800 \Leftrightarrow x = 800 \times 10 = 8000.$$

114. Let the monthly salary of Sameer be Rs. x .

Then, $[100 - (25 + 20)]\%$ of $[100 - (24 + 15)]\%$ of $x = 10736 \Leftrightarrow 55\% \text{ of } 61\% \text{ of } x = 10736$

$$\Leftrightarrow \frac{55}{100} \times \frac{61}{100} \times x = 10736 \Leftrightarrow x = \left(\frac{10736 \times 100 \times 100}{55 \times 61} \right) = 32000.$$

115. Let the total number of children be x .

$$\text{Then, } x \times (20\% \text{ of } x) = 405 \Leftrightarrow \frac{1}{5}x^2 = 405 \Leftrightarrow x^2 = 2025 \Leftrightarrow x = 45.$$

\therefore Number of sweets received by each child = $20\% \text{ of } 45 = 9$.

116. We have : $x + x\% \text{ of } 150 = 150$

$$\Leftrightarrow x + \frac{x}{100} \times 150 = 150 \Leftrightarrow \frac{5}{2}x = 150 \Leftrightarrow x = \left(\frac{150 \times 2}{5} \right) = 60.$$

$$117. 15 + \frac{1}{3}(n - 20) = 50\% \text{ of } n = \frac{50}{100}n = \frac{n}{2} \Leftrightarrow 90 + 2n - 40 = 3n \Leftrightarrow n = 50.$$

118. Let A's salary = Rs. x . Then, B's salary = Rs. $(2000 - x)$.

$$(100 - 95)\% \text{ of } A = (100 - 85)\% \text{ of } B \Leftrightarrow \frac{5}{100}x = \frac{15}{100}(2000 - x) \Leftrightarrow x = 1500.$$

119. Let $B + M + D = x$. Then, $B = 25\% \text{ of } x - 20 = \left(\frac{25}{100}x - 20 \right) = \left(\frac{x}{4} - 20 \right)$ and $D = 50$.

$$\therefore \frac{x}{4} - 20 + M + 50 = x \text{ or } M = \left(\frac{3x}{4} - 30 \right).$$

So, marks in Maths cannot be determined.

120. Let the total sales be Rs. x . Then, $5\frac{1}{2}\% \text{ of } x + \frac{1}{2}\% \text{ of } (x - 10000) = 1990$

$$\Leftrightarrow \frac{11}{2} \times \frac{1}{100} \times x + \frac{1}{2} \times \frac{1}{100} \times (x - 10000) = 1990$$

$$\Leftrightarrow 12x - 10000 = 398000 \Leftrightarrow 12x = 408000 \Leftrightarrow x = 34000.$$

121. Let the marks required be x . Then, $(62 + 35 + x) = 35\% \text{ of } (150 + 150 + 180)$

$$\Leftrightarrow 97 + x = \frac{35}{100} \times 480 \Leftrightarrow x = 168 - 97 = 71.$$

122. Let the number of students in the class be 100 and let the required average be x .

Then, $(10 \times 95) + (20 \times 90) + (70 \times x) = (100 \times 80)$

$$\Leftrightarrow 70x = 8000 - (950 + 1800) = 5250 \Leftrightarrow x = 75.$$

123. Let total marks = x . Then, $(30\% \text{ of } x) + 15 = (40\% \text{ of } x) - 35$

$$\Leftrightarrow \frac{30}{100}x + 15 = \frac{40}{100}x - 35 \Leftrightarrow \frac{1}{10}x = 50 \Leftrightarrow x = 500.$$

So, passing marks = $(30\% \text{ of } 500) + 15 = \left(\frac{30}{100} \times 500 + 15 \right) = 165$.

$$\therefore \text{Pass percentage} = \left(\frac{165}{500} \times 100 \right)\% = 33\%.$$

124. Let the price of a chair be Rs. x . Then, price of a table = Rs. $(x + 400)$.

$$\text{So, } 6(x + 400) + 6x = 4800 \Leftrightarrow 12x = 2400 \Leftrightarrow x = 200.$$

\therefore Price of a table = Rs. 600; Price of a chair = Rs. 200.

$$\text{Required percentage} = \left(\frac{400}{600} \times 100 \right)\% = 66\frac{2}{3}\%.$$

125. Let the total number of houses be x . Then,

$$\therefore \text{Number of houses having one female only} = (100 - 25)\% \text{ of } (100 - 40)\% \text{ of } x \\ = \left(\frac{75}{100} \times \frac{60}{100} \times x \right) = \frac{9}{20}x.$$

$$\therefore \text{Required percentage} = \left(\frac{9x}{20} \times \frac{1}{x} \times 100 \right)\% = 45\%.$$

126. Let the total population be x . Then,

$$\text{Poor population} = \frac{60}{100}x = \frac{3}{5}x. \quad \text{Illiterate population} = \frac{40}{100}x = \frac{2}{5}x.$$

$$\text{Illiterate rich} = 10\% \text{ of } (100 - 60)\% \text{ of } x = \left(\frac{10}{100} \times \frac{40}{100} \times x \right) = \frac{x}{25}.$$

$$\text{Illiterate poor} = \left(\frac{2}{5}x - \frac{x}{25} \right) = \frac{9x}{25}.$$

$$\therefore \text{Required percentage} = \left(\frac{9x}{25} \times \frac{5}{3x} \times 100 \right)\% = 60\%.$$

127. Number of males = 60% of 1000 = 600. Number of females = $(1000 - 600) = 400$.

Number of literates = 25% of 1000 = 250.

Number of literate males = 20% of 600 = 120.

Number of literate females = $(250 - 120) = 130$.

$$\therefore \text{Required percentage} = \left(\frac{130}{400} \times 100 \right)\% = 32.5\%.$$

128. Let the total number of candidates be x . Then, $\left(100 - 62\frac{1}{2}\right)\% \text{ of } 37\frac{1}{2}\% \text{ of } x = 342$

$$\Leftrightarrow \frac{75}{2} \times \frac{1}{100} \times \frac{75}{2} \times \frac{1}{100} \times x = 342 \Leftrightarrow \frac{9x}{64} = 342 \Leftrightarrow x = \left(\frac{342 \times 64}{9} \right) = 2432.$$

$$\text{Number of boys failed} = (100 - 75)\% \text{ of } \left(100 - 37\frac{1}{2} \right)\% \text{ of } 2432$$

$$= \left(\frac{25}{100} \times \frac{125}{2} \times \frac{1}{100} \times 2432 \right) = 380.$$

129. Let total population = x . Then, number of males = $\frac{5}{9}x$.

$$\text{Married males} = 30\% \text{ of } \frac{5}{9}x = \left(\frac{30}{100} \times \frac{5}{9}x \right) = \frac{x}{6}.$$

$$\text{Married females} = \frac{x}{6}; \quad \text{Number of females} = \left(x - \frac{5}{9}x \right) = \frac{4x}{9}.$$

$$\text{Unmarried females} = \left(\frac{4x}{9} - \frac{x}{6} \right) = \frac{5x}{18}.$$

$$\therefore \text{Required percentage} = \left(\frac{5x}{18} \times \frac{1}{x} \times 100 \right)\% = 27\frac{7}{9}\%.$$

130. Migrants = 35% of 728400 = $\left(\frac{35}{100} \times 728400 \right) = 254940$.

$$\text{Local population} = (728400 - 254940) = 473460.$$

Rural population = 20% of 473460 = 94692.

Urban population = $(254940 - 94692) = 160248$.

\therefore Female population = 48% of 473460 + 30% of 94692 + 40% of 160248

$$\begin{aligned} &= \left(\frac{48}{100} \times 473460 + \frac{30}{100} \times 94692 + \frac{40}{100} \times 160248 \right) \\ &= 227260.8 + 28407.6 + 64099.2 = 896660. \end{aligned}$$

131. Let the number of boys and girls be $3x$ and $2x$ respectively. Then,

$$\text{No. of students who are not adults} = \left(\frac{80}{100} \times 3x \right) + \left(\frac{75}{100} \times 2x \right) = \left(\frac{12x}{5} + \frac{3x}{2} \right) = \frac{39x}{10}.$$

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

132. Suppose monthly rent = Rs. x . Then, $12x - \frac{25}{2}\%$ of $12x - 1660 = 10\%$ of 500000

$$\Leftrightarrow 12x - \frac{25}{200} \times 12x - 1660 = 50000 \Leftrightarrow \frac{21x}{2} = 51660 \Leftrightarrow x = \left(51660 \times \frac{2}{21} \right) = 4920.$$

133. Let total debt = x . Asset = $\frac{87}{100}x$.

After paying 20% of the debt, he is left with 80% of the debt plus Rs. 42.

$$\therefore 80\% \text{ of } x + 42 = \frac{87}{100}x \Leftrightarrow \frac{87}{100}x - \frac{80}{100}x = 42 \Leftrightarrow x = 600.$$

$$\text{So, debt} = \text{Rs. } 600 \text{ and assets} = \text{Rs. } \left(\frac{87}{100} \times 600 \right) = \text{Rs. } 522.$$

134. Let the original price be Rs. 100.

$$\text{New final price} = 120\% \text{ of } (75\% \text{ of Rs. } 100) = \text{Rs. } \left(\frac{120}{100} \times \frac{75}{100} \times 100 \right) = \text{Rs. } 90.$$

\therefore Decrease = 10%.

135. Let the original price be Rs. 100.

$$\text{New final price} = 85\% \text{ of } (115\% \text{ of Rs. } 100) = \text{Rs. } \left(\frac{85}{100} \times \frac{115}{100} \times 100 \right) = \text{Rs. } 97.75.$$

\therefore Decrease = $(100 - 97.75)\% = 2.25\%$.

136. Let the original number be x .

$$\text{Final number obtained} = 110\% \text{ of } (90\% \text{ of } x) = \left(\frac{110}{100} \times \frac{90}{100} \times x \right) = \frac{99}{100}x.$$

$$\therefore x - \frac{99}{100}x = 10 \Leftrightarrow \frac{1}{100}x = 10 \Leftrightarrow x = 10 \times 100 = 1000.$$

137. Let the original price be Rs. x .

$$\therefore (100 - r)\% \text{ of } (100 + r)\% \text{ of } x = 1$$

$$\Rightarrow \frac{(100 - r)}{100} \times \frac{(100 + r)}{100} \times x = 1 \Rightarrow x = \frac{100 \times 100}{(100 - r)(100 + r)} = \frac{10000}{(10000 - r^2)}.$$

138. Let original income = Rs. 100. Then, saving = Rs. 10 and expenditure = Rs. 90.

New income = Rs. 120, New saving = Rs. 10.

New expenditure = Rs. $(120 - 10) = \text{Rs. } 110$.

Increase in expenditure = Rs. $(110 - 90) = \text{Rs. } 20$.

$$\therefore \text{Increase\%} = \left(\frac{20}{90} \times 100 \right)\% = 22\frac{2}{9}\%.$$

139. Let Madan's income be Rs. x .

Then, Net income = $(100 - 10)\%$ of Rs. x = 90% of Rs. x = Rs. $\frac{9x}{10}$.

New net income = 85% of 110% of Rs. x = Rs. $\left(\frac{85}{100} \times \frac{110}{100} \times x\right)$ = Rs. $\frac{187}{200}x$.

$$\therefore \frac{187x}{200} - \frac{9x}{10} = 350 \Leftrightarrow \frac{7x}{200} = 350 \Leftrightarrow x = \left(\frac{350 \times 200}{7}\right) = 10000.$$

140. Let his investment in the year 2000 be Rs. x .

Then, income in 2000 = Rs. $[x + 20\% \text{ of } x]$ = Rs. $\frac{120}{100}x$.

Income in 2001 = Rs. $\left[\frac{126}{100}(x - 5000)\right]$.

$$\therefore \frac{120}{100}x = \frac{126}{100}(x - 5000) \Leftrightarrow 120x = 126(x - 5000) \Leftrightarrow 6x = 630000 \Leftrightarrow x = 105000.$$

141. Let original salary = Rs. 100. New salary = Rs. 120.

Decrease on 120 = 20. Decrease on 100 = $\left(\frac{20}{120} \times 100\right)\% = 16\frac{2}{3}\%$.

142. Let original number = 100.

New number = $120\% \text{ of } 120\% \text{ of } 100 = \left(\frac{120}{100} \times \frac{120}{100} \times 100\right) = 144$.

Decrease on 144 = 44. Decrease on 100 = $\left(\frac{44}{144} \times 100\right)\% = 30\frac{5}{9}\%$.

143. Let original price per T.V. = Rs. 100 and original sale = 100 T.V.s.

Then, total revenue = Rs. (100×100) = Rs. 10,000.

New revenue = Rs. (75×120) = Rs. 9000.

\therefore Decrease in revenue = $\left(\frac{1000}{10000} \times 100\right)\% = 10\%$.

144. Let original consumption = 100 units and original price = Rs. 100 per unit.

Original expenditure = Rs. (100×100) = Rs. 10000.

New expenditure = Rs. (120×80) = Rs. 9600.

\therefore Decrease in expenditure = $\left(\frac{400}{10000} \times 100\right)\% = 4\%$.

145. Let the total original sale be Rs. 100. Then, original number of visitors = 100.

New number of visitors = $\frac{120}{0.75} = 160$.

\therefore Increase% = 60%.

146. Suppose the business value changes from x to y .

4% of x = 5% of $y \Rightarrow \frac{4}{100}x = \frac{5}{100}y \Rightarrow y = \frac{4}{5}x$.

\therefore Change in business = $\left(x - \frac{4}{5}x\right) = \frac{x}{5}$.

Percentage slump = $\left(\frac{\frac{x}{5}}{x} \times \frac{1}{x} \times 100\right)\% = 20\%$.

147. Let the original fraction be $\frac{x}{y}$. Then, new fraction = $\frac{140\% \text{ of } x}{180\% \text{ of } y} = \frac{140x}{180y} = \frac{7x}{9y}$.

$$\therefore \frac{\text{New fraction}}{\text{Original fraction}} = \left(\frac{7x}{9y} \times \frac{y}{x} \right) = \frac{7}{9}.$$

148. Decrease in consumption = $\left[\frac{R}{(100+R)} \times 100 \right]\% = \left(\frac{30}{130} \times 100 \right)\% = 23\frac{1}{13}\%$.

149. Increase in consumption = $\left[\frac{R}{(100-R)} \times 100 \right]\% = \left(\frac{16}{84} \times 100 \right)\% = \frac{400}{21}\% = 19.04\% \approx 19\%$.

150. Let original consumption be 1 unit costing Rs. 100.

New cost = Rs. 125. New consumption = $\left(\frac{1}{125} \times 100 \right) = \frac{4}{5}$ unit.

$$\therefore \frac{\text{Reduction in consumption}}{\text{Original consumption}} = \frac{\left(1 - \frac{4}{5} \right)}{1} = \frac{1}{5}, \text{ i.e., } 1 : 5.$$

151. Let original consumption = 100 kg and new consumption = x kg.

$$\text{So, } 100 \times 6 = x \times 7.50 \Leftrightarrow x = 80 \text{ kg.}$$

\therefore Reduction in consumption = 20%.

152. Let expenditures on food and other items be Rs. $2x$ and Rs. $5x$.

$$\text{Then, } 2x + 5x = 2590 \text{ or } x = 370.$$

So, expenditure on food = Rs. (2×370) = Rs. 740.

Expenditure on other items = Rs. (5×370) = Rs. 1850.

New expenditure = 110% of Rs. 740 + 115% of Rs. 1850

$$= \text{Rs.} \left(\frac{110}{100} \times 740 + \frac{115}{100} \times 1850 \right) = \text{Rs.} (814 + 2127.50) = \text{Rs.} 2941.50.$$

\therefore Desired increase = Rs. $(2941.50 - 2590)$ = Rs. 351.50.

153. Population after 3 years = $64000 \times \left(1 + \frac{5}{2 \times 100} \right)^3 = \left(64000 \times \frac{41}{40} \times \frac{41}{40} \times \frac{41}{40} \right) = 68921$.

154. Cost after 2 years = $\text{Rs.} \left[20 \times \left(1 + \frac{8}{100} \right)^2 \right] = \text{Rs.} \left(20 \times \frac{27}{25} \times \frac{27}{25} \right) = \text{Rs.} 23.33$.

155. Present population = $160000 \times \left(1 + \frac{3}{100} \right) \left(1 + \frac{5}{2 \times 100} \right) \left(1 + \frac{5}{100} \right)$
 $= \left(160000 \times \frac{103}{100} \times \frac{41}{40} \times \frac{21}{20} \right) = 177366$.

156. Present population = $62500 \times \left(1 - \frac{4}{100} \right)^2 = \left(62500 \times \frac{24}{25} \times \frac{24}{25} \right) = 57600$.

157. Let the present value be Rs. 100.

Value after 3 years = $\text{Rs.} \left[100 \times \left(1 - \frac{20}{100} \right)^3 \right] = \text{Rs.} \left(100 \times \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} \right) = \text{Rs.} 51.20$.

\therefore Reduction in value = $(100 - 51.20)\% = 48.8\%$.

158. Population in 1998 = $\frac{138915}{\left(1 + \frac{5}{100}\right)^3} = \left(138915 \times \frac{20}{21} \times \frac{20}{21} \times \frac{20}{21}\right) = 120000.$

159. Purchase price = Rs. $\left[\frac{8748}{\left(1 - \frac{10}{100}\right)^3} \right] = \text{Rs.} \left(8748 \times \frac{10}{9} \times \frac{10}{9} \times \frac{10}{9}\right) = \text{Rs.} 12000.$

160. Number of ticketless travellers in April

$$= 4000 \times \left(1 + \frac{5}{100}\right) \left(1 - \frac{5}{100}\right) \left(1 - \frac{10}{100}\right) = \left(4000 \times \frac{21}{20} \times \frac{19}{20} \times \frac{9}{10}\right) = 3591.$$

161. Number of bushes in the beginning

$$= \frac{26730}{\left(1 + \frac{10}{100}\right) \left(1 + \frac{8}{100}\right) \left(1 - \frac{10}{100}\right)} = \left(26730 \times \frac{10}{11} \times \frac{25}{27} \times \frac{10}{9}\right) = 25000.$$

162. Let the production in 1998 be 100 units. Then,

$$\begin{aligned} \text{Production in 2002} &= 100 \times \left(1 + \frac{15}{100}\right)^2 \left(1 - \frac{10}{100}\right) \left(1 + \frac{15}{100}\right) \\ &= \left(100 \times \frac{23}{20} \times \frac{23}{20} \times \frac{9}{10} \times \frac{23}{20}\right) = 136.88. \end{aligned}$$

\therefore Increase in production = $(136.88 - 100)\% = 36.88\% = 37\%.$

163. $10 \text{ crores} \times \left(1 + \frac{R}{100}\right)^3 = 13.31 \text{ crores.}$

$$\therefore \left(1 + \frac{R}{100}\right)^3 = \frac{13.31 \text{ crores}}{10 \text{ crores}} = \frac{13.31}{10} = \frac{1331}{1000} = \left(\frac{11}{10}\right)^3.$$

$$\text{So, } \left(1 + \frac{R}{100}\right) = \frac{11}{10} \Leftrightarrow \left(1 + \frac{R}{100}\right) = \left(1 + \frac{1}{10}\right) \Leftrightarrow \frac{R}{100} = \frac{1}{10} \Leftrightarrow R = 10.$$

164. Let the required time be n years. Then, $72900 \times \left(1 + \frac{10}{100}\right)^n = 133100 \times \left(1 - \frac{10}{100}\right)^n$

$$\Rightarrow \left(\frac{11}{10}\right)^n \times \left(\frac{10}{9}\right)^n = \frac{133100}{72900} \Leftrightarrow \left(\frac{11}{9}\right)^n = \frac{1331}{729} = \left(\frac{11}{9}\right)^3 \Leftrightarrow n = 3.$$

165. Let original population = 100.

$$\text{Population after 3 years} = 100 \times \left(1 + \frac{3\frac{1}{2}}{100}\right)^3 = 100 \times \frac{207}{200} \times \frac{207}{200} \times \frac{207}{200} = 110.87.$$

\therefore Increase = $(110.87 - 100)\% = 10.87\% = 10.8\%.$

166. Net growth on 1000 = $(32 - 11) = 21$. Net growth on 100 = $\left(\frac{21}{1000} \times 100\right)\% = 2.1\%.$

167. Let the number of males be x . Then, number of females = $(5000 - x)$.

$$\therefore 10\% \text{ of } x + 15\% \text{ of } (5000 - x) = (5600 - 5000)$$

$$\Leftrightarrow \frac{10}{100}x + \frac{15}{100}(5000 - x) = 600 \Leftrightarrow 10x + 75000 - 15x = 60000$$

$$\Leftrightarrow 5x = 15000 \Leftrightarrow x = 3000.$$

168. $A = 125\% \text{ of } B \Rightarrow A = \frac{125}{100} B \Rightarrow B = \frac{100}{125} A = \left(\frac{4}{5} \times 100\right)\% \text{ of } A = 80\% \text{ of } A.$

169. B's salary is less than A's by $\left[\frac{50}{(100+50)} \times 100\right]\% \text{ i.e., } \frac{100}{3}\% = 33\frac{1}{3}\%.$

170. Excess of B's height over A's $= \left[\frac{40}{(100-40)} \times 100\right]\% = \frac{200}{3}\% = 66\frac{2}{3}\%.$

171. $p = 6q$. So, q is less than p by $5q$.

$$\therefore \text{Required percentage} = \left(\frac{5q}{p} \times 100\right)\% = \left(\frac{5q}{6q} \times 100\right)\% = 83\frac{1}{3}\%.$$

172. Let third number be x .

$$\text{Then, first number} = 70\% \text{ of } x = \frac{7x}{10}; \text{second number} = 63\% \text{ of } x = \frac{63x}{100}.$$

$$\text{Difference} = \left(\frac{7x}{10} - \frac{63x}{100}\right) = \frac{7x}{100}.$$

$$\therefore \text{Required percentage} = \left(\frac{7x}{100} \times \frac{10}{7x} \times 100\right)\% = 10\%.$$

173. Let third number be x .

$$\text{Then, first number} = 112\frac{1}{2}\% \text{ of } x = \frac{9x}{8}; \text{second number} = 125\% \text{ of } x = \frac{5}{4}x.$$

$$\therefore \text{Required percentage} = \left(\frac{9x}{8} \times \frac{4}{5x} \times 100\right)\% = 90\%.$$

174. $A = 40\% \text{ of } B = 40\% \text{ of } (25\% \text{ of } C) = \left(\frac{40}{100} \times \frac{25}{100} \times 100\right)\% \text{ of } C = 10\% \text{ of } C.$

175. $\frac{5}{100}A = \frac{15}{100}B \text{ and } \frac{10}{100}B = \frac{20}{100}C \Rightarrow A = 3B \text{ and } B = 2C = 2 \times 2000 = 4000.$

$$\therefore A = 3 \times 4000 = 12000.$$

$$\text{Hence, } A + B + C = (12000 + 4000 + 2000) = 18000.$$

176. $P = \frac{140}{100}A = \frac{140}{100} \left(\frac{80}{100}M\right) = \left(\frac{140}{100} \times \frac{80}{100} \times 100\right)\% \text{ of } M = 112\% \text{ of } M.$

177. Let Deepak's monthly income = Rs. 100. Then, Raunaq's monthly income = Rs. 80.

$$\text{Amit's monthly income} = \text{Rs. } \left(\frac{130}{100} \times 80\right) = \text{Rs. } 104.$$

If difference between Amit's and Deepak's income is Rs. 4, then Raunaq's income

$$= \text{Rs. } 80.$$

$$\text{If difference is Rs. 800, Raunaq's income} = \text{Rs. } \left(\frac{80}{4} \times 800\right) = \text{Rs. } 16000.$$

178. $A = \frac{120}{100}B, B = \frac{120}{100}C \text{ and } C = \frac{85}{100}D.$

$$\therefore B = \frac{5}{6}A, C = \frac{5}{6}B \text{ and } D = \frac{20}{17}C.$$

$$B = \frac{5}{6} \times 576 = 480; C = \frac{5}{6} \times 480 = 400; D = \frac{20}{17} \times 400 = \frac{8000}{17}.$$

$$\text{So, required percentage} = \left(\frac{8000}{17} \times \frac{1}{800} \times 100\right)\% = 58.82\%.$$

179. Let number of students appeared from school A = 100.

Then, number of students qualified from school A = 70.

Number of students appeared from school B = 120.

$$\text{Number of students qualified from school B} = \left(\frac{150}{100} \times 70 \right) = 105.$$

$$\therefore \text{Required percentage} = \left(\frac{105}{120} \times 100 \right)\% = 87.5\%.$$

180. Quantity of pulp in 100 kg of fresh fruits = $(100 - 68)\%$ of 100 kg = 32 kg

Let the quantity of dry fruit obtained be x kg.

$$\text{Then, } (100 - 20)\% \text{ of } x = 32 \Leftrightarrow \frac{80}{100}x = 32 \Leftrightarrow x = \left(\frac{32 \times 100}{80} \right) = 40.$$

181. Let the reduced weight be x kg.

Clearly, the quantity of pulp remains the same in both the cases.

So, $(100 - 96)\%$ of 20 kg = $(100 - 95)\%$ of x kg

$$\Leftrightarrow 4\% \text{ of } 20 \text{ kg} = 5\% \text{ of } x \text{ kg} \Leftrightarrow x = \left(\frac{4}{5} \times 20 \right) \text{ kg} = 16 \text{ kg.}$$

182. Quantity of alcohol in 400 ml solution = $\left(\frac{15}{100} \times 400 \right)$ ml = 60 ml.

Quantity of water = $(400 - 60)$ ml = 340 ml.

Let x ml of alcohol be added.

$$\text{Then, } \frac{60+x}{400+x} = \frac{32}{100} \Leftrightarrow 6000 + 100x = 12800 + 32x \Leftrightarrow 68x = 6800 \Leftrightarrow x = 100.$$

183. Quantity of water in 10 litres = 5% of 10 litres = 0.5 litres.

Let x litres of pure milk be added. Then, $\frac{0.5}{10+x} = \frac{2}{100} \Leftrightarrow 2x = 30 \Leftrightarrow x = 15$.

184. Quantity of alcohol in 9 ml lotion = $\left(\frac{50}{100} \times 9 \right)$ ml = 4.5 ml.

Let the water to be added be x ml.

$$\text{Then, } \frac{4.5}{9+x} = \frac{30}{100} \Leftrightarrow 270 + 30x = 450 \Leftrightarrow x = 6 \text{ ml.}$$

185. Quantity of sugar = $\left(\frac{40}{100} \times 3 \right)$ kg = 1.2 kg.

$$\therefore \text{New percentage} = \left(\frac{1.2}{4} \times 100 \right)\% = 30\%.$$

186. Required percentage = $\left(\frac{20\% \text{ of } 10 + 35\% \text{ of } 4}{10+4} \times 100 \right)\% = \left(\frac{3.4}{14} \times 100 \right)\% = 24\frac{2}{7}\%$.

187. Let the original quantity be x kg. Vanaspati ghee in x kg = $\left(\frac{40}{100}x \right)$ kg = $\left(\frac{2x}{5} \right)$ kg.

$$\text{Now, } \frac{\frac{2x}{5}}{x+10} = \frac{20}{100} \Leftrightarrow \frac{2x}{5x+50} = \frac{1}{5} \Leftrightarrow 5x = 50 \Leftrightarrow x = 10.$$

188. Let the original total weight be x . Weight of container = $\frac{25}{100}x = \frac{x}{4}$.

$$\text{Original weight of fluid} = \left(x - \frac{x}{4}\right) = \frac{3x}{4}.$$

$$\text{New weight of (container + fluid)} = \frac{50}{100}x = \frac{x}{2}. \text{ New weight of fluid} = \left(\frac{x}{2} - \frac{x}{4}\right) = \frac{x}{4}.$$

$$\therefore \text{Required fraction} = \frac{\left(\frac{3x}{4} - \frac{x}{4}\right)}{\frac{3x}{4}} = \frac{x}{2} \times \frac{4}{3x} = \frac{2}{3}.$$

189. Let total quantity of original milk = 1000 gm.

Milk after first operation = 80% of 1000 = 800 gm.

Milk after second operation = 80% of 800 = 640 gm.

Milk after third operation = 80% of 640 = 512 gm.

\therefore Strength of final mixture = 51.2%.

190. Let the capacity of the tank be 100 litres. Then,

Initially : A type petrol = 100 litres.

After first operation :

$$\text{A type petrol} = \left(\frac{100}{2}\right) = 50 \text{ litres}; \text{B type petrol} = 50 \text{ litres}.$$

After second operation :

$$\text{A type petrol} = \left(\frac{50}{2} + 50\right) = 75 \text{ litres}; \text{B type petrol} = \left(\frac{50}{2}\right) = 25 \text{ litres}.$$

After third operation :

$$\text{A type petrol} = \left(\frac{75}{2}\right) = 37.5 \text{ litres}; \text{B type petrol} = \left(\frac{25}{2} + 50\right) = 62.5 \text{ litres}.$$

\therefore Required percentage = 37.5%.

191. Total money = Rs. $\left(600 \times \frac{25}{100} + 1200 \times \frac{50}{100}\right)$ = Rs. 750.

$$25 \text{ paise coins removed} = \left(\frac{12}{100} \times 600\right) = 72.$$

$$50 \text{ paise coins removed} = \left(\frac{24}{100} \times 1200\right) = 288.$$

$$\text{Money removed} = \text{Rs.} \left(72 \times \frac{25}{100} + 288 \times \frac{50}{100}\right) = \text{Rs.} 162.$$

$$\therefore \text{Required percentage} = \left(\frac{162}{750} \times 100\right)\% = 21.6\%.$$

192. Let the original price be Rs. 100 per kg.

Money required to buy 49 kg of rice = Rs. (100×49) = Rs. 4900.

New price = Rs. 98 per kg.

$$\therefore \text{Quantity of rice bought} = \left(\frac{4900}{98}\right) \text{ kg} = 50 \text{ kg}.$$

193. Let original price = Rs. x per kg. Reduced price = Rs. $\left(\frac{79x}{100}\right)$ per kg.

$$\therefore \frac{100}{79x} - \frac{100}{x} = 10.5 \Leftrightarrow \frac{10000}{79x} - \frac{100}{x} = 10.5$$

$$\Leftrightarrow 10000 - 7900 = 10.5 \times 79x \Leftrightarrow x = \frac{2100}{10.5 \times 79}$$

\therefore Reduced price = Rs. $\left(\frac{79}{100} \times \frac{2100}{10.5 \times 79}\right)$ per kg = Rs. 2 per kg.

194. Let the original price per egg be Rs. x . Then, increased price = Rs. $\left(\frac{130}{100}x\right)$.

$$\therefore \frac{7.80}{x} - \frac{7.80}{\frac{130}{100}x} = 3 \Leftrightarrow \frac{7.80}{x} - \frac{7.80}{130x} = 3$$

$$\Leftrightarrow 1014 - 780 = 3 \times 130x \Leftrightarrow 390x = 234 \Leftrightarrow x = 0.6$$

So, present price per dozen = Rs. $\left(12 \times \frac{130}{100} \times 0.6\right)$ = Rs. 9.36.

195. Let original price = Rs. x per kg. Reduced price = Rs. $\left(\frac{90x}{100}\right)$ per kg.

$$\therefore \frac{279}{\left(\frac{90x}{100}\right)} - \frac{279}{x} = 6.2 \Leftrightarrow \frac{27900}{90x} - \frac{279}{x} = 6.2$$

$$\Leftrightarrow 27900 - 25110 = 6.2 \times 90x$$

$$\Leftrightarrow 558x = 2790 \Leftrightarrow x = 5$$

\therefore Required difference = 10% of Rs. 5 = Re. 0.50.

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

So, $n(A \cup B) = n(A) + n(B) - n(A \cap B) = 34 + 42 - 20 = 56$.

\therefore Percentage failed in either or both the subjects = 56.

Hence, percentage passed = $(100 - 56)\% = 44\%$.

197. $n(A) = 40$, $n(B) = 50$, $n(A \cap B) = 10$.

$n(A \cup B) = n(A) + n(B) - n(A \cap B) = 40 + 50 - 10 = 80$.

\therefore Percentage reading either or both newspapers = 80%.

Hence, percentage reading neither newspaper = $(100 - 80)\% = 20\%$.

198. $n(A) = 325$, $n(B) = 175$, $n(A \cup B) = 450 - 50 = 400$.

Required number = $n(A \cap B) = n(A) + n(B) - n(A \cup B) = 325 + 175 - 400 = 100$.

199. $n(A) = \left(\frac{60}{100} \times 96\right) = \frac{288}{5}$, $n(B) = \left(\frac{30}{100} \times 96\right) = \frac{144}{5}$, $n(A \cap B) = \left(\frac{15}{100} \times 96\right) = \frac{72}{5}$.

$$\therefore n(A \cup B) = n(A) + n(B) - n(A \cap B) = \frac{288}{5} + \frac{144}{5} - \frac{72}{5} = \frac{360}{5} = 72$$

So, people who had either or both types of lunch = 72.

Hence, people who had neither type of lunch = $(96 - 72) = 24$.

200. $n(A) = \left(\frac{75}{100} \times 600 \right) = 450$, $n(B) = \left(\frac{45}{100} \times 600 \right) = 270$, $n(A \cup B) = 600$.

$$\therefore n(A \cap B) = n(A) + n(B) - n(A \cup B) = (450 + 270 - 600) = 120.$$

201. Let total number be x . Then,

$$n(A) = \frac{72}{100}x = \frac{18x}{25}, n(B) = \frac{44}{100}x = \frac{11x}{25} \text{ and } n(A \cap B) = 40.$$

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

$$\Rightarrow x - \frac{18x}{25} + \frac{11x}{25} - 40 = \frac{29x}{25} - x = 40 \Rightarrow \frac{4x}{25} = 40 \Rightarrow x = 250.$$

202. Let the total number of students be x .

Number passed in one or both is given by :

$$n(A \cup B) = n(A) + n(B) - n(A \cap B) = 65\% \text{ of } x + 60\% \text{ of } x - 40\% \text{ of } x$$

$$= \left(\frac{65}{100}x + \frac{60}{100}x - \frac{40}{100}x \right) = \frac{85}{100}x = \frac{17}{20}x.$$

$$\therefore \text{Failed in both} = \left(x - \frac{17}{20}x \right) = \frac{3x}{20}.$$

$$\therefore \frac{3x}{20} = 90 \Leftrightarrow x = \left(\frac{90 \times 20}{3} \right) = 600.$$

203. Failed in 1st subject = $\left(\frac{35}{100} \times 2500 \right) = 875$.

$$\text{Failed in 2nd subject} = \left(\frac{42}{100} \times 2500 \right) = 1050.$$

$$\text{Failed in both} = \left(\frac{15}{100} \times 2500 \right) = 375.$$

$$\text{Failed in 1st subject only} = (875 - 375) = 500.$$

$$\text{Failed in 2nd subject only} = (1050 - 375) = 675.$$

$$\therefore \text{Passed in 2nd only} + \text{Passed in 1st only} = (675 + 500) = 1175.$$

11. PROFIT AND LOSS

IMPORTANT FACTS

Cost Price : The price at which an article is purchased, is called its **cost price**, abbreviated as **C.P.**

Selling Price : The price at which an article is sold, is called its **selling price**, abbreviated as **S.P.**

Profit or Gain : If S.P. is greater than C.P., the seller is said to have a **profit or gain**.

Loss : If S.P. is less than C.P., the seller is said to have incurred a **loss**.

FORMULAE

$$1. \text{Gain} = (\text{S.P.}) - (\text{C.P.})$$

$$2. \text{Loss} = (\text{C.P.}) - (\text{S.P.})$$

3. Loss or gain is always reckoned on C.P.

$$4. \text{Gain\%} = \left(\frac{\text{Gain} \times 100}{\text{C.P.}} \right)$$

$$5. \text{Loss\%} = \left(\frac{\text{Loss} \times 100}{\text{C.P.}} \right)$$

$$6. \text{S.P.} = \frac{(100 + \text{Gain\%})}{100} \times \text{C.P.}$$

$$7. \text{S.P.} = \frac{(100 - \text{Loss\%})}{100} \times \text{C.P.}$$

$$8. \text{C.P.} = \frac{100}{(100 + \text{Gain\%})} \times \text{S.P.}$$

$$9. \text{C.P.} = \frac{100}{(100 - \text{Loss\%})} \times \text{S.P.}$$

10. If an article is sold at a gain of say, 35%, then S.P. = 135% of C.P.

11. If an article is sold at a loss of say, 35%, then S.P. = 65% of C.P.

12. When a person sells two similar items, one at a gain of say, $x\%$, and the other at a loss of $x\%$, then the seller always incurs a loss given by :

$$\text{Loss\%} = \left(\frac{\text{Common Loss and Gain\%}}{10} \right)^2 = \left(\frac{x}{10} \right)^2$$

13. If a trader professes to sell his goods at cost price, but uses false weights, then

$$\text{Gain\%} = \left[\frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100 \right] \%$$

SOLVED EXAMPLES

Ex. 1. A man buys an article for Rs. 27.50 and sells it for Rs. 28.60. Find his gain percent.

Sol. C.P. = Rs. 27.50, S.P. = Rs. 28.60.

So, Gain = Rs. (28.60 - 27.50) = Rs. 1.10.

$$\therefore \text{Gain\%} = \left(\frac{1.10}{27.50} \times 100 \right) \% = 4\%$$

Ex. 2. If a radio is purchased for Rs. 490 and sold for Rs. 465.50, find the loss percent.

Sol. C.P. = Rs. 490, S.P. = Rs. 465.50.

$$\therefore \text{Loss} = \text{Rs. } (490 - 465.50) = \text{Rs. } 24.50.$$

$$\therefore \text{Loss\%} = \left(\frac{24.50}{490} \times 100 \right)\% = 5\%.$$

Ex. 3. Find S.P., when

(i) C.P. = Rs. 56.25, Gain = 20% (ii) C.P. = Rs. 80.40, Loss = 5%

$$\text{Sol. (i)} \quad \text{S.P.} = 120\% \text{ of Rs. } 56.25 = \text{Rs. } \left(\frac{120}{100} \times 56.25 \right) = \text{Rs. } 67.50$$

$$\text{Sol. (ii)} \quad \text{S.P.} = 85\% \text{ of Rs. } 80.40 = \text{Rs. } \left(\frac{85}{100} \times 80.40 \right) = \text{Rs. } 68.34.$$

Ex. 4. Find C.P., when

(i) S.P. = Rs. 40.60, Gain = 16% (ii) S.P. = Rs. 51.70, Loss = 12%

$$\text{Sol. (i)} \quad \text{C.P.} = \text{Rs. } \left(\frac{100}{116} \times 40.60 \right) = \text{Rs. } 35.$$

$$\text{Sol. (ii)} \quad \text{C.P.} = \text{Rs. } \left(\frac{100}{88} \times 51.70 \right) = \text{Rs. } 58.75.$$

Ex. 5. A person incurs 5% loss by selling a watch for Rs. 1140. At what price should the watch be sold to earn 5% profit? (R.R.B. 2002)

Sol. Let the new S.P. be Rs. x . Then,

$$(100 - \text{loss\%}) : (\text{1st S.P.}) = (100 + \text{gain\%}) : (\text{2nd S.P.}) \\ \Rightarrow \left(\frac{100 - 5}{1140} \right) = \left(\frac{100 + 5}{x} \right) \Rightarrow x = \left(\frac{105 \times 1140}{95} \right) = 1260.$$

\therefore New S.P. = Rs. 1260.

Ex. 6. A book was sold for Rs. 27.50 with a profit of 10%. If it were sold for Rs. 25.75, then what would have been the percentage of profit or loss?

(Hotel Management, 2003)

Sol. S.P. = Rs. 27.50, Profit = 10%.

$$\text{So, C.P.} = \text{Rs. } \left(\frac{100}{110} \times 27.50 \right) = \text{Rs. } 25.$$

When S.P. = Rs. 25.75, profit = Rs. $(25.75 - 25) = \text{Rs. } 0.75$.

$$\therefore \text{Profit\%} = \left(\frac{0.75}{25} \times 100 \right)\% = 3\%.$$

Ex. 7. If the cost price is 96% of the selling price, then what is the profit percent?

Sol. Let S.P. = Rs. 100. Then, C.P. = Rs. 96; Profit = Rs. 4.

$$\therefore \text{Profit\%} = \left(\frac{4}{96} \times 100 \right)\% = \frac{25}{6}\% = 4.17\%.$$

Ex. 8. The C.P. of 21 articles is equal to S.P. of 18 articles. Find the gain or loss percent.

Sol. Let C.P. of each article be Re. 1.

Then, C.P. of 18 articles = Rs. 18, S.P. of 18 articles = Rs. 21.

$$\therefore \text{Gain\%} = \left(\frac{3}{18} \times 100 \right)\% = 16\frac{2}{3}\%.$$

Ex. 9. By selling 33 metres of cloth, one gains the selling price of 11 metres. Find the gain percent. (Section Officers', 2001)

$$\text{Sol. } (\text{S.P. of } 33 \text{ m}) - (\text{C.P. of } 33 \text{ m}) = \text{Gain} = \text{S.P. of } 11 \text{ m.}$$

$$\therefore \text{S.P. of } 22 \text{ m} = \text{C.P. of } 33 \text{ m.}$$

Let C.P. of each metre be Re. 1. Then, C.P. of 22 m = Rs. 22, S.P. of 22 m = Rs. 33.

$$\therefore \text{Gain \%} = \left(\frac{11}{22} \times 100 \right) \% = 50\%.$$

Ex. 10. A vendor bought bananas at 6 for Rs. 10 and sold them at 4 for Rs. 6. Find his gain or loss percent.

Sol. Suppose, number of bananas bought = L.C.M. of 6 and 4 = 12.

$$\therefore \text{C.P.} = \text{Rs.} \left(\frac{10}{6} \times 12 \right) = \text{Rs.} 20; \text{S.P.} = \text{Rs.} \left(\frac{6}{4} \times 12 \right) = \text{Rs.} 18.$$

$$\therefore \text{Loss \%} = \left(\frac{2}{20} \times 100 \right) \% = 10\%.$$

Ex. 11. A man bought toffees at 3 for a rupee. How many for a rupee must he sell to gain 50%?

$$\text{Sol. C.P. of 3 toffees} = \text{Re.} 1; \text{S.P. of 3 toffees} = 150\% \text{ of Re.} 1 = \frac{3}{2}.$$

$$\text{For Re.} \frac{3}{2}, \text{toffees sold} = 3. \text{For Re.} 1, \text{toffees sold} = \left(3 \times \frac{2}{3} \right) = 2.$$

Ex. 12. A grocer purchased 80 kg of sugar at Rs. 13.50 per kg and mixed it with 120 kg sugar at Rs. 16 per kg. At what rate should he sell the mixture to gain 16%?

Sol. C.P. of 200 kg of mixture = Rs. $(80 \times 13.50 + 120 \times 16) = \text{Rs.} 3000.$

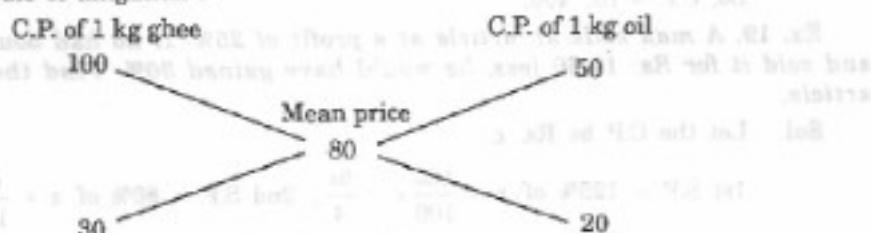
$$\text{S.P.} = 116\% \text{ of Rs.} 3000 = \text{Rs.} \left(\frac{116}{100} \times 3000 \right) = \text{Rs.} 3480.$$

$$\therefore \text{Rate of S.P. of the mixture} = \text{Rs.} \left(\frac{3480}{200} \right) \text{ per kg} = \text{Rs.} 17.40 \text{ per kg.}$$

Ex. 13. Pure ghee costs Rs. 100 per kg. After adulterating it with vegetable oil costing Rs. 50 per kg, a shopkeeper sells the mixture at the rate of Rs. 96 per kg, thereby making a profit of 20%. In what ratio does he mix the two?

$$\text{Sol. Mean cost price} = \text{Rs.} \left(\frac{100}{120} \times 96 \right) = \text{Rs.} 80 \text{ per kg.}$$

By the rule of alligation :



$$\therefore \text{Required ratio} = 30 : 20 = 3 : 2.$$

Ex. 14. A dishonest dealer professes to sell his goods at cost price but uses a weight of 960 gms for a kg. weight. Find his gain percent.

$$\text{Sol. Gain \%} = \left[\frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100 \right] \% = \left(\frac{40}{960} \times 100 \right) \% = 4 \frac{1}{6}\%.$$

Ex. 15. If the manufacturer gains 10%, the wholesale dealer 15% and the retailer 25%, then find the cost of production of a table, the retail price of which is Rs. 1265?

Sol. Let the cost of production of the table be Rs. x .

Then, 125% of 115% of 110% of x = 1265

$$\Rightarrow \frac{125}{100} \times \frac{115}{100} \times \frac{110}{100} \times x = 1265 \Rightarrow \frac{253}{160} x = 1265 \Rightarrow x = \left(\frac{1265 \times 160}{253} \right) = \text{Rs. } 800.$$

Ex. 16. Monika purchased a pressure cooker at $\frac{9}{10}$ th of its selling price and sold it at 8% more than its S.P. Find her gain percent.

Sol. Let the S.P. be Rs. x . Then, C.P. = Rs. $\frac{9x}{10}$, Receipt = 108% of Rs. x = Rs. $\frac{27x}{25}$.

$$\text{Gain} = \text{Rs.} \left(\frac{27x}{25} - \frac{9x}{10} \right) = \text{Rs.} \left(\frac{108x - 90x}{100} \right) = \text{Rs.} \frac{18x}{100}.$$

$$\therefore \text{Gain\%} = \left(\frac{18x}{100} \times \frac{10}{9x} \times 100 \right)\% = 20\%.$$

Ex. 17. An article is sold at a certain price. By selling it at $\frac{2}{3}$ of that price one loses 10%. Find the gain percent at original price.

Sol. Let the original S.P. be Rs. x . Then, New S.P. = Rs. $\frac{2}{3}x$, Loss = 10%.

$$\text{So, C.P.} = \text{Rs.} \left(\frac{100}{90} \times \frac{2}{3}x \right) = \frac{20x}{27}.$$

$$\text{Now, C.P.} = \text{Rs.} \frac{20x}{27}, \text{S.P.} = \text{Rs. } x, \text{Gain} = \text{Rs.} \left(x - \frac{20x}{27} \right) = \text{Rs.} \frac{7x}{27}.$$

$$\therefore \text{Gain\%} = \left(\frac{7x}{27} \times \frac{27}{20x} \times 100 \right)\% = 35\%.$$

Ex. 18. A tradesman sold an article at a loss of 20%. If the selling price had been increased by Rs. 100, there would have been a gain of 5%. What was the cost price of the article?

(S.S.C. 2004)

Sol. Let C.P. be Rs. x . Then, $(105\% \text{ of } x) - (80\% \text{ of } x) = 100$ or $25\% \text{ of } x = 100$

$$\therefore \frac{x}{4} = 100 \text{ or } x = 400.$$

So, C.P. = Rs. 400.

Ex. 19. A man sells an article at a profit of 25%. If he had bought it at 20% less and sold it for Rs. 10.50 less, he would have gained 30%. Find the cost price of the article.

Sol. Let the C.P. be Rs. x .

$$\text{1st S.P.} = 125\% \text{ of } x = \frac{125}{100}x = \frac{5x}{4}; \text{ 2nd S.P.} = 80\% \text{ of } x = \frac{80}{100}x = \frac{4x}{5}.$$

$$\text{2nd S.P.} = 130\% \text{ of } \frac{4x}{5} = \left(\frac{130}{100} \times \frac{4x}{5} \right) = \frac{26x}{25}.$$

$$\therefore \frac{5x}{4} - \frac{26x}{25} = 10.50 \Leftrightarrow \frac{25x}{100} = 10.50 \Leftrightarrow x = \left(\frac{10.50 \times 100}{25} \right) = 50.$$

Hence, C.P. = Rs. 50.

Ex. 20. The price of a jewel, passing through three hands, rises on the whole by 65%. If the first and the second sellers earned 20% and 25% profit respectively, find the percentage profit earned by the third seller.

Sol. Let the original price of the jewel be Rs. P and let the profit earned by the third seller be $x\%$.

Then, $(100 + x)\%$ of 125% of 120% of P = 165% of P

$$\Rightarrow \left[\frac{(100+x)}{100} \times \frac{125}{100} \times \frac{120}{100} \times P \right] = \left(\frac{165}{100} \times P \right)$$

$$\Rightarrow (100+x) = \left(\frac{165 \times 100 \times 100}{125 \times 120} \right) = 110 \Rightarrow x = 10\%.$$

Ex. 21. A man sold two flats for Rs. 6,75,958 each. On one he gains 16% while on the other he loses 16%. How much does he gain or lose in the whole transaction?

Sol. Remember : In such a case, there is always a loss. The selling price is immaterial.

$$\therefore \text{Loss}\% = \left(\frac{\text{Common Loss and Gain}\%}{10} \right)^2 = \left(\frac{16}{10} \right)^2 \% = \left(\frac{64}{25} \right)\% = 2.56\%.$$

Ex. 22. A dealer sold three-fourth of his articles at a gain of 20% and the remaining at cost price. Find the gain earned by him in the whole transaction.

Sol. Let C.P. of whole be Rs. x.

$$\text{C.P. of } \frac{3}{4} \text{ th} = \text{Rs. } \frac{3x}{4}, \text{ C.P. of } \frac{1}{4} \text{ th} = \text{Rs. } \frac{x}{4}.$$

$$\text{Total S.P.} = \text{Rs.} \left[\left(120\% \text{ of } \frac{3x}{4} \right) + \frac{x}{4} \right] = \text{Rs.} \left(\frac{9x}{10} + \frac{x}{4} \right) = \text{Rs. } \frac{23x}{20}.$$

$$\text{Gain} = \text{Rs.} \left(\frac{23x}{20} - x \right) = \text{Rs. } \frac{3x}{20}.$$

$$\therefore \text{Gain}\% = \left(\frac{3x}{20} \times \frac{1}{x} \times 100 \right)\% = 15\%.$$

Ex. 23. A man bought a horse and a carriage for Rs. 3000. He sold the horse at a gain of 20% and the carriage at a loss of 10%, thereby gaining 2% on the whole. Find the cost of the horse. (M.B.A. 2002)

Sol. Let the C.P. of the horse be Rs. x. Then, C.P. of the carriage = Rs. $(3000 - x)$.

$$\therefore 20\% \text{ of } x - 10\% \text{ of } (3000 - x) = 2\% \text{ of } 3000$$

$$\Rightarrow \frac{x}{5} - \frac{(3000 - x)}{10} = 60 \Rightarrow 2x - 3000 + x = 600 \Rightarrow 3x = 3600 \Rightarrow x = 1200.$$

Hence, C.P. of the horse = Rs. 1200.

Ex. 24. Find the single discount equivalent to a series discount of 20%, 10% and 5%.

Sol. Let marked price be Rs. 100.

Then, Net S.P. = 95% of 90% of 80% of Rs. 100

$$= \text{Rs.} \left(\frac{95}{100} \times \frac{90}{100} \times \frac{80}{100} \times 100 \right) = \text{Rs. } 68.40.$$

$$\therefore \text{Required discount} = (100 - 68.40)\% = 31.6\%.$$

Ex. 25. After getting two successive discounts, a shirt with a list price of Rs. 150 is available at Rs. 105. If the second discount is 12.5%, find the first discount.

Sol. Let the first discount be $x\%$.

Then, 87.5% of $(100 - x)\%$ of 150 = 105

$$\Rightarrow \frac{87.5}{100} \times \frac{(100 - x)}{100} \times 150 = 105 \Rightarrow 100 - x = \left(\frac{105 \times 100 \times 100}{150 \times 87.5} \right) = 80$$

$$\Rightarrow x = (100 - 80) = 20.$$

$$\therefore \text{First discount} = 20\%.$$

Ex. 26. An uneducated retailer marks all his goods at 50% above the cost price and thinking that he will still make 25% profit, offers a discount of 25% on the marked price. What is his actual profit on the sales? (IGNOU, 2003)

Sol. Let C.P. = Rs. 100. Then, marked price = Rs. 150.
S.P. = 75% of Rs. 150 = Rs. 112.50.

$$\therefore \text{Gain\%} = 12.50\%.$$

Ex. 27. A retailer buys 40 pens at the marked price of 36 pens from a wholesaler. If he sells these pens giving a discount of 1%, what is the profit percent? (S.S.C. 2003)

Sol. Let the marked price of each pen be Re. 1.

Then, C.P. of 40 pens = Rs. 36. S.P. of 40 pens = 99% of Rs. 40 = Rs. 39.60.

Ex. 28. At what percentage above the C.P. must an article be marked so as to gain 33% after allowing a customer a discount of 5%? (M.B.A. 2003)

Sol. Let C.P. = Rs. 100. Then, S.P. = Rs. 133.

Let marked price be Rs. x .

$$\text{Then, } 95\% \text{ of } x = 133 \Rightarrow \frac{95}{100}x = 133 \Rightarrow x = \left(133 \times \frac{100}{95} \right) = 140.$$

\therefore Marked price = 40% above C.P.

Ex. 29. When a producer allows 36% commission on the retail price of his product, he earns a profit of 8.8%. What would be his profit percent if the commission is reduced by 24%? (M.B.A. 2002)

Sol. Let retail price = Rs. 100. Then, commission = Rs. 36.

$$\therefore \text{S.P.} = \text{Rs. } (100 - 36) = \text{Rs. } 64.$$

But, profit = 8.8%.

$$\therefore \text{C.P.} = \text{Rs. } \left(\frac{100}{108.8} \times 64 \right) = \text{Rs. } \frac{1000}{17}.$$

New commission = Rs. 12. New S.P. = Rs. $(100 - 12) = \text{Rs. } 88$.

$$\text{Gain} = \text{Rs. } \left(88 - \frac{1000}{17} \right) = \text{Rs. } \frac{496}{17}.$$

$$\therefore \text{Gain\%} = \left(\frac{496}{17} \times \frac{17}{1000} \times 100 \right)\% = 49.6\%.$$

EXERCISE 11A

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (\checkmark) against the correct answer :

1. I gain 70 paise on Rs. 70. My gain percent is :

- (a) 0.1% (b) 1% (c) 7% (d) 10%

2. In terms of percentage profit, which is the best transaction ? (C.B.I. 2003)

C.P. (in Rs.)	Profit (in Rs.)
(a) 36	17
(b) 50	24
(c) 40	19
(d) 60	29

16. Saransh purchased 120 reams of paper at Rs. 80 per ream. He spent Rs. 280 on transportation, paid octroi at the rate of 40 paise per ream and paid Rs. 72 to the coolie. If he wants to have a gain of 8%, what must be the selling price per ream ?
 (a) Rs. 86 (b) Rs. 87.48 (c) Rs. 89 (d) Rs. 90
17. A person bought 20 litres of milk at the rate of Rs. 8 per litre. He got it churned after spending Rs. 10 and 5 kg of cream and 20 litres of toned milk were obtained. If he sold the cream at Rs. 30 per kg and toned milk at Rs. 4 per litre, his profit in the transaction is :
 (a) 25% (b) 35.3% (c) 37.5% (d) 42.5%
18. Jacob bought a scooter for a certain sum of money. He spent 10% of the cost on repairs and sold the scooter for a profit of Rs. 1100. How much did he spend on repairs if he made a profit of 20% ?
 (Assistant Grade, 1997)
 (a) Rs. 400 (b) Rs. 440 (c) Rs. 500 (d) Rs. 550
19. A manufacturer undertakes to supply 2000 pieces of a particular component at Rs. 25 per piece. According to his estimates, even if 5% fail to pass the quality tests, then he will make a profit of 25%. However, as it turned out, 50% of the components were rejected. What is the loss to the manufacturer ?
 (M.A.T. 2003)
 (a) Rs. 12,000 (b) Rs. 13,000 (c) Rs. 14,000 (d) Rs. 15,000
20. A trader buys a chair for Rs. 600 and sells it for Rs. 765 at a credit of 4 months. Reckoning money worth 6% p.a., his gain percent is :
 (a) 20% (b) $22\frac{1}{2}\%$ (c) 25% (d) $27\frac{1}{2}\%$
21. When a plot is sold for Rs. 18,700, the owner loses 15%. At what price must the plot be sold in order to gain 15% ?
 (A.A.O. Exam, 2003)
 (a) Rs. 21,000 (b) Rs. 22,500 (c) Rs. 25,300 (d) Rs. 25,800
22. A fruitseller sells mangoes at the rate of Rs. 9 per kg and thereby loses 20%. At what price per kg, he should have sold them to make a profit of 5% ?
 (R.R.B. 2002)
 (a) Rs. 11.81 (b) Rs. 12 (c) Rs. 12.25 (d) Rs. 12.31
23. A property dealer sells a house for Rs. 5,30,000 and in the bargain makes a profit of 5%. Had he sold it for Rs. 5,00,000, then what percentage of loss or gain he would have made ?
 (Hotel Management, 2001)
 (a) $2\frac{1}{4}\%$ gain (b) 10% loss (c) $12\frac{1}{2}\%$ loss (d) $16\frac{2}{3}\%$ loss
24. A shopkeeper sells one transistor for Rs. 840 at a gain of 20% and another for Rs. 960 at a loss of 4%. His total gain or loss percent is :
 (Hotel Management, 1999)
 (a) $5\frac{15}{17}\%$ loss (b) $5\frac{15}{17}\%$ gain (c) $6\frac{2}{3}\%$ gain (d) None of these
25. If selling price of an article is $\frac{4}{3}$ of its cost price, the profit in the transaction is :
 (a) $16\frac{2}{3}\%$ (b) $20\frac{1}{2}\%$ (c) $25\frac{1}{2}\%$ (d) $33\frac{1}{3}\%$
26. The ratio of the cost price and the selling price is 4 : 5. The profit percent is :
 (a) 10% (b) 20% (c) 25% (d) 30%
 (Hotel Management, 2003)
27. The ratio between the sale price and the cost price of an article is 7 : 5. What is the ratio between the profit and the cost price of that article ?
 (Bank P.O. 2000)
 (a) 2 : 7 (b) 5 : 2 (c) 7 : 2
 (d) Data inadequate (e) None of these

28. A man gains 20% by selling an article for a certain price. If he sells it at double the price, the percentage of profit will be : (S.S.C. 2004)
 (a) 40 (b) 100 (c) 120 (d) 140
29. If selling price is doubled, the profit triples. Find the profit percent : (M.A.T. 2001)
 (a) $66\frac{2}{3}\%$ (b) 100 (c) $105\frac{1}{3}\%$ (d) 120
30. At what profit percent must an article be sold so that by selling at half that price, there may be a loss of 30% ?
 (a) 25% (b) 36% (c) 40% (d) 42%
31. The C.P. of an article is 40% of the S.P. The percent that the S.P. is of C.P. is :
 (a) 250 (b) 240 (c) 60 (d) 40
32. By selling a pen for Rs. 15, a man loses one-sixteenth of what it costs him. The cost price of the pen is :
 (a) Rs. 16 (b) Rs. 18 (c) Rs. 20 (d) Rs. 21
33. By selling an article, Michael earned a profit equal to one-fourth of the price he bought it. If he sold it for Rs. 375, what was the cost price ?
 (a) Rs. 281.75 (b) Rs. 300 (c) Rs. 312.50 (d) Rs. 350
34. 10% loss on selling price is what percent loss on the cost price ?
 (a) $9\frac{1}{11}\%$ (b) $9\frac{2}{11}\%$ (c) 10% (d) 11%
35. If loss is $\frac{1}{3}$ of S.P., the loss percentage is :
 (a) $16\frac{2}{3}\%$ (b) 20% (c) 25% (d) $33\frac{1}{3}\%$
36. In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit ? (M.A.T. 1998)
 (a) 30% (b) 70% (c) 100% (d) 250%
37. The profit earned by selling an article for Rs. 832 is equal to the loss incurred when the same article is sold for Rs. 448. What should be the sale price for making 50% profit ? (Bank P.O. 2000)
 (a) Rs. 920 (b) Rs. 960 (c) Rs. 1060 (d) Rs. 1200 (e) None of these
38. The profit earned by selling an article for Rs. 900 is double the loss incurred when the same article is sold for Rs. 450. At what price should the article be sold to make 25% profit ?
 (a) Rs. 600 (b) Rs. 750 (c) Rs. 800 (d) Data inadequate
39. The percentage profit earned by selling an article for Rs. 1920 is equal to the percentage loss incurred by selling the same article for Rs. 1280. At what price should the article be sold to make 25% profit ? (SIDBI, 2000)
 (a) Rs. 2000 (b) Rs. 2200 (c) Rs. 2400
 (d) Data inadequate (e) None of these
40. Profit earned by selling an article for Rs. 1060 is 20% more than the loss incurred by selling the article for Rs. 950. At what price should the article be sold to earn 20% profit ?
 (a) Rs. 980 (b) Rs. 1080 (c) Rs. 1800 (d) None of these
41. If the cost price of 12 pens is equal to the selling price of 8 pens, the gain percent is :
 (a) 25% (b) $33\frac{1}{3}\%$ (c) 50% (d) $66\frac{2}{3}\%$
 (S.S.C. 2004)

42. The cost price of 19 articles is equal to the selling price of 16 articles. Gain percent is :
 (a) $3\frac{9}{17}\%$ (b) $15\frac{15}{19}\%$ (c) $18\frac{3}{4}\%$ (d) 20%
43. If the selling price of 50 articles is equal to the cost price of 40 articles, then the loss or gain percent is :
 (a) 20% loss (b) 20% gain (c) 25% loss (d) 25% gain
 (Hotel Management, 2003)
44. If by selling 110 mangoes, the C.P. of 120 mangoes is realised, the gain percent is :
 (a) $9\frac{1}{11}\%$ (b) $9\frac{1}{9}\%$ (c) $10\frac{10}{11}\%$ (d) $11\frac{1}{9}\%$
45. The cost price of 20 articles is the same as the selling price of x articles. If the profit is 25%, then the value of x is :
 (a) 15 (b) 16 (c) 18 (d) 25
 (M.A.T. 2004)
46. On an order of 5 dozen boxes of a consumer product, a retailer receives an extra dozen free. This is equivalent to allowing him a discount of :
 (a) 15% (b) $16\frac{1}{6}\%$ (c) $16\frac{2}{3}\%$ (d) 20%
 (C.B.I. 1997)
47. A man sold 18 cots for Rs. 16,800, gaining thereby the cost price of 3 cots. The cost price of a cot is :
 (a) Rs. 650 (b) Rs. 700 (c) Rs. 750 (d) Rs. 800
 (S.S.C. 2000)
48. If on selling 12 notebooks, a seller makes a profit equal to the selling price of 4 notebooks, what is his percent profit ?
 (a) $16\frac{2}{3}\%$ (b) 25 (c) 50
 (d) Data inadequate (e) None of these
 (Bank P.O. 2000)
49. On selling 17 balls at Rs. 720, there is a loss equal to the cost price of 5 balls. The cost price of a ball is :
 (a) Rs. 45 (b) Rs. 50 (c) Rs. 55 (d) Rs. 60
 (S.S.C. 2004)
50. A vendor loses the selling price of 4 oranges on selling 36 oranges. His loss percent is :
 (a) 10% (b) $11\frac{1}{9}\%$ (c) $12\frac{1}{2}\%$ (d) None of these
 (Section Officers', 2003)
51. A man buys 2 dozen bananas at Rs. 16 per dozen. After selling 18 bananas at the rate of Rs. 12 per dozen, the shopkeeper reduced the rate to Rs. 4 per dozen. The percent loss is :
 (a) 25.2% (b) 32.4% (c) 36.5% (d) 37.5%
52. A man bought apples at the rate of 8 for Rs. 34 and sold them at the rate of 12 for Rs. 57. How many apples should be sold to earn a net profit of Rs. 45 ?
 (a) 90 (b) 100 (c) 135 (d) 150
 (S.S.C. 2003)
53. Oranges are bought at the rate of 10 for Rs. 25 and sold at the rate of 9 for Rs. 25. The profit is :
 (a) $9\frac{1}{11}\%$ (b) 10% (c) $11\frac{1}{9}\%$ (d) $12\frac{1}{2}\%$
54. Some articles were bought at 6 for Rs. 5 and sold at 5 for Rs. 6. Gain percent is :
 (a) 30% (b) $33\frac{1}{3}\%$ (c) 35% (d) 44%
 (S.S.C. 2004)
55. A man bought some fruits at the rate of 16 for Rs. 24 and sold them at the rate of 8 for Rs. 18. What is the profit percent ?
 (a) 25% (b) 40% (c) 50% (d) 60% (e) None of these
 (Bank P.O. 2003)

56. A man purchased a box full of pencils at the rate of 7 for Rs. 9 and sold all of them at the rate of 8 for Rs. 11. In this transaction, he gained Rs. 10. How many pencils did the box contain ? (C.B.I. 1997)
- (a) 100 (b) 112 (c) 114 (d) 115
57. A man bought a number of clips at 3 for a rupee and an equal number at 2 for a rupee. At what price per dozen should he sell them to make a profit of 20% ? (C.B.I. 1998)
- (a) Rs. 4 (b) Rs. 5 (c) Rs. 6 (d) Rs. 7
58. A man buys eggs at 2 for Re. 1 and an equal number at 3 for Rs. 2 and sells the whole at 5 for Rs. 3. His gain or loss percent is : (C.B.I. 1998)
- (a) $2\frac{2}{7}\%$ loss (b) $3\frac{6}{7}\%$ gain (c) $3\frac{2}{7}\%$ loss (d) $2\frac{6}{7}\%$ gain
59. A man bought some oranges at Rs. 10 per dozen and bought the same number of oranges at Rs. 8 per dozen. He sold these oranges at Rs. 11 per dozen and gained Rs. 120. The total number of oranges bought by him was : (C.B.I. 1998)
- (a) 30 dozens (b) 40 dozens (c) 50 dozens (d) 60 dozens
60. A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20% ? (C.B.I. 1998)
- (a) 3 (b) 4 (c) 5 (d) 6
61. By selling 12 toffees for a rupee, a man loses 20%. How many for a rupee should he sell to get a gain of 20% ? (R.R.B. 2003)
- (a) 5 (b) 8 (c) 10 (d) 15
62. By selling 45 lemons for Rs. 40, a man loses 20%. How many should he sell for Rs. 24 to gain 20% in the transaction ? (C.B.I. 1998)
- (a) 16 (b) 18 (c) 20 (d) 22
63. A trader mixes 26 kg of rice at Rs. 20 per kg with 30 kg of rice of other variety at Rs. 36 per kg and sells the mixture at Rs. 30 per kg. His profit percent is : (Bank P.O. 2003)
- (a) No profit, no loss (b) 5% (c) 8%
 (d) 10% (e) None of these
64. Arun purchased 30 kg of wheat at the rate of Rs. 11.50 per kg and 20 kg of wheat at the rate of Rs. 14.25 per kg. He mixed the two and sold the mixture. Approximately what price per kg should he sell the mixture to make 30% profit ? (Bank P.O. 1999)
- (a) Rs. 14.80 (b) Rs. 15.40 (c) Rs. 15.60
 (d) Rs. 16.30 (e) Rs. 18.20
65. Padam purchased 30 kg of rice at the rate of Rs. 17.50 per kg and another 30 kg rice at a certain rate. He mixed the two and sold the entire quantity at the rate of Rs. 18.60 per kg and made 20% overall profit. At what price per kg did he purchase the lot of another 30 kg rice ? (Bank P.O. 2000)
- (a) Rs. 12.50 (b) Rs. 13.50 (c) Rs. 14.50
 (d) Rs. 15.50 (e) None of these
66. A trader mixes three varieties of groundnuts costing Rs. 50, Rs. 20 and Rs. 30 per kg in the ratio 2 : 4 : 3 in terms of weight, and sells the mixture at Rs. 33 per kg. What percentage of profit does he make ? (Hotel Management, 1998)
- (a) 8% (b) 9% (c) 10% (d) None of these
67. A dairymen pays Rs. 6.40 per litre of milk. He adds water and sells the mixture at Rs. 8 per litre, thereby making 37.5% profit. The proportion of water to milk received by the customers is : (M.A.T. 2003)
- (a) 1 : 10 (b) 1 : 12 (c) 1 : 15 (d) 1 : 20

68. By mixing two brands of tea and selling the mixture at the rate of Rs. 177 per kg, a shopkeeper makes a profit of 18%. If to every 2 kg of one brand costing Rs. 200 per kg, 3 kg of the other brand is added, then how much per kg does the other brand cost ?
 (a) Rs. 110 (b) Rs. 120 (c) Rs. 140 (d) None of these
 (Hotel Management, 1999)
69. The manufacturer of a certain item can sell all he can produce at the selling price of Rs. 60 each. It costs him Rs. 40 in materials and labour to produce each item and he has overhead expenses of Rs. 3000 per week in order to operate the plant. The number of units he should produce and sell in order to make a profit of at least Rs. 1000 per week, is :
 (a) 200 (b) 250 (c) 300 (d) 400
70. A dishonest dealer uses a scale of 90 cm instead of a metre scale and claims to sell at cost price. His profit is :
 (N.I.E.T. 2000)
 (a) 9% (b) 10% (c) 12% (d) None of these
71. A shopkeeper professes to sell his goods at cost price but uses a weight of 800 gm instead of kilogram weight. Thus, he makes a profit of :
 (C.B.I. 1997)
 (a) 20% (b) $16\frac{2}{3}\%$ (c) 25% (d) None of these
72. A dishonest dealer professes to sell his goods at cost price. But he uses a false weight and thus gains $6\frac{18}{47}\%$. For a kg, he uses a weight of :
 (A.A.O. Exam, 2003)
 (a) 940 gms (b) 947 gms (c) 953 gms (d) 960 gms
73. A shopkeeper cheats to the extent of 10% while buying as well as selling, by using false weights. His total gain is :
 (Bank P.O. 2003)
 (a) 10% (b) 11% (c) 20% (d) 21% (e) $22\frac{2}{9}\%$
74. A grocer sells rice at a profit of 10% and uses weights which are 20% less than the market weight. The total gain earned by him will be :
 (a) 30% (b) 35% (c) 37.5% (d) None of these
75. A fair price shopkeeper takes 10% profit on his goods. He lost 20% goods during theft. His loss percent is :
 (S.S.C. 2000)
 (a) 8 (b) 10 (c) 11 (d) 12
76. A sells a bicycle to B at a profit of 20%. B sells it to C at a profit of 25%. If C pays Rs. 225 for it, the cost price of the bicycle for A is :
 (B.S.F. 2001)
 (a) Rs. 110 (b) Rs. 120 (c) Rs. 125 (d) Rs. 150
77. A bought a radio set and spent Rs. 110 on its repairs. He then sold it to B at 20% profit, B sold it to C at a loss of 10% and C sold it for Rs. 1188 at a profit of 10%. What is the amount for which A bought the radio set ?
 (a) Rs. 850 (b) Rs. 890 (c) Rs. 930 (d) Rs. 950
78. A house worth Rs. 1,50,000 is sold by X to Y at 5% profit. Y sells the house back to X at 2% loss. Then, in the entire transaction :
 (a) X loses Rs. 1350 (b) X gains Rs. 3150
 (c) X loses Rs. 4350 (d) X gains Rs. 4350
79. A manufacturer sells a pair of glasses to a wholesale dealer at a profit of 18%. The wholesaler sells the same to a retailer at a profit of 20%. The retailer in turn sells them to a customer for Rs. 30.09, thereby earning a profit of 25%. The cost price for the manufacturer is :
 (a) Rs. 15 (b) Rs. 16 (c) Rs. 17 (d) Rs. 18

80. An article was sold for Rs. 144. If the percentage of profit was numerically equal to the cost price, the cost of the article was :
 (a) Rs. 72 (b) Rs. 80 (c) Rs. 90 (d) Rs. 100
81. Rahul purchased a scooter at $\frac{13}{15}$ th of its selling price and sold it at 12% more than its selling price. His gain is :
 (a) 20% (b) $29\frac{3}{13}\%$ (c) 30% (d) $38\frac{1}{13}\%$
82. A man buys an article for 10% less than its value and sells it for 10% more than its value. His gain or loss percent is :
 (a) no profit, no loss (b) 20% profit
 (c) less than 20% profit (d) more than 20% profit
83. Samant bought a microwave oven and paid 10% less than the original price. He sold it with 30% profit on the price he had paid. What percentage of profit did Samant earn on the original price ?
 (Bank P.O. 2002)
 (a) 17% (b) 20% (c) 27% (d) 32% (e) None of these
84. If 5% more is gained by selling an article for Rs. 350 than by selling it for Rs. 340, the cost of the article is :
 (a) Rs. 50 (b) Rs. 160 (c) Rs. 200 (d) Rs. 225
85. If a man reduces the selling price of a fan from Rs. 400 to Rs. 380, his loss increases by 2%. The cost price of the fan is :
 (R.R.B. 2001)
 (a) Rs. 480 (b) Rs. 500 (c) Rs. 600 (d) None of these
86. An article when sold at a gain of 5% yields Rs. 15 more than when sold at a loss of 5%. Its cost price would be :
 (a) Rs. 150 (b) Rs. 200 (c) Rs. 250 (d) Rs. 300
87. A shopkeeper sells an article at a loss of $12\frac{1}{2}\%$. Had he sold it for Rs. 51.80 more, he would have earned a profit of 6%. The cost price of the article is :
 (a) Rs. 280 (b) Rs. 300 (c) Rs. 380 (d) Rs. 400
 (Section Officers', 2003)
88. The difference between the cost price and sale price of an article is Rs. 240. If the profit is 20%, the selling price is :
 (a) Rs. 1240 (b) Rs. 1400 (c) Rs. 1600 (d) None of these
89. A dealer sold an article at a loss of $2\frac{1}{2}\%$. Had he sold it for Rs. 100 more, he would have gained $7\frac{1}{2}\%$. To gain $12\frac{1}{2}\%$, he should sell it for :
 (a) Rs. 850 (b) Rs. 925 (c) Rs. 1080 (d) Rs. 1125
90. The cash difference between the selling prices of an article at a profit of 4% and 6% is Rs. 3. The ratio of the two selling prices is :
 (C.B.I. 2003)
 (a) 51 : 52 (b) 52 : 53 (c) 51 : 53 (d) 52 : 55
91. A shopkeeper sells two watches for Rs. 308 each. On one he gets 12% profit and on the other 12% loss. His profit or loss in the entire transaction was : (B.S.F. 2001)
 (a) Neither profit, nor loss (b) $1\frac{11}{25}\%$ loss
 (c) $1\frac{11}{25}\%$ profit (d) $3\frac{2}{25}\%$ loss
92. A man sells two flats at the rate of Rs. 1.995 lakhs each. On one he gains 5% and on the other, he loses 5%. His gain or loss percent in the whole transaction is :
 (a) 0.25% loss (b) 0.25% gain (c) 2.5% loss (d) 25% loss

93. A man sells two commodities for Rs. 4000 each, neither losing nor gaining in the deal. If he sold one commodity at a gain of 25%, the other commodity is sold at a loss of :
 (a) $16\frac{2}{3}\%$ (b) $18\frac{2}{9}\%$ (c) 25% (d) None of these.
94. A house and a shop were sold for Rs. 1 lakh each. In this transaction, the house sale resulted into 20% loss whereas the shop sale resulted into 20% profit. The entire transaction resulted in :
 (a) no loss, no gain (b) loss of Rs. $\frac{1}{12}$ lakh
 (c) loss of Rs. $\frac{1}{18}$ lakh (d) gain of Rs. $\frac{1}{24}$ lakh
95. Ranjan purchased 120 tables at a price of Rs. 110 per table. He sold 30 tables at a profit of Rs. 12 per table and 75 tables at a profit of Rs. 14 per table. The remaining tables were sold at a loss of Rs. 7 per table. What is the average profit per table ?
 (a) Rs. 10.04 (b) Rs. 10.875 (c) Rs. 12.80 (d) Rs. 12.875
96. Hemant sold 10 sarees for a total profit of Rs. 460 and 12 sarees for a total profit of Rs. 144. At what profit per saree should he sell the remaining 20 sarees so that he gets an average profit of Rs. 18 per saree ?
 (a) Rs. 7.40 (b) Rs. 7.60 (c) Rs. 7.80 (d) Rs. 8
97. Sanket purchased 20 dozen notebooks at Rs. 48 per dozen. He sold 8 dozen at 10% profit and the remaining 12 dozen with 20% profit. What is his profit percentage in the transaction ?
 (a) 7.68 (b) 15 (c) 16 (d) 19.2
98. A man purchased sugar worth Rs. 400. He sold $\frac{3}{4}$ th at a loss of 10% and the remainder at a gain of 10%. On the whole, he gets :
 (a) a loss of 5% (b) a gain of $5\frac{1}{2}\%$
 (c) a loss of $5\frac{1}{19}\%$ (d) a loss of $5\frac{5}{19}\%$
99. A businessman sold $\frac{2}{3}$ of his stock at a gain of 20% and the rest at a gain of 14%. The overall percentage of gain to the businessman is :
 (a) 12% (b) 17% (c) 18% (d) 20%
100. A cloth merchant sold half of his cloth at 20% profit, half of the remaining at 20% loss and the rest was sold at the cost price. In the total transaction, his gain or loss will be :
 (S.S.C. 2003)
 (a) Neither loss nor gain (b) 5% loss
 (c) 5% gain (d) 10% gain
101. A person purchases 90 clocks and sells 40 clocks at a gain of 10% and 50 clocks at a gain of 20%. If he sold all of them at a uniform profit of 15%, then he would have got Rs. 40 less. The cost price of each clock is :
 (Hotel Management, 2003)
 (a) Rs. 50 (b) Rs. 60 (c) Rs. 80 (d) Rs. 90
102. A person earns 15% on an investment but loses 10% on another investment. If the ratio of the two investments be 3 : 5, what is the gain or loss on the two investments taken together ?
 (a) $6\frac{1}{4}\%$ loss (b) $13\frac{1}{8}\%$ gain (c) $13\frac{1}{8}\%$ loss (d) None of these
103. A man bought goods worth Rs. 6000 and sold half of them at a gain of 10%. At what gain percent must he sell the remainder so as to get a gain of 25% on the whole ?
 (a) 25% (b) 30% (c) 35% (d) 40%

80. An article was sold for Rs. 144. If the percentage of profit was numerically equal to the cost price, the cost of the article was :
 (a) Rs. 72 (b) Rs. 80 (c) Rs. 90 (d) Rs. 100
81. Rahul purchased a scooter at $\frac{13}{15}$ th of its selling price and sold it at 12% more than its selling price. His gain is :
 (a) 20% (b) $29\frac{3}{13}\%$ (c) 30% (d) $38\frac{1}{13}\%$
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 (Bank P.O. 2002)
 (a) 17% (b) 20% (c) 27% (d) 32% (e) None of these
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 (C.B.I. 1997)
 (a) Rs. 50 (b) Rs. 160 (c) Rs. 200 (d) Rs. 225
85. If a man reduces the selling price of a fan from Rs. 400 to Rs. 380, his loss increases by 2%. The cost price of the fan is :
 (R.R.B. 2001)
 (a) Rs. 480 (b) Rs. 500 (c) Rs. 600 (d) None of these
86. An article when sold at a gain of 5% yields Rs. 15 more than when sold at a loss of 5%. Its cost price would be :
 (a) Rs. 150 (b) Rs. 200 (c) Rs. 250 (d) Rs. 300
87. A shopkeeper sells an article at a loss of $12\frac{1}{2}\%$. Had he sold it for Rs. 51.80 more, he would have earned a profit of 6%. The cost price of the article is :
 (Section Officers', 2003)
 (a) Rs. 280 (b) Rs. 300 (c) Rs. 380 (d) Rs. 400
88. The difference between the cost price and sale price of an article is Rs. 240. If the profit is 20%, the selling price is :
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90. The cash difference between the selling prices of an article at a profit of 4% and 6% is Rs. 3. The ratio of the two selling prices is :
 (C.B.I. 2003)
 (a) 51 : 52 (b) 52 : 53 (c) 51 : 53 (d) 52 : 55
91. A shopkeeper sells two watches for Rs. 308 each. On one he gets 12% profit and on the other 12% loss. His profit or loss in the entire transaction was : (B.S.F. 2001)
 (a) Neither profit, nor loss (b) $1\frac{11}{25}\%$ loss
 (c) $1\frac{11}{25}\%$ profit (d) $3\frac{2}{25}\%$ loss
92. A man sells two flats at the rate of Rs. 1.995 lakhs each. On one he gains 5% and on the other, he loses 5%. His gain or loss percent in the whole transaction is :
 (a) 0.25% loss (b) 0.25% gain (c) 2.5% loss (d) 25% loss

104. A fruitseller has 24 kg of apples. He sells a part of these at a gain of 20% and the balance at a loss of 5%. If on the whole he earns a profit of 10%, the amount of apples sold at a loss is :
 (a) 4.6 kg (b) 6 kg (c) 9.6 kg (d) 11.4 kg
105. Two-third of a consignment was sold at a profit of 5% and the remainder at a loss of 2%. If the total profit was Rs. 400, the value of the consignment (in Rs.) was :
 (a) 10,000 (b) 12,000 (c) 15,000 (d) 20,000
106. A trader purchases a watch and a wall clock for Rs. 390. He sells them making a profit of 10% on the watch and 15% on the wall clock. He earns a profit of Rs. 51.50. The difference between the original prices of the wall clock and the watch is equal to :
 (a) Rs. 80 (b) Rs. 100 (c) Rs. 110 (d) Rs. 120
107. Albert buys 4 horses and 9 cows for Rs. 13,400. If he sells the horses at 10% profit and the cows at 20% profit, then he earns a total profit of Rs. 1880. The cost of a horse is :
 (C.D.S. 2003)
 (a) Rs. 1000 (b) Rs. 2000 (c) Rs. 2500 (d) Rs. 3000
108. A man purchases two clocks A and B at a total cost of Rs. 650. He sells A with 20% profit and B at a loss of 25% and gets the same selling price for both the clocks. What are the purchasing prices of A and B respectively ?
 (a) Rs. 225, Rs. 425 (b) Rs. 250, Rs. 400
 (c) Rs. 275, Rs. 375 (d) Rs. 300, Rs. 350
109. The C.P. of two watches taken together is Rs. 840. If by selling one at a profit of 16% and the other at a loss of 12%, there is no loss or gain in the whole transaction, then the C.P. of the two watches are respectively :
 (a) Rs. 360, Rs. 480 (b) Rs. 480, Rs. 360
 (c) Rs. 380, Rs. 460 (d) Rs. 400, Rs. 440
110. On selling a chair at 7% loss and a table at 17% gain, a man gains Rs. 296. If he sells the chair at 7% gain and the table at 12% gain, then he gains Rs. 400. The actual price of the table is :
 (a) Rs. 1600 (b) Rs. 1800 (c) Rs. 2200 (d) Rs. 2400
111. A shopkeeper offers 2.5% discount on cash purchases. What cash amount would Rohan pay for a cycle, the marked price of which is Rs. 650 ?
 (IGNOU, 2003)
 (a) Rs. 633.25 (b) Rs. 633.75 (c) Rs. 634 (d) Rs. 635
112. If a company sells a car with a marked price of Rs. 2,72,000 and gives a discount of 4% on Rs. 2,00,000 and 2.5% on the remaining amount of Rs. 72,000, then the actual price charged by the company for the car is :
 (S.S.C. 2003)
 (a) Rs. 2,50,000 (b) Rs. 2,55,000 (c) Rs. 2,60,100 (d) Rs. 2,62,200
113. Garima purchased a briefcase with an additional 10% discount on the reduced price after deducting 20% on the labelled price. If the labelled price was Rs. 1400, at what price did she purchase the briefcase ?
 (Bank P.O. 2002)
 (a) Rs. 980 (b) Rs. 1008 (c) Rs. 1056 (d) Rs. 1120 (e) None of these
114. A bag marked at Rs. 80 is sold for Rs. 68. The rate of discount is :
 (a) 12% (b) 15% (c) $17\frac{11}{17}\%$ (d) 20%
115. A pair of articles was bought for Rs. 37.40 at a discount of 15%. What must be the marked price of each of the articles ?
 (A.A.O. Exam, 2003)
 (a) Rs. 11 (b) Rs. 22 (c) Rs. 33 (d) Rs. 44
116. A shopkeeper gives 12% additional discount on the discounted price, after giving an initial discount of 20% on the labelled price of a radio. If the final sale price of the radio is Rs. 704, then what is its labelled price ?
 (R.R.B. 2002)
 (a) Rs. 844.80 (b) Rs. 929.28 (c) Rs. 1000 (d) Rs. 1044.80

131. The marked price of a watch was Rs. 720. A man bought the same for Rs. 550.80 after getting two successive discounts, the first being 10%. What was the second discount rate? (S.S.C. 2000)
- (a) 12% (b) 14% (c) 15% (d) 18%
132. A shopkeeper purchased 150 identical pieces of calculators at the rate of Rs. 250 each. He spent an amount of Rs. 2500 on transport and packing. He fixed the labelled price of each calculator at Rs. 320. However, he decided to give a discount of 5% on the labelled price. What is the percentage profit earned by him? (Bank P.O. 1999)
- (a) 14% (b) 15% (c) 16% (d) 20% (e) None of these
133. A trader marked the price of his commodity so as to include a profit of 25%. He allowed discount of 16% on the marked price. His actual profit was : (S.S.C. 2004)
- (a) 5% (b) 9% (c) 16% (d) 25%
134. A tradesman marks his goods 30% above the C.P. If he allows a discount of $\frac{1}{4}\%$, then his gain percent is : (Bank P.O. 1999)
- (a) $21\frac{7}{8}\%$ (b) 22% (c) $23\frac{3}{4}\%$ (d) None of these
135. The price of an article is raised by 30% and then two successive discounts of 10% each are allowed. Ultimately, the price of the article is : (S.S.C. 2003)
- (a) decreased by 5.3% (b) increased by 3% (c) increased by 5.3% (d) increased by 10%
136. A retailer buys 30 articles from a wholesaler at the price of 27. If he sells them at their marked price, the gain percent in the transaction is : (Bank P.O. 1999)
- (a) $9\frac{1}{11}\%$ (b) 10% (c) $11\frac{1}{9}\%$ (d) $16\frac{2}{3}\%$
137. By selling an umbrella for Rs. 300, a shopkeeper gains 20%. During a clearance sale, the shopkeeper allows a discount of 10% on the marked price. His gain percent during the sale is : (M.B.A. 2002)
- (a) 7 (b) 7.5 (c) 8 (d) 9
138. The cost price of an article is 64% of the marked price. Calculate the gain percent after allowing a discount of 12%. (C.B.I. 1998)
- (a) 37.5% (b) 48% (c) 50.5% (d) 52%
139. A shopkeeper allows a discount of 10% on the marked price of an item but charges a sales tax of 8% on the discounted price. If the customer pays Rs. 680.40 as the price including the sales tax, then what is the marked price of the item?
- (a) Rs. 630 (b) Rs. 700 (c) Rs. 780 (d) None of these
140. At what percent above the cost price must a shopkeeper mark his goods so that he gains 20% even after giving a discount of 10% on the marked price? (S.S.C. 2004)
- (a) 25% (b) 30% (c) $33\frac{1}{3}\%$ (d) $37\frac{1}{2}\%$
141. At what price should a shopkeeper mark a radio that costs him Rs. 1200 in order that he may offer a discount of 20% on the marked price and still make a profit of 25%? (Bank P.O. 1998)
- (a) Rs. 1675 (b) Rs. 1875 (c) Rs. 1900 (d) Rs. 2025 (e) None of these
142. A shopkeeper earns a profit of 12% on selling a book at 10% discount on the printed price. The ratio of the cost price to the printed price of the book is : (Bank P.O. 1999)
- (a) 45 : 56 (b) 50 : 61 (c) 55 : 69 (d) 99 : 125
143. By selling an article at $\frac{2}{5}$ of the marked price, there is a loss of 25%. The ratio of the marked price and the cost price of the article is : (S.S.C. 2003)
- (a) 2 : 5 (b) 5 : 2 (c) 8 : 15 (d) 15 : 8

156. Even after reducing the marked price of a transistor by Rs. 32, a shopkeeper makes a profit of 15%. If the cost price be Rs. 320, what percentage of profit would he have made if he had sold the transistor at the marked price ?
 (a) 10% (b) 20% (c) 25% (d) None of these

157. A shopkeeper sold an article offering a discount of 5% and earned a profit of 23.5%. What would have been the percentage of profit earned if no discount was offered ?
 (a) 24.5 (b) 28.5 (c) 30
 (d) Data inadequate (e) None of these (Bank P.O. 2002)

158. Komal buys an article at a discount of 25%. At what percentage above the cost price should he sell it to make a profit of 25% over the original list price ?
 (a) 25 (b) 30 (c) 40 (d) 66.67

159. Peter bought an item at 20% discount on its original price. He sold it with 40% increase on the price he bought it. The new sale price is by what percent more than the original price ? (Bank P.O. 2003)
 (a) 7.5 (b) 8 (c) 10 (d) 12 (e) None of these

160. Tarun got 30% concession on the labelled price of an article and sold it for Rs. 8750 with 25% profit on the price he bought. What was the labelled price ?
 (a) Rs. 10,000 (b) Rs. 12,000 (c) Rs. 16,000
 (d) Data inadequate (e) None of these

ANSWERS

- | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1. (b) | 2. (d) | 3. (d) | 4. (c) | 5. (b) | 6. (c) | 7. (c) | 8. (a) | 9. (c) |
| 10. (c) | 11. (c) | 12. (c) | 13. (d) | 14. (c) | 15. (a) | 16. (d) | 17. (b) | 18. (c) |
| 19. (b) | 20. (c) | 21. (c) | 22. (a) | 23. (d) | 24. (b) | 25. (d) | 26. (c) | 27. (e) |
| 28. (d) | 29. (b) | 30. (c) | 31. (a) | 32. (a) | 33. (b) | 34. (a) | 35. (c) | 36. (b) |
| 37. (b) | 38. (b) | 39. (a) | 40. (d) | 41. (c) | 42. (c) | 43. (a) | 44. (a) | 45. (b) |
| 46. (c) | 47. (d) | 48. (c) | 49. (d) | 50. (a) | 51. (d) | 52. (a) | 53. (c) | 54. (d) |
| 55. (c) | 56. (b) | 57. (c) | 58. (d) | 59. (d) | 60. (c) | 61. (b) | 62. (b) | 63. (b) |
| 64. (d) | 65. (b) | 66. (c) | 67. (a) | 68. (d) | 69. (a) | 70. (d) | 71. (c) | 72. (a) |
| 73. (d) | 74. (c) | 75. (d) | 76. (d) | 77. (b) | 78. (b) | 79. (c) | 80. (b) | 81. (b) |
| 82. (d) | 83. (a) | 84. (c) | 85. (d) | 86. (a) | 87. (a) | 88. (d) | 89. (d) | 90. (b) |
| 91. (b) | 92. (a) | 93. (a) | 94. (b) | 95. (b) | 96. (b) | 97. (c) | 98. (a) | 99. (c) |
| 100. (c) | 101. (c) | 102. (d) | 103. (d) | 104. (c) | 105. (c) | 106. (c) | 107. (b) | 108. (b) |
| 109. (a) | 110. (d) | 111. (b) | 112. (d) | 113. (b) | 114. (b) | 115. (b) | 116. (c) | 117. (a) |
| 118. (c) | 119. (c) | 120. (a) | 121. (b) | 122. (b) | 123. (a) | 124. (b) | 125. (d) | 126. (b) |
| 127. (b) | 128. (b) | 129. (c) | 130. (a) | 131. (b) | 132. (a) | 133. (a) | 134. (a) | 135. (c) |
| 136. (c) | 137. (c) | 138. (a) | 139. (b) | 140. (c) | 141. (b) | 142. (a) | 143. (d) | 144. (d) |
| 145. (b) | 146. (a) | 147. (a) | 148. (d) | 149. (b) | 150. (a) | 151. (b) | 152. (a) | 153. (e) |
| 154. (d) | 155. (e) | 156. (c) | 157. (c) | 158. (c) | 159. (d) | 160. (a) | | |

SOLUTIONS

1. Gain% = $\left(\frac{0.70}{70} \times 100\right)\% = 1\%$.
 2. (a) Profit% = $\left(\frac{17}{36} \times 100\right)\% = 47\frac{2}{9}\%$. (b) Profit% = $\left(\frac{24}{50} \times 100\right)\% = 48\%$.

$$(c) \text{ Profit \%} = \left(\frac{19}{40} \times 100 \right)\% = 47\frac{1}{2}\%. \quad (d) \text{ Profit \%} = \left(\frac{29}{60} \times 100 \right)\% = 48\frac{1}{3}\%.$$

Clearly, (d) is the best transaction.

3. Least C.P. = Rs. (200×8) = Rs. 1600. Greatest S.P. = Rs. (425×8) = Rs. 3400.

Required profit = Rs. $(3400 - 1600)$ = Rs. 1800.

4. Profit = Rs. $(2602.58 - 2090.42)$ = Rs. 512.16.

$$\text{Profit \%} = \left(\frac{512.16}{2090.42} \times 100 \right)\% = \left(\frac{512160}{209042} \times 100 \right)\% = 24.5\% \approx 25\%.$$

5. C.P. = Rs. $(4700 + 800)$ = Rs. 5500; S.P. = Rs. 5800.

$$\therefore \text{Gain \%} = \left(\frac{300}{5500} \times 100 \right)\% = 5\frac{5}{11}\%.$$

6. C.P. of 1 kg = Rs. $\left(\frac{420}{70} \right)$ = Rs. 6. S.P. of 1 kg = Rs. 6.50.

$$\therefore \text{Gain \%} = \left(\frac{0.50}{6} \times 100 \right)\% = \frac{25}{3}\% = 8\frac{1}{3}\%.$$

7. C.P. of 1 toy = Rs. $\left(\frac{375}{12} \right)$ = Rs. 31.25. S.P. of 1 toy = Rs. 33.

$$\therefore \text{Profit \%} = \left(\frac{1.75}{31.25} \times 100 \right)\% = \frac{28}{5}\% = 5.6\%.$$

8. C.P. of 1 orange = Rs. $\left(\frac{350}{100} \right)$ = Rs. 3.50. S.P. of 1 orange = Rs. $\left(\frac{48}{12} \right)$ = Rs. 4.

$$\therefore \text{Gain \%} = \left(\frac{0.50}{3.50} \times 100 \right)\% = \frac{100}{7}\% = 14\frac{2}{7}\%.$$

9. S.P. = 85% of Rs. 1400 = Rs. $\left(\frac{85}{100} \times 1400 \right)$ = Rs. 1190.

10. C.P. for B = 120% of Rs. 400 = Rs. $\left(\frac{120}{100} \times 400 \right)$ = Rs. 480.

$$\text{C.P. for C} = 110\% \text{ of Rs. } 480 = \text{Rs. } \left(\frac{110}{100} \times 480 \right) = \text{Rs. } 528.$$

11. C.P. = Rs. $(80000 + 5000 + 1000)$ = Rs. 86000, Profit = 25%.

$$\therefore \text{S.P.} = 125\% \text{ of Rs. } 86000 = \text{Rs. } \left(\frac{125}{100} \times 86000 \right) = \text{Rs. } 107500.$$

12. S.P. = Rs. 100, gain = Rs. 15.

$$\therefore \text{C.P.} = \text{Rs. } (100 - 15) = \text{Rs. } 85.$$

$$\text{Gain \%} = \left(\frac{15}{85} \times 100 \right)\% = \frac{300}{17}\% = 17\frac{11}{17}\%.$$

13. C.P. = Rs. $\left(\frac{100}{75} \times 34.80 \right)$ = Rs. 46.40.

14. C.P. = Rs. $\left(\frac{100}{122.50} \times 392 \right)$ = Rs. $\left(\frac{1000}{1225} \times 392 \right)$ = Rs. 320.

$$\therefore \text{Profit} = \text{Rs. } (392 - 320) = \text{Rs. } 72.$$

15. 110% of S.P. = 616 \Rightarrow S.P. = Rs. $\left(\frac{616 \times 100}{110}\right)$ = Rs. 560.

$$\therefore \text{C.P.} = \text{Rs.} \left(\frac{100}{112} \times 560 \right) = \text{Rs.} 500.$$

16. Total investment = Rs. $\left(120 \times 80 + 280 + \frac{40}{100} \times 120 + 72 \right)$

$$= \text{Rs.} (9600 + 280 + 48 + 72) = \text{Rs.} 10000.$$

S.P. of 120 reams = 108% of Rs. 10000 = Rs. 10800.

$$\therefore \text{S.P. per ream} = \text{Rs.} \left(\frac{10800}{120} \right) = \text{Rs.} 90.$$

17. Investment = Rs. $(20 \times 8 + 10)$ = Rs. 170. Receipt = Rs. $(30 \times 5 + 20 \times 4)$ = Rs. 230.

$$\therefore \text{Gain\%} = \left(\frac{60}{170} \times 100 \right)\% = 35.29\% \approx 35.3\%.$$

18. Let the C.P. be Rs. x . Then, 20% of x = 1100 \Rightarrow $\frac{20}{100} \times x = 1100 \Rightarrow x = 5500$.

C.P. = Rs. 5500, Expenditure on repairs = 10%.

$$\text{Actual price} = \text{Rs.} \left(\frac{100}{110} \times 5500 \right) = \text{Rs.} 5000.$$

\therefore Expenditure on repairs = Rs. $(5500 - 5000)$ = Rs. 500.

19. Total cost incurred = Rs. $\left[\frac{100}{125} \times 25 \times (95\% \text{ of } 2000) \right]$

$$= \text{Rs.} \left(\frac{100}{125} \times 25 \times 1900 \right) = \text{Rs.} 38000.$$

Loss to the manufacturer = Rs. $[38000 - (25 \times 1000)]$ = Rs. 13000.

20. C.P. = Rs. $\left(600 + \frac{600 \times 6 \times 4}{100 \times 12} \right)$ = Rs. 612. Gain = Rs. $(765 - 612)$ = Rs. 153.

$$\therefore \text{Gain\%} = \left(\frac{153}{612} \times 100 \right)\% = 25\%.$$

21. $85 : 18700 = 115 : x$ or $x = \left(\frac{18700 \times 115}{85} \right)$ = 25300.

Hence, S.P. = Rs. 25,300.

22. $80 : 9 = 105 : x$ or $x = \left(\frac{9 \times 105}{80} \right)$ = 11.81.

Hence, S.P. per kg = Rs. 11.81.

23. C.P. = Rs. $\left(\frac{100}{105} \times 630000 \right)$ = Rs. 600000.

$$\therefore \text{Required loss\%} = \left(\frac{100000}{600000} \times 100 \right)\% = 16\frac{2}{3}\%.$$

24. C.P. of 1st transistor = Rs. $\left(\frac{100}{120} \times 840 \right)$ = Rs. 700.

C.P. of 2nd transistor = Rs. $\left(\frac{100}{96} \times 960 \right)$ = Rs. 1000.

So, total C.P. = Rs. (700 + 1000) = Rs. 1700.

Total S.P. = Rs. (840 + 960) = Rs. 1800.

$$\therefore \text{Gain \%} = \left(\frac{100}{1700} \times 100 \right)\% = 5\frac{15}{17}\%.$$

25. Let C.P. = Rs. x . Then, S.P. = Rs. $\frac{4x}{3}$. Gain = Rs. $\left(\frac{4x}{3} - x \right)$ = Rs. $\frac{x}{3}$.

$$\therefore \text{Gain \%} = \left(\frac{x}{3} \times \frac{1}{x} \times 100 \right)\% = 33\frac{1}{3}\%.$$

26. Let C.P. = Rs. $4x$. Then, S.P. = Rs. $5x$. Gain = Rs. $(5x - 4x) = \text{Rs. } x$

$$\therefore \text{Gain \%} = \left(\frac{x}{4x} \times 100 \right)\% = 25\%.$$

27. Let C.P. = Rs. $5x$ and S.P. = Rs. $7x$. Then, Gain = Rs. $2x$.

\therefore Required ratio = $2x : 5x = 2 : 5$.

28. Let C.P. = Rs. x . Then, S.P. = Rs. (120% of x) = Rs. $\frac{6x}{5}$.

$$\text{New S.P.} = \text{Rs.} \left(2 \times \frac{6x}{5} \right) = \text{Rs.} \frac{12x}{5}. \text{ Profit} = \text{Rs.} \left(\frac{12x}{5} - x \right) = \text{Rs.} \frac{7x}{5}.$$

$$\therefore \text{Profit \%} = \left(\frac{7x}{5} \times \frac{1}{x} \times 100 \right)\% = 140\%.$$

29. Let C.P. be Rs. x and S.P. be Rs. y . Then, $3(y - x) = (2y - x) \Rightarrow y = 2x$.

Profit = Rs. $(y - x)$ = Rs. $(2x - x)$ = Rs. x .

$$\therefore \text{Profit \%} = \left(\frac{x}{x} \times 100 \right)\% = 100\%.$$

30. Let S.P. = Rs. x . New S.P. = Rs. $\frac{x}{2}$, Loss = 30%.

$$\text{So, C.P.} = \text{Rs.} \left(\frac{100}{70} \times \frac{x}{2} \right) = \text{Rs.} \frac{5x}{7}. \text{ Profit} = \text{Rs.} \left(x - \frac{5x}{7} \right) = \text{Rs.} \frac{2x}{7}.$$

$$\therefore \text{Profit \%} = \left(\frac{2x}{7} \times \frac{7}{5x} \times 100 \right)\% = 40\%.$$

31. C.P. = $\frac{40}{100} \times \text{S.P.} \Rightarrow \text{S.P.} = \frac{5}{2} \text{C.P.} = \left(\frac{5}{2} \times 100 \right)\% \text{ of C.P.} = 250\% \text{ of C.P.}$

32. Let the C.P. be Rs. x . Then, $x - 15 = \frac{x}{16} \Rightarrow x - \frac{x}{16} = 15 \Rightarrow \frac{15x}{16} = 15 \Rightarrow x = 16$.

\therefore C.P. = Rs. 16.

33. S.P. = C.P. + $\frac{1}{4}$ C.P. = $\frac{5}{4}$ C.P.

$$\therefore \frac{5}{4} \text{C.P.} = 375 \Rightarrow \text{C.P.} = \text{Rs.} \left(375 \times \frac{4}{5} \right) = \text{Rs.} 300.$$

34. Let S.P. = Rs. 100. Then, Loss = Rs. 10, C.P. = Rs. $(100 + 10)$ = Rs. 110.

$$\therefore \text{Loss \%} = \left(\frac{10}{110} \times 100 \right)\% = 9\frac{1}{11}\%.$$

35. Let S.P. = Rs. x . Then, Loss = Rs. $\frac{x}{3}$. C.P. = Rs. $\left(x + \frac{x}{3} \right)$ = Rs. $\frac{4x}{3}$.

$$\therefore \text{Loss \%} = \left(\frac{x}{3} \times \frac{3}{4x} \times 100 \right)\% = 25\%.$$

36. Let C.P. = Rs. 100. Then, Profit = Rs. 320, S.P. = Rs. 420.
 New C.P. = 125% of Rs. 100 = Rs. 125; New S.P. = Rs. 420.
 Profit = Rs. (420 - 125) = Rs. 295.
- $$\therefore \text{Required percentage} = \left(\frac{295}{420} \times 100 \right)\% = \frac{1475}{21}\% \approx 70\%.$$
37. Let C.P. = Rs. x . Then, $832 - x = x - 448 \Rightarrow 2x = 1280 \Rightarrow x = 640$.
- $$\therefore \text{Required S.P.} = 150\% \text{ of Rs. } 640 = \text{Rs. } \left(\frac{150}{100} \times 640 \right) = \text{Rs. } 960.$$
38. Let C.P. = Rs. x . Then, $900 - x = 2(x - 450) \Rightarrow 3x = 1800 \Rightarrow x = 600$.
- $$\therefore \text{Required S.P.} = 125\% \text{ of Rs. } 600 = \text{Rs. } \left(\frac{125}{100} \times 600 \right) = \text{Rs. } 750.$$
39. Let C.P. be Rs. x .
- Then, $\frac{1920 - x}{x} \times 100 = \frac{x - 1280}{x} \times 100 \Rightarrow 1920 - x = x - 1280$
 $\Rightarrow 2x = 3200 \Rightarrow x = 1600$.
- $$\therefore \text{Required S.P.} = 125\% \text{ of Rs. } 1600 = \text{Rs. } \left(\frac{125}{100} \times 1600 \right) = \text{Rs. } 2000.$$
40. Let C.P. be Rs. x .
- Then, $(1060 - x) = \frac{120}{100}(x - 950) \Rightarrow 106000 - 100x = 120x - 120 \times 950$
 $\Rightarrow 220x = 220000 \Rightarrow x = 1000$.
- $$\therefore \text{Desired S.P.} = \text{Rs. } \left(\frac{120}{100} \times 1000 \right) = \text{Rs. } 1200.$$
41. Let C.P. of each pen be Re. 1. Then, C.P. of 8 pens = Rs. 8; S.P. of 8 pens = Rs. 12.
- $$\therefore \text{Gain\%} = \left(\frac{4}{8} \times 100 \right)\% = 50\%.$$
42. Let C.P. of each article be Re. 1.
- Then, C.P. of 16 articles = Rs. 16; S.P. of 16 articles = Rs. 19.
- $$\therefore \text{Gain\%} = \left(\frac{3}{16} \times 100 \right)\% = 18\frac{3}{4}\%.$$
43. Let C.P. of each article be Re. 1.
- Then, C.P. of 50 articles = Rs. 50; S.P. of 50 articles = Rs. 40.
- $$\therefore \text{Loss\%} = \left(\frac{10}{50} \times 100 \right)\% = 20\%.$$
44. Let C.P. of each mango be Re. 1.
- C.P. of 110 mangoes = Rs. 110; S.P. of 110 mangoes = Rs. 120.
- $$\therefore \text{Gain\%} = \left(\frac{10}{110} \times 100 \right)\% = 9\frac{1}{11}\%.$$
45. Let C.P. of each article be Re. 1. C.P. of x articles = Rs. x ; S.P. of x articles = Rs. 20.
 Profit = Rs. $(20 - x)$.
- $$\therefore \frac{20 - x}{x} \times 100 = 25 \Rightarrow 2000 - 100x = 25x \Rightarrow 125x = 2000 \Rightarrow x = 16.$$
46. Clearly, the retailer gets 1 dozen out of 6 dozens free.
- $$\therefore \text{Equivalent discount} = \left(\frac{1}{6} \times 100 \right)\% = 16\frac{2}{3}\%.$$

47. $(S.P. \text{ of } 18 \text{ cots}) - (C.P. \text{ of } 18 \text{ cots}) = (C.P. \text{ of } 3 \text{ cots})$
 $\Rightarrow C.P. \text{ of } 21 \text{ cots} = S.P. \text{ of } 18 \text{ cots} = \text{Rs. } 16800$
 $\Rightarrow C.P. \text{ of } 1 \text{ cot} = \text{Rs. } \left(\frac{16800}{21} \right) = \text{Rs. } 800.$
48. $(S.P. \text{ of } 12 \text{ notebooks}) - (C.P. \text{ of } 12 \text{ notebooks}) = (S.P. \text{ of } 4 \text{ notebooks})$
 $\Rightarrow C.P. \text{ of } 12 \text{ notebooks} = S.P. \text{ of } 8 \text{ notebooks}$
Let C.P. of each notebook be Re. 1.
Then, C.P. of 8 notebooks = Rs. 8; S.P. of 8 notebooks = Rs. 12.
 $\therefore \text{Gain \%} = \left(\frac{4}{8} \times 100 \right)\% = 50\%$
49. $(C.P. \text{ of } 17 \text{ balls}) - (S.P. \text{ of } 17 \text{ balls}) = (C.P. \text{ of } 5 \text{ balls})$
 $\Rightarrow C.P. \text{ of } 12 \text{ balls} = S.P. \text{ of } 17 \text{ balls} = \text{Rs. } 720$
 $\Rightarrow C.P. \text{ of } 1 \text{ ball} = \text{Rs. } \left(\frac{720}{12} \right) = \text{Rs. } 60.$
50. $(C.P. \text{ of } 36 \text{ mangoes}) - (S.P. \text{ of } 36 \text{ mangoes}) = \text{Loss} = (S.P. \text{ of } 4 \text{ mangoes})$
 $\Rightarrow S.P. \text{ of } 40 \text{ mangoes} = C.P. \text{ of } 36 \text{ mangoes}$
Let C.P. of each mango be Re. 1.
C.P. of 40 mangoes = Rs. 40; S.P. of 40 mangoes = Rs. 36.
 $\therefore \text{Loss \%} = \left(\frac{4}{40} \times 100 \right)\% = 10\%$
51. C.P. = Rs. $(16 \times 2) = 32$. S.P. = Rs. $(12 \times 1.5 + 4 \times 0.5) = \text{Rs. } (18 + 2) = \text{Rs. } 20$.
 $\therefore \text{Loss \%} = \left(\frac{12}{32} \times 100 \right)\% = 37.5\%$.
52. C.P. of 1 apple = Rs. $\left(\frac{34}{8} \right) = \text{Rs. } 4.25$. S.P. of 1 apple = Rs. $\left(\frac{57}{12} \right) = \text{Rs. } 4.75$.
Profit on each apple = Re. 0.50.
 $\therefore \text{Number of apples required} = \left(\frac{45}{0.50} \right) = 90$.
53. Suppose, number of oranges bought = L.C.M. of 9 and 10 = 90.
C.P. of 90 oranges = Rs. $\left(\frac{25}{10} \times 90 \right) = \text{Rs. } 225$.
S.P. of 90 oranges = Rs. $\left(\frac{25}{9} \times 90 \right) = \text{Rs. } 250$.
 $\therefore \text{Profit \%} = \left(\frac{25}{225} \times 100 \right)\% = \frac{100}{9}\% = 11\frac{1}{9}\%$.
54. Suppose, number of articles bought = L.C.M. of 6 and 5 = 30.
C.P. of 30 articles = Rs. $\left(\frac{5}{6} \times 30 \right) = \text{Rs. } 25$. S.P. of 30 articles = Rs. $\left(\frac{6}{5} \times 30 \right) = \text{Rs. } 36$.
 $\therefore \text{Gain \%} = \left(\frac{11}{25} \times 100 \right)\% = 44\%$.
55. Suppose, number of fruits bought = L.C.M. of 16 and 8 = 16.
C.P. of 16 fruits = Rs. 24. S.P. of 16 fruits = Rs. $\left(\frac{18}{8} \times 16 \right) = \text{Rs. } 36$.
 $\therefore \text{Profit \%} = \left(\frac{12}{24} \times 100 \right)\% = 50\%$.

56. Suppose, number of pencils bought = L.C.M. of 7 and 8 = 56.
 C.P. of 56 pencils = Rs. $\left(\frac{9}{7} \times 56\right)$ = Rs. 72. S.P. of 56 pencils = Rs. $\left(\frac{11}{8} \times 56\right)$ = Rs. 77.
 Now, Rs. 5 are gained on 56 pencils.
 So, Rs. 10 are gained on $\left(\frac{56}{5} \times 10\right)$ = 112 pencils.
57. Suppose he bought 1 dozen clips of each kind.
 C.P. of 2 dozens = Rs. $\left(\frac{1}{3} \times 12 + \frac{1}{2} \times 12\right)$ = Rs. 10.
 ∴ S.P. of 2 dozens = 120% of Rs. 10 = Rs. $\left(\frac{120}{100} \times 10\right)$ = Rs. 12.
 Hence, S.P. per dozen = Rs. 6.
58. Suppose he buys 6 eggs of each kind.
 C.P. of 12 eggs = Rs. $\left(\frac{1}{2} \times 6 + \frac{2}{3} \times 6\right)$ = Rs. 7. S.P. of 12 eggs = Rs. $\left(\frac{3}{5} \times 12\right)$ = Rs. 7.20.
 ∴ Gain = $\left(\frac{0.20}{7} \times 100\right)\%$ = $2\frac{6}{7}\%$.
59. C.P. of 2 dozen oranges = Rs. (10 + 8) = Rs. 18. S.P. of 2 dozen oranges = Rs. 22.
 If profit is Rs. 4, oranges bought = 2 dozen.
 If profit is Rs. 120, oranges bought = $\left(\frac{2}{4} \times 120\right)$ dozens = 60 dozens.
60. C.P. of 6 toffees = Re. 1. S.P. of 6 toffees = 120% of Re. 1 = Rs. $\frac{6}{5}$.
 For Rs. $\frac{6}{5}$, toffees sold = 6. For Re. 1, toffees sold = $\left(6 \times \frac{5}{6}\right)$ = 5.
61. Let S.P. of 12 toffees be Rs. x Then, $80 : 1 = 120 : x$ or $x = \left(\frac{120}{80}\right) = \frac{3}{2}$.
 For Rs. $\frac{3}{2}$, toffees sold = 12. For Re. 1, toffees sold = $\left(12 \times \frac{2}{3}\right) = 8$.
62. Let S.P. of 45 lemons be Rs. x Then, $80 : 40 = 120 : x$ or $x = \left(\frac{120 \times 40}{80}\right) = 60$.
 For Rs. 60, lemons sold = 45. For Rs. 24, lemons sold = $\left(\frac{45}{60} \times 24\right) = 18$.
63. C.P. of 56 kg rice = Rs. $(26 \times 20 + 30 \times 36)$ = Rs. (520 + 1080) = Rs. 1600.
 S.P. of 56 kg rice = Rs. (56×30) = Rs. 1680.
 ∴ Gain = $\left(\frac{80}{1600} \times 100\right)\%$ = 5%.
64. C.P. of 50 kg wheat = Rs. $(30 \times 11.50 + 20 \times 14.25)$ = Rs. (345 + 285) = Rs. 630.
 S.P. of 50 kg wheat = 130% of Rs. 630 = Rs. $\left(\frac{130}{100} \times 630\right)$ = Rs. 819.
 ∴ S.P. per kg = Rs. $\left(\frac{819}{50}\right)$ = Rs. 16.38 = Rs. 16.30.

65. Let the required price per kg be Rs. x . Then,
 C.P. of 60 kg rice = Rs. $(30 \times 17.50 + 30 \times x) = \text{Rs. } (525 + 30x)$.
 S.P. of 60 kg rice = Rs. $(60 \times 18.60) = \text{Rs. } 1116$.
 $\therefore \frac{1116 - (525 + 30x)}{525 + 30x} \times 100 = 20 \Leftrightarrow \frac{591 - 30x}{525 + 30x} = \frac{1}{5}$
 $\Leftrightarrow 2955 - 150x = 525 + 30x \Leftrightarrow 180x = 2430 \Leftrightarrow x = \left(\frac{2430}{180}\right) = \left(\frac{27}{2}\right) = 13.50$.
 So, the C.P. of second lot is Rs. 13.50 per kg.

66. Suppose he bought 2 kg, 4 kg and 3 kg of the three varieties.

C.P. of 9 kg = Rs. $(2 \times 50 + 4 \times 20 + 3 \times 30)$ = Rs. 270.

So, the C.P. of second lot is Rs. 13.50 per kg.

66. Suppose he bought 2 kg, 4 kg and 3 kg of the three varieties.

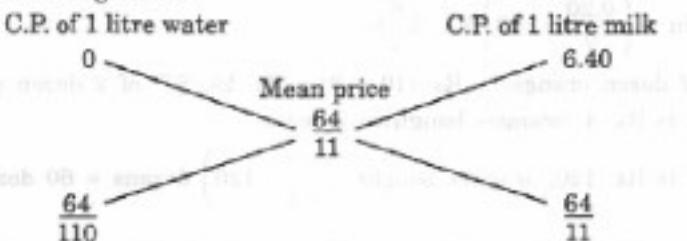
C.P. of 9 kg = Rs. $(2 \times 50 + 4 \times 20 + 3 \times 30)$ = Rs. 270.

S.P. of 9 kg = Rs. $(9 \times 33) =$ Rs. 297.

$$\therefore \text{Profit\%} = \left(\frac{27}{270} \times 100 \right)\% = 10\%. \quad \text{It will result in 10\% profit}$$

- $$67. \text{ Mean cost price} = \text{Rs. } \left(\frac{100}{137.5} \times 8 \right) = \text{Rs. } \frac{64}{11}.$$

By the rule of alligation :-



$$\therefore \text{Required ratio} = \frac{64}{110} : \frac{64}{11} = 1 : 10.$$

68. Let the cost of the other brand be Rs. x per kg.

$$\text{C.P. of } 5 \text{ kg} = \text{Rs. } (2 \times 200 + 3 \times x) = \text{Rs. } (400 + 3x).$$

S.P. of 5 kg = Rs. (5×177) = Rs. 885.

$$\frac{885 - (400 + 3x)}{400 + 3x} \times 100 = 18 \Leftrightarrow \frac{485 - 3x}{400 + 3x} = \frac{9}{50}$$

$$\Leftrightarrow 24250 - 150x - 3600 + 27x \Leftrightarrow 177x - 20650 \Leftrightarrow x = \left(\frac{350}{3}\right) - 116\frac{2}{3}.$$

So, cost of the other brand = Rs. 116.66.

69. Suppose he must produce x items. Then, CP = Rs. $(40x + 300)$, SP = Rs. $60x$.

$$\therefore 60x - (40x + 300) = 1000 \text{ or } 20x = 4000 \text{ or } x = 200.$$

- $$70. \text{ Gain\%} = \left(\frac{10}{90} \times 100 \right)\% = 11\frac{1}{9}\%.$$

$$71. \text{ Profit\%} = \left(\frac{200}{800} \times 100 \right)\% = 25\%.$$

72. Let error = x gms. Then, $\frac{x}{1000 - x} \times 100 = 6\frac{18}{47} \Leftrightarrow \frac{100x}{1000 - x} = \frac{300}{47}$

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Weight used = (1200 - 60) = 1140 gm.

73. Rule : Gain% = $\frac{(100 + \text{common gain}\%)^2}{100} - 100.$

$$\therefore \text{Gain\%} = \left[\frac{(100 + 10)^2}{100} - 100 \right] \% = \left(\frac{12100 - 10000}{100} \right) \% = 21\%.$$

74. Let us consider a packet of rice marked 1 kg.

Its actual weight is 80% of 1000 gm = 800 gm.

Let C.P. of each gm be Re. 1. Then, C.P. of this packet = Rs. 800.

$$\text{S.P. of this packet} = 110\% \text{ of C.P. of 1 kg} = \text{Rs.} \left(\frac{110}{100} \times 1000 \right) = \text{Rs.} 1100.$$

$$\therefore \text{Gain\%} = \left(\frac{300}{800} \times 100 \right) \% = 37.5\%.$$

75. Suppose he has 100 items. Let C.P. of each item be Re. 1.

Total cost = Rs. 100. Number of items left after theft = 80.

S.P. of each item = Rs. 1.10.

$$\therefore \text{Total sale} = \text{Rs.} (1.10 \times 80) = \text{Rs.} 88.$$

$$\text{Hence, Loss\%} = \left(\frac{12}{100} \times 100 \right) \% = 12\%.$$

76. 125% of 120% of A = 225 $\Rightarrow \frac{125}{100} \times \frac{120}{100} \times A = 225 \Rightarrow A = \left(225 \times \frac{2}{3} \right) = 150.$

77. 110% of 90% of 120% of A = 1188

$$\Rightarrow \frac{110}{100} \times \frac{90}{100} \times \frac{120}{100} A = 1188 \Rightarrow \frac{1188}{1000} A = 1188 \Rightarrow A = 1000.$$

\therefore A purchased it for Rs. (1000 - 110) = Rs. 890.

78. Money spent by X = Rs. 150000.

Money received by X = 105% of Rs. 150000 = Rs. 157500.

C.P. to X = 98% of Rs. 157500 = Rs. 154350.

\therefore X gains Rs. (157500 - 154350) = Rs. 3150.

79. Let the cost price for the manufacturer be Rs. x.

Then, 125% of 120% of 118% of x = 30.09.

$$\Rightarrow \frac{125}{100} \times \frac{120}{100} \times \frac{118}{100} x = \frac{3009}{100} \Rightarrow \frac{177}{100} x = \frac{3009}{100} \Rightarrow x = \left(\frac{3009}{177} \right) = 17.$$

80. Let C.P. = Rs. x, Profit% = x% and S.P. = Rs. 144.

$$\therefore x = \left[\frac{100}{(100+x)} \times 144 \right] \Rightarrow x^2 + 100x = 14400 \Rightarrow x^2 + 100x - 14400 = 0$$

$$\Rightarrow x^2 + 180x - 80x - 14400 = 0 \Rightarrow (x+180)(x-80) = 0 \Rightarrow x = 80.$$

81. Let S.P. be Rs. x. Then, C.P. = Rs. $\frac{13}{15}x$, Receipt = 112% of Rs. x = Rs. $\frac{28}{25}x$.

$$\text{Gain} = \text{Rs.} \left(\frac{28x}{25} - \frac{13x}{15} \right) = \text{Rs.} \frac{19x}{75}.$$

$$\therefore \text{Gain\%} = \left(\frac{19x}{75} \times \frac{15}{13x} \times 100 \right) \% = \frac{380}{13} \% = 29\frac{3}{13}\%.$$

82. Let the article be worth Rs. x .

$$\text{C.P.} = 90\% \text{ of Rs. } x = \text{Rs. } \frac{9x}{10}; \text{ S.P.} = 110\% \text{ of Rs. } x = \text{Rs. } \frac{11x}{10}.$$

$$\text{Gain} = \text{Rs. } \left(\frac{11x}{10} - \frac{9x}{10} \right) = \text{Rs. } \frac{x}{5}.$$

$$\therefore \text{Gain\%} = \left(\frac{\frac{x}{5}}{\frac{9x}{10}} \times 100 \right)\% = 22\frac{2}{9}\% > 20\%.$$

83. Let original price = Rs. 100.

$$\text{Then C.P.} = \text{Rs. } 90, \text{ S.P.} = 130\% \text{ of Rs. } 90 = \text{Rs. } \left(\frac{130}{100} \times 90 \right) = \text{Rs. } 117.$$

$$\therefore \text{Required percentage} = (117 - 100)\% = 17\%.$$

84. Let C.P. be Rs. x . Then, $5\% \text{ of } x = (350 - 340) = 10 \Rightarrow \frac{x}{20} = 10 \Rightarrow x = 200$.

85. Let C.P. be Rs. x . Then, $2\% \text{ of } x = (400 - 380) = 20 \Rightarrow \frac{x}{50} = 20 \Rightarrow x = 1000$.

86. Let C.P. be Rs. x . Then, $\frac{105}{100}x - \frac{95}{100}x = 15 \Rightarrow \frac{10x}{100} = 15 \Rightarrow x = 150$.

87. Let C.P. be Rs. x . Then, $(106\% \text{ of } x) - \left(87\frac{1}{2}\% \text{ of } x \right) = 51.80$

$$\Rightarrow 18\frac{1}{2}\% \text{ of } x = 51.80 \Rightarrow x = \left(\frac{51.80 \times 100 \times 2}{37} \right) = 280.$$

88. Let the C.P. be Rs. x .

$$\text{Then, S.P.} = 120\% \text{ of Rs. } x = \text{Rs. } \left(x \times \frac{120}{100} \right) = \text{Rs. } \frac{6x}{5}.$$

$$\therefore \frac{6x}{5} - x = 240 \Leftrightarrow x = 1200.$$

$$\therefore \text{S.P.} = \text{Rs. } \left(\frac{6}{5} \times 1200 \right) = \text{Rs. } 1200.$$

89. Let C.P. be Rs. x . Then,

$$\left(107\frac{1}{2}\% \text{ of } x \right) - \left(97\frac{1}{2}\% \text{ of } x \right) = 100 \Rightarrow 10\% \text{ of } x = 100 \Rightarrow x = 1000.$$

$$\therefore \text{Desired S.P.} = 112\frac{1}{2}\% \text{ of Rs. } 1000 = \text{Rs. } \left(\frac{225}{2} \times \frac{1}{100} \times 1000 \right) = \text{Rs. } 1125.$$

90. Let C.P. of the article be Rs. x . Then, Required ratio = $\frac{104\% \text{ of } x}{106\% \text{ of } x} = \frac{104}{106} = \frac{52}{53} = 52 : 53$.

91. Loss% = $\left(\frac{\text{Common Loss and Gain\%}}{10} \right)^2 \% = \left(\frac{12}{10} \right)^2 \% = \frac{36}{25}\% = 1\frac{11}{25}\%$.

92. Loss% = $\left(\frac{5}{10} \right)^2 \% = (0.5)^2\% = 0.25\%$.

93. Total S.P. = Rs. 8000 and Total C.P. = Rs. 8000.

$$\text{S.P. of 1st commodity} = \text{Rs. } 4000. \text{ Gain on it} = 25\%.$$

$$\therefore \text{C.P. of 1st commodity} = \text{Rs. } \left(\frac{100}{125} \times 4000 \right) = \text{Rs. } 3200.$$

C.P. of 2nd commodity = Rs. (8000 - 3200) = Rs. 4800.

S.P. of 2nd commodity = Rs. 4000.

$$\therefore \text{Loss on 2nd commodity} = \left(\frac{800}{4800} \times 100 \right)\% = 16\frac{2}{3}\%.$$

94. Total S.P. = Rs. 2 lakh.

$$\text{C.P. of house} = \text{Rs.} \left(\frac{100}{80} \times 1 \right) \text{lakh} = \text{Rs.} \frac{5}{4} \text{lakh.}$$

$$\text{C.P. of shop} = \text{Rs.} \left(\frac{100}{120} \times 1 \right) \text{lakh} = \text{Rs.} \frac{5}{6} \text{lakh.}$$

$$\text{Total C.P.} = \text{Rs.} \left(\frac{5}{4} + \frac{5}{6} \right) \text{lakh} = \text{Rs.} \frac{25}{12} \text{lakh.}$$

$$\therefore \text{Loss} = \text{Rs.} \left(\frac{25}{12} - 2 \right) \text{lakh} = \text{Rs.} \frac{1}{12} \text{lakh.}$$

95. Total C.P. = Rs. (120 × 110) = Rs. 13200.

$$\begin{aligned} \text{Total S.P.} &= \text{Rs.} [(30 \times 110 + 30 \times 12) + (75 \times 110 + 75 \times 14) + (15 \times 110 - 15 \times 7)] \\ &= \text{Rs.} 14505. \end{aligned}$$

$$\text{Average profit} = \text{Rs.} \left(\frac{14505 - 13200}{120} \right) = \text{Rs.} \frac{1305}{120} = \text{Rs.} 10.875.$$

96. Total profit required = Rs. (42 × 18) = Rs. 756.

Profit on 22 sarees = Rs. (460 + 144) = Rs. 604.

Profit on 20 sarees = Rs. (756 - 604) = Rs. 152.

$$\text{Average profit on these sarees} = \text{Rs.} \left(\frac{152}{20} \right) = \text{Rs.} 7.60.$$

97. C.P. of 20 dozen = Rs. (48 × 20) = Rs. 960.

$$\text{C.P. of 8 dozen} = \text{Rs.} (48 \times 8) = \text{Rs.} 384.$$

$$\text{C.P. of 12 dozen} = \text{Rs.} (960 - 384) = \text{Rs.} 576.$$

$$\text{Total S.P.} = \text{Rs.} \left(\frac{110}{100} \times 384 + \frac{120}{100} \times 576 \right) = \text{Rs.} 1113.60.$$

$$\therefore \text{Profit\%} = \left(\frac{153.60}{960} \times 100 \right)\% = 16\%.$$

98. C.P. of $\frac{3}{4}$ th = Rs. $\left(\frac{3}{4} \times 400 \right)$ = Rs. 300, C.P. of $\frac{1}{4}$ th = Rs. 100.

$$\therefore \text{Total S.P.} = (90\% \text{ of Rs.} 300 + 110\% \text{ of Rs.} 100) = \text{Rs.} 380.$$

$$\text{Loss} = \left(\frac{20}{400} \times 100 \right)\% = 5\%.$$

99. Let C.P. of whole be Rs. x . C.P. of $\frac{2}{3}$ rd = Rs. $\frac{2x}{3}$, C.P. of $\frac{1}{3}$ rd = Rs. $\frac{x}{3}$.

$$\text{Total S.P.} = \text{Rs.} \left[\left(120\% \text{ of } \frac{2x}{3} \right) + \left(114\% \text{ of } \frac{x}{3} \right) \right] = \text{Rs.} \left(\frac{4x}{5} + \frac{19x}{50} \right) = \text{Rs.} \frac{59x}{50}.$$

$$\text{Gain} = \text{Rs.} \left(\frac{59x}{50} - x \right) = \text{Rs.} \frac{9x}{50}.$$

$$\therefore \text{Gain\%} = \left(\frac{9x}{50} \times \frac{1}{x} \times 100 \right)\% = 18\%.$$

100. Let C.P. of whole be Rs. x . C.P. of $\frac{1}{2}$ stock = Rs. $\frac{x}{2}$, C.P. of $\frac{1}{4}$ stock = Rs. $\frac{x}{4}$.

$$\text{Total S.P.} = \text{Rs.} \left[\left(120\% \text{ of } \frac{x}{2} \right) + \left(80\% \text{ of } \frac{x}{4} \right) + \frac{x}{4} \right] = \text{Rs.} \left(\frac{3x}{5} + \frac{x}{5} + \frac{x}{4} \right) = \text{Rs.} \frac{21x}{20}$$

$$\text{Gain} = \text{Rs.} \left(\frac{21x}{20} - x \right) = \text{Rs.} \frac{x}{20}$$

$$\therefore \text{Gain\%} = \left(\frac{\frac{x}{20}}{x} \times 100 \right)\% = 5\%$$

101. Let C.P. of each clock be Rs. x . Then, C.P. of 90 clocks = Rs. $90x$

$$\therefore [(110\% \text{ of } 40x) + (120\% \text{ of } 50x)] - (115\% \text{ of } 90x) = 40$$

$$\Rightarrow 44x + 60x - 103.5x = 40 \Rightarrow 0.5x = 40 \Rightarrow x = 80.$$

102. Let the investments be $3x$ and $5x$. Then, total investment = $8x$.

$$\text{Total receipt} = (115\% \text{ of } 3x + 90\% \text{ of } 5x) = (3.45x + 4.5x) = 7.95x.$$

$$\therefore \text{Loss} = \left(\frac{0.05x}{8x} \times 100 \right)\% = 0.625\%$$

103. Let the required gain percent be $x\%$.

$$\text{Then, } (110\% \text{ of } 3000) + [(100 + x)\% \text{ of } 3000] = 125\% \text{ of } 6000$$

$$\Rightarrow \left(\frac{110}{100} \times 3000 \right) + \left[\frac{(100 + x)}{100} \times 3000 \right] = \frac{125}{100} \times 6000$$

$$\Rightarrow 30(100 + x) = 4200 \Rightarrow 100 + x = 140 \Rightarrow x = 40\%$$

104. Let the quantity sold at a loss be x kg and let C.P. per kg be Re. 1.

$$\text{Total C.P.} = \text{Rs. } 24.$$

$$\text{Total S.P.} = \text{Rs.} [120\% \text{ of } (24 - x) + 95\% \text{ of } x] = \text{Rs.} \left[\frac{6}{5} (24 - x) + \frac{19x}{20} \right] = \text{Rs.} \left(\frac{576 - 5x}{20} \right)$$

$$\therefore \frac{576 - 5x}{20} = 110\% \text{ of } 24 \Rightarrow \frac{576 - 5x}{20} = \frac{264}{10} \Rightarrow 576 - 5x = 528$$

$$\Rightarrow 5x = 48 \Rightarrow x = 9.6 \text{ kg.}$$

105. Let the total value be Rs. x . Value of $\frac{2}{3}$ rd = Rs. $\frac{2x}{3}$, Value of $\frac{1}{3}$ rd = Rs. $\frac{x}{3}$.

$$\text{Total S.P.} = \text{Rs.} \left[\left(105\% \text{ of } \frac{2x}{3} \right) + \left(98\% \text{ of } \frac{x}{3} \right) \right] = \text{Rs.} \left(\frac{210x}{300} + \frac{98x}{300} \right) = \text{Rs.} \frac{308x}{300}$$

$$\therefore \frac{308x}{300} - x = 400 \Rightarrow \frac{8x}{300} = 400 \Rightarrow x = \left(\frac{400 \times 300}{8} \right) = 15000.$$

106. Let C.P. of watch be Rs. x . Then, C.P. of wall clock = Rs. $(390 - x)$.

$$\therefore (10\% \text{ of } x) + [15\% \text{ of } (390 - x)] = 51.50 \Rightarrow \frac{10}{100} \times x + \frac{15}{100} \times (390 - x) = \frac{515}{10}$$

$$\Rightarrow 10x + 5850 - 15x = 5150 \Rightarrow 5x = 700 \Rightarrow x = 140.$$

So, C.P. of watch = Rs. 140, C.P. of wall clock = Rs. 250.

$$\therefore \text{Difference} = \text{Rs.} (250 - 140) = \text{Rs.} 110.$$

107. Let C.P. of each horse be Rs. x and C.P. of each cow be Rs. y . Then,

$$4x + 9y = 13400 \quad \dots(i)$$

$$\text{And, } 10\% \text{ of } 4x + 20\% \text{ of } 9y = 1880$$

$$\Rightarrow \frac{2}{5}x + \frac{9}{5}y = 1880 \Rightarrow 2x + 9y = 9400 \quad \dots(ii)$$

Solving (i) and (ii), we get : $x = 2000$ and $y = 600$.

\therefore Cost price of each horse = Rs. 2000.

108. Let C.P. of clock A be Rs. x and that of clock B be Rs. $(650 - x)$. Then,

$$\begin{aligned} 120\% \text{ of } x = 75\% \text{ of } (650 - x) &\Rightarrow 650 - x = \frac{120}{75}x = \frac{8}{5}x \\ &\Rightarrow \frac{13}{5}x = 650 \Rightarrow x = \left(\frac{650 \times 5}{13}\right) = 250. \end{aligned}$$

\therefore C.P. of A = Rs. 250, C.P. of B = Rs. 400.

109. Let the C.P. of the watches be Rs. x and Rs. $(840 - x)$.

$$(116\% \text{ of } x) + [88\% \text{ of } (840 - x)] = 840$$

$$\Rightarrow 116x + 73920 - 88x = 84000 \Rightarrow 28x = 10080 \Rightarrow x = 360.$$

\therefore Their cost prices are Rs. 360 and Rs. 480.

110. Let C.P. of the chair be Rs. x and that of the table be Rs. y .

$$\text{Then, } 17\% \text{ of } y - 7\% \text{ of } x = 296 \Rightarrow 17y - 7x = 29600 \quad \dots(i)$$

$$\text{And, } 12\% \text{ of } y + 7\% \text{ of } x = 400 \Rightarrow 12y + 7x = 40000 \quad \dots(ii)$$

Solving (i) and (ii), we get : $y = 2400$ and $x = 1600$.

\therefore C.P. of table = Rs. 2400.

111. S.P. = $97\frac{1}{2}\%$ of Rs. 650 = Rs. $\left(\frac{195}{2} \times \frac{1}{100} \times 650\right)$ = Rs. 633.75.

112. M.P. = Rs. 272000.

Discount = Rs. $[(4\% \text{ of } 200000) + (2.5\% \text{ of } 72000)]$ = Rs. $(8000 + 1800)$ = Rs. 9800.

\therefore Actual price = Rs. $(272000 - 9800)$ = Rs. 262200.

113. C.P. = 90% of 80% of Rs. 1400 = Rs. $\left(\frac{90}{100} \times \frac{80}{100} \times 1400\right)$ = Rs. 1008.

114. Rate of discount = $\left(\frac{12}{80} \times 100\right)\% = 15\%$.

115. S.P. of each article = Rs. $\left(\frac{37.40}{2}\right)$ = Rs. 18.70.

Let M.P. be Rs. x .

$$\text{Then, } 85\% \text{ of } x = 18.70 \Rightarrow x = \left(\frac{18.70 \times 100}{85}\right) = 22.$$

116. Let the labelled price be Rs. x .

$$88\% \text{ of } 80\% \text{ of } x = 704 \Rightarrow x = \left(\frac{704 \times 100 \times 100}{88 \times 80}\right) = 1000.$$

117. S.P. after 1st discount = Rs. $\left(\frac{80}{100} \times 1500\right)$ = Rs. 1200.

Net S.P. = Rs. 1104. Discount on Rs. 1200 = Rs. 96.

$$\therefore \text{Required discount} = \left(\frac{96}{1200} \times 100\right)\% = 8\%.$$

118. Let the costs of the two articles be x and y . Then, $15\% \text{ of } x = 20\% \text{ of } y \Rightarrow \frac{x}{y} = \frac{20}{15} = \frac{4}{3}$.

So, x and y must be in the ratio of 4 : 3.

119. Let the list price be Rs. x .

$$\Rightarrow \frac{80}{100}x = 24 \Rightarrow x = \frac{24 \times 100}{80} = 30.$$

\therefore Required S.P. = 70% of Rs. 30 = Rs. 21.

120. Let the list price be Rs. x . It needs to nett home a off and A. And it is 45% net. [05]

$$\therefore (100 - x)\% \text{ of } x = y \Rightarrow \left(\frac{100 - x}{100} \right) \times x = y \Rightarrow x = \left(\frac{100y}{100 - x} \right)$$

121. Let the labelled price be Rs. x . Then, [05]

$$(80\% \text{ of } x) - (75\% \text{ of } x) = 500 \Rightarrow 5\% \text{ of } x = 500 \Rightarrow x = \left(\frac{500 \times 100}{5} \right) = 10000.$$

122. Let marked price be Rs. 100. [05]

$$\text{Then, Final S.P.} = 70\% \text{ of } 80\% \text{ of Rs. } 100 = \text{Rs.} \left(\frac{70}{100} \times \frac{80}{100} \times 100 \right) = \text{Rs. } 56.$$

$$\therefore \text{Single discount} = (100 - 56)\% = 44\%.$$

123. Let marked price be Rs. 100. [05]

$$\text{Then, S.P.} = 85\% \text{ of } 88\% \text{ of } 90\% \text{ of Rs. } 100 = \text{Rs.} \left(\frac{85}{100} \times \frac{88}{100} \times \frac{90}{100} \times 100 \right) = \text{Rs. } 67.32.$$

$$\therefore \text{Single discount} = (100 - 67.32)\% = 32.68\%.$$

124. S.P. = 90% of 80% of Rs. 2000 = $\text{Rs.} \left(\frac{90}{100} \times \frac{80}{100} \times 2000 \right) = \text{Rs. } 1440.$ [05]

125. S.P. = 95% of 95% of Rs. 80 = $\text{Rs.} \left(\frac{95}{100} \times \frac{95}{100} \times 80 \right) = \text{Rs. } 72.20.$ [05]

126. Actual price = 95% of 90% of 85% of Rs. 12000 [05]

$$= \text{Rs.} \left(\frac{95}{100} \times \frac{90}{100} \times \frac{85}{100} \times 12000 \right) = \text{Rs. } 8721. [05]$$

127. Let the original price be Rs. x . Then, [05]

$$95\% \text{ of } 88\% \text{ of } x = 209 \Rightarrow x = \left(\frac{209 \times 100 \times 100}{95 \times 88} \right) = 250.$$

128. S.P. in 1st case = 60% of Rs. 100000 = $\text{Rs. } 60000.$ [05]

- S.P. in 2nd case = 96% of 64% of Rs. 100000 [05]

$$= \text{Rs.} \left(\frac{96}{100} \times \frac{64}{100} \times 100000 \right) = \text{Rs. } 61440. [05]$$

$$\therefore \text{Difference} = \text{Rs.} (61440 - 60000) = \text{Rs. } 1440. [05]$$

129. Let the amount of the bill be Rs. x . Then, [05]

$$(65\% \text{ of } x) - (80\% \text{ of } 80\% \text{ of } x) = 22 \Rightarrow \left(\frac{65}{100} \times x \right) - \left(\frac{80}{100} \times \frac{80}{100} \times x \right) = 22$$

$$\Rightarrow \frac{65}{100}x - \frac{64}{100}x = 22 \Rightarrow \frac{x}{100} = 22 \Rightarrow x = 2200. [05]$$

130. S.P. in 1st case = 94% of 70% of Rs. 700 = $\text{Rs.} \left(\frac{94}{100} \times \frac{70}{100} \times 700 \right) = \text{Rs. } 460.60.$ [05]

$$\text{S.P. in 2nd case} = 84\% \text{ of } 80\% \text{ of Rs. } 700 = \text{Rs.} \left(\frac{84}{100} \times \frac{80}{100} \times 700 \right) = \text{Rs. } 470.40. [05]$$

$$\therefore \text{Difference} = \text{Rs.} (470.40 - 460.60) = \text{Rs. } 9.80. [05]$$

131. Let the second discount rate be $x\%.$ Then, [05]

$$(100 - x)\% \text{ of } 90\% \text{ of } 720 = 550.80$$

$$\Rightarrow \frac{(100 - x)}{100} \times \frac{90}{100} \times 720 = 550.80 \Rightarrow (100 - x) = \left(\frac{550.80}{9 \times 72} \right) = 85 \Rightarrow x = 15.$$

$$\therefore \text{Second discount rate} = 15\%. [05]$$

132. Cost of each calculator = Rs. $\left(250 + \frac{2500}{150}\right) = \text{Rs. } 266\frac{2}{3}$.

S.P. of each calculator = Rs. $\left(\frac{95}{100} \times 320\right) = \text{Rs. } 304.$

\therefore Profit% = $\left(\frac{112}{3} \times \frac{3}{800}\right)\% = 14\%$.

133. Let C.P. be Rs. 100. Then, marked price = Rs. 125.

S.P. = 84% of Rs. 125 = Rs. $\left(\frac{84}{100} \times 125\right) = \text{Rs. } 105.$

\therefore Profit% = $(105 - 100)\% = 5\%$.

134. Let C.P. be Rs. 100. Then, marked price = Rs. 130.

S.P. = $\left(100 - \frac{25}{4}\right)\% \text{ of Rs. } 130 = \text{Rs. } \left(\frac{375}{400} \times 130\right) = \text{Rs. } 121.875.$

\therefore Profit% = $(121.875 - 100)\% = 21.875\% = \frac{21875}{1000}\% = 21\frac{7}{8}\%.$

135. Let the original price be Rs. 100. Then, marked price = Rs. 130.

Final price = 90% of 90% of Rs. 130 = Rs. $\left(\frac{90}{100} \times \frac{90}{100} \times 130\right) = \text{Rs. } 105.30.$

\therefore Increase in price = $(105.30 - 100)\% = 5.3\%$.

136. Let the marked price of each article be Re. 1.

Then, C.P. of 30 = Rs. 27, S.P. of 30 = Rs. 30.

\therefore Gain% = $\left(\frac{3}{27} \times 100\right)\% = 11\frac{1}{9}\%.$

137. Marked price = Rs. 300. C.P. = Rs. $\left(\frac{100}{120} \times 300\right) = \text{Rs. } 250.$

Sale price = 90% of Rs. 300 = Rs. 270.

\therefore Required gain% = $\left(\frac{20}{250} \times 100\right)\% = 8\%.$

138. Let marked price = Rs. 100. Then, C.P. = Rs. 64, S.P. = Rs. 88.

\therefore Gain% = $\left(\frac{24}{64} \times 100\right)\% = 37.5\%.$

139. Let the marked price be Rs. x . Then, 108% of 90% of x = 680.40

$$\Rightarrow \frac{108}{100} \times \frac{90}{100} x = 680.40 \Rightarrow x = \left(\frac{68040 \times 100}{108 \times 90}\right) = \text{Rs. } 700.$$

140. Let C.P. = Rs. 100. Then, S.P. = Rs. 120.

Let marked price be Rs. x . Then, 90% of x = 120 $\Rightarrow x = \left(\frac{120 \times 100}{90}\right) = 133\frac{1}{3}.$

\therefore Marked price = $33\frac{1}{3}\%$ above C.P.

141. C.P. = Rs. 1200, S.P. = 125% of Rs. 1200 = Rs. $\left(\frac{125}{100} \times 1200\right) = \text{Rs. } 1500.$

Let marked price be Rs. x . Then, 80% of x = 1500 $\Rightarrow x = \left(\frac{1500 \times 100}{80}\right) = 1875.$

\therefore Marked price = Rs. 1875.

142. Let cost price be Rs. 100. Then, S.P. = Rs. 112.

Let printed price be Rs. x .

$$90\% \text{ of } x = 112 \Rightarrow x = \left(\frac{112 \times 100}{90} \right) = \text{Rs. } \frac{1120}{9}.$$

$$\therefore \text{Required ratio} = 100 : \frac{1120}{9} = 900 : 1120 = 45 : 56.$$

143. Let cost price = Rs. 100. Then,

$$\frac{2}{5} \text{ of (Marked Price)} = 75 \Rightarrow \text{Marked Price} = \text{Rs. } \left(\frac{75 \times 5}{2} \right) = \text{Rs. } \frac{375}{2}.$$

$$\therefore \text{Required ratio} = \frac{375}{2} : 100 = 375 : 200 = 15 : 8.$$

144. Let the C.P. of each article be Rs. 100.

Then, C.P. of 16 articles = Rs. (100×16) = Rs. 1600.

$$\text{S.P. of 15 articles} = \text{Rs. } \left(1600 \times \frac{135}{100} \right) = \text{Rs. } 2160.$$

$$\text{S.P. of each article} = \text{Rs. } \frac{2160}{15} = \text{Rs. } 144.$$

If S.P. is Rs. 96, marked price = Rs. 100.

$$\text{If S.P. is Rs. 144, marked price} = \text{Rs. } \left(\frac{100}{96} \times 144 \right) = \text{Rs. } 150.$$

\therefore Marked price = 50% above C.P.

145. Let C.P. = Rs. 100. Then, Marked Price = Rs. 110, S.P. = Rs. 99.

$$\therefore \text{Discount\%} = \left(\frac{11}{110} \times 100 \right)\% = 10\%.$$

146. Let C.P. = Rs. 100. Then, Marked Price = Rs. 135, S.P. = Rs. 108.

$$\therefore \text{Discount\%} = \left(\frac{27}{135} \times 100 \right)\% = 20\%.$$

147. Let C.P. of whole stock = Rs. 100. Then, Marked Price of whole stock = Rs. 120.

$$\text{M.P. of } \frac{1}{2} \text{ stock} = \text{Rs. } 60, \text{ M.P. of } \frac{1}{4} \text{ stock} = \text{Rs. } 30.$$

$$\therefore \text{Total S.P.} = \text{Rs. } [60 + (80\% \text{ of } 30) + (60\% \text{ of } 30)] = \text{Rs. } (60 + 24 + 18) = \text{Rs. } 102.$$

Hence, gain\% = $(102 - 100)\%$ = 2%.

148. Since the marked price is not given, so the cost price cannot be determined.

$$149. \text{S.P.} = 95\% \text{ of Rs. } 6500 = \text{Rs. } \left(\frac{95}{100} \times 6500 \right) = \text{Rs. } 6175.$$

Profit = 15%.

$$\therefore \text{C.P.} = \text{Rs. } \left(\frac{110}{115} \times 6175 \right) = \text{Rs. } 5369.56 \approx \text{Rs. } 5350.$$

$$150. \text{Let the labelled price be Rs. } x. \text{ Then, } 120\% \text{ of } x = 2880 \Rightarrow x = \left(\frac{2880 \times 100}{120} \right) = 2400.$$

$$\therefore \text{C.P.} = 85\% \text{ of Rs. } 2400 = \text{Rs. } \left(\frac{85}{100} \times 2400 \right) = \text{Rs. } 2040.$$

151. Marked price = Rs. 30. S.P. = Rs. $\left[\left(\frac{85}{100} \times 30 \right) - 1.50 \right] = \text{Rs. } (25.50 - 1.50) = \text{Rs. } 24.$

Let C.P. be Rs. x . Then, 120% of $x = 24 \Rightarrow x = \left(\frac{24 \times 100}{120} \right) = \text{Rs. } 20.$

152. Let the marked price be Rs. 100.

Then, S.P. = Rs. $\left(\frac{90}{100} \times 100 \right) = \text{Rs. } 90$. Gain = 20%.

$\therefore \text{C.P.} = \text{Rs. } \left(\frac{100}{120} \times 90 \right) = \text{Rs. } 75.$

New commission = Rs. 20; New S.P. = Rs. 80.

$\therefore \text{New Profit} = \left(\frac{5}{75} \times 100 \right)\% = 6\frac{2}{3}\%$.

153. S.P. = Rs. 17940. Let marked price be Rs. x .

Then, $\frac{92}{100}x = 17940 \Rightarrow x = \text{Rs. } \left(17940 \times \frac{100}{92} \right) = \text{Rs. } 19500.$

C.P. = Rs. $\left(\frac{100}{119.6} \times 17940 \right) = \text{Rs. } \left(\frac{1000}{1196} \times 17940 \right) = \text{Rs. } 15000.$

Now C.P. = Rs. 15000, S.P. = Rs. 19500.

$\therefore \text{Required profit\%} = \left(\frac{4500}{15000} \times 100 \right)\% = 30\%.$

154. S.P. of 1 article = Rs. 45. Let marked price of each article be Rs. x .

Then, $\frac{90}{100}x = 45 \Rightarrow x = \text{Rs. } \left(\frac{45 \times 100}{90} \right) = \text{Rs. } 50.$

C.P. = Rs. $\left(\frac{100}{150} \times 45 \right) = \text{Rs. } 30.$

Now, C.P. = Rs. 30, S.P. = Rs. 50.

$\therefore \text{Required profit\%} = \left(\frac{20}{30} \times 100 \right)\% = 66\frac{2}{3}\%.$

155. S.P. of 1 saree = Rs. 266. Let the labelled price of each saree be Rs. x .

Then, $\frac{95}{100}x = 266 \Rightarrow x = \text{Rs. } \left(\frac{266 \times 100}{95} \right) = \text{Rs. } 280.$

Now, S.P. = Rs. 280, Profit = 12%.

$\therefore \text{C.P. of 1 saree} = \text{Rs. } \left(\frac{100}{112} \times 280 \right) = \text{Rs. } 250.$

156. C.P. = Rs. 320, Profit = 15%.

S.P. = Rs. $\left(\frac{115}{100} \times 320 \right) = \text{Rs. } 368$. Marked price = Rs. $(368 + 32) = \text{Rs. } 400$.

$\therefore \text{Required profit\%} = \left(\frac{80}{320} \times 100 \right)\% = 25\%.$

157. Let C.P. be Rs. 100. Then, S.P. = Rs. 123.50.

Let marked price be Rs. x . Then, $\frac{95}{100}x = 123.50 \Rightarrow x = \text{Rs. } \left(\frac{12350}{95} \right) = \text{Rs. } 130.$

Now, S.P. = Rs. 130, C.P. = Rs. 100. $\therefore \text{Profit\%} = 30\%.$

158. Let original list price = Rs. 100. Then, C.P. = Rs. 75. Desired S.P. = Rs. 125.

$$\therefore \text{Required percentage} = \left(\frac{50}{75} \times 100 \right)\% = 66.67\%.$$

159. Let the original price be Rs. 100. Then, C.P. = Rs. 80.

$$\text{S.P.} = 140\% \text{ of Rs. } 80 = \text{Rs.} \left(\frac{140}{100} \times 80 \right) = \text{Rs. } 112.$$

$$\therefore \text{Required percentage} = (112 - 100)\% = 12\%.$$

160. C.P. = Rs. $\left(\frac{100}{125} \times 8750 \right)$ = Rs. 7000. Let the labelled price be Rs. x .

$$\text{Then, } \frac{70}{100}x = 7000 \Rightarrow x = \text{Rs.} \left(\frac{7000 \times 100}{70} \right) = \text{Rs. } 10000.$$

EXERCISE 11B

(DATA SUFFICIENCY TYPE QUESTIONS)

1. A shopkeeper sells some toys at Rs. 250 each. What percent profit does he make ? To find the answer, which of the following information given in Statements I and II is / are necessary ?

I. Number of toys sold.

(a) Only I is necessary.

(c) Both I and II are necessary.

(e) None of these

II. Cost price of each toy.

(b) Only II is necessary.

(d) Either I or II is necessary.

2. A shopkeeper sells some articles at the profit of 25% on the original price. What is the exact amount of profit ?

To find the answer, which of the following information given in Statements I and II is / are necessary ?

I. Sale price of the article.

(a) Only I is necessary.

(c) Either I or II is necessary.

(e) None of these

II. Number of articles sold.

(b) Only II is necessary.

(d) Both I and II are necessary.

Directions (Questions 3 to 13) : Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the question. Read both the statements and

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

3. By selling a product with 20% profit, how much profit was earned ?

I. The difference between cost and selling price is Rs. 40.

II. The selling price is 120 percent of the cost price. (S.B.I.P.O. 2003)

4. What is the cost price of the article ?
 I. The profit earned on the article is one-third of the cost price.
 II. The article is sold for Rs. 400.

5. What would have been the selling price per kg of rice? (Bank P.O. 1999)
 I. 50 kg of rice was purchased for Rs. 3350 and Rs. 150 were spent on transport.
 II. Profit earned was 5%.

6. How much was the loss ?
 I. The cost is Rs. 300.
 II. The loss is 25% of the selling price.

7. A man mixes two types of rice (X and Y) and sells the mixture at the rate of Rs. 17 per kg. Find his profit percentage. (M.B.A. 2002)
 I. The rate of X is Rs. 20 per kg.
 II. The rate of Y is Rs. 13 per kg.

8. What is the percent profit earned by selling the product ? (Bank P.O. 2003)
 I. The profit earned was Rs. 50.
 II. Had it been sold for Rs. 310, the profit would have been Rs. 70.

9. What is the cost price of the cassette ?
 I. The percent profit made when the cassette is sold for Rs. 78 is twice as much as when it is sold for Rs. 69.
 II. If the price of the cassette is marked at 20% above the cost price and a discount of 10% is offered on the marked price, the seller gains 8%.

10. What was the cost price of the suitcase purchased by Richard ? (Bank P.O. 2002)
 I. Richard got 20% concession on the labelled price.
 II. Richard sold the suitcase for Rs. 2000 with 25% profit on the labelled price.

11. By selling a product for Rs. 100, how much profit was earned ? (Bank P.O. 2002)
 I. 20% profit would have been earned if it were sold for Rs. 90.
 II. The profit was one-third of the purchase price.

12. What is the price of a banana ?
 I. A man can buy 14 bananas and 35 oranges for Rs. 84.
 II. With 50% discount on the price of bananas, Rs. 12 would buy 4 bananas and 5 oranges.

13. How much profit did Anand make by selling a bed ? (S.B.I.P.O. 1998)
 I. He bought the bed with 40% discount on labelled price.
 II. He sold it with 20% profit on the labelled price.

Directions (Questions 14 to 20) : Each of the following questions consists of a question followed by three statements I, II and III. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.

15. What was the amount of profit earned ? (Bank P.O. 2003)

I. 10% discount was offered on the labelled price.

II. Had there been no discount, profit would have been 30%.

III. Selling price was more than the cost price by 20%.

(a) All I, II and III

(b) Any two of the three

(c) III, and either I or II

(d) I, and either II or III

(e) Question cannot be answered even with the information in all the three statements.

16. What was the cost price of the watch ?

I. The shopkeeper labelled the price of the watch 20% above the cost price.

II. After allowing a discount of 15% on the labelled price, the shopkeeper charges Rs. 408 for the watch.

III. Had there been no discount, the shopkeeper would have earned 20% profit.

(a) I, and either II or III

(b) II, and either I or III

(c) III, and either I or II

(d) I and II only

(e) Any two of the three

17. How much profit did Manick earn on the cost price of an article by selling it ?

I. He got 15% discount on the marked price at the time of purchase.

II. He sold it for Rs. 3060.

III. He earned 2% profit on the marked price.

(S.B.I.P.O. 2000)

(a) I and II only

(b) II and III only

(c) I only or II and III together

(d) All I, II and III

(e) Even I, II and III together are not sufficient to answer the question.

18. By selling an article what is the profit percent gained ?

(S.B.I.P.O. 2002)

I. 5% discount is given on list price.

II. If discount is not given, 20% profit is gained.

III. The cost price of the article is Rs. 5000.

(a) Only I and II

(b) Only II and III

(c) Only I and III

(d) All I, II and III

(e) None of these

19. An item costing Rs. 3000 is sold at a certain discount. Find the rate of discount offered.

I. The profit earned after discount is 5%.

II. Had the discount rate been doubled, the seller incurs a loss of 15%.

III. The item is marked at a price 25% above the cost price.

(a) Only I and II

(b) Only II and III

(c) Only I and III

(d) All I, II and III

(e) Any two of the three

20. What was the percentage of discount given ?

(R.B.I. 2003)

I. 23.5% profit was earned by selling an almirah for Rs. 12,350.

II. If there were no discount, the earned profit would have been 30%.

III. The cost price of the almirah was Rs. 10,000.

(a) Only I and II

(b) Only II and III

(c) Only I and III

(d) Any two of the three

(e) None of these

Directions (Questions 21 to 22) : Each of these questions is followed by three statements. You have to study the question and all the three statements given to decide whether any information provided in the statement(s) is/are redundant and can be dispensed with while answering the given question.

21. What is the percent profit earned by the shopkeeper on selling the articles in his shop ?

I. Labelled price of the articles sold was 130% of the cost price.

II. Cost price of each article was Rs. 550.

III. A discount of 10% on labelled price was offered.

(S.B.I.P.O. 2001)

ANSWERS

1. (b) 2. (d) 3. (a) 4. (e) 5. (e) 6. (c) 7. (d) 8. (b)
9. (a) 10. (e) 11. (c) 12. (d) 13. (d) 14. (d) 15. (e) 16. (b)
17. (d) 18. (a) 19. (e) 20. (e) 21. (b) 22. (b)

SOLUTIONS

1. S.P. = Rs. 250 each. To find gain percent, we must know the C.P. of each.
 \therefore Correct answer is (b).

2. Gain = 25% of C.P.
 In order to find gain, we must know the sale price of each article and the number of articles sold.
 \therefore Correct answer is (d).

3. Gain = 20%
 I. Profit = (S.P.) - (C.P.) = Rs. 40.
 Thus, I gives the answer. But, II does not give the answer.
 \therefore Correct answer is (a).

4. I. Gain = $\frac{1}{3}$ (C.P.).
 II. S.P. = Rs. 400.

$$\text{Gain} = (\text{S.P.}) - (\text{C.P.}) \Rightarrow \frac{1}{3} (\text{C.P.}) = (\text{Rs. } 400) - (\text{C.P.}) \Rightarrow \left(1 + \frac{1}{3}\right) (\text{C.P.}) = \text{Rs. } 400$$

$$\Rightarrow \text{C.P.} = \text{Rs.} \left(400 \times \frac{3}{4}\right) = \text{Rs. } 300.$$

Thus, I and II both are needed to get the answer.
 \therefore Correct answer is (e).

5. I. Total C.P. of 50 kg = Rs. $(3350 + 150) = \text{Rs. } 3500.$
 \therefore C.P. of 1 kg = Rs. $\left(\frac{3500}{50}\right) = \text{Rs. } 70.$
 II. Gain = 5%.
 \therefore S.P. of 1 kg = 105% of Rs. 70 = Rs. $\left(70 \times \frac{105}{100}\right) = \text{Rs. } 73.50.$

∴ Correct answer is (c).

6. I. C.P. = Rs. 300.

II. Loss = 25% of S.P.

Let S.P. be Rs. x . Then, loss = 25% of Rs. x = Rs. $\frac{x}{4}$.

$$\text{Loss} = (\text{C.P.}) - (\text{S.P.}) \Rightarrow \frac{x}{4} = 300 - x \Rightarrow \left(x + \frac{x}{4}\right) = 300$$

$$\Rightarrow x = \left(300 \times \frac{4}{5}\right) = 240.$$

$$\therefore \text{Loss} = 25\% \text{ of Rs. } 240 = \text{Rs. } \left(\frac{25}{100} \times 240\right) = \text{Rs. } 60.$$

Thus, I and II are required to get the answer.

\therefore Correct answer is (e).

7. The ratio in which X and Y are mixed, is not given.

So, both I and II together cannot give the answer.

\therefore Correct answer is (d).

8. II gives, S.P. = Rs. 310 and gain = Rs. 70.

\therefore C.P. = Rs. $(310 - 70)$ = Rs. 240.

$$\therefore \text{Gain \%} = \left(\frac{70}{240} \times 100\right)\%.$$

Thus, II alone gives the answer.

Clearly, I alone does not give the answer.

\therefore Correct answer is (b).

9. Let the C.P. be Rs. x . Then,

$$\text{I. } \frac{(78-x)}{x} \times 100 = 2 \times \frac{(69-x)}{x} \times 100 \Leftrightarrow 78 - x = 138 - 2x \Leftrightarrow x = 60.$$

Thus, I only gives the answer.

$$\text{II. Let the C.P. be Rs. } x. \text{ Then, M.P.} = \text{Rs. } \left(\frac{120}{100} \times x\right) = \text{Rs. } \frac{6x}{5}.$$

$$\therefore \text{S.P.} = 90\% \text{ of } \text{Rs. } \frac{6x}{5} = \text{Rs. } \left(\frac{6x}{5} \times \frac{90}{100}\right) = \text{Rs. } \frac{27x}{25}.$$

Thus, $108\% \text{ of } x = \frac{27x}{25}$. This does not give x .

\therefore II does not give the answer.

\therefore Correct answer is (a).

10. Let the labelled price be Rs. x .

$$\text{I. C.P.} = 80\% \text{ of } \text{Rs. } x = \text{Rs. } \left(x \times \frac{80}{100}\right) = \text{Rs. } \frac{4x}{5}.$$

$$\text{II. S.P.} = \text{Rs. } 2000, \text{ S.P.} = 125\% \text{ of } \text{Rs. } x = \text{Rs. } \left(\frac{125}{100} \times x\right) = \text{Rs. } \frac{5x}{4}.$$

$$\therefore \frac{5x}{4} = 2000 \Rightarrow x = \frac{2000 \times 4}{5} = 1600.$$

$$\therefore \text{C.P.} = \text{Rs. } \frac{4x}{5} = \text{Rs. } \left(\frac{4}{5} \times 1600\right) = \text{Rs. } 1280.$$

Thus, I and II together give the answer.

\therefore Correct answer is (e).

11. S.P. = Rs. 100.

I. When S.P. = Rs. 90, Gain = 20%.

$$\therefore \text{C.P.} = \text{Rs.} \left(\frac{100}{120} \times 90 \right) = \text{Rs.} 75.$$

Now, (C.P. = Rs. 75 and S.P. = Rs. 100) \Rightarrow Profit = Rs. 25.

Thus, I alone gives the answer.

- II. Let the C.P. be Rs. x . Then, gain = Rs. $\frac{x}{3}$.

$$\therefore \text{S.P.} = \text{Rs.} \left(x + \frac{x}{3} \right) = \text{Rs.} \frac{4x}{3}.$$

$$\text{Thus, } \frac{4x}{3} = 100 \Rightarrow x = \left(\frac{3 \times 100}{4} \right) = 75 \text{ and so C.P.} = \text{Rs.} 75.$$

Thus, II alone gives the answer.

\therefore Correct answer is (c).

12. Let the price of a banana be Rs. x and that of an orange Rs. y .

$$\text{I. } 14x + 35y = 84 \Rightarrow 2x + 5y = 12 \quad \dots(i)$$

$$\text{II. } 4x + 5y = 12 \Rightarrow 2x + 5y = 12 \quad \dots(ii)$$

Thus, even I and II together do not give the answer.

\therefore Correct answer is (d).

13. I. Let the labelled price be Rs. x .

$$\text{C.P.} = 60\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{60}{100} \right) = \text{Rs.} \frac{3x}{5}.$$

$$\text{II. S.P.} = 120\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{120}{100} \right) = \text{Rs.} \frac{6x}{5}.$$

$$\text{Profit} = \text{Rs.} \left(\frac{6x}{5} - \frac{3x}{5} \right) = \text{Rs.} \frac{3x}{5}.$$

Thus, even I and II together do not give the answer.

\therefore Correct answer is (d).

14. I. Total gain = Rs. 1596.

II. C.P. of each article = Rs. 632.

III. S.P. of each article = Rs. 765.

Let the number of articles be x .

$$\text{Then, } 765x - 632x = 1596 \Rightarrow x = \frac{1596}{133} = 12.$$

Thus, all I, II and III are needed to get the answer.

\therefore Correct answer is (d).

15. Let the M.P. be Rs. x .

$$\text{I. S.P.} = 90\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{90}{100} \right) = \text{Rs.} \frac{9x}{10}.$$

II. If S.P. = Rs. x , then gain = 30%.

$$\therefore \text{C.P.} = \text{Rs.} \left(\frac{100}{130} \times x \right) = \text{Rs.} \frac{10x}{13}.$$

III. Gain = 20%.

Thus, I, II, III do not give the answer.

\therefore Correct answer is (e).

16. I. Let the C.P. be Rs. x .

$$\text{Then, M.P.} = 120\% \text{ of Rs. } x = \text{Rs.} \left(\frac{120}{100} \times x \right) = \text{Rs.} \frac{6x}{5}$$

$$\text{II. S.P.} = 85\% \text{ of M.P.} = \text{Rs.} \left(\frac{6x}{5} \times \frac{85}{100} \right) = \text{Rs.} \frac{51x}{50}$$

$$\therefore \frac{51x}{50} = 408 \Rightarrow x = \left(408 \times \frac{50}{51} \right) \Rightarrow x = 400.$$

Thus, I and II give the answer.

$$\text{III. When there is no discount, then S.P.} = \text{M.P.} = \text{Rs.} \frac{6x}{5} \quad [\text{From I}]$$

Thus, II and III give the same answer.

\therefore Correct answer is (b).

17. Let the M.P. be Rs. x .

$$\text{I. C.P.} = 85\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{85}{100} \right) = \text{Rs.} \frac{17x}{20}$$

$$\text{II. S.P.} = \text{Rs.} 3060.$$

$$\text{III. } 102\% \text{ of } x = 3060 \Rightarrow x = \left(3060 \times \frac{100}{102} \right) = 3000.$$

$$\therefore \text{C.P.} = \text{Rs.} \frac{17x}{20} = \text{Rs.} \left(\frac{17}{20} \times 3000 \right) = \text{Rs.} 2550.$$

$$\text{So, gain} = \text{Rs.} (3060 - 2550) = \text{Rs.} 510.$$

Thus all I, II and III give the answer.

\therefore Correct answer is (d).

18. I. Let the list price be Rs. x .

$$\text{Then, S.P.} = 95\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{95}{100} \right) = \text{Rs.} \frac{19x}{20}$$

$$\text{II. When S.P.} = \text{Rs. } x \text{ and gain} = 20\%$$

$$\text{Then, C.P.} = \text{Rs.} \left(\frac{100}{120} \times x \right) = \text{Rs.} \frac{5x}{6}$$

$$\therefore \text{Gain} = \left(\frac{19x}{20} - \frac{5x}{6} \right) = \left(\frac{57x - 50x}{60} \right) = \frac{7x}{60}$$

$$\therefore \text{Gain\%} = \left(\frac{7x}{60} \times \frac{6}{5x} \times 100 \right)\% = 14\%.$$

Thus, I and II only give the answer.

\therefore Correct answer is (a).

19. C.P. = Rs. 3000. Let the rate of discount be $x\%$.

$$\text{I. S.P.} = 105\% \text{ of Rs. } 3000 = \text{Rs.} 3150.$$

$$\text{II. Let M.P.} = \text{Rs. } x. \text{ Then, } \frac{(x - 3150)}{(x - 85\% \text{ of } 3000)} = \frac{1}{2} \Rightarrow x = 3750.$$

$$\text{From I and II, discount} = \text{Rs.} (3750 - 3150) = \text{Rs.} 600.$$

$$\text{Discount\%} = \left(\frac{600}{3750} \times 100 \right)\% = 16\%.$$

Thus, I and II give the answer.

III. M.P. = 125% of Rs. 3000 = Rs. 3750.

From I and III, discount = (M.P.) - (S.P.) = Rs. 600.

Thus, Discount% can be calculated.

Thus, I and III give the answer.

From II and III, we get : discount = Rs. $\left(\frac{3750 - 85\% \text{ of } 3000}{2} \right)$ = Rs. 600.

Thus, II and III give the answer.

\therefore Correct answer is (e).

20. I. S.P. = Rs. 12350, Gain = 23.5%.

\therefore C.P. = Rs. $\left(\frac{100}{123.5} \times 12350 \right)$ = Rs. 10000.

II. M.P. = 130% of C.P. = 130% of Rs. 10000 = Rs. 13000.

From I and II, discount = Rs. (13000 - 12350) = Rs. 650.

Discount% = $\left(\frac{650}{13000} \times 100 \right)\%$ = 5%.

Thus, I and II give the answer.

III gives C.P. = Rs. 10000.

So, II and III give the answer.

\therefore Correct answer is (e).

21. I. Let C.P. be Rs. x . Then, M.P. = 130% of x = Rs. $\frac{13x}{10}$.

III. S.P. = 90% of M.P.

Thus, I and III give, S.P. = Rs. $\left(\frac{90}{100} \times \frac{13x}{10} \right)$ = Rs. $\frac{117x}{100}$.

Gain = Rs. $\left(\frac{117x}{100} - x \right)$ = Rs. $\frac{17x}{100}$.

Thus, from I and III, gain% can be obtained.

Clearly, II is redundant.

\therefore Correct answer is (b).

22. I. C.P. = Rs. 1500.

I. Gain = 10.5%.

\therefore From I and II, we get

S.P. = 110.5% of C.P. = Rs. $\left(\frac{110.5}{100} \times 1500 \right)$ = Rs. 1657.50.

Discount = 15%.

\therefore M.P. = Rs. $\left(\frac{100}{85} \times 1657.50 \right)$ = Rs. 1950.

Thus, I and II give the answer and so III is redundant.

III. M.P. = 130% of C.P.

From II and III, we get : M.P. = Rs. $\left(\frac{130}{100} \times 1500 \right)$ = Rs. 1950.

\therefore II and III give the answer and so I is redundant.

So, either I or III is redundant.

\therefore Correct answer is (b).

12. RATIO AND PROPORTION

IMPORTANT FACTS AND FORMULAE

I. 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, $4 : 6 = 2 : 3$.

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

III. (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} .

IV. (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 $(a^{\frac{1}{3}} : b^{\frac{1}{3}})$.

(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 $a : b : c$.

$$\text{Sol. } a : b = 5 : 9 \text{ and } b : c = 4 : 7 = \left(4 \times \frac{9}{4}\right) : \left(7 \times \frac{9}{4}\right) = 9 : \frac{63}{4} = 20 : 36 : 63.$$

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 .

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

∴ Fourth proportional to 4, 9, 12 is 27.

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

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

∴ Third proportional to 16 and 36 is 81.

- (iii) Mean proportional between 0.08 and 0.18

$$\text{Sol. } \text{Mean proportional} = \sqrt{0.08 \times 0.18} = \sqrt{\frac{8}{100} \times \frac{18}{100}} = \sqrt{\frac{144}{10000}} = \frac{12}{100} = 0.12.$$

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

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

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

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

∴ 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 = $(35 + 28 + 20) = 83$.

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

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

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.

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

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

$$\therefore \text{Number of 50 p coins} = (5 \times 40) = 200; \text{Number of 25 p coins} = (9 \times 40) = 360; \\ \text{Number of 10 p coins} = (4 \times 40) = 160.$$

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,

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

∴ 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 :
 - (a) 4 : 9 : 16
 - (b) 8 : 9 : 12
 - (c) 8 : 9 : 16
 - (d) 8 : 9 : 24(S.S.C. 2002)
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 :
 - (a) 1.12
 - (b) 1.20
 - (c) 1.25
 - (d) 1.30(L.I.C. 2003)
13. If $x : y = 5 : 2$, then $(8x + 9y) : (8x + 2y)$ is :
 - (a) 22 : 29
 - (b) 26 : 61
 - (c) 29 : 22
 - (d) 61 : 26(S.S.C. 2001)
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 : (S.S.C. 2001)
- (a) $\frac{1}{55}$ (b) $\frac{1}{11}$ (c) $\frac{3}{11}$ (d) 55
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.A.O. 2003)
- (a) Rs. 122 (b) Rs. 129.60 (c) Rs. 146.60 (d) Rs. 188
36. A sum of Rs. 1300 is divided amongst P, Q, R and S such that $\frac{P's\ share}{Q's\ share} = \frac{Q's\ share}{R's\ share} = \frac{R's\ share}{S's\ share} = \frac{2}{3}$. 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 : (R.B.I. 2003)
- (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 ? (R.B.I. 2003)
- (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 ?
 (A) Rs. 21,000 (B) Rs. 26,000 (C) Rs. 28,000 (D) Data inadequate
 (Bank P.O. 2002)
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
 (R.R.B. 2002)
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
 (R.R.B. 2002)
48. The fourth proportional to 5, 8, 15 is :
 (A) 18 (B) 24 (C) 19 (D) 20 (E) 21
 (R.R.B. 2002)
49. The mean proportional between 234 and 104 is :
 (A) 12 (B) 39 (C) 54 (D) None of these
 (R.R.B. 2002)
50. The third proportional to 0.36 and 0.48 is :
 (A) 0.64 (B) 0.1728 (C) 0.42 (D) 0.94
 (R.R.B. 2002)
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) $\frac{x-y}{x+y}$
 (R.R.B. 2002)
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) $9 : 14$
 (R.R.B. 2002)
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
 (R.R.B. 2002)
54. The prices of a scooter and a TV. are in the ratio $7 : 5$. If the scooter costs Rs. 8000 more than a TV. set, then the price of a TV. set is :
 (A) Rs. 20,000 (B) Rs. 24,000 (C) Rs. 28,000 (D) Rs. 32,000
 (R.R.B. 2002)
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
 (R.R.B. 2002)
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
 (R.R.B. 2002)
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
 (R.R.B. 2002)
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
 (R.R.B. 2002)
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
 (R.R.B. 2002)
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
 (R.R.B. 2002)

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 : (C.D.S. 2002)
- (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 : (C.D.S. 2002)
- (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 ? (C.D.S. 2002)
- (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 : (C.D.S. 2002)
- (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 : (C.D.S. 2002)
- (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 : (C.D.S. 2002)
- (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 : (C.D.S. 2002)
- (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 : (C.D.S. 2002)
- (a) 52 cm (b) 48 cm (c) 32 cm (d) 28 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 ? (C.D.S. 2002)
- (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 ? (C.D.S. 2002)
- (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 : (C.D.S. 2002)
- (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

and so ratios which have lowest ratios will be ratios whose sum is least.

Thus, if we want to express ratios in lowest terms, we have to reduce the ratios to lowest terms.

$$1. A : B = 5 : 7, B : C = 6 : 11 = \left(6 \times \frac{7}{6}\right) : \left(11 \times \frac{7}{6}\right) = 7 : \frac{77}{6} \text{ and } 30 : 42 : 77.$$

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

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

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

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

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

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

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

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

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

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

$$\text{and } C : D = 6 : 7 = \left(6 \times \frac{15}{24}\right) : \left(7 \times \frac{15}{24}\right) = \frac{15}{4} : \frac{25}{8}$$

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

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

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

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

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

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

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

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

\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. $(x \times 5) = (0.75 \times 8) \Rightarrow x = \frac{6}{5} = 1.20.$ [By $\frac{6}{5} \times 50 = 60$ & $\frac{60}{50} = \text{gurad waz } 60\%]$

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. $\frac{x}{y} = \frac{2}{1} \Leftrightarrow \frac{x^2}{y^2} = \frac{4}{1} \Leftrightarrow \frac{x^2+y^2}{x^2-y^2} = \frac{4+1}{4-1} \quad [\text{By componendo and dividendo}]$
 $\Leftrightarrow \frac{x^2-y^2}{x^2+y^2} = \frac{3}{5} \Leftrightarrow (x^2-y^2) : (x^2+y^2) = 3 : 5.$

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

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

∴ Required ratio is $3 : 2.$

17. $x^2 + 4y^2 = 4xy \Leftrightarrow x^2 - 4xy + 4y^2 = 0 \Leftrightarrow (x-2y)^2 = 0$
 $\Leftrightarrow (x-2y) = 0 \Leftrightarrow x = 2y \Leftrightarrow \frac{x}{y} = \frac{2}{1}.$

∴ $x : y = 2 : 1.$

18. $5x^2 - 13xy + 6y^2 = 0 \Leftrightarrow 5x^2 - 10xy - 3xy + 6y^2 = 0$
 $\Leftrightarrow 5x(x-2y) - 3y(x-2y) = 0 \Leftrightarrow (x-2y)(5x-3y) = 0$
 $\Leftrightarrow x = 2y \text{ or } 5x = 3y \Leftrightarrow \frac{x}{y} = \frac{2}{1} \text{ or } \frac{x}{y} = \frac{3}{5}$

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

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

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

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

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

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 $3k = \left(\frac{110}{100} \times 3k\right) = \frac{33}{10}k$

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

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

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

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

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

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

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

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

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

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

$$\therefore \text{Greatest number} = 28.$$

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

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

$$\text{Sum of ratio terms} = (45 + 36 + 40) = 121.$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\therefore P's \text{ share} = \text{Rs. } (2 \times 80) = \text{Rs. } 160.$$

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

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

38. Let the third number be x .

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

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

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

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 $8x$)

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

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

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 $8x$)

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

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

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

$$\therefore \text{B's share} = \text{Rs. } 2x = \text{Rs. } (2 \times 1000) = \text{Rs. } 2000.$$

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. $7x$.

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

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

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

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

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

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

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

$$\therefore \text{Required number} = 2.$$

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 = $\frac{40}{(20+x)}$.

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

Quantity of water to be further added = 60 litres.

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

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

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 .

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

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 .

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

\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.

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

\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.

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

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

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

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

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.

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

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

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

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

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 = $1 : \frac{2}{3} = 3 : 2$.

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

Water in it = $(15 - 3)$ litres = 12 litres.

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

Quantity of alcohol in it = 3 litres.

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

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 = (3×15) years = 45 years and B's age = 15 years.

65. Total age of 3 boys = (25×3) 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. $10\% \text{ of } B = \frac{1}{4} G \Leftrightarrow \frac{10B}{100} = \frac{1}{4} G \Leftrightarrow B = \frac{5}{2} G$

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

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.

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

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

$$\text{Water in 2nd mix.} = (4x - 3x) \text{ litres} = x \text{ litres.}$$

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

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

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

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

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

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

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

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

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

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

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

$$540y + x = 1800 \quad \dots(i) \quad \text{and} \quad 620y + x = 2040 \quad \dots(ii)$$

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.

$$\text{Then, } 5x - 3y = 1600 \quad \dots(i) \quad \text{and} \quad 4x - 2y = 1600 \quad \dots(ii)$$

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

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

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

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

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

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

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

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.

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

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.

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

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

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

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

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

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

$$\therefore \text{Required ratio} = 16 : 56.$$

13. PARTNERSHIP

IMPORTANT FACTS AND FORMULAE

- Partnership :** When two or more than two persons run a business jointly, they are called **partners** and the deal is known as **partnership**.
- Ratio of Division of Gains :**
 - When investments of all the partners are for the same time, the gain or loss is distributed among the partners in the ratio of their investments.
Suppose A and B invest Rs. x and Rs. y respectively for a year in a business, then at the end of the year :
(A's share of profit) : (B's share of profit) = $x : y$.
 - When investments are for different time periods, then equivalent capitals are calculated for a unit of time by taking (capital \times number of units of time). Now, gain or loss is divided in the ratio of these capitals.
Suppose A invests Rs. x for p months and B invests Rs. y for q months, then
(A's share of profit) : (B's share of profit) = $xp : yq$.
- Working and Sleeping Partners :** A partner who manages the business is known as a **working partner** and the one who simply invests the money is a **sleeping partner**.

SOLVED EXAMPLES

Ex. 1. A, B and C started a business by investing Rs. 1,20,000, Rs. 1,35,000 and Rs. 1,50,000 respectively. Find the share of each, out of an annual profit of Rs. 56,700.

Sol. Ratio of shares of A, B and C = Ratio of their investments

$$= 120000 : 135000 : 150000 = 8 : 9 : 10.$$

$$\text{A's share} = \text{Rs. } \left(56700 \times \frac{8}{27} \right) = \text{Rs. } 16800.$$

$$\text{B's share} = \text{Rs. } \left(56700 \times \frac{9}{27} \right) = \text{Rs. } 18900.$$

$$\text{C's share} = \text{Rs. } \left(56700 \times \frac{10}{27} \right) = \text{Rs. } 21000.$$

Ex. 2. Alfred started a business investing Rs. 45,000. After 3 months, Peter joined him with a capital of Rs. 60,000. After another 6 months, Ronald joined them with a capital of Rs. 90,000. At the end of the year, they made a profit of Rs. 16,500. Find the share of each.

Sol. Clearly, Alfred invested his capital for 12 months, Peter for 9 months and Ronald for 3 months.

$$\text{So, ratio of their capitals} = (45000 \times 12) : (60000 \times 9) : (90000 \times 3)$$
$$= 540000 : 540000 : 270000 = 2 : 2 : 1.$$

$$\therefore \text{Alfred's share} = \text{Rs. } \left(16500 \times \frac{2}{5} \right) = \text{Rs. } 6600;$$

$$\text{Peter's share} = \text{Rs. } \left(16500 \times \frac{2}{5} \right) = \text{Rs. } 6600;$$

$$\text{Ronald's share} = \text{Rs. } \left(16500 \times \frac{1}{5} \right) = \text{Rs. } 3300.$$

Ex. 3. *A, B and C start a business each investing Rs. 20,000. After 5 months A withdrew Rs. 5000, B withdrew Rs. 4000 and C invests Rs. 6000 more. At the end of the year, a total profit of Rs. 69,900 was recorded. Find the share of each.*

Sol. Ratio of the capitals of A, B and C

$$= 20000 \times 5 : 15000 \times 7 : 20000 \times 5 + 16000 \times 7 : 20000 \times 5 + 26000 \times 7$$

$$= 205000 : 212000 : 282000 = 205 : 212 : 282$$

$$\therefore \text{A's share} = \text{Rs. } \left(69900 \times \frac{205}{699} \right) = \text{Rs. } 20500;$$

$$\text{B's share} = \text{Rs. } \left(69900 \times \frac{212}{699} \right) = \text{Rs. } 21200;$$

$$\text{C's share} = \text{Rs. } \left(69900 \times \frac{282}{699} \right) = \text{Rs. } 28200.$$

Ex. 4. *A, B and C enter into partnership. A invests 3 times as much as B invests and B invests two-third of what C invests. At the end of the year, the profit earned is Rs. 6600. What is the share of B?*

Sol. Let C's capital = Rs. x. Then, B's capital = Rs. $\frac{2}{3}x$.

$$\text{A's capital} = \text{Rs. } \left(3 \times \frac{2}{3}x \right) = \text{Rs. } 2x.$$

$$\text{Ratio of their capitals} = 2x : \frac{2}{3}x : x = 6 : 2 : 3.$$

$$\text{Hence, B's share} = \text{Rs. } \left(6600 \times \frac{2}{11} \right) = \text{Rs. } 1200.$$

Ex. 5. *Four milkmen rented a pasture. A grazed 24 cows for 3 months; B 10 cows for 5 months; C 35 cows for 4 months and D 21 cows for 3 months. If A's share of rent is Rs. 720, find the total rent of the field.*

Sol. Ratio of shares of A, B, C, D = $(24 \times 3) : (10 \times 5) : (35 \times 4) : (21 \times 3)$
 $= 72 : 50 : 140 : 63.$

Let total rent be Rs. x. Then, A's share = Rs. $\frac{72x}{325}$.

$$\therefore \frac{72x}{325} = 720 \Leftrightarrow x = \frac{720 \times 325}{72} = 3250.$$

Hence, total rent of the field is Rs. 3250.

Ex. 6. *A invested Rs. 76,000 in a business. After few months, B joined him with Rs. 57,000. At the end of the year, the total profit was divided between them in the ratio 2 : 1. After how many months did B join?*

Sol. Suppose B joined after x months. Then, B's money was invested for $(12 - x)$ months.

$$\therefore \frac{76000 \times 12}{57000 \times (12 - x)} = \frac{2}{1} \Leftrightarrow 912000 = 114000 (12 - x)$$

$$\Leftrightarrow 114 (12 - x) = 912 \Leftrightarrow (12 - x) = 8 \Leftrightarrow x = 4.$$

Hence, B joined after 4 months.

Ex. 7. A, B and C enter into a partnership by investing in the ratio of 3 : 2 : 4. After one year, B invests another Rs. 2,70,000 and C, at the end of 2 years, also invests Rs. 2,70,000. At the end of three years, profits are shared in the ratio of 3 : 4 : 5. Find the initial investment of each.

Sol. Let the initial investments of A, B and C be Rs. $3x$, Rs. $2x$ and Rs. $4x$ respectively. Then,

$$(3x \times 36) : [(2x \times 12) + (2x + 270000) \times 24] : [(4x \times 24) + (4x + 270000) \times 12]$$

$$= 3 : 4 : 5.$$

$$\Leftrightarrow 108x : (72x + 6480000) : (144x + 3240000) = 3 : 4 : 5$$

$$\therefore \frac{108x}{72x + 6480000} = \frac{3}{4} \Leftrightarrow 432x = 216x + 19440000$$

$$\Leftrightarrow 216x = 19440000 \Leftrightarrow x = 90000.$$

Hence, A's initial investment = $3x$ = Rs. 2,70,000;

B's initial investment = $2x$ = Rs. 1,80,000;

C's initial investment = $4x$ = Rs. 3,60,000.

EXERCISE 13A

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer :

- P and Q started a business investing Rs. 85,000 and Rs. 15,000 respectively. In what ratio the profit earned after 2 years be divided between P and Q respectively ?
 (a) 3 : 4 (b) 3 : 5 (c) 15 : 23 (d) 17 : 23 (e) None of these
 (B.S.R.B. 2003)
- Anand and Deepak started a business investing Rs. 22,500 and Rs. 35,000 respectively. Out of a total profit of Rs. 13,800, Deepak's share is :
 (a) Rs. 5400 (b) Rs. 7200 (c) Rs. 8400 (d) Rs. 9600
- A, B, C enter into a partnership investing Rs. 35,000, Rs. 45,000 and Rs. 55,000 respectively. The respective shares of A, B, C in an annual profit of Rs. 40,500 are :
 (a) Rs. 10,500, Rs. 13,500, Rs. 16,500 (b) Rs. 11,500, Rs. 13,000, Rs. 16,000
 (c) Rs. 11,000, Rs. 14,000, Rs. 15,500 (d) Rs. 11,500, Rs. 12,500, Rs. 16,500
 (C.B.I. 1997)
- Reena and Shaloo are partners in a business. Reena invests Rs. 35,000 for 8 months and Shaloo invests Rs. 42,000 for 10 months. Out of a profit of Rs. 31,570, Reena's share is :
 (a) Rs. 9471 (b) Rs. 12,628 (c) Rs. 18,040 (d) Rs. 18,942
- Kamal started a business investing Rs. 9000. After five months, Sameer joined with a capital of Rs. 8000. If at the end of the year, they earn a profit of Rs. 6970, then what will be the share of Sameer in the profit ?
 (R.R.B. 2003)
 (a) Rs. 1883.78 (b) Rs. 2380 (c) Rs. 3690 (d) Rs. 3864
- Simran started a software business by investing Rs. 50,000. After six months, Nanda joined her with a capital of Rs. 80,000. After 3 years, they earned a profit of Rs. 24,500. What was Simran's share in the profit ?
 (Bank P.O. 2004)
 (a) Rs. 9423 (b) Rs. 10,250 (c) Rs. 12,500 (d) Rs. 14,000 (e) None of these

16. Three partners A, B, C start a business. Twice A's capital is equal to thrice B's capital and B's capital is four times C's capital. Out of a total profit of Rs. 16,500 at the end of the year, B's share is :
 (a) Rs. 4000 (b) Rs. 6000 (c) Rs. 7500 (d) Rs. 6600
17. If 4 (A's capital) = 6 (B's capital) = 10 (C's capital), then out of a profit of Rs. 4650, C will receive :
 (a) Rs. 465 (b) Rs. 900 (c) Rs. 1550 (d) Rs. 2250
18. A, B and C enter into partnership. A invests some money at the beginning, B invests double the amount after 6 months and C invests thrice the amount after 8 months. If the annual profit be Rs. 27,000, C's share is :
 (a) Rs. 8625 (b) Rs. 9000 (c) Rs. 10,800 (d) Rs. 11,250
19. A, B, C hired a car for Rs. 520 and used it for 7, 8 and 11 hours respectively. Hire charges paid by B were :
 (a) Rs. 140 (b) Rs. 160 (c) Rs. 180 (d) Rs. 220
20. A, B and C rent a pasture. A puts 10 oxen for 7 months, B puts 12 oxen for 5 months and C puts 15 oxen for 3 months for grazing. If the rent of the pasture is Rs. 175, how much must C pay as his share of rent ? (S.S.C. 2000)
 (a) Rs. 45 (b) Rs. 50 (c) Rs. 55 (d) Rs. 60
21. In a business, A and C invested amounts in the ratio $2 : 1$, whereas the ratio between amounts invested by A and B was $3 : 2$. If Rs. 1,57,300 was their profit, how much amount did B receive ? (Bank P.O. 1999)
 (a) Rs. 24,200 (b) Rs. 36,300 (c) Rs. 48,400 (d) Rs. 72,600
22. A and B started a partnership business investing some amount in the ratio of $3 : 5$. C joined them after six months with an amount equal to that of B. In what proportion should the profit at the end of one year be distributed among A, B and C ?
 (a) $3 : 5 : 2$ (b) $3 : 5 : 5$ (c) $6 : 10 : 5$
 (d) Data inadequate (e) None of these (Bank P.O. 2000)
23. A, B and C enter into a partnership and their shares are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. After 2 months, A withdraws half of his capital and after 10 months, a profit of Rs. 378 is divided among them. What is B's share ? (S.S.C. 2000)
 (a) Rs. 129 (b) Rs. 144 (c) Rs. 156 (d) Rs. 168
24. A, B and C enter into a partnership in the ratio $\frac{7}{2} : \frac{4}{3} : \frac{6}{5}$. After 4 months, A increases his share by 50%. If the total profit at the end of one year be Rs. 21,600, then B's share in the profit is : (L.I.C.A.A.O. 2008)
 (a) Rs. 2100 (b) Rs. 2400 (c) Rs. 3600 (d) Rs. 4000
25. A, B, C started a business with their investments in the ratio $1 : 3 : 5$. After 4 months, A invested the same amount as before and B as well as C withdrew half of their investments. The ratio of their profits at the end of the year is :
 (a) $4 : 3 : 5$ (b) $5 : 6 : 10$ (c) $6 : 5 : 10$ (d) $10 : 5 : 6$
26. A and B entered into partnership with capitals in the ratio $4 : 5$. After 3 months, A withdrew $\frac{1}{4}$ of his capital and B withdrew $\frac{1}{5}$ of his capital. The gain at the end of 10 months was Rs. 760. A's share in this profit is : (A.A.O. Exam, 2003)
 (a) Rs. 330 (b) Rs. 360 (c) Rs. 380 (d) Rs. 430
27. In a partnership, A invests $\frac{1}{6}$ of the capital for $\frac{1}{6}$ of the time, B invests $\frac{1}{3}$ of the capital for $\frac{1}{3}$ of the time and C, the rest of the capital for the whole time. Out of a profit of Rs. 4600, B's share is :
 (a) Rs. 650 (b) Rs. 800 (c) Rs. 960 (d) Rs. 1000

28. A, B and C jointly thought of engaging themselves in a business venture. It was agreed that A would invest Rs. 6500 for 6 months, B, Rs. 8400 for 5 months and C, Rs. 10,000 for 3 months. A wants to be the working member for which he was to receive 5% of the profits. The profit earned was Rs. 7400. Calculate the share of B in the profit.
 (a) Rs. 1900 (b) Rs. 2660 (c) Rs. 2800 (d) Rs. 2840
 (M.B.A. 2002)
29. X and Y invested in a business. They earned some profit which they divided in the ratio of 2 : 3. If X invested Rs. 40,000, the amount invested by Y is :
 (a) Rs. 45,000 (b) Rs. 50,000 (c) Rs. 60,000 (d) Rs. 80,000
30. Manick received Rs. 6000 as his share out of the total profit of Rs. 9000 which he and Raunaq earned at the end of one year. If Manick invested Rs. 20,000 for 6 months, whereas Raunaq invested his amount for the whole year, what was the amount invested by Raunaq ?
 (a) Rs. 4000 (b) Rs. 5000 (c) Rs. 6000 (d) Rs. 10,000
31. A, B and C enter into a partnership with a capital in which A's contribution is Rs. 10,000. If out of a total profit of Rs. 1000, A gets Rs. 500 and B gets Rs. 300, then C's capital is :
 (a) Rs. 4000 (b) Rs. 5000 (c) Rs. 6000 (d) Rs. 9000
32. A, B and C started a shop by investing Rs. 27,000, Rs. 72,000 and Rs. 81,000 respectively. At the end of the year, the profits were distributed among them. If C's share of profit be Rs. 36,000, then the total profit was :
 (a) Rs. 80,000 (b) Rs. 95,600 (c) Rs. 1,08,000 (d) Rs. 1,16,000
33. A and B started a business jointly. A's investment was three times the investment of B and the period of his investment was two times the period of investment of B. If B received Rs. 4000 as profit, then their total profit is :
 (a) Rs. 16,000 (b) Rs. 20,000 (c) Rs. 24,000 (d) Rs. 28,000
34. A started a business with Rs. 21,000 and is joined afterwards by B with Rs. 36,000. After how many months did B join if the profits at the end of the year are divided equally ?
 (a) 3 (b) 4 (c) 5 (d) 6
35. A began a business with Rs. 85,000. He was joined afterwards by B with Rs. 42,500. For how much period does B join, if the profits at the end of the year are divided in the ratio of 3 : 1 ?
 (N.I.F.T. 2003)
 (a) 4 months (b) 5 months (c) 6 months (d) 8 months.
36. A starts business with Rs. 3500 and after 5 months, B joins with A as his partner. After a year, the profit is divided in the ratio 2 : 3. What is B's contribution in the capital ?
 (S.S.C. 2000)
 (a) Rs. 7500 (b) Rs. 8000 (c) Rs. 8500 (d) Rs. 9000
37. A and B start a business jointly. A invests Rs. 16,000 for 8 months and B remains in the business for 4 months. Out of total profit, B claims $\frac{2}{7}$ of the profit. How much money was contributed by B ?
 (a) Rs. 10,500 (b) Rs. 11,900 (c) Rs. 12,800 (d) Rs. 13,600
38. Two friends P and Q started a business investing in the ratio of 5 : 6. R joined them after six months investing an amount equal to that of Q's. At the end of the year, 20% profit was earned which was equal to Rs. 96,000. What was the amount invested by R ?
 (S.B.I.P.O. 1999)
 (a) Rs. 1,05,000 (b) Rs. 1,75,000 (c) Rs. 2,10,000
 (d) Data inadequate (e) None of these
39. Three partners shared the profit in a business in the ratio 5 : 7 : 8. They had partnered for 14 months, 8 months and 7 months respectively. What was the ratio of their investments ?
 (Hotel Management, 1998)
 (a) 5 : 7 : 8 (b) 28 : 49 : 64 (c) 38 : 28 : 21 (d) None of these

40. A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is Rs. 855, the total profit is :
 (a) Rs. 1425 (b) Rs. 1500 (c) Rs. 1537.50 (d) Rs. 1576
41. A and B started a business with initial investments in the ratio 14 : 15 and their annual profits were in the ratio 7 : 6. If A invested the money for 10 months, for how many months did B invest his money ?
 (a) 6 (b) 7 (c) 8 (d) 9
42. A and B are partners in a business. A contributes $\frac{1}{4}$ of the capital for 15 months and B received $\frac{2}{3}$ of the profit. For how long B's money was used ? (S.S.C. 2000)
 (a) 6 months (b) 9 months (c) 10 months (d) 1 year

ANSWERS

1. (e) 2. (c) 3. (a) 4. (b) 5. (b) 6. (e) 7. (a) 8. (b) 9. (a)
 10. (b) 11. (d) 12. (b) 13. (c) 14. (b) 15. (d) 16. (b) 17. (b) 18. (b)
 19. (b) 20. (a) 21. (c) 22. (c) 23. (b) 24. (d) 25. (b) 26. (a) 27. (b)
 28. (b) 29. (c) 30. (b) 31. (b) 32. (a) 33. (d) 34. (c) 35. (d) 36. (d)
 37. (c) 38. (e) 39. (d) 40. (b) 41. (c) 42. (c)

SOLUTIONS

1. $P : Q = 85000 : 15000 = 85 : 15 = 17 : 3.$

2. Ratio of their shares = $22500 : 35000 = 9 : 14.$

Deepak's share = Rs. $\left(13800 \times \frac{14}{23} \right) = \text{Rs. } 8400.$

3. $A : B : C = 35000 : 45000 : 55000 = 7 : 9 : 11.$

A's share = Rs. $\left(40500 \times \frac{7}{27} \right) = \text{Rs. } 10500.$

B's share = Rs. $\left(40500 \times \frac{9}{27} \right) = \text{Rs. } 13500.$

C's share = Rs. $\left(40500 \times \frac{11}{27} \right) = \text{Rs. } 16500.$

4. Ratio of their shares = $(35000 \times 8) : (42000 \times 10) = 2 : 3.$

Reena's share = Rs. $\left(31570 \times \frac{2}{5} \right) = \text{Rs. } 12628.$

5. Kamal : Sameer = $(9000 \times 12) : (8000 \times 7) = 108 : 56 = 27 : 14.$

\therefore Sameer's share = Rs. $\left(6970 \times \frac{14}{41} \right) = \text{Rs. } 2380.$

6. Simran : Nanda = $(50000 \times 36) : (80000 \times 30) = 3 : 4.$

\therefore Simran's share = Rs. $\left(24500 \times \frac{3}{7} \right) = \text{Rs. } 10500.$

7. $A : B : C = (20000 \times 24) : (15000 \times 24) : (20000 \times 18) = 4 : 3 : 3.$

\therefore B's share = Rs. $\left(25000 \times \frac{3}{10} \right) = \text{Rs. } 7500.$

8. Aman : Rakhi : Sagar = $(70000 \times 36) : (105000 \times 30) : (140000 \times 24) = 12 : 15 : 16$.
9. Arun : Kamal : Vinay = $(8000 \times 6) : (4000 \times 8) : (8000 \times 8) = 48 : 32 : 64 = 3 : 2 : 4$.
- ∴ Kamal's share = Rs. $\left(4005 \times \frac{2}{9}\right)$ = Rs. 890.
10. A : B : C = $(40000 \times 36) : (80000 \times 12 + 40000 \times 24) : (120000 \times 24 + 40000 \times 12)$
 $= 144 : 192 : 336 = 3 : 4 : 7$.
11. A : B : C = $(25 \text{ lakhs} \times 1) : (35 \text{ lakhs} \times 2) : (35 \text{ lakhs} \times 2 + 25 \text{ lakhs} \times 1) : (30 \text{ lakhs} \times 3)$
 $= 95 \text{ lakhs} : 95 \text{ lakhs} : 90 \text{ lakhs} = 19 : 19 : 18$.
12. Shekhar : Rajeev : Jatin
 $= (25000 \times 12 + 35000 \times 12 + 45000 \times 12) : (35000 \times 24) : (35000 \times 12)$
 $= 1260000 : 840000 : 420000 = 3 : 2 : 1$.
- ∴ Rajeev's share = Rs. $\left(150000 \times \frac{2}{6}\right)$ = Rs. 50000.
13. A : B : C = $(16000 \times 3 + 11000 \times 9) : (12000 \times 3 + 17000 \times 9) : (21000 \times 6)$
 $= 147 : 180 : 126 = 7 : 9 : 6$.
- ∴ Difference of B and C's shares = Rs. $\left(26400 \times \frac{9}{22} - 26400 \times \frac{6}{22}\right)$ = Rs. 3600.
14. A : B : C = $(5000 \times 4 + 2500 \times 8) : (4500 \times 6 + 3000 \times 6) : (7000 \times 6)$
 $= 40000 : 45000 : 42000 = 40 : 45 : 42$.
- ∴ A's share = Rs. $\left(5080 \times \frac{40}{127}\right)$ = Rs. 1600;
B's share = Rs. $\left(5080 \times \frac{45}{127}\right)$ = Rs. 1800;
C's share = Rs. $\left(5080 \times \frac{42}{127}\right)$ = Rs. 1680.
15. Let C = x. Then, B = x + 5000 and A = x + 5000 + 4000 = x + 9000.
So, x + x + 5000 + x + 9000 = 50000 $\Leftrightarrow 3x = 36000 \Leftrightarrow x = 12000$.
A : B : C = 21000 : 17000 : 12000 = 21 : 17 : 12.
- ∴ A's share = Rs. $\left(35000 \times \frac{21}{50}\right)$ = Rs. 14,700.
16. Let C = x. Then, B = 4x and 2A = 3 × 4x = 12x or A = 6x.
∴ A : B : C = 6x : 4x : x = 6 : 4 : 1.
- So, B's capital = Rs. $\left(16500 \times \frac{4}{11}\right)$ = Rs. 6000.
17. Let $4A = 6B = 10C = k$. Then, $A = \frac{k}{4}$, $B = \frac{k}{6}$ and $C = \frac{k}{10}$.
∴ A : B : C = $\frac{k}{4} : \frac{k}{6} : \frac{k}{10} = 15 : 10 : 6$.
- Hence, C's share = Rs. $\left(4650 \times \frac{6}{31}\right)$ = Rs. 900.
18. Let A's investment be Rs. x.
Then, Ratio of capitals = $(x \times 12) : (2x \times 6) : (3x \times 4) = 12x : 12x : 12x = 1 : 1 : 1$.
∴ C's share = Rs. $\left(27000 \times \frac{1}{3}\right)$ = Rs. 9000.

19. $A : B : C = 7 : 8 : 11$.

Hire charges paid by B = Rs. $\left(\frac{8}{26} \times 520 \right)$ = Rs. 160.

20. $A : B : C = 10 \times 7 : 12 \times 5 : 15 \times 3 = 70 : 60 : 45 = 14 : 12 : 9$.

\therefore C's rent = Rs. $\left(175 \times \frac{9}{35} \right)$ = Rs. 45.

21. $A : B = 3 : 2 \Rightarrow B : A = 2 : 3 = 4 : 6$ and $A : C = 2 : 1 = 6 : 3$.

So, $B : A : C = 4 : 6 : 3$ or $A : B : C = 6 : 4 : 3$.

\therefore B's share = Rs. $\left(157300 \times \frac{4}{13} \right)$ = Rs. 48400.

22. Let the initial investments of A and B be $3x$ and $5x$.

$$A : B : C = (3x \times 12) : (5x \times 12) : (5x \times 6) = 36 : 60 : 30 = 6 : 10 : 5.$$

23. Ratio of initial investments = $\frac{1}{2} : \frac{1}{3} : \frac{1}{4} = 6 : 4 : 3$.

Let their initial investments be $6x$, $2x$ and $3x$ respectively.

$$A : B : C = (6x \times 2 + 3x \times 10) : (4x \times 12) : (3x \times 12) = 42 : 48 : 36 = 7 : 8 : 6.$$

\therefore B's share = Rs. $\left(378 \times \frac{8}{21} \right)$ = Rs. 144.

24. Ratio of initial investments = $\frac{7}{2} : \frac{4}{3} : \frac{6}{5} = 105 : 40 : 36$.

Let the initial investments be $105x$, $40x$ and $36x$.

$$\therefore A : B : C = \left(105x \times 4 + \frac{150}{100} \times 105x \times 8 \right) : (40x \times 12) : (36x \times 12) \\ = 1680x : 480x : 432x = 35 : 10 : 9.$$

Hence, B's share = Rs. $\left(21600 \times \frac{10}{54} \right)$ = Rs. 4000.

25. Let their initial investments be x , $3x$ and $5x$ respectively. Then,

$$A : B : C = (x \times 4 + 2x \times 8) : \left(3x \times 4 + \frac{3x}{2} \times 8 \right) : \left(5x \times 4 + \frac{5x}{2} \times 8 \right) \\ = 20x : 24x : 40x = 5 : 6 : 10.$$

26. $A : B = \left[4x \times 3 + \left(4x - \frac{1}{4} \times 4x \right) \times 7 \right] : \left[5x \times 3 + \left(5x - \frac{1}{5} \times 5x \right) \times 7 \right] \\ = (12x + 21x) : (15x + 28x) = 33x : 43x = 33 : 43.$

\therefore A's share = Rs. $\left(760 \times \frac{33}{76} \right)$ = Rs. 330.

27. Suppose A invests Rs. $\frac{x}{6}$ for $\frac{y}{6}$ months. Then, B invests Rs. $\frac{x}{3}$ for $\frac{y}{3}$ months.

C invests $\left[x - \left(\frac{x}{6} + \frac{x}{3} \right) \right]$ i.e., Rs. $\frac{x}{2}$ for y months.

$\therefore A : B : C = \left(\frac{x}{6} \times \frac{y}{6} \right) : \left(\frac{x}{3} \times \frac{y}{3} \right) : \left(\frac{x}{2} \times y \right) = \frac{1}{36} : \frac{1}{9} : \frac{1}{2} = 1 : 4 : 18.$

Hence, B's share = Rs. $\left(4600 \times \frac{4}{23} \right)$ = Rs. 800.

28. For managing, A receives = 5% of Rs. 7400 = Rs. 370.
 Balance = Rs. $(7400 - 370) = \text{Rs. } 7030.$

Ratio of their investments = $(6500 \times 6) : (8400 \times 5) : (10000 \times 3)$

$$= 39000 : 42000 : 30000 = 13 : 14 : 10.$$

$$\therefore \text{B's share} = \text{Rs.} \left(7030 \times \frac{14}{37} \right) = \text{Rs. } 2660.$$

29. Suppose Y invested Rs. y . Then, $\frac{40000}{y} = \frac{2}{3}$ or $y = \left(\frac{40000 \times 3}{2} \right) = 60000.$

30. Suppose Raunaq invested Rs. x . Then, Maniek : Raunaq = $(20000 \times 6) : (x \times 12)$

$$\therefore \frac{120000}{12x} = \frac{6000}{3000} \text{ or } x = \frac{120000}{24} = 5000.$$

31. A : B : C = 500 : 300 : 200 = 5 : 3 : 2.

Let their capitals be $5x$, $3x$ and $2x$ respectively. Then, $5x = 10000 \Leftrightarrow x = 2000$.
 $\therefore \text{C's capital} = 2x = \text{Rs. } 4000.$

32. A : B : C = 27000 : 72000 : 81000 = 3 : 8 : 9. So, C's share : Total Profit = 9 : 20.

Let the total profit be Rs. x . Then, $\frac{9}{20} = \frac{36000}{x}$ or $x = \frac{36000 \times 20}{9} = 80000.$

33. Suppose B invested Rs. x for y months. Then, A invested Rs. $3x$ for $2y$ months.

So, A : B = $(3x \times 2y) : (x \times y) = 6xy : xy = 6 : 1.$

$\therefore \text{B's profit : Total profit} = 1 : 7.$

Let the total profit be Rs. x . Then, $\frac{1}{7} = \frac{4000}{x}$ or $x = 28000.$

34. Suppose B joined after x months.

Then, $21000 \times 12 = 36000 \times (12 - x) \Leftrightarrow 36x = 180 \Leftrightarrow x = 5.$

Hence, B joined after 5 months.

35. Suppose B joined for x months. Then, $\frac{85000 \times 12}{42500 \times x} = \frac{3}{1}$ or $x = \frac{85000 \times 12}{42500 \times 3} = 8.$

So, B joined for 8 months.

36. Let B's capital be Rs. x . Then, $\frac{3500 \times 12}{7x} = \frac{2}{3} \Leftrightarrow 14x = 126000 \Leftrightarrow x = 9000.$

37. Let the total profit be Rs. x . Then, $B = \frac{2x}{7}$ and $A = \left(x - \frac{2x}{7} \right) = \frac{5x}{7}.$

$$\text{So, } A : B = \frac{5x}{7} : \frac{2x}{7} = 5 : 2.$$

Let B's capital be Rs. y . Then, $\frac{16000 \times 8}{y \times 4} = \frac{5}{2} \Leftrightarrow y = \left(\frac{16000 \times 8 \times 2}{5 \times 4} \right) = 12800.$

38. Let the total profit be Rs. x .

Then, 20% of $x = 98000 \Leftrightarrow x = \left(\frac{98000 \times 100}{20} \right) = 490000.$

Let the capitals of P, Q and R be Rs. $5x$, Rs. $6x$ and Rs. $6x$ respectively. Then,

$$(5x \times 12) + (6x \times 12) + (6x \times 6) = 490000 \times 12$$

$$\Leftrightarrow 168x = 490000 \times 12 \Leftrightarrow x = \left(\frac{490000 \times 12}{168} \right) = 35000.$$

$\therefore \text{R's investment} = 6x = \text{Rs.} (6 \times 35000) = \text{Rs. } 210000.$

39. Let their investments be Rs. x for 14 months; Rs. y for 8 months and Rs. z for 7 months respectively.

Then, $14x : 8y : 7z = 5 : 7 : 8$.

$$\text{Now, } \frac{14x}{8y} = \frac{5}{7} \Leftrightarrow 70x = 40y \Leftrightarrow y = \frac{7}{4}x.$$

$$\text{And, } \frac{14x}{7z} = \frac{5}{8} \Leftrightarrow 112x = 35z \Leftrightarrow z = \frac{112}{35}x = \frac{16}{5}x.$$

$$\therefore x : y : z = x : \frac{7}{4}x : \frac{16}{5}x = 20 : 35 : 64.$$

40. Let the total profit be Rs. 100.

$$\text{After paying to charity, A's share} = \text{Rs. } \left(95 \times \frac{3}{5}\right) = \text{Rs. } 57.$$

If A's share is Rs. 57, total profit = Rs. 100.

$$\text{If A's share is Rs. 855, total profit} = \left(\frac{100}{57} \times 855\right) = 1500.$$

41. Suppose A invested Rs. $14x$ for 10 months and B invested Rs. $15x$ for y months. Then,

$$\frac{14x \times 10}{15x \times y} = \frac{7}{6} \Leftrightarrow y = \frac{840}{105} = 8.$$

Hence, B invested the money for 8 months.

42. Let the total profit be Rs. z . Then,

$$\text{B's share} = \text{Rs. } \frac{2z}{3}, \text{ A's share} = \text{Rs. } \left(z - \frac{2z}{3}\right) = \text{Rs. } \frac{z}{3}.$$

$$\therefore A : B = \frac{z}{3} : \frac{2z}{3} = 1 : 2.$$

Let the total capital be Rs. x and suppose B's money was used for x months. Then,

$$\frac{\frac{1}{3}x \times 15}{\frac{4}{3}x \times y} = \frac{1}{2} \Leftrightarrow y = \left(\frac{15 \times 2}{3}\right) = 10.$$

Thus, B's money was used for 10 months.

EXERCISE 13B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (Questions 1 to 4): Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the question. Read both the statements and

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

- Ravi, Gagan and Nitin are running a business firm in partnership. What is Gagan's share in the profit earned by them ? (M.B.A. 2002)
 - Ravi, Gagan and Nitin invested the amounts in the ratio of $2 : 4 : 7$.
 - Nitin's share in the profit is Rs. 8750.
 - A and B start a business jointly. What is A's share out of an annual profit of Rs. 23,800 ?
 - B's investment is $12\frac{1}{2}\%$ more than A's investment.
 - A's investment is Rs. 1,20,000.
 - A and B are in a partnership business of one year. At the end of the year, a profit of Rs. 20,000 was earned. What is A's share ?
 - A invested Rs. 50,000.
 - B withdrew his capital after 8 months.
 - Rahul, Anurag and Vivek started a business together. In what proportion would the annual profit be distributed among them ? (Bank P.O. 1999)
 - Rahul got one-fourth of the profit.
 - Rahul and Vivek contributed 75% of the total.

Directions (Questions 5 to 8) : Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the given question.

5. What is R's share of profit in a joint venture ? (S.B.I.P.O. 2000)

 - Q started business investing Rs. 80,000.
 - R joined him after 3 months.
 - P joined after 4 months with a capital of Rs. 1,20,000 and got Rs. 6000 as his share of profit.

(a) All I, II and III (b) I and III only (c) II and III only
 (d) Even with all I, II, and III, the answer cannot be arrived at
 (e) None of these

6. What is the difference in the shares of profit between P and Q in a joint business at the end of one year ?

 - P invested Rs. 80,000 and withdrew Rs. 20,000 after 6 months.
 - Q joined four months after the start of business.
 - Q's amount was 80% of P's amount during the last six months.

(a) I and II only (b) II and III only (c) All I, II and III
 (d) Even with all I, II and III together, the answer cannot be arrived at.
 (e) None of these.

7. A, B and C together start a business with a total investment of Rs. 15,000. At the end of the year, the total profit is Rs. 3000. What is A's share in the profit ?

 - A's contribution is $\frac{3}{2}$ times B's.
 - B's contribution is twice that of C.
 - A's contribution is thrice that of C.

(a) I and II only (b) II and III only (c) All I, II and III
 (d) Any two of the three (e) None of these

8. How much did Rohit get as profit at the year-end in the business done by Nitin, Rohit and Kunal ? (S.B.I.P.O. 1999)

 - Kunal invested Rs. 8000 for nine months, his profit was $\frac{3}{2}$ times that of Rohit's and his investment was four times that of Nitin.

Directions (Questions 9-10) : Each of these questions is followed by three statements. You have to study the question and all the three statements given to decide whether any information provided in the statement(s) is redundant and can be dispensed with while answering the given question.

ANSWERS

1. (e) 2. (a) 3. (d) 4. (e) 5. (d) 6. (d) 7. (d)

8. (d) 9. (b) 10. (a)

SOLUTIONS

- I. Let us name Ravi, Gagan and Nitin by R, G and N respectively.
 $R : G : N = 2 : 4 : 7$.
 II. $N = 8750$.

From I and II, we get :

When $N = 7$, then $G = 4$. When $N = 8750$, then $G = \left(\frac{4}{7} \times 8750\right) = 5000$

Thus, both I and II are needed to get the answer.

\therefore Correct answer is (e).

I. Let A's investment = Rs. x . Then, B's investment = $112\frac{1}{2}\%$ of Rs. x = Rs. $\left(\frac{9x}{8}\right)$.

investment II : I contributing half as many rupees as between I and III.

$$\therefore A : B = x : \frac{9x}{8} = 8 : 9.$$

(I has 1 year's)

(II has 1 year)

$$\text{A's share} = \text{Rs. } \left(23800 \times \frac{8}{17} \right) = \text{Rs. } 11200.$$

Thus, I only gives the answer.

II. A's investment = Rs. 120000.

This is not sufficient to get the answer.

Thus, I gives the answer but II is not sufficient to get the answer.

\therefore Correct answer is (a).

3. Since B's investment is not given, both the statements even do not give the answer.

\therefore Correct answer is (d).

4. Let the total investment be Rs. x . Then, $R = \frac{x}{4}$.

$$R + V = \left(\frac{75}{100} \times x \right) = \frac{3x}{4} \Rightarrow V = \left(\frac{3x}{4} - \frac{x}{4} \right) = \frac{x}{2}.$$

$$\therefore A = x - \left(\frac{x}{4} + \frac{x}{2} \right) = \frac{x}{4}.$$

$$R : A : V = \frac{x}{4} : \frac{x}{4} : \frac{x}{2} = 1 : 1 : 2.$$

Thus, both I and II are needed to get the answer.

\therefore Correct answer is (e).

5. From I, II and III, we get $P : Q : R = (120000 \times 8) : (80000 \times 12) : (x \times 9)$.

Since R's investment is not given, the above ratio cannot be given.

\therefore Given data is inadequate.

\therefore Correct answer is (d).

6. I. P's investment = $(80000 \times 6 + 60000 \times 6) = 840000$ for 1 month.

II & III. Q's investment = 80% of Rs. 60000 for 8 months

$$= \text{Rs. } (48000 \times 8) \text{ for 1 month} = 384000 \text{ for 1 month}$$

$$P : Q = 840000 : 384000 = 35 : 16.$$

But, the total profit is not given, so data is inadequate.

\therefore Correct answer is (d).

7. Let C's contribution be Rs. x .

From I and II, we get : $C = \text{Rs. } x$, $B = \text{Rs. } 2x$ and $A = \text{Rs. } \left(\frac{3}{2} \times 2x \right) = \text{Rs. } 3x$.

From II and III, we get $C = \text{Rs. } x$, $B = \text{Rs. } 2x$ and $A = \text{Rs. } 3x$.

From I and III, we get $C = \text{Rs. } x$, $A = \text{Rs. } 3x$ and $B = \text{Rs. } \left(\frac{2}{3} \times 3x \right) = \text{Rs. } 2x$.

Thus, $A : B : C = 3x : 2x : x = 3 : 2 : 1$.

$$\text{A's share} = \text{Rs. } \left(3000 \times \frac{3}{6} \right) = \text{Rs. } 1500.$$

Thus, any two of three give the answer.

\therefore Correct answer is (d).

8. I and II give, K = Rs. (8000×9) for 1 month = Rs. 72000 for 1 month.

$$N = \text{Rs. } \left(\frac{1}{4} \times 8000 \times 12 \right) \text{ for 1 month} = \text{Rs. 24000 for 1 month.}$$

R = Rs. 48000 for 1 month.

$$\therefore K : N : R = 72000 : 24000 : 48000 = 3 : 1 : 2.$$

III gives, total profit = Rs. 1000.

$$\therefore \text{Rohit's share} = \text{Rs. } \left(1000 \times \frac{2}{6} \right) = \text{Rs. } 333\frac{1}{3}.$$

\therefore Correct answer is (d).

9. I and II give, profit after 3 years = Rs. $\left(\frac{3}{8} \times 22000 \right) = \text{Rs. 8250.}$

From III also, profit after 3 years = Rs. $(2750 \times 3) = \text{Rs. 8250.}$

$$\therefore P's \text{ share} = \text{Rs. } \left(8250 \times \frac{5}{11} \right) = \text{Rs. 3750.}$$

Thus, (either III is redundant) or (I and II are redundant).

\therefore Correct answer is (b).

10. From III, $Y = X + Z \Rightarrow Y's \text{ investment is } 50\%.$

\therefore Share of Y is 50%.

Thus, I and II are redundant.

\therefore Correct answer is (a).

14. CHAIN RULE

IMPORTANT FACTS AND FORMULAE

1. **Direct Proportion** : Two quantities are said to be directly proportional, if on the increase (or decrease) of the one, the other increases (or decreases) to the same extent.

Ex. 1. Cost is directly proportional to the number of articles.
(More Articles, More Cost)

Ex. 2. Work done is directly proportional to the number of men working on it.
(More Men, More Work)

2. **Indirect Proportion** : Two quantities are said to be indirectly proportional, if on the increase of the one, the other decreases to the same extent and vice-versa.

Ex. 1. The time taken by a car in covering a certain distance is inversely proportional to the speed of the car.
(More speed, Less is the time taken to cover a distance)

Ex. 2. Time taken to finish a work is inversely proportional to the number of persons working at it.
(More persons, Less is the time taken to finish a job)

Remark : In solving questions by chain rule, we compare every item with the term to be found out.

SOLVED EXAMPLES

Ex. 1. If 15 toys cost Rs. 234, what do 35 toys cost ?

Sol. Let the required cost be Rs. x. Then,

More toys, More cost (Direct Proportion)

$$\therefore 15 : 35 :: 234 : x \Leftrightarrow (15 \times x) = (35 \times 234) \Rightarrow x = \left(\frac{35 \times 234}{15} \right) = 546.$$

Hence, the cost of 35 toys is Rs. 546.

Ex. 2. If 36 men can do a piece of work in 25 hours, in how many hours will 15 men do it ?

Sol. Let the required number of hours be x. Then,

Less men, More hours (Indirect Proportion)

$$\therefore 15 : 36 :: 25 : x \Leftrightarrow (15 \times x) = (36 \times 25) \Leftrightarrow x = \frac{36 \times 25}{15} = 60.$$

Hence, 15 men can do it in 60 hours.

Ex. 3. If the wages of 6 men for 15 days be Rs. 2100, then find the wages of 9 men for 12 days.

Sol. Let the required wages be Rs. x.

More men, More wages (Direct Proportion)

Less days, Less wages (Direct Proportion)

$$\text{Men } 6 : 9 \\ \text{Days } 15 : 12 \Bigg\} :: 2100 : x$$

done alone at his wage from ₹1.1 has work for a boy to help him to complete A.T. all
 $\therefore (6 \times 15 \times x) = (9 \times 12 \times 2100) \Leftrightarrow x = \left(\frac{9 \times 12 \times 2100}{6 \times 15} \right) = 2520.$

Hence, the required wages are Rs. 2520.

Ex. 4. If 20 men can build a wall 56 metres long in 6 days, what length of a similar wall can be built by 35 men in 3 days?

Sol. Let the required length be x metres.

More men, More length built (Direct Proportion)

Less days, Less length built (Direct Proportion)

Men $20 : 35 \left\{ \begin{array}{l} :: 56 : x \\ \text{less men, less length} \end{array} \right.$

Days $6 : 3 \left\{ \begin{array}{l} :: 56 : x \\ \text{less days, more length} \end{array} \right.$

$$\therefore (20 \times 6 \times x) = (35 \times 3 \times 56) \Leftrightarrow x = \frac{(35 \times 3 \times 56)}{120} = 49.$$

Hence, the required length is 49 m.

Ex. 5. If 15 men, working 9 hours a day, can reap a field in 16 days, in how many days will 18 men reap the field, working 8 hours a day?

Sol. Let the required number of days be x .

More men, Less days (Indirect Proportion)

Less hours per day, More days (Indirect Proportion)

Men $15 : 18 \left\{ \begin{array}{l} :: 16 : x \\ \text{less men, more days} \end{array} \right.$

Hours per day $8 : 9 \left\{ \begin{array}{l} :: 16 : x \\ \text{more hours per day, less days} \end{array} \right.$

$$\therefore (18 \times 8 \times x) = (15 \times 9 \times 16) \Leftrightarrow x = \left(\frac{15 \times 144}{144} \right) = 15.$$

Hence, required number of days = 15.

Ex. 6. If 9 engines consume 24 metric tonnes of coal, when each is working 8 hours a day, how much coal will be required for 8 engines, each running 13 hours a day, it being given that 3 engines of former type consume as much as 4 engines of latter type?

Sol. Let 3 engines of former type consume 1 unit in 1 hour.

Then, 4 engines of latter type consume 1 unit in 1 hour.

$$\therefore 1 \text{ engine of former type consumes } \frac{1}{3} \text{ unit in 1 hour.}$$

$$1 \text{ engine of latter type consumes } \frac{1}{4} \text{ unit in 1 hour.}$$

Let the required consumption of coal be x units.

Less engines, Less coal consumed (Direct Proportion)

More working hours, More coal consumed (Direct Proportion)

Less rate of consumption, Less coal consumed (Direct Proportion)

Number of engines $9 : 8 \left\{ \begin{array}{l} :: 24 : x \\ \text{less engines, less coal} \end{array} \right.$

Working hours $8 : 13 \left\{ \begin{array}{l} :: 24 : x \\ \text{more working hours, more coal} \end{array} \right.$

Rate of consumption $\frac{1}{3} : \frac{1}{4} \left\{ \begin{array}{l} :: 24 : x \\ \text{less rate of consumption, less coal} \end{array} \right.$

$$\therefore \left(9 \times 8 \times \frac{1}{3} \times x \right) = \left(8 \times 13 \times \frac{1}{4} \times 24 \right) \Leftrightarrow 24x = 624 \Leftrightarrow x = 26.$$

Hence, the required consumption of coal = 26 metric tonnes.

Ex. 7. A contract is to be completed in 46 days and 117 men were set to work, each working 8 hours a day. After 33 days, $\frac{4}{7}$ of the work is completed. How many additional men may be employed so that the work may be completed in time, each man now working 9 hours a day?

Sol. Remaining work = $\left(1 - \frac{4}{7}\right) = \frac{3}{7}$. Remaining period = (46 - 33) days = 13 days.

Let the total men working at it be x .

Less work, Less men

(Direct Proportion)

Less days. More men

(Indirect Proportion)

More Hrs./Day, Less men

(Indirect Proportion)

$$\begin{array}{l} \text{Work} \quad \frac{4}{7} : \frac{3}{7} \\ \text{Days} \quad 13 : 33 \\ \text{Hrs / Day} \quad 9 : 8 \end{array} :: 117 : x$$

$$\therefore \frac{4}{7} \times 13 \times 9 \times x = \frac{3}{7} \times 33 \times 8 \times 117 \text{ or } x = \left(\frac{3 \times 33 \times 8 \times 117}{4 \times 13 \times 9} \right) = 198.$$

Additional men to be employed = $(198 - 117) = 81$.

Ex. 8. A garrison of 3300 men had provisions for 32 days, when given at the rate of 850 gms per head. At the end of 7 days, a reinforcement arrives and it was found that the provisions will last 17 days more, when given at the rate of 825 gms per head. What is the strength of the reinforcement?

Sol. The problem becomes :

3300 men taking 850 gms per head have provisions for $(32 - 7)$ or 25 days. How many men taking 825 gms each have provisions for 17 days?

Less ration per head, more men (Indirect Proportion)

Less days. More men.

(Indirect Proportion)

$$\left. \begin{array}{l} \text{Ration } 825 : 850 \\ \text{Days } 17 : 25 \end{array} \right\} :: 3300 : x$$

$$\therefore 825 \times 17 \times x = 850 \times 25 \times 3300 \text{ or } x = \frac{850 \times 25 \times 3300}{825 \times 17} = 5000.$$

$$\text{Strength of reinforcement} = (5500 - 3300) = 1700$$

EXERCISE 14

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark against the correct answer.

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

 - If the cost of x metres of wire is d rupees, then what is the cost of y metres of wire at the same rate ? (M.B.A. 2002)

(a) Rs. $\left(\frac{xy}{d}\right)$ (b) Rs. (xd) (c) Rs. (yd) (d) Rs. $\left(\frac{yd}{x}\right)$
 - If the price of 6 toys is Rs. 264.37, what will be the approximate price of 5 toys ? (Bank PO. 2000)

(a) Rs. 140 (b) Rs. 100 (c) Rs. 200 (d) Rs. 220 (e) Rs. 240

3. The price of 357 mangoes is Rs. 1517.25. What will be the approximate price of 9 dozens of such mangoes ?
 (a) Rs. 3000 (b) Rs. 3500 (c) Rs. 4000 (d) Rs. 2500
4. If a quarter kg of potato costs 60 paise, how many paise will 200 gm cost ?
 (a) 48 paise (b) 54 paise (c) 56 paise (d) 72 paise
 (C.B.I. 2001)
5. If 11.25 m of a uniform iron rod weighs 42.75 kg, what will be the weight of 6 m of the same rod ?
 (a) 22.8 kg (b) 25.6 kg (c) 28 kg (d) 26.5 kg
6. On a scale of map, 0.6 cm represents 6.6 km. If the distance between the points on the map is 80.5 cm, the actual distance between these points is :
 (a) 9 km (b) 72.5 km (c) 190.75 km (d) 885.5 km
7. An industrial loom weaves 0.128 metres of cloth every second. Approximately, how many seconds will it take for the loom to weave 25 metres of cloth ?
 (a) 178 (b) 195 (c) 204 (d) 488
 (M.B.A. 2003)
8. A flagstaff 17.5 m high casts a shadow of length 40.25 m. The height of the building, which casts a shadow of length 28.75 m under similar conditions will be : (M.B.A. 2002)
 (a) 10 m (b) 12.5 m (c) 17.5 m (d) 21.25 m
9. A man completes $\frac{5}{8}$ of a job in 10 days. At this rate, how many more days will it take him to finish the job ?
 (a) 5 (b) 6 (c) 7 (d) $7\frac{1}{2}$
 (M.B.A. 2003)
10. 36 men can complete a piece of work in 18 days. In how many days will 27 men complete the same work ?
 (Bank P.O. 1998)
 (a) 12 (b) 18 (c) 22 (d) 24 (e) None of these
11. A fort had provision of food for 150 men for 45 days. After 10 days, 25 men left the fort. The number of days for which the remaining food will last, is : (S.S.C. 2001)
 (a) $29\frac{1}{5}$ (b) $37\frac{1}{4}$ (c) 42 (d) 54
12. A wheel that has 6 cogs is meshed with a larger wheel of 14 cogs. When the smaller wheel has made 21 revolutions, then the number of revolutions made by the larger wheel is :
 (M.A.T. 2000)
 (a) 4 (b) 9 (c) 12 (d) 49
13. In a camp, there is a meal for 120 men or 200 children. If 150 children have taken the meal, how many men will be catered to with the remaining meal ?
 (a) 20 (b) 30 (c) 40 (d) 50
 (Railways, 2003)
14. The cost of 16 packets of salt, each weighing 900 grams is Rs. 28. What will be the cost of 27 packets, if each packet weighs 1 kg ?
 (a) Rs. 52.50 (b) Rs. 56 (c) Rs. 58.50 (d) Rs. 64.75
15. 4 mat-weavers can weave 4 mats in 4 days. At the same rate, how many mats would be woven by 8 mat-weavers in 8 days ?
 (S.S.C. 2004)
 (a) 4 (b) 8 (c) 12 (d) 16
16. Running at the same constant rate, 6 identical machines can produce a total of 270 bottles per minute. At this rate, how many bottles could 10 such machines produce in 4 minutes ?
 (M.A.T. 2004)
 (a) 648 (b) 1800 (c) 2700 (d) 10800

17. In a dairy farm, 40 cows eat 40 bags of husk in 40 days. In how many days one cow will eat one bag of husk ? (Railways, 2003)
- (a) 1 (b) $\frac{1}{40}$ (c) 40 (d) 80
18. 12 men working 8 hours per day complete a piece of work in 10 days. To complete the same work in 8 days, working 15 hours a day, the number of men required, is : (a) 4 (b) 5 (c) 6 (d) 8
19. 10 men, working 6 hours a day can complete a work in 18 days. How many hours a day must 15 men work to complete the same work in 12 days ? (S.S.C. 2004)
- (a) 6 (b) 10 (c) 12 (d) 15
20. 39 persons can repair a road in 12 days, working 5 hours a day. In how many days will 30 persons, working 6 hours a day, complete the work ? (C.B.I. 2003)
- (a) 10 (b) 13 (c) 14 (d) 15
21. 3 pumps, working 8 hours a day, can empty a tank in 2 days. How many hours a day must 4 pumps work to empty the tank in 1 day ? (M.B.A. 2002)
- (a) 9 (b) 10 (c) 11 (d) 12
22. If 8 men can reap 80 hectares in 24 days, then how many hectares can 36 men reap in 30 days ? (C.B.I. 2001)
- (a) 350 (b) 400 (c) 425 (d) 450
23. A certain number of persons can dig a trench 100 m long, 50 m broad and 10 m deep in 10 days. The same number of persons can dig another trench 20 m broad and 15 m deep in 30 days. The length of the second trench is : (a) 400 m (b) 500 m (c) 800 m (d) 900 m
24. If 5 men or 9 women can do a piece of work in 19 days, then in how many days will 3 men and 6 women do the same work ? (a) 12 (b) 15 (c) 18 (d) 21
25. 49 pumps can empty a reservoir in $6\frac{1}{2}$ days, working 8 hours a day. If 196 pumps are used for 5 hours each day, then the same work will be completed in : (a) 2 days (b) $2\frac{1}{2}$ days (c) $2\frac{3}{5}$ days (d) 3 days
26. 30 labourers, working 7 hours a day can finish a piece of work in 18 days. If the labourers work 6 hours a day, then the number of labourers to finish the same piece of work in 30 days, will be : (a) 15 (b) 21 (c) 22 (d) 25
27. If 7 spiders make 7 webs in 7 days, then 1 spider will make 1 web in how many days ? (a) 1 (b) $\frac{7}{2}$ (c) 7 (d) 49 (Railways, 2003)
28. If 18 pumps can raise 2170 tonnes of water in 10 days, working 7 hours a day; in how many days will 16 pumps raise 1736 tonnes of water, working 9 hours a day ? (a) 6 (b) 7 (c) 8 (d) 9
29. If 80 lamps can be lighted, 5 hours per day for 10 days for Rs. 21.25, then the number of lamps, which can be lighted 4 hours daily for 30 days, for Rs. 76.50, is : (a) 100 (b) 120 (c) 150 (d) 160
30. If 12 carpenters, working 6 hours a day, can make 460 chairs in 24 days, how many chairs will 18 carpenters make in 36 days, each working 8 hours a day ? (a) 1260 (b) 1320 (c) 920 (d) 1380

31. 400 persons, working 9 hours per day complete $\frac{1}{4}$ th of the work in 10 days. The number of additional persons, working 8 hours per day, required to complete the remaining work in 20 days, is :
- (a) 675 (b) 275 (c) 250 (d) 225
32. If 9 examiners can examine a certain number of answer books in 12 days, working 5 hours a day; for how many hours a day would 4 examiners have to work in order to examine twice the number of answer books in 30 days ?
- (a) 6 (b) 8 (c) 9 (d) 10
33. If 17 labourers can dig a ditch 20 m long in 18 days, working 8 hours a day; how many more labourers should be engaged to dig a similar ditch 39 m long in 6 days, each labourer working 9 hours a day ?
- (a) 34 (b) 51 (c) 68 (d) 85
34. 20 men complete one-third of a piece of work in 20 days. How many more men should be employed to finish the rest of the work in 25 more days ?
- (a) 10 (b) 12 (c) 15 (d) 20
35. If 18 binders bind 900 books in 10 days, how many binders will be required to bind 660 books in 12 days ?
- (a) 22 (b) 14 (c) 13 (d) 11
36. If $\frac{3}{5}$ of a cistern is filled in 1 minute, how much more time will be required to fill the rest of it ?
- (a) 30 sec (b) 40 sec (c) 36 sec (d) 24 sec
37. If x men, working x hours per day, can do x units of work in x days, then y men, working y hours per day would be able to complete how many units of work in y days ?
- (a) $\frac{x^2}{y^3}$ (b) $\frac{x^3}{y^2}$ (c) $\frac{y^2}{x^3}$ (d) $\frac{y^3}{x^2}$
38. A rope makes 70 rounds of the circumference of a cylinder whose radius of the base is 14 cm. How many times can it go round a cylinder with radius 20 cm ?
- (a) 40 (b) 49 (c) 100 (d) None of these
39. If 5 engines consume 6 metric tonnes of coal when each is running 9 hours a day, how many metric tonnes of coal will be needed for 8 engines, each running 10 hours a day, it being given that 3 engines of the former type consume as much as 4 engines of the latter type ?
- (a) $3\frac{1}{8}$ (b) 8 (c) $8\frac{8}{9}$ (d) $6\frac{12}{25}$
40. If a certain number of workmen can do a piece of work in 25 hours, in how many hours will another set of an equal number of men, do a piece of work, twice as great, supposing that 2 men of the first set can do as much work in an hour, as 3 men of the second set do in an hour ?
- (a) 60 (b) 75 (c) 90 (d) 105
41. Some persons can do a piece of work in 12 days. Two times the number of such persons will do half of that work in :
- (a) 6 days (b) 4 days (c) 3 days (d) 12 days
42. A certain number of men can finish a piece of work in 100 days. If, there were 10 men less, it would take 10 days more for the work to be finished. How many men were there originally ?
- (a) 75 (b) 82 (c) 100 (d) 110

43. In a camp, 95 men had provisions for 200 days. After 5 days, 30 men left the camp. For how many days will the remaining food last now ?
 (a) 180 (b) 285 (c) $139\frac{16}{19}$ (d) None of these
44. A garrison of 500 men had provisions for 27 days. After 3 days a reinforcement of 300 men arrived. For how many more days will the remaining food last now ?
 (a) 15 (b) 16 (c) $17\frac{1}{2}$ (d) 18
45. A garrison had provisions for a certain number of days. After 10 days, $\frac{1}{5}$ of the men desert and it is found that the provisions will now last just as long as before. How long was that ?
 (a) 15 days (b) 25 days (c) 35 days (d) 50 days
46. 15 men take 21 days of 8 hours each to do a piece of work. How many days of 6 hours each would 21 women take, if 3 women do as much work as 2 men ?
 (a) 18 (b) 20 (c) 25 (d) 30
47. A contractor undertook to do a certain piece of work in 9 days. He employed certain number of men, but 6 of them being absent from the very first day, the rest could finish the work in 15 days. The number of men originally employed were :
 (a) 12 (b) 15 (c) 18 (d) 24
48. A contractor undertakes to do a piece of work in 40 days. He engages 100 men at the beginning and 100 more after 35 days and completes the work in stipulated time. If he had not engaged the additional men, how many days behind schedule would it be finished ?
 (a) 3 (b) 5 (c) 6 (d) 9
49. A contractor employed 30 men to do a piece of work in 38 days. After 25 days, he employed 5 men more and the work was finished one day earlier. How many days he would have been behind, if he had not employed additional men ?
 (a) 1 (b) $1\frac{1}{4}$ (c) $1\frac{3}{4}$ (d) $1\frac{1}{2}$
50. 12 men and 18 boys, working $7\frac{1}{2}$ hours a day, can do a piece of work in 60 days. If a man works equal to 2 boys, then how many boys will be required to help 21 men to do twice the work in 50 days, working 9 hours a day ?
 (a) 30 (b) 42 (c) 48 (d) 90
51. If 3 men or 6 boys can do a piece of work in 10 days, working 7 hours a day; how many days will it take to compete a piece of work twice as large with 6 men and 2 boys working together for 8 hours a day ?
 (a) 6 (b) $7\frac{1}{2}$ (c) $8\frac{1}{2}$ (d) 9
52. 2 men and 7 boys can do a piece of work in 14 days; 3 men and 8 boys can do the same in 11 days. Then, 8 men and 6 boys can do three times the amount of this work in :
 (a) 18 days (b) 21 days (c) 24 days (d) 30 days

ANSWERS

1. (d) 2. (d) 3. (d) 4. (a) 5. (a) 6. (d) 7. (b) 8. (b) 9. (b)
 10. (d) 11. (c) 12. (b) 13. (b) 14. (a) 15. (d) 16. (b) 17. (c) 18. (d)
 19. (a) 20. (b) 21. (d) 22. (d) 23. (b) 24. (b) 25. (c) 26. (b) 27. (c)

28. (b) 29. (b) 30. (d) 31. (b) 32. (c) 33. (b) 34. (b) 35. (d) 36. (b)
 37. (d) 38. (b) 39. (b) 40. (b) 41. (c) 42. (d) 43. (b) 44. (a) 45. (d)
 46. (d) 47. (b) 48. (b) 49. (a) 50. (b) 51. (b) 52. (b)

SOLUTIONS

1. Cost of x metres = Rs. d . Cost of 1 metre = Rs. $\left(\frac{d}{x}\right)$.

$$\text{Cost of } y \text{ metres} = \text{Rs.} \left(\frac{d}{x} \times y \right) = \text{Rs.} \left(\frac{yd}{x} \right).$$

2. Let the required price be Rs. x . Then, *Less toys, Less cost (Direct Proportion)*

$$\therefore 6 : 5 :: 264.37 : x \Leftrightarrow 6x = (5 \times 264.37) \Leftrightarrow x = \frac{(5 \times 264.37)}{6} \Leftrightarrow x = 220.308.$$

\therefore Approximate price of 5 toys = Rs. 220.

3. Let the required price be Rs. x . Then, *More mangoes, More price (Direct Proportion)*

$$\therefore 357 : (49 \times 12) :: 1517.25 : x$$

$$\Leftrightarrow 357x = (49 \times 12 \times 1517.25) \Leftrightarrow x = \frac{(49 \times 12 \times 1517.25)}{357} \Leftrightarrow x = 2499.$$

Hence, the approximate price is Rs. 2500.

4. Let the required cost be x paise. *Less weight, Less cost (Direct Proportion)*

$$\therefore 250 : 200 :: 60 : x \Leftrightarrow 250 \times x = (200 \times 60) \Leftrightarrow x = \frac{(200 \times 60)}{250} \Leftrightarrow x = 48.$$

5. Let the required weight be x kg. Then, *Less length, Less weight (Direct Proportion)*

$$\therefore 11.25 : 6 :: 42.75 : x \Leftrightarrow 11.25 \times x = 6 \times 42.75 \Leftrightarrow x = \frac{(6 \times 42.75)}{11.25} \Leftrightarrow x = 228.$$

6. Let the actual distance be x km. Then,

More distance on the map, More is the actual distance (Direct Proportion)

$$\therefore 0.6 : 80.5 :: 6.6 : x \Leftrightarrow 0.6x = 80.5 \times 6.6 \Leftrightarrow x = \frac{80.5 \times 6.6}{0.6} \Leftrightarrow x = 885.5.$$

7. Let the required time be x seconds. Then, *More metres, more time (Direct Proportion)*

$$\therefore 0.128 : 25 :: 1 : x$$

$$\Leftrightarrow 0.128 \times x = 25 \times 1 \Leftrightarrow x = \frac{25}{0.128} = \frac{25 \times 1000}{128} \Leftrightarrow x = 195.31.$$

\therefore Required time = 195 sec (approximately).

8. Let the height of the building be x metres.

Less lengthy shadow, Less is the height (Direct Proportion)

$$\therefore 40.25 : 28.75 :: 17.5 : x \Leftrightarrow 40.25 \times x = 28.75 \times 17.5$$

$$\Leftrightarrow x = \frac{(28.75 \times 17.5)}{40.25} \Leftrightarrow x = 12.5.$$

9. Work done = $\frac{5}{8}$. Balance work = $\left(1 - \frac{5}{8}\right) = \frac{3}{8}$.

Less work, Less days (Direct Proportion)

Let the required number of days be x .

$$\text{Then, } \frac{5}{8} : \frac{3}{8} :: 10 : x \Leftrightarrow \frac{5}{8} \times x = \frac{3}{8} \times 10 \Leftrightarrow x = \left(\frac{3}{8} \times 10 \times \frac{8}{5} \right) = 6.$$

10. Let the required number of days be x .

Then, *Less men, More days (Indirect Proportion)*

$$\therefore 27 : 36 :: 18 : x \Leftrightarrow 27 \times x = 36 \times 18 \Leftrightarrow x = \frac{36 \times 18}{27} \Leftrightarrow x = 24.$$

11. After 10 days : 150 men had food for 35 days.

Suppose 125 men had food for x days. Now, *Less men, More days (Indirect Proportion)*

$$\therefore 125 : 150 :: 35 : x \Leftrightarrow 125 \times x = 150 \times 35 \Leftrightarrow x = \frac{150 \times 35}{125} \Leftrightarrow x = 42.$$

Hence, the remaining food will last for 42 days.

12. Let the required number of revolutions made by larger wheel be x .

Then, *More cogs, Less revolutions (Indirect Proportion)*

$$\therefore 14 : 6 :: 21 : x \Leftrightarrow 14 \times x = 6 \times 21 \Leftrightarrow x = \left(\frac{6 \times 21}{14} \right) = 9.$$

13. There is a meal for 200 children. 150 children have taken the meal.

Remaining meal is to be catered to 50 children.

Now, 200 children = 120 men

$$50 \text{ children} = \left(\frac{120}{200} \times 50 \right) \text{ men} = 30 \text{ men.}$$

14. Let the required cost be Rs. x . Then,

More packets, More cost

(*Direct Proportion*)

More weight, More cost

(*Direct Proportion*)

packets $16 : 27 \quad \left\{ \right. :: 28 : x$

Weight $900 : 1000 \quad \left\{ \right. :: 28 : x$

$$\therefore (16 \times 900 \times x) = (27 \times 1000 \times 28) \Leftrightarrow x = \frac{(27 \times 1000 \times 28)}{16 \times 900} = \frac{105}{2} = 52.50.$$

15. Let the required number of mats be x .

More weavers, More mats (*Direct Proportion*)

More days, More mats (*Direct Proportion*)

weavers $4 : 8 \quad \left\{ \right. :: 4 : x$

Days $4 : 8 \quad \left\{ \right. :: 4 : x$

$$\therefore 4 \times 4 \times x = 8 \times 8 \times 4 \Leftrightarrow x = \frac{(8 \times 8 \times 4)}{(4 \times 4)} = 16.$$

16. Let the required number of bottles be x .

More machines, More bottles (*Direct Proportion*)

More minutes, More bottles (*Direct Proportion*)

Machines $6 : 10 \quad \left\{ \right. :: 270 : x$

Time (in Minutes) $1 : 4 \quad \left\{ \right. :: 270 : x$

$$\therefore 6 \times 1 \times x = 10 \times 4 \times 270 \Leftrightarrow x = \frac{10 \times 4 \times 270}{6} \Leftrightarrow x = 1800.$$

17. Let the required number of days be x .

Less cows, More days (*Indirect Proportion*)

Less bags, Less days (*Direct Proportion*)

Cows $1 : 40 \quad \left\{ \right. :: 40 : x$

Bags $40 : 1 \quad \left\{ \right. :: 40 : x$

$$\therefore 1 \times 40 \times x = 40 \times 1 \times 40 \Leftrightarrow x = 40.$$

18. Let the required number of men be x .
Less days, More men (Indirect Proportion)
More working hrs per day, Less men (Indirect Proportion)
- $$\left. \begin{array}{l} \text{Days} \quad 8 : 10 \\ \text{Working Hrs} \quad 15 : 8 \end{array} \right\} :: 12 : x$$
- $$\therefore 8 \times 15 \times x = 10 \times 8 \times 12 \Leftrightarrow x = \frac{10 \times 8 \times 12}{8 \times 15} \Leftrightarrow x = 8.$$
19. Let the required number of hours per day be x .
More men, Less hours per day (Indirect Proportion)
Less days, More hours per day (Indirect Proportion)
- $$\left. \begin{array}{l} \text{Men} \quad 15 : 10 \\ \text{Days} \quad 12 : 18 \end{array} \right\} :: 6 : x$$
- $$\therefore 15 \times 12 \times x = 10 \times 18 \times 6 \Leftrightarrow x = \frac{10 \times 18 \times 6}{15 \times 12} \Leftrightarrow x = 6.$$
20. Let the required number of days be x .
Less persons, More days (Indirect Proportion)
More working hrs per day, Less days (Indirect Proportion)
- $$\left. \begin{array}{l} \text{Persons} \quad 30 : 39 \\ \text{Working hrs/day} \quad 6 : 5 \end{array} \right\} :: 12 : x$$
- $$\therefore 30 \times 6 \times x = 39 \times 5 \times 12 \Leftrightarrow x = \frac{39 \times 5 \times 12}{30 \times 6} \Leftrightarrow x = 13.$$
21. Let the required number of working hours per day be x .
More pumps, Less working hours per day (Indirect Proportion)
Less days, More working hours per day (Indirect Proportion)
- $$\left. \begin{array}{l} \text{Pumps} \quad 4 : 3 \\ \text{Days} \quad 1 : 2 \end{array} \right\} :: 8 : x$$
- $$\therefore 4 \times 1 \times x = 3 \times 2 \times 8 \Leftrightarrow x = \frac{3 \times 2 \times 8}{4} \Leftrightarrow x = 12.$$
22. Let the required number of hectares be x . Then,
More men, More hectares (Direct Proportion)
More days, More hectares (Direct Proportion)
- $$\left. \begin{array}{l} \text{Men} \quad 8 : 36 \\ \text{Days} \quad 24 : 30 \end{array} \right\} :: 80 : x$$
- $$\therefore 8 \times 24 \times x = 36 \times 30 \times 80 \Leftrightarrow x = \frac{(36 \times 30 \times 80)}{(8 \times 24)} \Leftrightarrow x = 450.$$
23. Let the required length be x metres.
More breadth, Less length (Indirect Proportion)
More depth, Less length (Indirect Proportion)
More days, More length (Direct Proportion)
- $$\left. \begin{array}{l} \text{Breadth} \quad 20 : 50 \\ \text{Depth} \quad 15 : 10 \\ \text{Days} \quad 10 : 30 \end{array} \right\} :: 100 : x$$
- $$\therefore 20 \times 15 \times 10 \times x = 50 \times 10 \times 30 \times 100 \Leftrightarrow x = \frac{(50 \times 10 \times 30 \times 100)}{(20 \times 15 \times 10)} \Leftrightarrow x = 500.$$

24. Let the required number of days be x .

$$5 \text{ men} = 9 \text{ women} \Leftrightarrow 3 \text{ men} = \left(\frac{9}{5} \times 3\right) \text{ women} = \frac{27}{5} \text{ women}$$

$$\therefore (3 \text{ men and } 6 \text{ women}) = \left(\frac{27}{5} + 6\right) \text{ women} = \frac{57}{5} \text{ women}$$

Now, *More women, Less days (Indirect Proportion)*

$$\therefore \frac{57}{5} : 9 :: 19 : x \Leftrightarrow \frac{57}{5} \times x = 9 \times 19 \Leftrightarrow x = \left(9 \times 19 \times \frac{5}{57}\right) = 15$$

25. Let the required number of days be x . Then,

More pumps, Less days (Indirect Proportion)

Less working hrs/day, More days (Indirect Proportion)

$$\begin{array}{l} \text{Pumps} \quad 196 : 49 \\ \text{Working Hrs/Day} \quad 5 : 8 \end{array} \left. \begin{array}{l} \text{:: } 13 : x \\ \text{:: } \frac{13}{2} : x \end{array} \right\}$$

$$\therefore 196 \times 5 \times x = 49 \times 8 \times \frac{13}{2} \Leftrightarrow x = \left(49 \times 8 \times \frac{13}{2} \times \frac{1}{196 \times 5}\right) \Leftrightarrow x = \frac{13}{5} = 2\frac{3}{5}$$

26. Let the required number of labourers be x . Then,

Less working hrs/day, More labourers (Indirect Proportion)

More days, Less labourers (Indirect Proportion)

$$\begin{array}{l} \text{Working Hrs/Day} \quad 6 : 7 \\ \text{Days} \quad 30 : 18 \end{array} \left. \begin{array}{l} \text{:: } 30 : x \\ \text{:: } 30 : x \end{array} \right\}$$

$$\therefore 6 \times 30 \times x = 7 \times 18 \times 30 \Leftrightarrow 6x = 126 \Leftrightarrow x = 21$$

27. Let the required number of days be x . Then,

Less spiders, More days (Indirect Proportion)

Less webs, Less days (Direct Proportion)

$$\begin{array}{l} \text{Spiders } 1 : 7 \\ \text{Webs } 7 : 1 \end{array} \left. \begin{array}{l} \text{:: } 7 : x \\ \text{:: } 1 \times 7 \times x = 7 \times 1 \times 7 \Leftrightarrow x = 7 \end{array} \right\}$$

28. Let the required number of days be x . Then,

Less pumps, More days (Indirect Proportion)

Less weight, Less days (Direct Proportion)

More hours/day, Less days (Indirect Proportion)

$$\begin{array}{l} \text{Pumps} \quad 16 : 18 \\ \text{Weight} \quad 2170 : 1736 \\ \text{Hours/Day} \quad 9 : 7 \end{array} \left. \begin{array}{l} \text{:: } 10 : x \\ \text{:: } 10 : x \end{array} \right\}$$

$$\therefore (16 \times 2170 \times 9 \times x) = (18 \times 1736 \times 7 \times 10) \Leftrightarrow x = \frac{18 \times 1736 \times 7 \times 10}{16 \times 2170 \times 9} = 7$$

29. Let the required number of lamps be x .

Less hours per day, More lamps (Indirect Proportion)

More money, More lamps (Direct Proportion)

More days, Less lamps (Indirect Proportion)

$$\begin{array}{l} \text{Hours per day} \quad 4 : 5 \\ \text{Money} \quad 21.25 : 76.50 \end{array} \left. \begin{array}{l} \text{:: } 80 : x \\ \text{:: } 80 : x \end{array} \right\}$$

$$\therefore 4 \times 21.25 \times 30 \times x = 5 \times 76.50 \times 10 \times 80 \Leftrightarrow$$

$$x = \frac{5 \times 76.50 \times 10 \times 80}{4 \times 21.25 \times 30} \Rightarrow x = 120.$$

30. Let the required number of chairs be x . Then,

More carpenters, More chairs (Direct Proportion)

More hours per day, More chairs (Direct Proportion)

More days, More chairs (Direct Proportion)

$$\begin{array}{l|l} \text{Carpenters} & 12 : 18 \\ \text{Hours per day} & 6 : 8 \\ \text{Days} & 24 : 36 \end{array} \Rightarrow \frac{12}{18} = \frac{6}{8} = \frac{24}{36} \Rightarrow x = \frac{(18 \times 8 \times 36 \times 460)}{(12 \times 6 \times 24)} = 1380.$$

and method is same

\therefore Required number of chairs = 1380.

31. Let the number of persons completing the work in 20 days be x .

$$\text{Work done} = \frac{1}{4}, \text{ Remaining work} = \left(1 - \frac{1}{4}\right) = \frac{3}{4}.$$

Less hours per day, More men required (Indirect Proportion)

More work, More men required (Direct Proportion)

More days, Less men required (Indirect Proportion)

$$\begin{array}{l|l} \text{Hours per day} & 8 : 9 \\ \text{Work} & \frac{1}{4} : \frac{3}{4} \\ \text{Days} & 20 : 10 \end{array} \Rightarrow \frac{8}{9} = \frac{\frac{1}{4}}{\frac{3}{4}} = \frac{20}{x} \Rightarrow x = 40.$$

and above is same by taking reciprocal of both sides

$\therefore 8 \times \frac{1}{4} \times 20 \times x = 9 \times \frac{3}{4} \times 10 \times 40 \Rightarrow 40x = 27000 \Rightarrow x = 675.$

\therefore Additional men = $(675 - 400) = 275.$

32. Let the required number of working hours per day be x .

Less examiners, More working hours per day (Indirect Proportion)

More days, Less working hours per day (Indirect Proportion)

More answer books, More working hours per day (Direct Proportion)

$$\begin{array}{l|l} \text{Examiners} & 4 : 9 \\ \text{Days} & 30 : 12 \\ \text{Answer books} & 1 : 2 \end{array} \Rightarrow \frac{4}{9} = \frac{30}{12} = \frac{x}{5} \Rightarrow x = 9.$$

and above is same by taking reciprocal of both sides

$\therefore (4 \times 30 \times 1 \times x) = (9 \times 12 \times 2 \times 5) \Rightarrow 120x = 1080 \Rightarrow x = 9.$

33. Let the total number of men to be engaged be x .

More length, More labourers (Direct Proportion)

Less days, More labourers (Indirect Proportion)

More hours per day, Less labourers (Indirect Proportion)

$$\begin{array}{l|l} \text{Length} & 26 : 39 \\ \text{Days} & 6 : 18 \\ \text{Hours per day} & 9 : 8 \end{array} \Rightarrow \frac{26}{39} = \frac{6}{18} = \frac{x}{17} \Rightarrow x = 51.$$

and above is same by taking reciprocal of both sides

$$\therefore (26 \times 6 \times 9 \times x) = (39 \times 18 \times 8 \times 17) \Rightarrow x = \frac{(39 \times 18 \times 8 \times 17)}{(26 \times 6 \times 9)} = 51.$$

\therefore Number of more labourers = $(68 - 51) = 17.$

34. Let the total number of men be x . Work done = $\frac{1}{3}$, Remaining work = $\left(1 - \frac{1}{3}\right) = \frac{2}{3}.$

More work, More men (Direct Proportion)

More days, Less men (Indirect Proportion)

$$\begin{aligned} \text{Work } \frac{1}{3} : \frac{2}{3} &:: 20 : x \\ \text{Days } 25 : 20 &:: 18 : x \\ \therefore \left(\frac{1}{3} \times 25 \times x \right) &= \left(\frac{2}{3} \times 20 \times 18 \right) \Leftrightarrow x = \frac{800}{25} = 32 \\ \therefore \text{More men to be employed} &= (32 - 20) = 12. \end{aligned}$$

35. Let the required number of binders be x .

Less books, Less binders (Direct Proportion)

More days, Less binders (Indirect Proportion)

$$\begin{aligned} \text{Books } 900 : 600 &:: 12 : x \\ \text{Days } 12 : 10 &:: 18 : x \\ \therefore (900 \times 12 \times x) &= (600 \times 10 \times 18) \Leftrightarrow x = \frac{600 \times 10 \times 18}{900 \times 12} = 11. \end{aligned}$$

36. Let the required time be x seconds.

$$\text{Part filled} = \frac{3}{5}, \text{ Remaining part} = \left(1 - \frac{3}{5}\right) = \frac{2}{5}.$$

Less part, Less time (Direct Proportion)

$$\therefore \frac{3}{5} : \frac{2}{5} :: 60 : x \Leftrightarrow \left(\frac{3}{5} \times x\right) = \left(\frac{2}{5} \times 60\right) \Leftrightarrow x = 40.$$

37. Let the required number of units of work be x .

More men, More work (Direct Proportion)

More working hours, More work (Direct Proportion)

More days, More work (Direct Proportion)

$$\begin{aligned} \text{Men } x : y &:: x : z \\ \text{Hours per day } x : y &:: x : z \\ \text{Days } x : y &:: x : z \\ \therefore (x \times x \times x \times z) &= (y \times y \times y \times x) \Leftrightarrow z = \frac{y^3}{x^2}. \end{aligned}$$

38. Let the required number of rounds be x .

More radius, Less rounds (Indirect Proportion)

$$\therefore 20 : 14 :: 70 : x \Leftrightarrow (20 \times x) = (14 \times 70) \Leftrightarrow x = \frac{14 \times 70}{20} \Leftrightarrow x = 49.$$

Hence, the required number of rounds = 49.

39. Let the required quantity of coal be x metric tonnes.

More engines, More coal (Direct Proportion)

More hours per day, More coal (Direct Proportion)

More rate, More coal (Direct Proportion)

$$\begin{aligned} \text{Engines } 5 : 8 &:: x : 6 \\ \text{Hours per day } 9 : 10 &:: 6 : x \\ \text{Rate } \frac{1}{3} : \frac{1}{4} &:: x : 6 \\ \therefore (5 \times 9 \times \frac{1}{3}) &= (8 \times 10 \times \frac{1}{4}) \Leftrightarrow x = 80. \end{aligned}$$

$$\therefore \left(5 \times 9 \times \frac{1}{3} \times x\right) = \left(8 \times 10 \times \frac{1}{4} \times 6\right) \Leftrightarrow 15x = 120 \Leftrightarrow x = 8.$$

40. Let the required number of hours be x .

Speeds of working of first and second type of men are $\frac{1}{2}$ and $\frac{1}{3}$.

More work, More time (*Direct Proportion*)

Less speed, More time (*Indirect Proportion*)

Work $1 : 2 \Rightarrow 25 : x$

Speed $\frac{1}{3} : \frac{1}{2} \Rightarrow x : 25$

$$\therefore \left(1 \times \frac{1}{3} \times x\right) = \left(2 \times \frac{1}{2} \times 25\right) \Leftrightarrow x = 75$$

41. Let x men can do the work in 12 days and the required number of days be z .

More men, Less days (*Indirect Proportion*)

Less work, Less days (*Direct Proportion*)

Men $2x : x \Rightarrow 12 : z$

Work $1 : \frac{1}{2} \Rightarrow z : 12$

$$\therefore (2x \times 1 \times z) = \left(x \times \frac{1}{2} \times 12\right) \Leftrightarrow 2xz = 6x \Leftrightarrow z = 3.$$

42. Originally, let there be x men.

Less men, More days (*Indirect Proportion*)

$$\therefore (x - 10) : x :: 100 : 110 \Leftrightarrow (x - 10) \times 110 = x \times 100 \Leftrightarrow 10x = 1100 \Leftrightarrow x = 110.$$

43. Let the remaining food will last for x days.

95 men had provisions for 195 days. 65 men had provisions for x days.

Less men, More days (*Indirect Proportion*)

$$\therefore 65 : 95 :: 195 : x \Leftrightarrow (65 \times x) = (95 \times 195) \Leftrightarrow x = \frac{95 \times 195}{65} = 285.$$

44. Let the remaining food will last for x days.

500 men had provisions for $(27 - 3) = 24$ days.

$(500 + 300)$ men had provisions for x days.

More men, Less days (*Indirect Proportion*)

$$\therefore 800 : 500 :: 24 : x \Leftrightarrow (800 \times x) = (500 \times 24) \Leftrightarrow x = \left(\frac{500 \times 24}{800}\right) = 15.$$

45. Initially, let there be x men having food for y days.

After 10 days, x men had food for $(y - 10)$ days. Also, $\left(x - \frac{x}{5}\right)$ men had food for y days.

$$\therefore x(y - 10) = \frac{4x}{5} \times y \Leftrightarrow 5xy - 50x = 4xy \Leftrightarrow xy - 50x = 0$$

$$\Leftrightarrow x(y - 50) = 0 \Leftrightarrow y - 50 = 0 \Leftrightarrow y = 50.$$

46. 3 women = 2 men. So, 21 women = 14 men.

Less men, More days (*Indirect Proportion*)

Less hours per day, More days (*Indirect Proportion*)

Men $14 : 15 \Rightarrow 21 : x$

Hours per day $6 : 8 \Rightarrow 12 : x$

$$\therefore (14 \times 6 \times x) = (15 \times 8 \times 21) \Leftrightarrow x = \frac{(15 \times 8 \times 21)}{(14 \times 6)} = 30.$$

\therefore Required number of days = 30.

47. Let there be x men at the beginning.

Less men, More days (Indirect Proportion)

$$\therefore 15 : 9 :: x : (x - 6) \Leftrightarrow 15(x - 6) = 9x \Leftrightarrow 6x = 90 \Leftrightarrow x = 15.$$

48. $(100 \times 35) + (200 \times 5)$ men can finish the work in 1 day.

$\therefore 4500$ men can finish the work in 1 day. 100 men can finish it in $\frac{4500}{100} = 45$ days.
This is 5 days behind schedule.

49. After 25 days, 35 men complete the work in 12 days.

Thus, 35 men can finish the remaining work in 12 days.

$$\therefore 30 \text{ men can do it in } \frac{(12 \times 35)}{30} = 14 \text{ days, which is 1 day behind.}$$

50. 1 man = 2 boys $\Leftrightarrow (12 \text{ men} + 18 \text{ boys}) = (12 \times 2 + 18) \text{ boys} = 42 \text{ boys.}$

Let required number of boys = x . $21 \text{ men} + x \text{ boys} = (21 \times 2 + x) \text{ boys} = (42 + x) \text{ boys.}$

Less days, More boys (Indirect Proportion)

More hrs per day, Less boys (Indirect Proportion)

Days	50 : 60
Hours per day	$9 : \frac{15}{2} :: 42 : (42 + x)$
Work	1 : 2

$$\therefore [50 \times 9 \times 1 \times (42 + x)] = \left(60 \times \frac{15}{2} \times 2 \times 42\right)$$

$$\Leftrightarrow (42 + x) = \frac{37800}{450} \Leftrightarrow 42 + x = 84 \Leftrightarrow x = 42.$$

51. 3 men = 6 boys $\Leftrightarrow (6 \text{ men} + 2 \text{ boys}) = 14 \text{ boys.}$

More work, More days (Direct Proportion)

More boys, Less days (Indirect Proportion)

More hours per day, Less days (Indirect Proportion)

Work	1 : 2
Boys	$14 : 6 :: 10 : x$
Hours per day	8 : 7

$$\therefore (1 \times 14 \times 8 \times x) = (2 \times 6 \times 7 \times 10) \Leftrightarrow x = \frac{840}{112} = 7\frac{1}{2}.$$

52. $(2 \times 14) \text{ men} + (7 \times 14) \text{ boys} = (3 \times 11) \text{ men} + (8 \times 11) \text{ boys.}$

$$\Leftrightarrow 5 \text{ men} = 10 \text{ boys} \Leftrightarrow 1 \text{ man} = 2 \text{ boys.}$$

$$\therefore (2 \text{ men} + 7 \text{ boys}) = (2 \times 2 + 7) \text{ boys} = 11 \text{ boys.}$$

$$(8 \text{ men} + 6 \text{ boys}) = (8 \times 2 + 6) \text{ boys} = 22 \text{ boys.}$$

Let the required number of days be x .

Now, *More boys, Less days (Indirect Proportion)*

More work, More days (Direct Proportion)

Boys	$22 : 11 :: 14 : x$
Work	$1 : 3$

$$\therefore (22 \times 1 \times x) = (11 \times 3 \times 14) \Leftrightarrow x = \frac{462}{22} = 21.$$

Hence, the required number of days = 21.

15. TIME AND WORK

IMPORTANT FACTS AND FORMULAE

1. If A can do a piece of work in n days, then A's 1 day's work = $\frac{1}{n}$.
2. If A's 1 day's work = $\frac{1}{n}$, then A can finish the work in n days.
3. If A is thrice as good a workman as B, then :
Ratio of work done by A and B = 3 : 1.
Ratio of times taken by A and B to finish a work = 1 : 3.

SOLVED EXAMPLES

Ex. 1. Worker A takes 8 hours to do a job. Worker B takes 10 hours to do the same job. How long should it take both A and B, working together but independently, to do the same job? (IGNOU, 2003)

Sol. A's 1 hour's work = $\frac{1}{8}$, B's 1 hour's work = $\frac{1}{10}$.

$$(A + B)'s \text{ 1 hour's work} = \left(\frac{1}{8} + \frac{1}{10} \right) = \frac{9}{40}.$$

$$\therefore \text{Both A and B will finish the work in } \frac{40}{9} = 4\frac{4}{9} \text{ days.}$$

Ex. 2. A and B together can complete a piece of work in 4 days. If A alone can complete the same work in 12 days, in how many days can B alone complete that work? (Bank P.O. 2003)

Sol. (A + B)'s 1 day's work = $\frac{1}{4}$, A's 1 day's work = $\frac{1}{12}$.

$$\therefore B's \text{ 1 day's work} = \left(\frac{1}{4} - \frac{1}{12} \right) = \frac{1}{6}.$$

Hence, B alone can complete the work in 6 days.

Ex. 3. A can do a piece of work in 7 days of 9 hours each and B can do it in 6 days of 7 hours each. How long will they take to do it, working together $8\frac{2}{5}$ hours a day?

Sol. A can complete the work in $(7 \times 9) = 63$ hours.

B can complete the work in $(6 \times 7) = 42$ hours.

$$\therefore A's \text{ 1 hour's work} = \frac{1}{63} \text{ and } B's \text{ 1 hour's work} = \frac{1}{42}.$$

$$(A + B)'s \text{ 1 hour's work} = \left(\frac{1}{63} + \frac{1}{42} \right) = \frac{5}{126}.$$

$$\text{Both will finish the work in } \left(\frac{126}{5} \right) \text{ hrs.}$$

$$\text{Number of days of } 8\frac{2}{5} \text{ hrs each} = \left(\frac{126}{5} \times \frac{5}{42} \right) = 3 \text{ days.}$$

Ex. 4. *A and B can do a piece of work in 18 days; B and C can do it in 24 days; A and C can do it in 36 days. In how many days will A, B and C finish it, working together and separately?*

Sol. $(A + B)$'s 1 day's work = $\frac{1}{18}$, $(B + C)$'s 1 day's work = $\frac{1}{24}$,

and $(A + C)$'s 1 day's work = $\frac{1}{36}$.

Adding, we get : $2(A + B + C)$'s 1 day's work = $\left(\frac{1}{18} + \frac{1}{24} + \frac{1}{36}\right) = \frac{9}{72} = \frac{1}{8}$.

$\therefore (A + B + C)$'s 1 day's work = $\frac{1}{16}$.

Thus, A, B and C together can finish the work in 16 days.

Now, A's 1 day's work = $[(A + B + C)$'s 1 day's work] - $[(B + C)$'s 1 day's work]

$$= \left(\frac{1}{16} - \frac{1}{24}\right) = \frac{1}{48}.$$

\therefore A alone can finish the work in 48 days.

Similarly, B's 1 day's work = $\left(\frac{1}{16} - \frac{1}{36}\right) = \frac{5}{144}$.

\therefore B alone can finish the work in $\frac{144}{5} = 28\frac{4}{5}$ days.

And, C's 1 day's work = $\left(\frac{1}{16} - \frac{1}{18}\right) = \frac{1}{144}$.

\therefore C alone can finish the work in 144 days.

Ex. 5. *A is twice as good a workman as B and together they finish a piece of work in 18 days. In how many days will A alone finish the work?*

Sol. $(A$'s 1 day's work) : $(B$'s 1 day's work) = 2 : 1.

$(A + B)$'s 1 day's work = $\frac{1}{18}$.

Divide $\frac{1}{18}$ in the ratio 2 : 1.

A 's 1 day's work = $\left(\frac{1}{18} \times \frac{2}{3}\right) = \frac{1}{27}$.

Hence, A alone can finish the work in 27 days.

Ex. 6. *A can do a certain job in 12 days. B is 60% more efficient than A. How many days does B alone take to do the same job?*

Sol. Ratio of times taken by A and B = $100 : 160 = 8 : 5$.

Suppose B alone takes x days to do the job.

Then, $8 : 5 :: 12 : x \Rightarrow 8x = 5 \times 12 \Rightarrow x = 7\frac{1}{2}$ days.

Ex. 7. *A can do a piece of work in 80 days. He works at it for 10 days and then B alone finishes the remaining work in 42 days. In how much time will A and B, working together, finish the work?*

Sol. Work done by A in 10 days = $\left(\frac{1}{80} \times 10\right) = \frac{1}{8}$.

$$\text{Remaining work} = \left(1 - \frac{1}{8}\right) = \frac{7}{8}, \text{ i.e., } 1 \text{ man's 1 day's work is done by } \frac{7}{8} \text{ men.}$$

Now, $\frac{7}{8}$ work is done by B in 42 days. \Rightarrow 1 man's 1 day's work is done by $\frac{8}{7}$ men.

Whole work will be done by B in $(42 \times \frac{8}{7}) = 48$ days.

\therefore A's 1 day's work = $\frac{1}{80}$ and B's 1 day's work = $\frac{1}{48}$.

\therefore (A + B)'s 1 day's work = $\left(\frac{1}{80} + \frac{1}{48}\right) = \frac{8}{240} = \frac{1}{30}$.

Hence, both will finish the work in 30 days.

Ex. 8. *A and B undertake to do a piece of work for Rs. 600. A alone can do it in 6 days while B alone can do it in 8 days. With the help of C, they finish it in 3 days. Find the share of each.*

$$\text{Sol. } \text{C's 1 day's work} = \frac{1}{3} - \left(\frac{1}{6} + \frac{1}{8}\right) = \frac{1}{24}.$$

$$\therefore A : B : C = \text{Ratio of their 1 day's work} = \frac{1}{6} : \frac{1}{8} : \frac{1}{24} = 4 : 3 : 1.$$

$$\therefore \text{A's share} = \text{Rs. } \left(600 \times \frac{4}{8}\right) = \text{Rs. } 300, \text{ B's share} = \text{Rs. } \left(600 \times \frac{3}{8}\right) = \text{Rs. } 225.$$

$$\text{C's share} = \text{Rs. } [600 - (300 + 225)] = \text{Rs. } 75.$$

Ex. 9. *A and B working separately can do a piece of work in 9 and 12 days respectively. If they work for a day alternately, A beginning, in how many days, the work will be completed?*

$$\text{Sol. } (A + B)'s 2 \text{ days' work} = \left(\frac{1}{9} + \frac{1}{12}\right) = \frac{7}{36}.$$

$$\text{Work done in 5 pairs of days} = \left(5 \times \frac{7}{36}\right) = \frac{35}{36}.$$

$$\text{Remaining work} = \left(1 - \frac{35}{36}\right) = \frac{1}{36}.$$

On 11th day, it is A's turn. $\frac{1}{9}$ work is done by him in 1 day.

$$\frac{1}{36} \text{ work is done by him in } \left(9 \times \frac{1}{36}\right) = \frac{1}{4} \text{ day.}$$

$$\therefore \text{Total time taken} = \left(10 + \frac{1}{4}\right) \text{ days} = 10\frac{1}{4} \text{ days.}$$

Ex. 10. *45 men can complete a work in 16 days. Six days after they started working, 30 more men joined them. How many days will they now take to complete the remaining work?*

Sol. (45 \times 16) men can complete the work in 1 day.

$$\therefore 1 \text{ man's 1 day's work} = \frac{1}{720}.$$

$$45 \text{ men's 6 days' work} = \left(\frac{1}{16} \times 6\right) = \frac{3}{8}. \text{ Remaining work} = \left(1 - \frac{3}{8}\right) = \frac{5}{8}.$$

$$75 \text{ men's 1 day's work} = \frac{75}{720} = \frac{5}{48}.$$

Now, $\frac{5}{48}$ work is done by them in 1 day.

$\therefore \frac{5}{8}$ work is done by them in $\left(\frac{48}{5} \times \frac{5}{8}\right) = 6$ days.

Ex. 11. 2 men and 3 boys can do a piece of work in 10 days while 3 men and 2 boys can do the same work in 8 days. In how many days can 2 men and 1 boy do the work?

Sol. Let 1 man's 1 day's work = x and 1 boy's 1 day's work = y .

Then, $2x + 3y = \frac{1}{10}$ and $3x + 2y = \frac{1}{8}$.

Solving, we get : $x = \frac{7}{200}$ and $y = \frac{1}{100}$.

(2 men + 1 boy)'s 1 day's work = $\left(2 \times \frac{7}{200} + 1 \times \frac{1}{100}\right) = \frac{16}{200} = \frac{2}{25}$.

So, 2 men and 1 boy together can finish the work in $\frac{25}{2} = 12\frac{1}{2}$ days.

EXERCISE 15A

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer :

- A does a work in 10 days and B does the same work in 15 days. In how many days they together will do the same work ? (R.R.B. 2003)

(a) 5 days (b) 6 days (c) 8 days (d) 9 days
- A can finish a work in 18 days and B can do the same work in half the time taken by A. Then, working together, what part of the same work they can finish in a day ?

(a) $\frac{1}{6}$ (b) $\frac{1}{9}$ (c) $\frac{2}{5}$ (d) $\frac{2}{7}$

(S.S.C. 2002)

- A tyre has two punctures. The first puncture alone would have made the tyre flat in 9 minutes and the second alone would have done it in 6 minutes. If air leaks out at a constant rate, how long does it take both the punctures together to make it flat ?

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

(D.M.R.C. 2003)

- A, B and C can complete a piece of work in 24, 6 and 12 days respectively. Working together, they will complete the same work in : (C.B.I. 2003)

(a) $\frac{1}{24}$ day (b) $\frac{7}{24}$ day (c) $3\frac{3}{7}$ days (d) 4 days

- A man can do a job in 15 days. His father takes 20 days and his son finishes it in 25 days. How long will they take to complete the job if they all work together ?

(a) Less than 6 days (b) Exactly 6 days
(c) Approximately 6.4 days (d) More than 10 days

(Hotel Management, 2003)

- A man can do a piece of work in 5 days, but with the help of his son, he can do it in 3 days. In what time can the son do it alone ? (S.S.C. 2004)

(a) $6\frac{1}{2}$ days (b) 7 days (c) $7\frac{1}{2}$ days (d) 8 days

7. A can lay railway track between two given stations in 16 days and B can do the same job in 12 days. With the help of C, they did the job in 4 days only. Then, C alone can do the job in : (S.S.C. 2003)
- (a) $9\frac{1}{5}$ days (b) $9\frac{2}{5}$ days (c) $9\frac{3}{5}$ days (d) 10 days
8. A takes twice as much time as B or thrice as much time to finish a piece of work. Working together, they can finish the work in 2 days. B can do the work alone in : (S.S.C. 2002)
- (a) 4 days (b) 6 days (c) 8 days (d) 12 days
9. X can do $\frac{1}{4}$ of a work in 10 days, Y can do 40% of the work in 40 days and Z can do $\frac{1}{3}$ of the work in 13 days. Who will complete the work first ? (S.S.C. 2001)
- (a) X (b) Y (c) Z (d) X and Z both
10. P, Q and R are three typists who working simultaneously can type 216 pages in 4 hours. In one hour, R can type as many pages more than Q as Q can type more than P. During a period of five hours, R can type as many pages as P can during seven hours. How many pages does each of them type per hour ? (S.S.C. 2002)
- (a) 14, 17, 20 (b) 15, 17, 22 (c) 15, 18, 21 (d) 16, 18, 22
11. Ronald and Elan are working on an assignment. Ronald takes 6 hours to type 32 pages on a computer, while Elan takes 5 hours to type 40 pages. How much time will they take, working together on two different computers to type an assignment of 110 pages ? (S.S.C. 2002)
- (a) 7 hours 30 minutes (b) 8 hours (c) 8 hours 15 minutes (d) 8 hours 25 minutes (SCMHRD, 2002)
12. Two workers A and B are engaged to do a work. A working alone takes 8 hours more to complete the job than if both worked together. If B worked alone, he would need $4\frac{1}{2}$ hours more to complete the job than they both working together. What time would they take to do the work together ? (S.S.C. 2002)
- (a) 4 hours (b) 5 hours (c) 6 hours (d) 7 hours
13. P can complete a work in 12 days working 8 hours a day. Q can complete the same work in 8 days working 10 hours a day. If both P and Q work together, working 8 hours a day, in how many days can they complete the work ? (Bank P.O. 1999)
- (a) $5\frac{5}{11}$ (b) $5\frac{6}{11}$ (c) $6\frac{5}{11}$ (d) $6\frac{6}{11}$
14. A and B can do a work in 12 days, B and C in 15 days, C and A in 20 days. If A, B and C work together, they will complete the work in : (S.S.C. 1999)
- (a) 5 days (b) $7\frac{5}{6}$ days (c) 10 days (d) $15\frac{2}{3}$ days
15. A and B can do a work in 8 days, B and C can do the same work in 12 days. A, B and C together can finish it in 6 days. A and C together will do it in : (R.R.B. 2001)
- (a) 4 days (b) 6 days (c) 8 days (d) 12 days
16. A and B can do a piece of work in 72 days; B and C can do it in 120 days; A and C can do it in 90 days. In what time can A alone do it ? (R.R.B. 2001)
- (a) 80 days (b) 100 days (c) 120 days (d) 150 days
17. A and B can do a piece of work in 5 days; B and C can do it in 7 days; A and C can do it in 4 days. Who among these will take the least time if put to do it alone ? (R.R.B. 2001)
- (a) A (b) B (c) C (d) Data inadequate

18. A can do a piece of work in 4 hours; B and C together can do it in 3 hours, while A and C together can do it in 2 hours. How long will B alone take to do it ?
 (a) 8 hours (b) 10 hours (c) 12 hours (d) 24 hours
 (S.S.C. 2002)
19. A can do a certain work in the same time in which B and C together can do it. If A and B together could do it in 10 days and C alone in 50 days, then B alone could do it in :
 (a) 15 days (b) 20 days (c) 25 days (d) 30 days
 (S.S.C. 2003)
20. A works twice as fast as B. If B can complete a work in 12 days independently, the number of days in which A and B can together finish the work is :
 (a) 4 days (b) 6 days (c) 8 days (d) 18 days
 (Asstt. Grade, 1997)
21. A is twice as good a workman as B and together they finish a piece of work in 14 days. The number of days taken by A alone to finish the work is :
 (a) 11 days (b) 21 days (c) 28 days (d) 42 days
 (S.S.C. 1999)
22. A is thrice as good a workman as B and therefore is able to finish a job in 60 days less than B. Working together, they can do it in :
 (a) 20 days (b) $22\frac{1}{2}$ days (c) 25 days (d) 30 days
 (S.S.C. 1999)
23. A and B can do a job together in 7 days. A is $\frac{3}{4}$ times as efficient as B. The same job can be done by A alone in :
 (a) $9\frac{1}{3}$ days (b) 11 days (c) $12\frac{1}{4}$ days (d) $16\frac{1}{3}$ days
 (S.S.C. 2003)
24. Sakshi can do a piece of work in 20 days. Tanya is 25% more efficient than Sakshi. The number of days taken by Tanya to do the same piece of work is :
 (a) 15 days (b) 16 days (c) 18 days (d) 25 days
 (Hotel Management, 2003)
25. A is 30% more efficient than B. How much time will they, working together, take to complete a job which A alone could have done in 23 days ?
 (a) 11 days (b) 13 days (c) $20\frac{3}{17}$ days (d) None of these
 (Hotel Management, 1998)
26. A does half as much work as B in three-fourth of the time. If together they take 18 days to complete the work, how much time shall B take to do it ?
 (a) 30 days (b) 35 days (c) 40 days (d) None of these
27. A is 50% as efficient as B. C does half of the work done by A and B together. If C alone does the work in 40 days, then A, B and C together can do the work in :
 (a) $13\frac{1}{3}$ days (b) 15 days (c) 20 days (d) 30 days
28. Two workers A and B working together completed a job in 5 days. If A worked twice as efficiently as he actually did and B worked $\frac{1}{3}$ as efficiently as he actually did, the work would have been completed in 3 days. A alone could complete the work in :
 (a) $5\frac{1}{4}$ days (b) $6\frac{1}{4}$ days (c) $7\frac{1}{2}$ days (d) None of these
29. A can do a work in 15 days and B in 20 days. If they work on it together for 4 days, then the fraction of the work that is left is :
 (a) $\frac{1}{4}$ (b) $\frac{1}{10}$ (c) $\frac{7}{15}$ (d) $\frac{8}{15}$
 (S.S.C. 2000)

30. A can finish a work in 18 days and B can do the same work in 15 days. B worked for 10 days and left the job. In how many days, A alone can finish the remaining work ?
 (a) 5 (b) $5\frac{1}{2}$ (c) 6 (d) 8
 (Bank P.O. 2002)
31. A and B can complete a work in 15 days and 10 days respectively. They started doing the work together but after 2 days B had to leave and A alone completed the remaining work. The whole work was completed in :
 (S.S.C. 2004)
 (a) 8 days (b) 10 days (c) 12 days (d) 15 days
32. A can finish a work in 24 days, B in 9 days and C in 12 days. B and C start the work but are forced to leave after 3 days. The remaining work was done by A in :
 (S.S.C. 2002)
 (a) 5 days (b) 6 days (c) 10 days (d) $10\frac{1}{2}$ days
 (S.S.C. 2003)
33. A machine P can print one lakh books in 8 hours, machine Q can print the same number of books in 10 hours while machine R can print them in 12 hours. All the machines are started at 9 a.m. while machine P is closed at 11 a.m. and the remaining two machines complete the work. Approximately at what time will the work be finished ?
 (Bank P.O. 2003)
 (a) 11:30 a.m. (b) 12 noon (c) 12:30 p.m. (d) 1 p.m.
34. A and B can do a piece of work in 30 days, while B and C can do the same work in 24 days and C and A in 20 days. They all work together for 10 days when B and C leave. How many days more will A take to finish the work ?
 (C.B.I. 2003)
 (a) 18 days (b) 24 days (c) 30 days (d) 36 days
35. X and Y can do a piece of work in 20 days and 12 days respectively. X started the work alone and then after 4 days Y joined him till the completion of the work. How long did the work last ?
 (Bank P.O. 2004)
 (a) 6 days (b) 10 days (c) 15 days (d) 20 days
36. A and B can together finish a work in 30 days. They worked together for 20 days and then B left. After another 20 days, A finished the remaining work. In how many days A alone can finish the job ?
 (S.S.C. 2003)
 (a) 40 (b) 50 (c) 54 (d) 60
37. X can do a piece of work in 40 days. He works at it for 8 days and then Y finished it in 16 days. How long will they together take to complete the work ?
 (a) $13\frac{1}{3}$ days (b) 15 days (c) 20 days (d) 56 days
 (Hotel Management, 1999)
38. A, B and C together can complete a piece of work in 10 days. All the three started working at it together and after 4 days A left. Then B and C together completed the work in 10 more days. A alone could complete the work in :
 (a) 15 days (b) 16 days (c) 25 days (d) 50 days
39. A does $\frac{4}{5}$ of a work in 20 days. He then calls in B and they together finish the remaining work in 3 days. How long B alone would take to do the whole work ?
 (a) 23 days (b) 37 days (c) $37\frac{1}{2}$ days (d) 40 days
 (S.S.C. 2002)
40. A and B together can do a piece of work in 30 days. A having worked for 16 days, B finishes the remaining work alone in 44 days. In how many days shall B finish the whole work alone ?
 (C.B.I. 1997)
 (a) 30 days (b) 40 days (c) 60 days (d) 70 days

41. A and B together can do a piece of work in 12 days, which B and C together can do in 16 days. After A has been working at it for 5 days and B for 7 days, C finishes it in 13 days. In how many days C alone will do the work ?
 (a) 16 (b) 24 (c) 36 (d) 48
42. A and B can do a piece of work in 45 days and 40 days respectively. They began to do the work together but A leaves after some days and then B completed the remaining work in 23 days. The number of days after which A left the work was :
 (a) 6 (b) 8 (c) 9 (d) 12
 (Bank P.O. 1998)
43. A can do a piece of work in 14 days which B can do in 21 days. They begin together but 3 days before the completion of the work, A leaves off. The total number of days to complete the work is :
 (R.R.B. 2002)
 (a) $6\frac{3}{5}$ (b) $8\frac{1}{2}$ (c) $10\frac{1}{5}$ (d) $13\frac{1}{2}$
44. A, B and C can complete a work separately in 24, 36 and 48 days respectively. They started together but C left after 4 days of start and A left 3 days before the completion of the work. In how many days will the work be completed ?
 (a) 15 days (b) 22 days (c) 25 days (d) 35 days
45. A, B and C together earn Rs. 300 per day, while A and C together earn Rs. 188 and B and C together earn Rs. 152. The daily earning of C is :
 (a) Rs. 40 (b) Rs. 68 (c) Rs. 112 (d) Rs. 150
46. A, B and C are employed to do a piece of work for Rs. 529. A and B together are supposed to do $\frac{19}{23}$ of the work and B and C together $\frac{8}{23}$ of the work. What amount should A be paid ?
 (C.B.I. 1997)
 (a) Rs. 315 (b) Rs. 345 (c) Rs. 355 (d) Rs. 375
47. Kim can do a work in 3 days while David can do the same work in 2 days. Both of them finish the work together and get Rs. 150. What is the share of Kim ?
 (a) Rs. 30 (b) Rs. 60 (c) Rs. 70 (d) Rs. 75
 (S.S.C. 1999)
48. If A can do $\frac{1}{4}$ of a work in 3 days and B can do $\frac{1}{6}$ of the same work in 4 days, how much will A get if both work together and are paid Rs. 180 in all ?
 (a) Rs. 36 (b) Rs. 60 (c) Rs. 108 (d) Rs. 120
49. A alone can do a piece of work in 6 days and B alone in 8 days. A and B undertook to do it for Rs. 3200. With the help of C, they completed the work in 3 days. How much is to be paid to C ?
 (S.S.C. 2004)
 (a) Rs. 375 (b) Rs. 400 (c) Rs. 600 (d) Rs. 800
50. A sum of money is sufficient to pay A's wages for 21 days and B's wages for 28 days. The same money is sufficient to pay the wages of both for :
 (a) 12 days (b) $12\frac{1}{4}$ days (c) 14 days (d) $24\frac{1}{2}$ days
51. A can do a piece of work in 10 days; B in 15 days. They work for 5 days. The rest of the work was finished by C in 2 days. If they get Rs. 1500 for the whole work, the daily wages of B and C are :
 (a) Rs. 150 (b) Rs. 225 (c) Rs. 250 (d) Rs. 300
52. A and B together can complete a work in 12 days. A alone can complete it in 20 days. If B does the work only for half a day daily, then in how many days A and B together will complete the work ?
 (R.R.B. 2003)
 (a) 10 days (b) 11 days (c) 15 days (d) 20 days

53. A alone can complete a work in 16 days and B alone in 12 days. Starting with A, they work on alternate days. The total work will be completed in : (S.S.C. 2004)
- (a) 12 days (b) 13 days (c) $13\frac{5}{7}$ days (d) $13\frac{3}{4}$ days
54. A, B and C can do a piece of work in 11 days, 20 days and 55 days respectively, working alone. How soon can the work be done if A is assisted by B and C on alternate days ?
- (a) 7 days (b) 8 days (c) 9 days (d) 10 days
55. A, B and C can do a piece of work in 20, 30 and 60 days respectively. In how many days can A do the work if he is assisted by B and C on every third day ?
- (a) 12 days (b) 15 days (c) 16 days (d) 18 days
- (R.R.B. 2002)
56. A and B can separately do a piece of work in 20 and 15 days respectively. They worked together for 6 days, after which B was replaced by C. If the work was finished in next 4 days, then the number of days in which C alone could do the work will be :
- (a) 30 (b) 35 (c) 40 (d) 60
57. A, B and C can do a piece of work in 36, 54 and 72 days respectively. They started the work but A left 8 days before the completion of the work while B left 12 days before the completion. The number of days for which C worked is :
- (a) 4 (b) 8 (c) 12 (d) 24
58. Twenty women can do a work in sixteen days. Sixteen men can complete the same work in fifteen days. What is the ratio between the capacity of a man and a woman ?
- (a) 3 : 4 (b) 4 : 3 (c) 5 : 3 (d) Data inadequate
- (B.S.R.B. 1998)
59. 10 men can complete a piece of work in 15 days and 15 women can complete the same work in 12 days. If all the 10 men and 15 women work together, in how many days will the work get completed ? (S.B.I.P.O. 1999)
- (a) 6 (b) $6\frac{1}{3}$ (c) $6\frac{2}{3}$ (d) $7\frac{2}{3}$
60. Seven men can complete a work in 12 days. They started the work and after 5 days, two men left. In how many days will the work be completed by the remaining men ?
- (a) 5 (b) 6 (c) 7 (d) 8 (e) None of these
61. 12 men complete a work in 9 days. After they have worked for 6 days, 6 more men join them. How many days will they take to complete the remaining work ?
- (a) 2 days (b) 3 days (c) 4 days (d) 5 days (e) None of these
- (R.R.B. 2002)
62. Three men, four women and six children can complete a work in seven days. A woman does double the work a man does and a child does half the work a man does. How many women alone can complete this work in 7 days ? (S.B.I.P.O. 2003)
- (a) 7 (b) 8 (c) 12 (d) Cannot be determined (e) None of these
63. A man, a woman and a boy can complete a job in 3, 4 and 12 days respectively. How many boys must assist 1 man and 1 woman to complete the job in $\frac{1}{4}$ of a day ?
- (a) 1 (b) 4 (c) 19 (d) 41
- (S.S.C. 2000)
64. 10 men and 15 women together can complete a work in 6 days. It takes 100 days for one man alone to complete the same work. How many days will be required for one woman alone to complete the same work ? (Bank P.O. 1999)
- (a) 90 (b) 125 (c) 145 (d) 150 (e) None of these

65. 12 men can complete a piece of work in 4 days, while 15 women can complete the same work in 4 days. 6 men start working on the job and after working for 2 days, all of them stopped working. How many women should be put on the job to complete the remaining work, if it is to be completed in 3 days ? (S.B.I.P.O. 2000)

(a) 15 (b) 18 (c) 22
 (d) Data inadequate (e) None of these

66. Twelve children take sixteen days to complete a work which can be completed by eight adults in twelve days. Sixteen adults started working and after three days ten adults left and four children joined them. How many days will they take to complete the remaining work ?

(a) 3 (b) 4 (c) 6 (d) 8 (e) None of these

67. 10 women can complete a work in 7 days and 10 children take 14 days to complete the work. How many days will 5 women and 10 children take to complete the work ?

(a) 3 (b) 5 (c) 7
 (d) Cannot be determined (e) None of these (Bank P.O. 2003)

68. Sixteen men can complete a work in twelve days. Twenty-four children can complete the same work in eighteen days. Twelve men and eight children started working and after eight days three more children joined them. How many days will they now take to complete the remaining work ?

(a) 2 days (b) 4 days (c) 6 days (d) 8 days (e) None of these

69. Twenty-four men can complete a work in sixteen days. Thirty-two women can complete the same work in twenty-four days. Sixteen men and sixteen women started working and worked for twelve days. How many more men are to be added to complete the remaining work in 2 days ? (Bank P.O. 1999)

(a) 16 (b) 24 (c) 36 (d) 48 (e) None of these

70. 5 men and 2 boys working together can do four times as much work as a man and a boy. Working capacities of a woman and a boy are in the ratio :

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

71. If 12 men and 16 boys can do a piece of work in 5 days; 13 men and 24 boys can do it in 4 days, then the ratio of the daily work done by a man to that of a boy is :

(a) 2 : 1 (b) 3 : 1 (c) 3 : 2 (d) 5 : 4 (S.S.C. 1999)

72. 4 men and 6 women can complete a work in 8 days, while 3 men and 7 women can complete it in 10 days. In how many days will 10 women complete it ?

(a) 35 (b) 40 (c) 45 (d) 50 (S.S.C. 2004)

73. One man, 3 women and 4 boys can do a piece of work in 96 hours, 2 men and 8 boys can do it in 80 hours, 2 men and 3 women can do it in 120 hours. 5 men and 12 boys can do it in :

(a) $39\frac{1}{11}$ hours (b) $42\frac{7}{11}$ hours (c) $43\frac{7}{11}$ hours (d) 44 hours

74. If 6 men and 8 boys can do a piece of work in 10 days while 26 men and 48 boys can do the same in 2 days, the time taken by 15 men and 20 boys in doing the same type of work will be : (S.S.C. 1999)

(a) 4 days (b) 5 days (c) 6 days (d) 7 days

ANSWERS

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

SOLUTIONS

1. A's 1 day's work = $\frac{1}{10}$ and B's 1 day's work = $\frac{1}{15}$.

\therefore (A + B)'s 1 day's work = $\left(\frac{1}{10} + \frac{1}{15}\right) = \frac{1}{6}$.

So, both together will finish the work in 6 days.

2. A's 1 day's work = $\frac{1}{18}$ and B's 1 day's work = $\frac{1}{9}$.

\therefore (A + B)'s 1 day's work = $\left(\frac{1}{18} + \frac{1}{9}\right) = \frac{1}{6}$.

3. 1 minute's work of both the punctures = $\left(\frac{1}{9} + \frac{1}{6}\right) = \frac{5}{18}$.

So, both the punctures will make the tyre flat in $\frac{18}{5} = 3\frac{3}{5}$ min.

4. (A + B + C)'s 1 day's work = $\left(\frac{1}{24} + \frac{1}{6} + \frac{1}{12}\right) = \frac{7}{24}$.

So, A, B and C together will complete the job in $\frac{24}{7} = 3\frac{3}{7}$ days.

5. 1 day's work of the three persons = $\left(\frac{1}{15} + \frac{1}{20} + \frac{1}{25}\right) = \frac{47}{300}$.

So, all the three together will complete the work in $\frac{300}{47} = 6.4$ days.

6. Son's 1 day's work = $\left(\frac{1}{3} - \frac{1}{5}\right) = \frac{2}{15}$.

\therefore The son alone can do the work in $\frac{15}{2} = 7\frac{1}{2}$ days.

7. (A + B + C)'s 1 day's work = $\frac{1}{4}$, A's 1 day's work = $\frac{1}{16}$, B's 1 day's work = $\frac{1}{12}$.

\therefore C's 1 day's work = $\frac{1}{4} - \left(\frac{1}{16} + \frac{1}{12}\right) = \left(\frac{1}{4} - \frac{7}{48}\right) = \frac{5}{48}$.

So, C alone can do the work in $\frac{48}{5} = 9\frac{3}{5}$ days.

8. Suppose A, B and C take x , $\frac{x}{2}$ and $\frac{x}{3}$ hours respectively to finish the work.

$$\text{Then, } \left(\frac{1}{x} + \frac{2}{x} + \frac{3}{x} \right) = \frac{1}{2} \Rightarrow \frac{6}{x} = \frac{1}{2} \Rightarrow x = 12.$$

So, B takes 6 hours to finish the work.

9. Whole work will be done by X in $(10 \times 4) = 40$ days.

$$\text{Whole work will be done by Y in } \left(40 \times \frac{100}{40} \right) = 100 \text{ days.}$$

Whole work will be done by Z in $(13 \times 3) = 39$ days.

\therefore Z will complete the work first.

10. Let the number of pages typed in one hour by P, Q and R be x , y and z respectively.
Then,

$$x + y + z = \frac{216}{4} \Rightarrow x + y + z = 54 \quad \dots(i)$$

$$z - y = y - x \Rightarrow 2y = x + z \quad \dots(ii)$$

$$5z = 7x \Rightarrow x = \frac{5}{7}z \quad \dots(iii)$$

Solving (i), (ii) and (iii), we get $x = 15$, $y = 18$, $z = 21$.

11. Number of pages typed by Ronald in 1 hour $= \frac{32}{6} = \frac{16}{3}$.

$$\text{Number of pages typed by Elan in 1 hour} = \frac{40}{5} = 8.$$

$$\text{Number of pages typed by both in 1 hour} = \left(\frac{16}{3} + 8 \right) = \frac{40}{3}.$$

$$\therefore \text{Time taken by both to type 110 pages} = \left(110 \times \frac{3}{40} \right) \text{ hrs} = 8\frac{1}{4} \text{ hrs} = 8 \text{ hrs } 15 \text{ min.}$$

12. Let A and B together take x hours to complete the work. Then,

A alone takes $(x + 8)$ hrs and B alone takes $\left(x + \frac{9}{2} \right)$ hrs to complete the work. Then,

$$\frac{1}{(x+8)} + \frac{1}{\left(x + \frac{9}{2} \right)} = \frac{1}{x} \Rightarrow \frac{1}{(x+8)} + \frac{2}{(2x+9)} = \frac{1}{x} \Rightarrow x(4x+25) = (x+8)(2x+9)$$

$$\Rightarrow 2x^2 = 72 \Rightarrow x^2 = 36 \Rightarrow x = 6.$$

13. P can complete the work in (12×8) hrs. $= 96$ hrs.

Q can complete the work in (8×10) hrs. $= 80$ hrs.

$$\therefore P's \text{ 1 hour's work} = \frac{1}{96} \text{ and } Q's \text{ 1 hour's work} = \frac{1}{80}.$$

$$(P+Q)'s \text{ 1 hour's work} = \left(\frac{1}{96} + \frac{1}{80} \right) = \frac{11}{480}.$$

$$\text{So, both P and Q will finish the work in } \left(\frac{480}{11} \right) \text{ hrs.}$$

$$\therefore \text{Number of days of 8 hours each} = \left(\frac{480}{11} \times \frac{1}{8} \right) = \frac{60}{11} \text{ days} = 5\frac{5}{11} \text{ days.}$$

14. (A + B)'s 1 day's work = $\frac{1}{12}$; (B + C)'s 1 day's work = $\frac{1}{15}$; (A + C)'s 1 day's work = $\frac{1}{20}$.

Adding, we get : 2 (A + B + C)'s 1 day's work = $\left(\frac{1}{12} + \frac{1}{15} + \frac{1}{20}\right) = \frac{12}{60} = \frac{1}{5}$.

\therefore (A + B + C)'s 1 day's work = $\frac{1}{10}$.

So, A, B and C together can complete the work in 10 days.

15. (A + B + C)'s 1 day's work = $\frac{1}{6}$; (A + B)'s 1 day's work = $\frac{1}{8}$.

(B + C)'s 1 day's work = $\frac{1}{12}$. $\frac{1}{12} = \frac{3}{36}$ $\frac{1}{12} = \frac{1}{36}$

\therefore (A + C)'s 1 day's work = $\left(2 \times \frac{1}{6}\right) - \left(\frac{1}{8} + \frac{1}{12}\right) = \left(\frac{1}{3} - \frac{5}{24}\right) = \frac{3}{24} = \frac{1}{8}$.

So, A and C together will do the work in 8 days.

16. (A + B)'s 1 day's work = $\frac{1}{72}$; (B + C)'s 1 day's work = $\frac{1}{120}$; (A + C)'s 1 day's work = $\frac{1}{90}$.

Adding, we get : 2 (A + B + C)'s 1 day's work = $\left(\frac{1}{72} + \frac{1}{120} + \frac{1}{90}\right) = \frac{12}{360} = \frac{1}{30}$.

\Rightarrow (A + B + C)'s 1 day's work = $\frac{1}{60}$.

So, A's 1 day's work = $\left(\frac{1}{60} - \frac{1}{120}\right) = \frac{1}{120}$.

\therefore A alone can do the work in 120 days.

17. (A + B)'s 1 day's work = $\frac{1}{5}$; (B + C)'s 1 day's work = $\frac{1}{7}$; (A + C)'s 1 day's work = $\frac{1}{4}$.

Adding, we get : 2 (A + B + C)'s 1 day's work = $\left(\frac{1}{5} + \frac{1}{7} + \frac{1}{4}\right) = \frac{83}{140}$.

(A + B + C)'s 1 day's work = $\frac{83}{280}$.

A's 1 day's work = $\left(\frac{83}{280} - \frac{1}{7}\right) = \frac{43}{280}$; B's 1 day's work = $\left(\frac{83}{280} - \frac{1}{4}\right) = \frac{13}{280}$;

C's 1 day's work = $\left(\frac{83}{280} - \frac{1}{5}\right) = \frac{27}{280}$.

Thus time taken by A, B, C is $\frac{280}{43}$ days, $\frac{280}{13}$ days, $\frac{280}{27}$ days respectively.

Clearly, the time taken by A is least.

18. A's 1 hour's work = $\frac{1}{4}$; (B + C)'s 1 hour's work = $\frac{1}{3}$; (A + C)'s 1 hour's work = $\frac{1}{2}$.

(A + B + C)'s 1 hour's work = $\left(\frac{1}{4} + \frac{1}{3}\right) = \frac{7}{12}$.

B's 1 hour's work = $\left(\frac{7}{12} - \frac{1}{2}\right) = \frac{1}{12}$.

\therefore B alone will take 12 hours to do the work.

19. (A + B)'s 1 day's work = $\frac{1}{10}$; C's 1 day's work = $\frac{1}{50}$. From Ques 1 of B + C) - B1

$$(A + B + C)'s 1 day's work = \left(\frac{1}{10} + \frac{1}{50} \right) = \frac{6}{50} = \frac{3}{25} \quad A \text{ alone can finish the work in } 25 \text{ days} \quad \dots(i)$$

Also, A's 1 day's work = (B + C)'s 1 day's work $\dots(ii)$

$$\text{From (i) and (ii), we get : } 2 \times (\text{A's 1 day's work}) = \frac{3}{25}. \quad \text{A's 1 day's work is } \frac{3}{50} \text{ of the total work.} \quad \dots(iii)$$

$$\Rightarrow \text{A's 1 day's work} = \frac{3}{50}. \quad \text{A's 1 day's work is } \frac{3}{50} \text{ of the total work.} \quad \dots(iv)$$

$$\therefore \text{B's 1 day's work} = \left(\frac{1}{10} - \frac{3}{50} \right) = \frac{2}{50} = \frac{1}{25}. \quad \text{B's 1 day's work is } \frac{1}{25} \text{ of the total work.} \quad \dots(v)$$

So, B alone could do the work in 25 days.

20. Ratio of rates of working of A and B = 2 : 1. So, ratio of times taken = 1 : 2.

$$\therefore \text{A's 1 day's work} = \frac{1}{6}; \text{B's 1 day's work} = \frac{1}{12}. \quad \text{The ratio of times taken by A and B is } 1 : 2. \quad \dots(i)$$

$$(A + B)'s 1 day's work = \left(\frac{1}{6} + \frac{1}{12} \right) = \frac{3}{12} = \frac{1}{4}. \quad \text{A and B together can finish the work in } 4 \text{ days.} \quad \dots(ii)$$

So, A and B together can finish the work in 4 days.

21. (A's 1 day's work) : (B's 1 day's work) = 2 : 1.

$$(A + B)'s 1 day's work = \frac{1}{14}. \quad \text{A's 1 day's work is } \frac{1}{14} \text{ of the total work.} \quad \dots(i)$$

Divide $\frac{1}{14}$ in the ratio 2 : 1. $\text{A's 1 day's work is } \frac{2}{3} \text{ of the total work.} \quad \dots(ii)$

$$\therefore \text{A's 1 day's work} = \left(\frac{1}{14} \times \frac{2}{3} \right) = \frac{1}{21}. \quad \text{A's 1 day's work is } \frac{1}{21} \text{ of the total work.} \quad \dots(iii)$$

Hence, A alone can finish the work in 21 days.

22. Ratio of times taken by A and B = 1 : 3.

If difference of time is 2 days, B takes 3 days.

$$\text{If difference of time is 60 days, B takes } \left(\frac{3}{2} \times 60 \right) = 90 \text{ days.} \quad \text{B takes } 90 \text{ days.} \quad \dots(i)$$

So, A takes 30 days to do the work.

$$\text{A's 1 day's work} = \frac{1}{30}; \text{B's 1 day's work} = \frac{1}{90}. \quad \text{A's 1 day's work is } \frac{1}{30} \text{ of the total work.} \quad \dots(ii)$$

$$(A + B)'s 1 day's work = \left(\frac{1}{30} + \frac{1}{90} \right) = \frac{4}{90} = \frac{2}{45}. \quad \text{A and B together can do the work in } \frac{45}{2} = 22\frac{1}{2} \text{ days.} \quad \dots(iii)$$

\therefore A and B together can do the work in $\frac{45}{2} = 22\frac{1}{2}$ days.

23. (A's 1 day's work) : (B's 1 day's work) = $\frac{7}{4} : 1 = 7 : 4$.

Let A's and B's 1 day's work be $7x$ and $4x$ respectively.

$$\text{Then, } 7x + 4x = \frac{1}{7} \Rightarrow 11x = \frac{1}{7} \Rightarrow x = \frac{1}{77}. \quad \text{A's 1 day's work is } \frac{1}{77} \text{ of the total work.} \quad \dots(i)$$

$$\therefore \text{A's 1 day's work} = \left(\frac{1}{77} \times 7 \right) = \frac{1}{11}. \quad \text{A's 1 day's work is } \frac{1}{11} \text{ of the total work.} \quad \dots(ii)$$

24. Ratio of times taken by Sakshi and Tanya = $125 : 100 = 5 : 4$.

Suppose Tanya takes x days to do the work.

$$5 : 4 :: 20 : x \Rightarrow x = \left(\frac{4 \times 20}{5} \right) \Rightarrow x = 16 \text{ days.}$$

Hence, Tanya takes 16 days to complete the work.

25. Ratio of times taken by A and B = $100 : 130 = 10 : 13$.

Suppose B takes x days to do the work.

$$\text{Then, } 10 : 13 :: 23 : x \Rightarrow x = \left(\frac{23 \times 13}{10} \right) \Rightarrow x = \frac{299}{10}.$$

$$\text{A's 1 day's work} = \frac{1}{23}; \text{B's 1 day's work} = \frac{10}{299}.$$

$$(\text{A} + \text{B})\text{'s 1 day's work} = \left(\frac{1}{23} + \frac{10}{299} \right) = \frac{23}{299} = \frac{1}{13}.$$

\therefore A and B together can complete the job in 13 days.

26. Suppose B takes x days to do the work.

$$\therefore \text{A takes } \left(2 \times \frac{3}{4} x \right) = \frac{3x}{2} \text{ days to do it.}$$

$$(\text{A} + \text{B})\text{'s 1 day's work} = \frac{1}{18}.$$

$$\therefore \frac{1}{x} + \frac{2}{3x} = \frac{1}{18} \text{ or } x = 30.$$

27. (A's 1 day's work) : (B's 1 day's work) = $150 : 100 = 3 : 2$.

Let A's and B's 1 day's work be $3x$ and $2x$ respectively.

$$\text{Then, C's 1 day's work} = \left(\frac{3x + 2x}{2} \right) = \frac{5x}{2}.$$

$$\therefore \frac{5x}{2} = \frac{1}{40} \text{ or } x = \left(\frac{1}{40} \times \frac{2}{5} \right) = \frac{1}{100}.$$

$$\text{A's 1 day's work} = \frac{3}{100}; \text{B's 1 day's work} = \frac{1}{50}; \text{C's 1 day's work} = \frac{1}{40}.$$

$$(\text{A} + \text{B} + \text{C})\text{'s 1 day's work} = \left(\frac{3}{100} + \frac{1}{50} + \frac{1}{40} \right) = \frac{15}{200} = \frac{3}{40}.$$

So, A, B and C together can do the work in $\frac{40}{3} = 13\frac{1}{3}$ days.

28. Let A's 1 day's work = x and B's 1 day's work = y .

$$\text{Then, } x + y = \frac{1}{5} \text{ and } 2x + \frac{1}{3}y = \frac{1}{3}.$$

$$\text{Solving, we get: } x = \frac{4}{25} \text{ and } y = \frac{1}{25}.$$

$$\therefore \text{A's 1 day's work} = \frac{4}{25}.$$

So, A alone could complete the work in $\frac{25}{4} = 6\frac{1}{4}$ days.

29. A's 1 day's work = $\frac{1}{15}$; B's 1 day's work = $\frac{1}{20}$.

$$(\text{A} + \text{B})\text{'s 1 day's work} = \left(\frac{1}{15} + \frac{1}{20} \right) = \frac{7}{60}.$$

$(A + B)$'s 4 days' work = $\left(\frac{7}{60} \times 4\right) = \frac{7}{15}$. Thus, total work to finish = 1.

\therefore Remaining work = $\left(1 - \frac{7}{15}\right) = \frac{8}{15}$.

30. B's 10 days' work = $\left(\frac{1}{15} \times 10\right) = \frac{2}{3}$. Remaining work = $\left(1 - \frac{2}{3}\right) = \frac{1}{3}$.

Now, $\frac{1}{18}$ work is done by A in 1 day.

$\therefore \frac{1}{3}$ work is done by A in $\left(18 \times \frac{1}{3}\right) = 6$ days.

31. $(A + B)$'s 1 day's work = $\left(\frac{1}{15} + \frac{1}{10}\right) = \frac{1}{6}$.

Work done by A and B in 2 days = $\left(\frac{1}{6} \times 2\right) = \frac{1}{3}$. Remaining work = $\left(1 - \frac{1}{3}\right) = \frac{2}{3}$.

Now, $\frac{1}{15}$ work is done by A in 1 day.

$\therefore \frac{2}{3}$ work will be done by A in $\left(15 \times \frac{2}{3}\right) = 10$ days.

Hence, total time taken = $(10 + 2) = 12$ days.

32. $(B + C)$'s 1 day's work = $\left(\frac{1}{9} + \frac{1}{12}\right) = \frac{7}{36}$.

Work done by B and C in 3 days = $\left(\frac{7}{36} \times 3\right) = \frac{7}{12}$.

Remaining work = $\left(1 - \frac{7}{12}\right) = \frac{5}{12}$.

Now, $\frac{1}{24}$ work is done by A in 1 day.

So, $\frac{5}{12}$ work is done by A in $\left(24 \times \frac{5}{12}\right) = 10$ days.

33. $(P + Q + R)$'s 1 hour's work = $\left(\frac{1}{8} + \frac{1}{10} + \frac{1}{12}\right) = \frac{37}{120}$.

Work done by P, Q and R in 2 hours = $\left(\frac{37}{120} \times 2\right) = \frac{37}{60}$.

Remaining work = $\left(1 - \frac{37}{60}\right) = \frac{23}{60}$.

$(Q + R)$'s 1 hour's work = $\left(\frac{1}{10} + \frac{1}{12}\right) = \frac{11}{60}$.

Now, $\frac{11}{60}$ work is done by Q and R in 1 hour.

So, $\frac{23}{60}$ work will be done by Q and R in $\left(\frac{60}{11} \times \frac{23}{60}\right) = \frac{23}{11}$ hours ≈ 2 hours.

So, the work will be finished approximately 2 hours after 11 a.m., i.e., around 1 p.m.

34. $2(A + B + C)$'s 1 day's work = $\left(\frac{1}{30} + \frac{1}{24} + \frac{1}{20}\right) = \frac{15}{120} = \frac{1}{8}$.

$$\Rightarrow (A + B + C)$$
's 1 day's work = $\frac{1}{16}$.

Work done by A, B and C in 10 days = $\frac{10}{16} = \frac{5}{8}$. Remaining work = $\left(1 - \frac{5}{8}\right) = \frac{3}{8}$.

A's 1 day's work = $\left(\frac{1}{16} - \frac{1}{24}\right) = \frac{1}{48}$.

Now, $\frac{1}{48}$ work is done by A in 1 day.

So, $\frac{3}{8}$ work will be done by A in $\left(48 \times \frac{3}{8}\right) = 18$ days.

35. Work done by X in 4 days = $\left(\frac{1}{20} \times 4\right) = \frac{1}{5}$. Remaining work = $\left(1 - \frac{1}{5}\right) = \frac{4}{5}$.

(X + Y)'s 1 day's work = $\left(\frac{1}{20} + \frac{1}{12}\right) = \frac{8}{60} = \frac{2}{15}$.

Now, $\frac{2}{15}$ work is done by X and Y in 1 day.

So, $\frac{4}{5}$ work will be done by X and Y in $\left(\frac{15}{2} \times \frac{4}{5}\right) = 6$ days.

Hence, total time taken = (6 + 4) days = 10 days.

36. (A + B)'s 20 days' work = $\left(\frac{1}{30} \times 20\right) = \frac{2}{3}$. Remaining work = $\left(1 - \frac{2}{3}\right) = \frac{1}{3}$.

Now, $\frac{1}{3}$ work is done by A in 20 days.

Whole work will be done by A in $(20 \times 3) = 60$ days.

37. Work done by X in 8 days = $\left(\frac{1}{40} \times 8\right) = \frac{1}{5}$. Remaining work = $\left(1 - \frac{1}{5}\right) = \frac{4}{5}$.

Now, $\frac{4}{5}$ work is done by Y in 16 days.

Whole work will be done by Y in $\left(16 \times \frac{5}{4}\right) = 20$ days.

\therefore X's 1 day's work = $\frac{1}{40}$, Y's 1 day's work = $\frac{1}{20}$.

(X + Y)'s 1 day's work = $\left(\frac{1}{40} + \frac{1}{20}\right) = \frac{3}{40}$.

Hence, X and Y will together complete the work in $\frac{40}{3} = 13\frac{1}{3}$ days.

38. Work done by A, B and C in 4 days = $\left(\frac{1}{10} \times 4\right) = \frac{2}{5}$. Remaining work = $\left(1 - \frac{2}{5}\right) = \frac{3}{5}$.

Now, $\frac{3}{5}$ work is done by B and C in 10 days.

Whole work will be done by B and C in $\left(10 \times \frac{5}{3}\right) = \frac{50}{3}$ days.

$$(A + B + C)'s \text{ 1 day's work} = \frac{1}{10}, (B + C)'s \text{ 1 day's work} = \frac{3}{50}$$

$$A's \text{ 1 day's work} = \left(\frac{1}{10} - \frac{3}{50} \right) = \frac{2}{50} = \frac{1}{25}$$

$\therefore A$ alone could complete the work in 25 days.

$$39. \text{ Whole work is done by } A \text{ in } \left(20 \times \frac{5}{4} \right) = 25 \text{ days.}$$

$$\text{Now, } \left(1 - \frac{4}{5} \right) \text{ i.e., } \frac{1}{5} \text{ work is done by } A \text{ and } B \text{ in 3 days.}$$

Whole work will be done by A and B in $(3 \times 5) = 15$ days.

$$A's \text{ 1 day's work} = \frac{1}{25}, (A + B)'s \text{ 1 day's work} = \frac{1}{15}$$

$$\therefore B's \text{ 1 day's work} = \left(\frac{1}{15} - \frac{1}{25} \right) = \frac{4}{150} = \frac{2}{75}$$

$$\text{So, } B \text{ alone would do the work in } \frac{75}{2} = 37\frac{1}{2} \text{ days.}$$

$$40. \text{ Let } A's \text{ 1 day's work} = x \text{ and } B's \text{ 1 day's work} = y.$$

$$\text{Then, } x + y = \frac{1}{30} \text{ and } 16x + 44y = 1.$$

$$\text{Solving these two equations, we get : } x = \frac{1}{60} \text{ and } y = \frac{1}{60}$$

$$\therefore B's \text{ 1 day's work} = \frac{1}{60}.$$

Hence, B alone shall finish the whole work in 60 days.

$$41. A's 5 \text{ days' work} + B's 7 \text{ days' work} + C's 13 \text{ days' work} = 1$$

$$\Rightarrow (A + B)'s 5 \text{ days' work} + (B + C)'s 2 \text{ days' work} + C's 11 \text{ days' work} = 1$$

$$\Rightarrow \frac{5}{12} + \frac{2}{16} + C's 11 \text{ days' work} = 1$$

$$\Rightarrow C's 11 \text{ days' work} = 1 - \left(\frac{5}{12} + \frac{2}{16} \right) = \frac{11}{24}$$

$$\Rightarrow C's 1 \text{ day's work} = \left(\frac{11}{24} \times \frac{1}{11} \right) = \frac{1}{24}$$

$\therefore C$ alone can finish the work in 24 days.

$$42. (A + B)'s 1 \text{ day's work} = \left(\frac{1}{45} + \frac{1}{40} \right) = \frac{17}{360}$$

$$\text{Work done by } B \text{ in 23 days} = \left(\frac{1}{40} \times 23 \right) = \frac{23}{40}. \text{ Remaining work} = \left(1 - \frac{23}{40} \right) = \frac{17}{40}$$

$$\text{Now, } \frac{17}{360} \text{ work was done by } (A + B) \text{ in 1 day.}$$

$$\frac{17}{40} \text{ work was done by } (A + B) \text{ in } \left(1 \times \frac{360}{17} \times \frac{17}{40} \right) = 9 \text{ days.}$$

$\therefore A$ left after 9 days.

43. B's 3 days' work = $\left(\frac{1}{21} \times 3\right) = \frac{1}{7}$. Remaining work = $\left(1 - \frac{1}{7}\right) = \frac{6}{7}$.

(A + B)'s 1 day's work = $\left(\frac{1}{14} + \frac{1}{21}\right) = \frac{5}{42}$.

Now, $\frac{5}{42}$ work is done by A and B in 1 day.

$\therefore \frac{6}{7}$ work is done by A and B in $\left(\frac{42}{5} \times \frac{6}{7}\right) = \frac{36}{5}$ days.

Hence, total time taken = $\left(3 + \frac{36}{5}\right)$ days = $10\frac{1}{5}$ days.

44. (A + B + C)'s 1 day's work = $\left(\frac{1}{24} + \frac{1}{36} + \frac{1}{48}\right) = \frac{13}{144}$.

Work done by (A + B + C) in 4 days = $\left(\frac{13}{144} \times 4\right) = \frac{13}{36}$.

Work done by B in 3 days = $\left(\frac{1}{36} \times 3\right) = \frac{1}{12}$. Remaining work = $\left[1 - \left(\frac{13}{36} + \frac{1}{12}\right)\right] = \frac{5}{9}$.

(A + B)'s 1 day's work = $\left(\frac{1}{24} + \frac{1}{36}\right) = \frac{5}{72}$.

Now, $\frac{5}{72}$ work is done by A and B in $\left(\frac{72}{5} \times \frac{5}{9}\right) = 8$ days.

Hence, total time taken = (4 + 3 + 8) days = 15 days.

45. B's daily earning = Rs. (300 - 188) = Rs. 112.

A's daily earning = Rs. (300 - 152) = Rs. 148.

C's daily earning = Rs. [300 - (112 + 148)] = Rs. 40.

46. Work done by A = $\left(1 - \frac{8}{23}\right) = \frac{15}{23}$.

$\therefore A : (B + C) = \frac{15}{23} : \frac{8}{23} = 15 : 8$.

So, A's share = Rs. $\left(\frac{15}{23} \times 529\right) = \text{Rs. } 345$.

47. Kim's wages : David's wages = Kim's 1 day's work : David's 1 day's work

$$= \frac{1}{3} : \frac{1}{2} = 2 : 3.$$

\therefore Kim's share = Rs. $\left(\frac{2}{5} \times 150\right) = \text{Rs. } 60$.

48. Whole work is done by A in $(3 \times 4) = 12$ days.

Whole work is done by B in $(4 \times 6) = 24$ days.

A's wages : B's wages = A's 1 day's work : B's 1 day's work = $\frac{1}{12} : \frac{1}{24} = 2 : 1$.

\therefore A's share = Rs. $\left(\frac{2}{3} \times 180\right) = \text{Rs. } 120$.

49. C's 1 day's work = $\frac{1}{3} - \left(\frac{1}{6} + \frac{1}{8} \right) = \frac{1}{3} - \frac{7}{24} = \frac{1}{24}$.

A's wages : B's wages : C's wages = $\frac{1}{6} : \frac{1}{8} : \frac{1}{24} = 4 : 3 : 1$.

\therefore C's share = Rs. $\left(\frac{1}{8} \times 3200 \right)$ = Rs. 400.

50. Let total money be Rs. x.

A's 1 day's wages = Rs. $\frac{x}{21}$, B's 1 day's wages = Rs. $\frac{x}{28}$.

\therefore (A + B)'s 1 day's wages = Rs. $\left(\frac{x}{21} + \frac{x}{28} \right)$ = Rs. $\frac{x}{12}$.

\therefore Money is sufficient to pay the wages of both for 12 days.

51. Part of the work done by A = $\left(\frac{1}{10} \times 5 \right) = \frac{1}{2}$.

Part of the work done by B = $\left(\frac{1}{15} \times 5 \right) = \frac{1}{3}$.

Part of the work done by C = $1 - \left(\frac{1}{2} + \frac{1}{3} \right) = \frac{1}{6}$.

So, (A's share) : (B's share) : (C's share) = $\frac{1}{2} : \frac{1}{3} : \frac{1}{6} = 3 : 2 : 1$.

\therefore A's share = Rs. $\left(\frac{3}{6} \times 1500 \right)$ = Rs. 750, B's share = Rs. $\left(\frac{2}{6} \times 1500 \right)$ = Rs. 500,

C's share = Rs. $\left(\frac{1}{6} \times 1500 \right)$ = Rs. 250.

A's daily wages = Rs. $\left(\frac{750}{5} \right)$ = Rs. 150; B's daily wages = Rs. $\left(\frac{500}{5} \right)$ = Rs. 100;

C's daily wages = Rs. $\left(\frac{250}{2} \right)$ = Rs. 125.

\therefore Daily wages of B and C = Rs. (100 + 125) = Rs. 225.

52. B's 1 day's work = $\left(\frac{1}{12} - \frac{1}{20} \right) = \frac{2}{60} = \frac{1}{30}$.

Now, (A + B)'s 1 day's work = $\left(\frac{1}{20} + \frac{1}{60} \right) = \frac{4}{60} = \frac{1}{15}$. [\because B works for half day only]

So, A and B together will complete the work in 15 days.

53. (A + B)'s 2 days' work = $\left(\frac{1}{16} + \frac{1}{12} \right) = \frac{7}{48}$.

Work done in 6 pairs of days = $\left(\frac{7}{48} \times 6 \right) = \frac{7}{8}$. Remaining work = $\left(1 - \frac{7}{8} \right) = \frac{1}{8}$.

Work done by A on 13th day = $\frac{1}{16}$. Remaining work = $\left(\frac{1}{8} - \frac{1}{16} \right) = \frac{1}{16}$.

On 14th day, it is B's turn.

$\frac{1}{12}$ work is done by B in 1 day. $\frac{1}{16}$ work is done by B in $(12 \times \frac{1}{16}) = \frac{3}{4}$ day.

\therefore Total time taken = $13\frac{3}{4}$ days.

$$54. (A + B)'s 1 \text{ day's work} = \left(\frac{1}{11} + \frac{1}{20}\right) = \frac{31}{220}. (A + C)'s 1 \text{ day's work} = \left(\frac{1}{11} + \frac{1}{55}\right) = \frac{6}{55}.$$

$$\text{Work done in 2 days} = \left(\frac{31}{220} + \frac{6}{55}\right) = \frac{55}{220} = \frac{1}{4}.$$

Now, $\frac{1}{4}$ work is done by A in 2 days.

\therefore Whole work will be done in $(2 \times 4) = 8$ days.

$$55. A's 2 \text{ days' work} = \left(\frac{1}{20} \times 2\right) = \frac{1}{10}.$$

$$(A + B + C)'s 1 \text{ day's work} = \left(\frac{1}{20} + \frac{1}{30} + \frac{1}{60}\right) = \frac{6}{60} = \frac{1}{10}.$$

$$\text{Work done in 3 days} = \left(\frac{1}{10} + \frac{1}{10}\right) = \frac{1}{5}.$$

Now, $\frac{1}{5}$ work is done in 3 days.

\therefore Whole work will be done in $(3 \times 5) = 15$ days.

$$56. (A + B)'s 6 \text{ days' work} = 6 \left(\frac{1}{20} + \frac{1}{15}\right) = \frac{7}{10}; (A + C)'s 4 \text{ days' work} = \frac{3}{10};$$

$$(A + C)'s 1 \text{ day's work} = \frac{3}{40}. A's 1 \text{ day's work} = \frac{1}{20}.$$

$$\therefore C's 1 \text{ day's work} = \left(\frac{3}{40} - \frac{1}{20}\right) = \frac{1}{40}.$$

Hence, C alone can finish the work in 40 days.

57. Suppose the work was finished in x days.

Then, A's $(x - 8)$ days' work + B's $(x - 12)$ days' work + C's x days' work = 1

$$\Rightarrow \frac{(x - 8)}{36} + \frac{(x - 12)}{54} + \frac{x}{72} = 1 \Leftrightarrow 6(x - 8) + 4(x - 12) + 3x = 216$$

$$\therefore 13x = 312 \text{ or } x = 24.$$

58. (20×16) women can complete the work in 1 day.

$$\therefore 1 \text{ woman's 1 day's work} = \frac{1}{320}.$$

(16×15) men can complete the work in 1 day.

$$\therefore 1 \text{ man's 1 day's work} = \frac{1}{240}.$$

$$\text{So, required ratio} = \frac{1}{240} : \frac{1}{320} = 4 : 3.$$

$$59. 10 \text{ men's 1 day's work} = \frac{1}{15}; 15 \text{ women's 1 day's work} = \frac{1}{12}.$$

$$(10 \text{ men} + 15 \text{ women})'s 1 \text{ day's work} = \left(\frac{1}{15} + \frac{1}{12}\right) = \frac{9}{60} = \frac{3}{20}.$$

$$\therefore 10 \text{ men and 15 women will complete the work in } \frac{3}{20} = 6\frac{2}{3} \text{ days.}$$

60. (7×12) men can complete the work in 1 day.

$$\therefore 1 \text{ man's 1 day's work} = \frac{1}{84}.$$

$$7 \text{ men's 5 days' work} = \left(\frac{1}{12} \times 5 \right) = \frac{5}{12}. \text{ Remaining work} = \left(1 - \frac{5}{12} \right) = \frac{7}{12}.$$

$$5 \text{ men's 1 day's work} = \left(\frac{1}{84} \times 5 \right) = \frac{5}{84}.$$

$$\frac{5}{84} \text{ work is done by them in 1 day.}$$

$$\frac{7}{12} \text{ work is done by them in } \left(\frac{84}{5} \times \frac{7}{12} \right) = \frac{49}{5} \text{ days} = 9\frac{4}{5} \text{ days.}$$

$$61. 1 \text{ man's 1 day's work} = \frac{1}{108}.$$

$$12 \text{ men's 6 days' work} = \left(\frac{1}{9} \times 6 \right) = \frac{2}{3}. \text{ Remaining work} = \left(1 - \frac{2}{3} \right) = \frac{1}{3}.$$

$$18 \text{ men's 1 day's work} = \left(\frac{1}{108} \times 18 \right) = \frac{1}{6}.$$

$$\frac{1}{6} \text{ work is done by them in 1 day.}$$

$$\therefore \frac{1}{3} \text{ work is done by them in } \left(6 \times \frac{1}{3} \right) = 2 \text{ days.}$$

$$62. \text{ Let 1 woman's 1 day's work} = x.$$

$$\text{Then, 1 man's 1 day's work} = \frac{x}{2} \text{ and 1 child's 1 day's work} = \frac{x}{4}.$$

$$\text{So, } \left(\frac{3x}{2} + 4x + \frac{6x}{4} \right) = \frac{1}{7} \Rightarrow \frac{28x}{4} = \frac{1}{7} \Rightarrow x = \left(\frac{1}{7} \times \frac{4}{28} \right) = \frac{1}{49}.$$

\therefore 1 woman alone can complete the work in 49 days.

$$\text{So, to complete the work in 7 days, number of women required} = \left(\frac{49}{7} \right) = 7.$$

$$63. (1 \text{ man} + 1 \text{ woman})'s 1 \text{ day's work} = \left(\frac{1}{3} + \frac{1}{4} \right) = \frac{7}{12}.$$

$$\text{Work done by 1 man and 1 woman in } \frac{1}{4} \text{ day} = \left(\frac{7}{12} \times \frac{1}{4} \right) = \frac{7}{48}.$$

$$\text{Remaining work} = \left(1 - \frac{7}{48} \right) = \frac{41}{48}.$$

$$\text{Work done by 1 boy in } \frac{1}{4} \text{ day} = \left(\frac{1}{12} \times \frac{1}{4} \right) = \frac{1}{48}.$$

$$\therefore \text{Number of boys required} = \left(\frac{41}{48} \times 48 \right) = 41.$$

$$64. 1 \text{ man's 1 day's work} = \frac{1}{100}. (10 \text{ men} + 15 \text{ women})'s 1 \text{ day's work} = \frac{1}{6}.$$

$$15 \text{ women's 1 day's work} = \left(\frac{1}{6} - \frac{10}{100} \right) = \left(\frac{1}{6} - \frac{1}{10} \right) = \frac{1}{15}.$$

$$1 \text{ woman's 1 day's work} = \frac{1}{225}.$$

\therefore 1 woman alone can complete the work in 225 days.

$$65. 1 \text{ man's 1 day's work} = \frac{1}{48}; 1 \text{ woman's 1 day's work} = \frac{1}{60}.$$

$$6 \text{ men's 2 days' work} = \left(\frac{6}{48} \times 2 \right) = \frac{1}{4}. \text{ Remaining work} = \left(1 - \frac{1}{4} \right) = \frac{3}{4}.$$

Now, $\frac{1}{60}$ work is done in 1 day by 1 woman.

$$\text{So, } \frac{3}{4} \text{ work will be done in 3 days by } \left(60 \times \frac{3}{4} \times \frac{1}{3} \right) = 15 \text{ women.}$$

$$66. 1 \text{ child's 1 day's work} = \frac{1}{192}; 1 \text{ adult's 1 day's work} = \frac{1}{96}.$$

$$\text{Work done in 3 days} = \left(\frac{1}{96} \times 16 \times 3 \right) = \frac{1}{2}. \text{ Remaining work} = \left(1 - \frac{1}{2} \right) = \frac{1}{2}.$$

$$(6 \text{ adults} + 4 \text{ children})'s 1 \text{ day's work} = \left(\frac{6}{96} + \frac{4}{192} \right) = \frac{1}{12}.$$

$\frac{1}{12}$ work is done by them in 1 day.

$$\frac{1}{2} \text{ work is done by them } \left(12 \times \frac{1}{2} \right) = 6 \text{ days.}$$

$$67. 1 \text{ woman's 1 day's work} = \frac{1}{70}; 1 \text{ child's 1 day's work} = \frac{1}{140}.$$

$$(5 \text{ women} + 10 \text{ children})'s 1 \text{ day's work} = \left(\frac{5}{70} + \frac{10}{140} \right) = \left(\frac{1}{14} + \frac{1}{14} \right) = \frac{1}{7}.$$

\therefore 5 women and 10 children will complete the work in 7 days.

$$68. 1 \text{ man's 1 day's work} = \frac{1}{192}; 1 \text{ child's 1 day's work} = \frac{1}{432}.$$

$$\text{Work done in 8 days} = 8 \left(\frac{12}{192} + \frac{8}{432} \right) = 8 \left(\frac{1}{16} + \frac{1}{54} \right) = \frac{35}{54}.$$

$$\text{Remaining work} = \left(1 - \frac{35}{54} \right) = \frac{19}{54}.$$

$$(12 \text{ men} + 11 \text{ children})'s 1 \text{ day's work} = \left(\frac{12}{192} + \frac{11}{432} \right) = \frac{19}{216}.$$

Now, $\frac{19}{216}$ work is done by them in 1 day.

$$\therefore \frac{19}{54} \text{ work will be done by them in } \left(\frac{216}{19} \times \frac{19}{54} \right) = 4 \text{ days.}$$

$$69. 1 \text{ man's 1 day's work} = \frac{1}{384}; 1 \text{ woman's 1 day's work} = \frac{1}{768}.$$

$$\text{Work done in 12 days} = 12 \left(\frac{16}{384} + \frac{16}{768} \right) = \left(12 \times \frac{3}{48} \right) = \frac{3}{4}.$$

$$\text{Remaining work} = \left(1 - \frac{3}{4} \right) = \frac{1}{4}.$$

$$(16 \text{ men} + 16 \text{ women})'s \text{ 2 days' work} = 2 \left(\frac{16}{384} + \frac{16}{768} \right) = \left(2 \times \frac{1}{16} \right) = \frac{1}{8}$$

$$\text{Remaining work} = \left(\frac{1}{4} - \frac{1}{8} \right) = \frac{1}{8}.$$

$\frac{1}{384}$ work is done in 1 day by 1 man.

$$\therefore \frac{1}{8} \text{ work will be done in 2 days by } \left(384 \times \frac{1}{8} \times \frac{1}{2} \right) = 24 \text{ men.}$$

70. Let 1 man's 1 day's work = x and 1 boy's 1 day's work = y .

$$\text{Then, } 5x + 2y = 4(x + y) \Rightarrow x = 2y \Rightarrow \frac{x}{y} = \frac{2}{1}.$$

71. Let 1 man's 1 day's work = x and 1 boy's 1 day's work = y .

$$\text{Then, } 12x + 16y = \frac{1}{5} \text{ and } 13x + 24y = \frac{1}{4}.$$

Solving these two equations, we get : $x = \frac{1}{100}$ and $y = \frac{1}{200}$.

$$\therefore \text{Required ratio} = x:y = \frac{1}{100}:\frac{1}{200} = 2:1.$$

72. Let 1 man's 1 day's work = x and 1 woman's 1 day's work = y .

$$\text{Then, } 4x + 6y = \frac{1}{8} \text{ and } 3x + 7y = \frac{1}{10}.$$

Solving these two equations, we get : $x = \frac{11}{400}$, $y = \frac{1}{400}$.

$$\therefore 1 \text{ woman's 1 day's work} = \frac{1}{400}.$$

$$\Rightarrow 10 \text{ women's 1 day's work} = \left(\frac{1}{400} \times 10 \right) = \frac{1}{40}.$$

Hence, 10 women will complete the work in 40 days.

73. Let 1 man's 1 hour's work = x , 1 woman's 1 hour's work = y and 1 boy's 1 hour's work = z . Then,

$$x + 3y + 4z = \frac{1}{96} \quad \dots(i) \quad 2x + 8z = \frac{1}{80} \quad \dots(ii) \quad 2x + 3y = \frac{1}{120} \quad \dots(iii)$$

$$\text{Adding (ii) and (iii) and subtracting (i) from it, we get : } 3x + 4z = \frac{1}{96} \quad \dots(iv)$$

$$\text{From (ii) and (iv), we get } x = \frac{1}{480}. \text{ Substituting, we get : } y = \frac{1}{720}, z = \frac{1}{960}.$$

$$(5 \text{ men} + 12 \text{ boys})'s \text{ 1 hour's work} = \left(\frac{5}{480} + \frac{12}{960} \right) = \left(\frac{1}{96} + \frac{1}{80} \right) = \frac{11}{480}.$$

$\therefore 5 \text{ men and } 12 \text{ boys can do the work in } \frac{480}{11} \text{ i.e., } 43\frac{7}{11} \text{ hours.}$

74. Let 1 man's 1 day's work = x and 1 boy's 1 day's work = y .

$$\text{Then, } 6x + 8y = \frac{1}{10} \text{ and } 26x + 48y = \frac{1}{2}.$$

Solving these two equations, we get : $x = \frac{1}{100}$ and $y = \frac{1}{200}$.

$$(15 \text{ men} + 20 \text{ boys})\text{'s 1 day's work} = \left(\frac{15}{100} + \frac{20}{200} \right) = \frac{1}{4}.$$

\therefore 15 men and 20 boys can do the work in 4 days.

EXERCISE 15B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (Questions 1 to 4) : Each of the questions given below consists of a statement and/or a question followed by two statements labelled I and II. Read both the statements and

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

- How long will Machine Y, working alone, take to produce x candles ? (M.B.A. 2002)
 - Machine X produces x candles in 5 minutes.
 - Machine X and Machine Y working at the same time produce x candles in 2 minutes.
 - B alone can complete a work in 12 days. How many days will A, B and C together take to complete the work ?
 - A and B together can complete the work in 3 days.
 - B and C together can complete the work in 6 days.
 - Is it cheaper to employ X to do a certain job than to employ Y ?
 - X is paid 20% more per hour than Y, but Y takes 2 hours longer to complete the job.
 - X is paid Rs. 80 per hour.
 - A and B together can complete a task in 7 days. B alone can do it in 20 days. What part of the work was carried out by A ? (M.B.A. 1998)

1. A completed the job alone after A and B worked together for 5 days.

- II. Part of the work done by A could have been done by B and C together in 6 days.

Directions (Questions 5 to 9) : Each of the following questions consists of a question followed by three statements I, II and III. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.

6. In how many days can the work be completed by A and B together ?
 I. A alone can complete the work in 8 days.
 II. If A alone works for 5 days and B alone works for 6 days, the work gets completed.
 III. B alone can complete the work in 16 days. (Bank P.O. 2003)
 (a) I and II only (b) II and III only (c) Any two of the three
 (d) II and either I or III (e) None of these
7. How many workers are required for completing the construction work in 10 days ?
 I. 20% of the work can be completed by 8 workers in 8 days.
 II. 20 workers can complete the work in 16 days.
 III. One-eighth of the work can be completed by 8 workers in 5 days. (Bank P.O. 2003)
 (a) I only (b) II and III only (c) III only
 (d) I and III only (e) Any one of the three
8. In how many days can the work be done by 9 men and 15 women ?
 I. 6 men and 5 women can complete the work in 6 days.
 II. 3 men and 4 women can complete the work in 10 days.
 III. 18 men and 15 women can complete the work in 2 days.
 (a) III only (b) All I, II and III (c) Any two of the three
 (d) Any one of the three (e) None of these
9. In how many days can 10 women finish a work ? (R.B.I. 2002)
 I. 10 men can complete the work in 6 days.
 II. 10 men and 10 women together can complete the work in $3\frac{3}{7}$ days.
 III. If 10 men work for 3 days and thereafter 10 women replace them, the remaining work is completed in 4 days.
 (a) Any two of the three (b) I and II only (c) II and III only
 (d) I and III only (e) None of these

Directions (Questions 10-11) : Each of these questions is followed by three statements. You have to study the question and all the three statements given to decide whether any information provided in the statement(s) is/are redundant and can be dispensed with while answering the given question.

10. In how many days can the work be completed by A, B and C together ?
 I. A and B together can complete the work in 6 days.
 II. B and C together can complete the work in $3\frac{3}{4}$ days.
 III. A and C together can complete the work in $3\frac{1}{3}$ days. (S.B.I.P.O. 2001)
 (a) Any one of the three (b) I only
 (c) II only (d) III only
 (e) Information in all the three statements is necessary to answer the question.
11. 8 men and 14 women are working together in a field. After working for 3 days, 5 men and 8 women leave the work. How many more days will be required to complete the work ? (S.B.I.P.O. 1999)
 I. 19 men and 12 women together can complete the work in 18 days.
 II. 16 men can complete two-third of the work in 16 days.
 III. In a day, the work done by three men is equal to the work done by four women.
 (a) I only (b) II only (c) III only
 (d) I or II or III (e) II or III only

ANSWERS

1. (e) 2. (e) 3. (d) 4. (a) 5. (d) 6. (c) 7. (e) 8. (c)
 9. (a) 10. (e) 11. (d)

SOLUTIONS

1. I gives, Machine X produces $\frac{x}{5}$ candles in 1 min.

II gives, Machines X and Y produce $\frac{x}{2}$ candles in 1 min.

From I and II, Y produces $\left(\frac{x}{2} - \frac{x}{5}\right) = \frac{3x}{10}$ candles in 1 min.

$\frac{3x}{10}$ candles are produced by Y in 1 min.

x candles will be produced by Y in $\left(\frac{10}{3x} \times x\right)$ min = $\frac{10}{3}$ min.

Thus, I and II both are necessary to get the answer.

∴ Correct answer is (e).

2. Given : B's 1 day's work = $\frac{1}{12}$.

I gives, (A + B)'s 1 day's work = $\frac{1}{3}$.

⇒ A's 1 day's work = $\left(\frac{1}{3} - \frac{1}{12}\right) = \frac{3}{12} = \frac{1}{4}$.

II gives, (B + C)'s 1 day's work = $\frac{1}{6}$ ⇒ C's 1 day's work = $\left(\frac{1}{6} - \frac{1}{12}\right) = \frac{1}{12}$.

∴ (A + B + C)'s 1 day's work = $\left(\frac{1}{4} + \frac{1}{12} + \frac{1}{12}\right) = \frac{5}{12}$.

Hence, they all finish the work in $\frac{12}{5} = 2\frac{2}{5}$ days.

Thus, I and II both are necessary to get the answer.

∴ Correct answer is (e).

3. Suppose X takes x hours and Y takes $(x + 2)$ hours to complete the job.

II. X is paid Rs. 80 per hour.

Total payment to X = Rs. $(80x)$.

$$\text{I. } X = 120\% \text{ of } Y = \frac{120}{100} Y = \frac{6}{5} Y \Rightarrow Y = \frac{5}{6} X.$$

∴ Y is paid Rs. $\left(\frac{5}{6} \times 80\right)$ per hour ⇒ Y is paid Rs. $\left[\frac{200}{3}(x+2)\right]$.

We cannot compare $(80x)$ and $\frac{200}{3}(x+2)$.

∴ Correct answer is (d).

4. B's 1 day's work = $\frac{1}{20}$. (A + B)'s 1 day's work = $\frac{1}{7}$.

I. (A + B)'s 5 day's work = $\frac{5}{7}$. Remaining work = $\left(1 - \frac{5}{7}\right) = \frac{2}{7}$.

$\therefore \frac{2}{7}$ work was carried by A.

II. is irrelevant.

\therefore Correct answer is (a).

5. I. A can complete the job in 30 days.

\therefore A's 1 day's work = $\frac{1}{30}$. Remaining work = $\left(1 - \frac{5}{7}\right) = \frac{2}{7}$.

II. B can complete the job in 40 days.

\therefore B's 1 day's work = $\frac{1}{40}$.

III. B takes 10 days more than A to complete the job.

I and II gives, (A + B)'s 1 day's work = $\left(\frac{1}{30} + \frac{1}{40}\right) = \frac{7}{120}$.

\therefore I and III also give the same answer.

II and III also give the same answer.

\therefore Correct answer is (d).

6. I. A can complete the job in 8 days. So, A's 1 day's work = $\frac{1}{8}$.

II. A works for 5 days, B works for 6 days and the work is completed.

III. B can complete the job in 16 days. So, B's 1 day's work = $\frac{1}{16}$.

I and III : (A + B)'s 1 day's work = $\left(\frac{1}{8} + \frac{1}{16}\right) = \frac{3}{16}$.

\therefore Both can finish the work in $\frac{16}{3}$ days.

II and III : Suppose A takes x days to finish the work.

Then, $\frac{5}{x} + \frac{6}{16} = 1 \Rightarrow \frac{5}{x} = \left(1 - \frac{3}{8}\right) = \frac{5}{8} \Rightarrow x = 8$.

\therefore (A + B)'s 1 day's work = $\left(\frac{1}{8} + \frac{1}{16}\right) = \frac{3}{16}$.

\therefore Both can finish it in $\frac{16}{3}$ days.

I and II : A's 1 day's work = $\frac{1}{8}$. Suppose B takes x days to finish the work.

Then from II, $\left(5 \times \frac{1}{8} + 6 \times \frac{1}{x} = 1\right) \Rightarrow \frac{6}{x} = \left(1 - \frac{5}{8}\right) = \frac{3}{8} \Rightarrow x = \left(\frac{8 \times 6}{3}\right) = 16$.

\therefore (A + B)'s 1 day's work = $\left(\frac{1}{8} + \frac{1}{16}\right) = \frac{3}{16}$.

\therefore Both can finish it in $\frac{16}{3}$ days.

Hence, the correct answer is (c).

7. I. $\frac{20}{100}$ work can be completed by (8×8) workers in 1 day.

\Rightarrow Whole work can be completed by $(8 \times 8 \times 5)$ workers in 1 day

$$= \frac{8 \times 8 \times 5}{10} \text{ workers in 10 days} = 32 \text{ workers in 10 days.}$$

II. (20×16) workers can finish it in 1 day.

$$\Rightarrow \frac{(20 \times 16)}{10} \text{ workers can finish it in 10 days.}$$

\Rightarrow 32 workers can finish it in 10 days.

III. $\frac{1}{8}$ work can be completed by (8×5) workers in 1 day.

\Rightarrow Whole work can be completed by $(8 \times 5 \times 8)$ workers in 1 day

$$= \frac{8 \times 5 \times 8}{10} \text{ workers in 10 days} = 32 \text{ workers in 10 days.}$$

\therefore Any one of the three gives the answer.

\therefore Correct answer is (e).

8. Clearly, any two of the three will give two equations in x and y , which can be solved simultaneously.

\therefore Correct answer is (c).

[For example I and II together give $\left(6x + 5y = \frac{1}{6}, 3x + 4y = \frac{1}{10}\right)$.]

9. I. (10×6) men can complete the work in 1 day

$$\Rightarrow 1 \text{ man's 1 day's work} = \frac{1}{60}.$$

II. $\left(10 \times \frac{24}{7}\right)$ men + $\left(10 \times \frac{24}{7}\right)$ women can complete the work in 1 day.

$$\Rightarrow \left(\frac{240}{7}\right) \text{ men's 1 day work} + \left(\frac{240}{7}\right) \text{ women's 1 day work} = 1$$

$$\Rightarrow \left(\frac{240}{7} \times \frac{1}{60}\right) + \left(\frac{240}{7}\right) \text{ women's 1 day's work} = 1.$$

$$\Rightarrow \left(\frac{240}{7}\right) \text{ women's 1 day's work} = \left(1 - \frac{4}{7}\right) = \frac{3}{7}$$

$$\Rightarrow 10 \text{ women's 1 day's work} = \left(\frac{3}{7} \times \frac{7}{240} \times 10\right) = \frac{1}{8}.$$

So, 10 women can finish the work in 8 days.

III. $(10 \text{ men's work for 3 days}) + (10 \text{ women's work for 4 days}) = 1$

$$\Rightarrow (10 \times 3) \text{ men's 1 day's work} + (10 \times 4) \text{ women's 1 day's work} = 1$$

$$\Rightarrow 30 \text{ men's 1 day's work} + 40 \text{ women's 1 day's work} = 1.$$

Thus, I and III will give us the answer.

And, II and III will give us the answer.

\therefore Correct answer is (a).

10. I. (A + B)'s 1 day's work = $\frac{1}{6}$. (B + C)'s 1 day's work alone is more than $\frac{02}{001}$. I

II. (B + C)'s 1 day's work = $\frac{4}{15}$.

III. (A + C)'s 1 day's work = $\frac{3}{10}$.

Adding, we get 2 (A + B + C)'s 1 day's work = $\left(\frac{1}{6} + \frac{4}{15} + \frac{3}{10}\right) = \frac{22}{30}$

\Rightarrow (A + B + C)'s 1 day's work = $\left(\frac{1}{2} \times \frac{22}{30}\right) = \frac{11}{30}$.

Thus, A, B and C together can finish the work in $\frac{30}{11}$ days.

Hence I, II and III are necessary to answer the question.

\therefore Correct answer is (e).

11. Clearly, I only gives the answer.

Similarly, II only gives the answer.

And, III only gives the answer.

\therefore Correct answer is (d).

16. PIPES AND CISTERNS

IMPORTANT FACTS AND FORMULAE

1. Inlet : A pipe connected with a tank or a cistern or a reservoir, that fills it, is known as an inlet.

Outlet : A pipe connected with a tank or a cistern or a reservoir, emptying it, is known as an outlet.

2. (i) If a pipe can fill a tank in x hours, then :

$$\text{part filled in 1 hour} = \frac{1}{x}$$

(ii) If a pipe can empty a full tank in y hours, then :

$$\text{part emptied in 1 hour} = \frac{1}{y}$$

(iii) If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where $y > x$), then on opening both the pipes, the net part filled

$$\text{in 1 hour} = \left(\frac{1}{x} - \frac{1}{y} \right)$$

(iv) If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where $x > y$), then on opening both the pipes, the net part emptied

$$\text{in 1 hour} = \left(\frac{1}{y} - \frac{1}{x} \right)$$

SOLVED EXAMPLES

Ex. 1. Two pipes A and B can fill a tank in 36 hours and 45 hours respectively. If both the pipes are opened simultaneously, how much time will be taken to fill the tank?

Sol. Part filled by A in 1 hour = $\frac{1}{36}$; Part filled by B in 1 hour = $\frac{1}{45}$.

$$\text{Part filled by } (A + B) \text{ in 1 hour} = \left(\frac{1}{36} + \frac{1}{45} \right) = \frac{9}{180} = \frac{1}{20}$$

Hence, both the pipes together will fill the tank in 20 hours.

Ex. 2. Two pipes can fill a tank in 10 hours and 12 hours respectively while a third pipe empties the full tank in 20 hours. If all the three pipes operate simultaneously, in how much time will the tank be filled ?

Sol. Net part filled in 1 hour = $\left(\frac{1}{10} + \frac{1}{12} - \frac{1}{20} \right) = \frac{8}{60} = \frac{2}{15}$

$$\therefore \text{The tank will be full in } \frac{15}{2} \text{ hrs} = 7 \text{ hrs } 30 \text{ min.}$$

Ex. 3. If two pipes function simultaneously, the reservoir will be filled in 12 hours. One pipe fills the reservoir 10 hours faster than the other. How many hours does it take the second pipe to fill the reservoir ?

Sol. Let the reservoir be filled by first pipe in x hours.

Then, second pipe will fill it in $(x + 10)$ hours.

$$\begin{aligned} \therefore \frac{1}{x} + \frac{1}{(x+10)} &= \frac{1}{12} \quad \Leftrightarrow \quad \frac{x+10+x}{x(x+10)} = \frac{1}{12} \\ \Leftrightarrow x^2 - 14x - 120 &= 0 \quad \Leftrightarrow (x-20)(x+6) = 0 \\ \Leftrightarrow x &= 20. \end{aligned}$$

[neglecting the -ve value of x]

So, the second pipe will take $(20 + 10)$ hrs i.e., 30 hrs to fill the reservoir.

Ex. 4. A cistern has two taps which fill it in 12 minutes and 15 minutes respectively. There is also a waste pipe in the cistern. When all the three are opened, the empty cistern is full in 20 minutes. How long will the waste pipe take to empty the full cistern?

Sol. Work done by the waste pipe in 1 minute

$$= \frac{1}{20} - \left(\frac{1}{12} + \frac{1}{15} \right) = \frac{1}{10}$$

[- ve sign means emptying]

∴ Waste pipe will empty the full cistern in 10 minutes.

Ex. 5. An electric pump can fill a tank in 3 hours. Because of a leak in the tank, it took $3\frac{1}{2}$ hours to fill the tank. If the tank is full, how much time will the leak take to empty it?

$$\text{Sol. Work done by the leak in 1 hour} = \left[\frac{1}{3} - \frac{1}{\left(\frac{7}{2}\right)} \right] = \left(\frac{1}{3} - \frac{2}{7} \right) = \frac{1}{21}$$

∴ The leak will empty the tank in 21 hours.

Ex. 6. Two pipes can fill a cistern in 14 hours and 16 hours respectively. The pipes are opened simultaneously and it is found that due to leakage in the bottom it took 32 minutes more to fill the cistern. When the cistern is full, in what time will the leak empty it?

$$\text{Sol. Work done by the two pipes in 1 hour} = \left(\frac{1}{14} + \frac{1}{16} \right) = \frac{15}{112}$$

∴ Time taken by these pipes to fill the tank = $\frac{112}{15}$ hrs = 7 hrs 28 min.

Due to leakage, time taken = 7 hrs 28 min + 32 min = 8 hrs

$$\therefore \text{Work done by (two pipes + leak) in 1 hour} = \frac{1}{8}$$

$$\text{Work done by the leak in 1 hour} = \left(\frac{15}{112} - \frac{1}{8} \right) = \frac{1}{112}$$

∴ Leak will empty the full cistern in 112 hours.

Ex. 7. Two pipes A and B can fill a tank in 36 min. and 45 min. respectively. A water pipe C can empty the tank in 30 min. First A and B are opened. After 7 minutes, C is also opened. In how much time, the tank is full?

$$\text{Sol. Part filled in 7 min.} = 7 \left(\frac{1}{36} + \frac{1}{45} \right) = \frac{7}{20}$$

$$\text{Remaining part} = \left(1 - \frac{7}{20} \right) = \frac{13}{20}$$

Net part filled in 1 min. when A, B and C are opened = $\left(\frac{1}{36} + \frac{1}{45} - \frac{1}{30}\right) = \frac{1}{60}$.

Now, $\frac{1}{60}$ part is filled in 1 min.

$\frac{13}{20}$ part is filled in $\left(60 \times \frac{13}{20}\right) = 39$ min.

Total time taken to fill the tank = $(39 + 7)$ min. = 46 min.

Ex. 8. Two pipes A and B can fill a tank in 24 min. and 32 min. respectively. If both the pipes are opened simultaneously, after how much time B should be closed so that the tank is full in 18 minutes?

Sol. Let B be closed after x minutes. Then,

part filled by $(A + B)$ in x min. + part filled by A in $(18 - x)$ min. = 1

$$\therefore x\left(\frac{1}{24} + \frac{1}{32}\right) + (18 - x) \times \frac{1}{24} = 1 \Leftrightarrow \frac{7x}{96} + \frac{18 - x}{24} = 1$$

$$\Leftrightarrow 7x + 4(18 - x) = 96 \Leftrightarrow x = 8.$$

Hence, B must be closed after 8 minutes.

EXERCISE 16A

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer :

- Two pipes A and B can fill a tank in 20 and 30 minutes respectively. If both the pipes are used together, then how long will it take to fill the tank? (M.A.T. 2003)
(a) 12 min (b) 15 min (c) 25 min (d) 50 min
- A cistern can be filled by a tap in 4 hours while it can be emptied by another tap in 9 hours. If both the taps are opened simultaneously, then after how much time will the cistern get filled? (Hotel Management, 1997)
(a) 4.5 hrs (b) 5 hrs (c) 6.5 hrs (d) 7.2 hrs
- A tap can fill a tank in 6 hours. After half the tank is filled, three more similar taps are opened. What is the total time taken to fill the tank completely?
(a) 3 hrs 15 min (b) 3 hrs 45 min (c) 4 hrs (d) 4 hrs 15 min
(S.S.C. 2003)
- A water tank is two-fifth full. Pipe A can fill a tank in 10 minutes and pipe B can empty it in 6 minutes. If both the pipes are open, how long will it take to empty or fill the tank completely? (Bank P.O. 1999)
(a) 6 min. to empty (b) 6 min. to fill (c) 9 min. to empty
(d) 9 min. to fill (e) None of these
- Pipe A can fill a tank in 5 hours, pipe B in 10 hours and pipe C in 30 hours. If all the pipes are open, in how many hours will the tank be filled? (C.B.I. 1997)
(a) 2 (b) 2.5 (c) 3 (d) 3.5
- Pipes A and B can fill a tank in 5 and 6 hours respectively. Pipe C can empty it in 12 hours. If all the three pipes are opened together, then the tank will be filled in:
(a) $1\frac{13}{17}$ hours (b) $2\frac{8}{11}$ hours (c) $3\frac{9}{17}$ hours (d) $4\frac{1}{2}$ hours
(Bank P.O. 2002)

7. Three pipes A, B and C can fill a tank from empty to full in 30 minutes, 20 minutes and 10 minutes respectively. When the tank is empty, all the three pipes are opened. A, B and C discharge chemical solutions P, Q and R respectively. What is the proportion of solution R in the liquid in the tank after 3 minutes ? (D.M.R.C. 2003)

(a) $\frac{5}{11}$ (b) $\frac{6}{11}$ (c) $\frac{7}{11}$ (d) $\frac{8}{11}$

8. Two pipes A and B can separately fill a cistern in 60 minutes and 75 minutes respectively. There is a third pipe in the bottom of the cistern to empty it. If all the three pipes are simultaneously opened, then the cistern is full in 50 minutes. In how much time, the third pipe alone can empty the cistern ? (S.S.C. 2003)

(a) 90 min (b) 100 min (c) 110 min (d) 120 min

9. A pump can fill a tank with water in 2 hours. Because of a leak, it took $2\frac{1}{3}$ hours to fill the tank. The leak can drain all the water of the tank in : (S.S.C. 2002)

(a) $4\frac{1}{3}$ hrs (b) 7 hrs (c) 8 hrs (d) 14 hrs

10. Two taps A and B can fill a tank in 5 hours and 20 hours respectively. If both the taps are open then due to a leakage, it took 30 minutes more to fill the tank. If the tank is full, how long will it take for the leakage alone to empty the tank ?

(a) $4\frac{1}{2}$ hrs (b) 9 hrs (c) 18 hrs (d) 36 hrs

11. Two pipes A and B together can fill a cistern in 4 hours. Had they been opened separately, then B would have taken 6 hours more than A to fill the cistern. How much time will be taken by A to fill the cistern separately ? (NABARD, 2001)

(a) 1 hr (b) 2 hrs (c) 6 hrs (d) 8 hrs.

12. One pipe can fill a tank three times as fast as another pipe. If together the two pipes can fill the tank in 36 minutes, then the slower pipe alone will be able to fill the tank in : (C.B.I. 2003)

(a) 81 min (b) 108 min (c) 144 min (d) 192 min

13. A tank is filled in 5 hours by three pipes A, B and C. The pipe C is twice as fast as B and B is twice as fast as A. How much time will pipe A alone take to fill the tank ?

(a) 20 hrs (b) 25 hrs (c) 35 hrs

(d) Cannot be determined (e) None of these (Bank P.O. 2003)

14. A tank is filled by three pipes with uniform flow. The first two pipes operating simultaneously fill the tank in the same time during which the tank is filled by the third pipe alone. The second pipe fills the tank 5 hours faster than the first pipe and 4 hours slower than the third pipe. The time required by the first pipe is :

(a) 6 hrs (b) 10 hrs (c) 15 hrs (d) 30 hrs

- (M.B.A. 2002)

15. 12 buckets of water fill a tank when the capacity of each tank is 13.5 litres. How many buckets will be needed to fill the same tank, if the capacity of each bucket is 9 litres ?

(a) 8 (b) 15 (c) 16 (d) 18

16. Bucket P has thrice the capacity as bucket Q. It takes 60 turns for bucket P to fill the empty drum. How many turns it will take for both the buckets P and Q, having each turn together to fill the empty drum ?

(a) 30 (b) 40 (c) 45 (d) 90

17. Two pipes A and B can fill a tank in 12 minutes and 15 minutes respectively. If both the taps are opened simultaneously, and the tap A is closed after 3 minutes, then how much more time will it take to fill the tank by tap B ?

(a) 7 min 15 sec (b) 7 min 45 sec (c) 8 min 5 sec (d) 8 min 15 sec

18. Two pipes A and B can fill a tank in 15 minutes and 20 minutes respectively. Both the pipes are opened together but after 4 minutes, pipe A is turned off. What is the total time required to fill the tank ?
 (U.P.S.C. 2002)
 (a) 10 min 20 sec (b) 11 min 45 sec (c) 12 min 30 sec (d) 14 min 40 sec
19. Two pipes A and B can fill a tank in 15 hours and 20 hours respectively while a third pipe C can empty the full tank in 25 hours. All the three pipes are opened in the beginning. After 10 hours, C is closed. In how much time, will the tank be full ?
 (a) 12 hrs (b) 13 hrs (c) 16 hrs (d) 18 hrs
20. A large tanker can be filled by two pipes A and B in 60 minutes and 40 minutes respectively. How many minutes will it take to fill the tanker from empty state if B is used for half the time and A and B fill it together for the other half ?
 (a) 15 min (b) 20 min (c) 27.5 min (d) 30 min
 (D.M.R.C. 2003)
21. Two pipes A and B can fill a cistern in 12 minutes and 15 minutes respectively while a third pipe C can empty the full tank in 6 minutes. A and B are kept open for 5 minutes in the beginning and then C is also opened. In what time is the cistern emptied ?
 (a) 30 min (b) 33 min (c) $37\frac{1}{2}$ min (d) 45 min
22. Two pipes A and B can fill a tank in 6 hours and 4 hours respectively. If they are opened on alternate hours and if pipe A is opened first, in how many hours, the tank shall be full ?
 (a) 4 (b) $4\frac{1}{2}$ (c) 5 (d) $5\frac{1}{2}$
23. Three taps A, B and C can fill a tank in 12, 15 and 20 hours respectively. If A is open all the time and B and C are open for one hour each alternately, the tank will be full in :
 (S.S.C. 1999)
 (a) 6 hrs (b) $6\frac{2}{3}$ hrs (c) 5 (d) $7\frac{1}{2}$ hrs
24. A booster pump can be used for filling as well as for emptying a tank. The capacity of the tank is 2400 m^3 . The emptying capacity of the tank is 10 m^3 per minute higher than its filling capacity and the pump needs 8 minutes lesser to empty the tank than it needs to fill it. What is the filling capacity of the pump ?
 (a) $50 \text{ m}^3/\text{min}$ (b) $60 \text{ m}^3/\text{min}$ (c) $72 \text{ m}^3/\text{min}$ (d) None of these
25. A leak in the bottom of a tank can empty the full tank in 8 hours. An inlet pipe fills water at the rate of 6 litres a minute. When the tank is full, the inlet is opened and due to the leak, the tank is empty in 12 hours. How many litres does the cistern hold ?
 (a) 7580 (b) 7960 (c) 8290 (d) 8640
26. Two pipes can fill a tank in 20 and 24 minutes respectively and a waste pipe can empty 3 gallons per minute. All the three pipes working together can fill the tank in 15 minutes. The capacity of the tank is :
 (Bank P.O. 2001)
 (a) 60 gallons (b) 100 gallons (c) 120 gallons (d) 180 gallons
27. Two pipes A and B can fill a cistern in $37\frac{1}{2}$ minutes and 45 minutes respectively. Both pipes are opened. The cistern will be filled in just half an hour, if the pipe B is turned off after :
 (S.S.C. 2004)
 (a) 5 min (b) 9 min (c) 10 min (d) 15 min
28. Three pipes A, B and C can fill a tank in 6 hours. After working at it together for 2 hours, C is closed and A and B can fill the remaining part in 7 hours. The number of hours taken by C alone to fill the tank is :
 (L.I.C.A.A.O. 2003)
 (a) 10 (b) 12 (c) 14 (d) 16

ANSWERS

- (1) (a) (2) (d) (3) (b) (4) (a) (5) (c) (6) (e) (7) (b) (8) (b)
 (9) (d) (10) (d) (11) (c) (12) (c) (13) (c) (14) (c) (15) (d) (16) (c)
 (17) (d) (18) (d) (19) (a) (20) (d) (21) (d) (22) (c) (23) (c) (24) (a)
 (25) (d) (26) (c) (27) (b) (28) (c)

SOLUTIONS

1. Part filled by A in 1 min. = $\frac{1}{20}$; Part filled by B in 1 min. = $\frac{1}{30}$.

$$\text{Part filled by } (A + B) \text{ in 1 min.} = \left(\frac{1}{20} + \frac{1}{30} \right) = \frac{1}{12}.$$

\therefore Both the pipes can fill the tank in 12 minutes.

$$2. \text{Net part filled in 1 hour} = \left(\frac{1}{4} - \frac{1}{9} \right) = \frac{5}{36}.$$

\therefore The cistern will be filled in $\frac{36}{5}$ hrs i.e., 7.2 hrs.

3. Time taken by one tap to fill half the tank = 3 hrs.

$$\text{Part filled by the four taps in 1 hour} = \left(4 \times \frac{1}{6} \right) = \frac{2}{3}.$$

$$\text{Remaining part} = \left(1 - \frac{1}{2} \right) = \frac{1}{2}.$$

$$\therefore \frac{2}{3} : \frac{1}{2} :: 1 : x \quad \text{or} \quad x = \left(\frac{1}{2} \times 1 \times \frac{3}{2} \right) = \frac{3}{4} \text{ hrs i.e., 45 mins.}$$

So, total time taken = 3 hrs 45 min.

4. Clearly, pipe B is faster than pipe A and so, the tank will be emptied.

$$\text{Part to be emptied} = \frac{2}{5}.$$

$$\text{Part emptied by } (A + B) \text{ in 1 minute} = \left(\frac{1}{6} - \frac{1}{10} \right) = \frac{1}{15}.$$

$$\therefore \frac{1}{15} : \frac{2}{5} :: 1 : x \quad \text{or} \quad x = \left(\frac{2}{5} \times 1 \times 15 \right) = 6 \text{ min.}$$

So, the tank will be emptied in 6 min.

5. Part filled by $(A + B + C)$ in 1 hour = $\left(\frac{1}{5} + \frac{1}{10} + \frac{1}{30} \right) = \frac{1}{3}$.

All the three pipes together will fill the tank in 3 hours.

6. Net part filled in 1 hour = $\left(\frac{1}{5} + \frac{1}{6} - \frac{1}{12} \right) = \frac{17}{60}.$

The tank will be full in $\frac{60}{17}$ hrs i.e., $3\frac{9}{17}$ hrs.

7. Part filled by $(A + B + C)$ in 3 minutes = $3 \left(\frac{1}{30} + \frac{1}{20} + \frac{1}{10} \right) = \left(3 \times \frac{11}{60} \right) = \frac{11}{20}.$

Part filled by C in 3 minutes = $\frac{3}{10}$.

\therefore Required ratio = $\left(\frac{3}{10} \times \frac{20}{11}\right) = \frac{6}{11}$.

8. Work done by the third pipe in 1 min.

$$= \frac{1}{50} - \left(\frac{1}{60} + \frac{1}{75}\right) = \left(\frac{1}{50} - \frac{3}{100}\right) = -\frac{1}{100}. \quad (-ve \text{ sign means emptying})$$

\therefore The third pipe alone can empty the cistern in 100 min.

9. Work done by the leak in 1 hour = $\left(\frac{1}{2} - \frac{3}{7}\right) = \frac{1}{14}$.

\therefore Leak will empty the tank in 14 hrs.

10. Part filled by (A + B) in 1 hour = $\left(\frac{1}{5} + \frac{1}{20}\right) = \frac{1}{4}$.

So, A and B together can fill the tank in 4 hours.

Work done by the leak in 1 hour = $\left(\frac{1}{4} - \frac{2}{9}\right) = \frac{1}{36}$.

\therefore Leak will empty the tank in 36 hrs.

11. Let the cistern be filled by pipe A alone in x hours.

Then, pipe B will fill it in $(x + 6)$ hours.

$$\begin{aligned} \therefore \frac{1}{x} + \frac{1}{(x+6)} &= \frac{1}{4} \quad \Leftrightarrow \quad \frac{x+6+x}{x(x+6)} = \frac{1}{4} \\ \Leftrightarrow x^2 - 2x - 24 &= 0 \quad \Leftrightarrow \quad (x-6)(x+4) = 0 \\ \Leftrightarrow x &= 6. \end{aligned} \quad [\text{neglecting the } -ve \text{ value of } x]$$

12. Let the slower pipe alone fill the tank in x minutes.

Then, faster pipe will fill it in $\frac{x}{3}$ minutes.

$$\therefore \frac{1}{x} + \frac{3}{x} = \frac{1}{36} \quad \Leftrightarrow \quad \frac{4}{x} = \frac{1}{36} \quad \Leftrightarrow \quad x = 144 \text{ min.}$$

13. Suppose pipe A alone takes x hours to fill the tank.

Then, pipes B and C will take $\frac{x}{2}$ and $\frac{x}{4}$ hours respectively to fill the tank.

$$\therefore \frac{1}{x} + \frac{2}{x} + \frac{4}{x} = \frac{1}{5} \quad \Leftrightarrow \quad \frac{7}{x} = \frac{1}{5} \quad \Leftrightarrow \quad x = 35 \text{ hrs.}$$

14. Suppose, first pipe alone takes x hours to fill the tank. Then, second and third pipes will take $(x-5)$ and $(x-9)$ hours respectively to fill the tank.

$$\begin{aligned} \therefore \frac{1}{x} + \frac{1}{(x-5)} &= \frac{1}{(x-9)} \quad \Leftrightarrow \quad \frac{x-5+x}{x(x-5)} = \frac{1}{(x-9)} \\ \Leftrightarrow (2x-5)(x-9) &= x(x-5) \quad \Leftrightarrow \quad x^2 - 18x + 45 = 0 \\ \Leftrightarrow (x-15)(x-3) &= 0 \quad \Leftrightarrow \quad x = 15. \end{aligned} \quad [\text{neglecting } x = 3]$$

15. Capacity of the tank = (12×13.5) litres = 162 litres.

Capacity of each bucket = 9 litres.

$$\text{Number of buckets needed} = \left(\frac{162}{9}\right) = 18.$$

16. Let capacity of P be x litres. Then, capacity of Q = $\frac{x}{3}$ litres.

Capacity of the drum = $60x$ litres.

$$\text{Required number of turns} = \frac{60x}{x + \frac{x}{3}} = \left(60x \times \frac{3}{4x} \right) = 45.$$

17. Part filled in 3 min. = $3\left(\frac{1}{12} + \frac{1}{15}\right) = \left(3 \times \frac{9}{60}\right) = \frac{9}{20}.$

$$\text{Remaining part} = \left(1 - \frac{9}{20}\right) = \frac{11}{20}.$$

$$\text{Part filled by B in 1 min.} = \frac{1}{15},$$

$$\frac{1}{15} : \frac{11}{20} :: 1 : x \quad \text{or} \quad x = \left(\frac{11}{20} \times 1 \times 15\right) = 8\frac{1}{4} \text{ min.} = 8 \text{ min. } 15 \text{ sec.}$$

\therefore Remaining part is filled by B in 8 min. 15 sec.

18. Part filled in 4 minutes = $4\left(\frac{1}{15} + \frac{1}{20}\right) = \frac{7}{15}.$

$$\text{Remaining part} = \left(1 - \frac{7}{15}\right) = \frac{8}{15}.$$

$$\text{Part filled by B in 1 minute} = \frac{1}{20},$$

$$\frac{1}{20} : \frac{8}{15} :: 1 : x \quad \text{or} \quad x = \left(\frac{8}{15} \times 1 \times 20\right) = 10\frac{2}{3} \text{ min.} = 10 \text{ min. } 40 \text{ sec.}$$

\therefore The tank will be full in (4 min. + 10 min. 40 sec) = 14 min. 40 sec.

19. Part filled in 10 hours = $10\left(\frac{1}{15} + \frac{1}{20} - \frac{1}{25}\right) = \frac{23}{30}.$

$$\text{Remaining part} = \left(1 - \frac{23}{30}\right) = \frac{7}{30}.$$

$$(A + B)'s 1 \text{ hour's work} = \left(\frac{1}{15} + \frac{1}{20}\right) = \frac{7}{60}.$$

$$\frac{7}{60} : \frac{7}{30} :: 1 : x \quad \text{or} \quad x = \left(\frac{7}{30} \times 1 \times \frac{60}{7}\right) = 2 \text{ hours.}$$

\therefore The tank will be full in (10 + 2) hrs = 12 hrs.

20. Part filled by (A + B) in 1 minute = $\left(\frac{1}{60} + \frac{1}{40}\right) = \frac{1}{24}.$

Suppose the tank is filled in x minutes.

$$\text{Then, } \frac{x}{2} \left(\frac{1}{24} + \frac{1}{40}\right) = 1 \quad \Leftrightarrow \quad \frac{x}{2} \times \frac{1}{15} = 1 \quad \Leftrightarrow \quad x = 30 \text{ min.}$$

21. Part filled in 5 min. = $5\left(\frac{1}{12} + \frac{1}{15}\right) = \left(5 \times \frac{9}{60}\right) = \frac{3}{4}.$

Part emptied in 1 min. when all the pipes are opened

$$= \frac{1}{6} - \left(\frac{1}{12} + \frac{1}{15}\right) = \left(\frac{1}{6} - \frac{3}{20}\right) = \frac{1}{60}.$$

Now, $\frac{1}{60}$ part is emptied in 1 min.

$\therefore \frac{3}{4}$ part will be emptied in $(60 \times \frac{3}{4}) = 45$ min.

$$22. A's \text{ work in 1 hour} = \frac{1}{6}, B's \text{ work in 1 hour} = \frac{1}{4}.$$

$$(A + B)'s \text{ 2 hour's work when opened alternately} = \left(\frac{1}{6} + \frac{1}{4} \right) = \frac{5}{12}.$$

$$(A + B)'s \text{ 4 hour's work when opened alternately} = \frac{10}{12} = \frac{5}{6}.$$

$$\text{Remaining part} = \left(1 - \frac{5}{6} \right) = \frac{1}{6}.$$

Now, it is A's turn and $\frac{1}{6}$ part is filled by A in 1 hour.

\therefore Total time taken to fill the tank = (4 + 1) hrs = 5 hrs.

$$23. (A + B)'s \text{ 1 hour's work} = \left(\frac{1}{12} + \frac{1}{15} \right) = \frac{9}{60} = \frac{3}{20}.$$

$$(A + C)'s \text{ 1 hour's work} = \left(\frac{1}{12} + \frac{1}{20} \right) = \frac{8}{60} = \frac{2}{15}.$$

$$\text{Part filled in 2 hrs} = \left(\frac{3}{20} + \frac{2}{15} \right) = \frac{17}{60}; \text{ Part filled in 6 hrs} = \left(3 \times \frac{17}{60} \right) = \frac{17}{20}.$$

$$\text{Remaining part} = \left(1 - \frac{17}{20} \right) = \frac{3}{20}.$$

Now, it is the turn of A and B and $\frac{3}{20}$ part is filled by A and B in 1 hour.

\therefore Total time taken to fill the tank = (6 + 1) hrs = 7 hrs.

24. Let the filling capacity of the pump be $x \text{ m}^3/\text{min.}$

Then, emptying capacity of the pump = $(x + 10) \text{ m}^3/\text{min.}$

$$\text{So, } \frac{2400}{x} - \frac{2400}{(x+10)} = 8 \Leftrightarrow x^2 + 10x - 3000 = 0$$

$$\Leftrightarrow (x - 50)(x + 60) = 0 \Leftrightarrow x = 50. \quad [\text{neglecting the -ve value of } x]$$

$$25. \text{Work done by the inlet in 1 hour} = \left(\frac{1}{8} - \frac{1}{12} \right) = \frac{1}{24}.$$

$$\text{Work done by the inlet in 1 min.} = \left(\frac{1}{24} \times \frac{1}{60} \right) = \frac{1}{1440}.$$

$$\therefore \text{Volume of } \frac{1}{1440} \text{ part} = 6 \text{ litres.}$$

$$\therefore \text{Volume of whole} = (1440 \times 6) \text{ litres} = 8640 \text{ litres.}$$

26. Work done by the waste pipe in 1 minute

$$= \frac{1}{15} - \left(\frac{1}{20} + \frac{1}{24} \right) = \left(\frac{1}{15} - \frac{11}{120} \right) = -\frac{1}{40}. \quad [-\text{ve sign means emptying}]$$

$$\therefore \text{Volume of } \frac{1}{40} \text{ part} = 3 \text{ gallons.}$$

$$\therefore \text{Volume of whole} = (3 \times 40) \text{ gallons} = 120 \text{ gallons.}$$

27. Let B be turned off after x minutes. Then,

Part filled by $(A + B)$ in x min. + Part filled by A in $(30 - x)$ min. = 1.

$$\therefore x \left(\frac{2}{75} + \frac{1}{45} \right) + (30 - x) \cdot \frac{2}{75} = 1$$

$$\Leftrightarrow \frac{11x}{225} + \frac{(60 - 2x)}{75} = 1 \Leftrightarrow 11x + 180 - 6x = 225 \Leftrightarrow x = 9.$$

28. Part filled in 2 hours = $\frac{2}{6} = \frac{1}{3}$, Remaining part = $\left(1 - \frac{1}{3}\right) = \frac{2}{3}$

$\therefore (A + B)$'s 7 hour's work = $\frac{2}{3}$; $(A + B)$'s 1 hour's work = $\frac{2}{21}$.

$$\therefore C$$
's 1 hour's work = $[(A + B + C)$'s 1 hour's work - $(A + B)$'s 1 hour's work] \\ = \left(\frac{1}{6} - \frac{2}{21} \right) = \frac{1}{14}

$\therefore C$ alone can fill the tank in 14 hours.

EXERCISE 16B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (Questions 1 to 4) : Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the given question. Read both the statements and

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

- How long will it take to empty the tank if both the inlet pipe A and the outlet pipe B are opened simultaneously ?
 - A can fill the tank in 16 minutes.
 - B can empty the full tank in 8 minutes.
- Two taps A and B, when opened together, can fill a tank in 6 hours. How long will it take for the pipe A alone to fill the tank ?
 - B alone takes 5 hours more than A to fill the tank.
 - The ratio of the time taken by A to that taken by B to fill the tank is 2 : 3.
- A tank is fitted with two inlet pipes A and B. Both the pipes are kept open for 10 minutes so that the tank is two-thirds full and then pipe A is closed. How much time will B take to fill the remaining part of the tank ?
 - Pipe A is thrice as fast as pipe B.
 - Pipe B alone can fill the tank in 60 minutes.
- How much time will the leak take to empty the full cistern ?
 - The cistern is normally filled in 9 hours.
 - It takes one hour more than the usual time to fill the cistern because of a leak in the bottom.

Directions (Questions 5-6) : Each of the questions below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question:

ANSWERS

1. (c) 2. (c) 3. (c) 4. (c) 5. (c) 6. (b)

SOLUTIONS

- I. A's 1 minute's filling work = $\frac{1}{16}$.
II. B's 1 minute's emptying work = $\frac{1}{8}$.
(A + B)'s 1 minute's emptying work = $\left(\frac{1}{8} - \frac{1}{16}\right) = \frac{1}{16}$.
∴ Tank will be emptied in 16 minutes.
Thus, both I and II are necessary to answer the question.
∴ Correct answer is (e).

- $$\begin{aligned}2. \quad & (A + B)'s \text{ 1 hour filling work} = \frac{1}{6}. \\& \text{I. Suppose A takes } x \text{ hours to fill the tank.} \\& \text{Then, B takes } (x + 5) \text{ hours to fill the tank.} \\& \therefore (A's \text{ 1 hour work}) + (B's \text{ 1 hour work}) = (A + B)'s \text{ 1 hour work} \\& \Leftrightarrow \frac{1}{x} + \frac{1}{(x + 5)} = \frac{1}{6} \quad \Leftrightarrow \frac{(x + 5) + x}{x(x + 5)} = \frac{1}{6} \\& \Leftrightarrow x^2 - 5x = 12x + 30 \quad \Leftrightarrow x^2 - 7x - 30 = 0 \\& \Leftrightarrow x^2 - 10x + 3x - 30 = 0 \quad \Leftrightarrow x(x - 10) + 3(x - 10) = 0 \\& \Leftrightarrow (x - 10)(x + 3) = 0 \quad \Leftrightarrow x = 10. \\& \text{So, A alone takes 10 hours to fill the tank.}\end{aligned}$$

II. Suppose A takes $2x$ hours and B takes $3x$ hours to fill the tank. Then,

$$\frac{1}{2x} + \frac{1}{3x} = \frac{1}{6} \Leftrightarrow \left(\frac{1}{2} + \frac{1}{3}\right) \cdot \frac{1}{x} = \frac{1}{6} \Leftrightarrow \frac{5}{6x} = \frac{1}{6} \Leftrightarrow x = 5.$$

So, A alone takes $(2 \times 5) = 10$ hours to fill the tank.

Thus, each one of I and II gives the answer.

∴ Correct answer is (c).

3. I. Let B's 1 min. work = $\frac{1}{x}$. Then, A's 1 min. work = $\frac{3}{x}$.

$$(A+B)'s 1 \text{ min. work} = \left(\frac{1}{x} + \frac{3}{x}\right) = \frac{4}{x}. \quad (\text{since B has 1 hr})$$

$$(A+B)'s 10 \text{ min. work} = \left(\frac{4}{x} \times 10\right) = \frac{40}{x}. \quad (\text{since B has 1 hr})$$

$$\therefore \frac{40}{x} = \frac{2}{3} \Leftrightarrow x = 60. \quad (\text{since B has 1 hr})$$

$$\therefore B's 1 \text{ min. work} = \frac{1}{60}. \quad (\text{since B has 1 hr})$$

$\frac{1}{60}$ part is filled by B in 1 min.

$\frac{1}{3}$ part is filled by B in $\left(60 \times \frac{1}{3}\right)$ min. = 20 min.

II. B's 1 min. work = $\frac{1}{60}$.

$\frac{1}{60}$ part is filled by B in 1 min.

$\frac{1}{3}$ part is filled by B in $\left(60 \times \frac{1}{3}\right)$ min. = 20 min.

Hence, the correct answer is (c).

4. I. Time taken to fill the cistern without leak = 9 hours.

$$\text{Part of cistern filled without leak in 1 hour} = \frac{1}{9}.$$

II. Time taken to fill the cistern in presence of leak = 10 hours.

$$\text{Net filling in 1 hour} = \frac{1}{10}.$$

$$\text{Work done by leak in 1 hour} = \left(\frac{1}{9} - \frac{1}{10}\right) = \frac{1}{90}.$$

∴ Leak will empty the full cistern in 90 hours.

Clearly, both I and II are necessary to answer the question.

∴ Correct answer is (e).

5. II. A's 1 hour work = $\frac{1}{16}$.

Suppose B fills the tank in x hours. Then, B's 1 hour work = $\frac{1}{x}$.

$$\text{I. Work done by A in 1 hour} = 150\% \text{ of } \frac{1}{x} = \left(\frac{1}{x} \times \frac{150}{100}\right) = \frac{3}{2x}.$$

$$\therefore \frac{3}{2x} = \frac{1}{16} \Leftrightarrow x = 24.$$

So, B can fill the tank in 24 hours.

$$(A + B)'s 1 \text{ hour work} = \left(\frac{1}{16} + \frac{1}{24} \right) = \frac{5}{48}.$$

$$\therefore (A + B) \text{ can fill the tank in } \frac{48}{5} \text{ hrs.}$$

Thus, I & II give the answer.

$$\text{III. Work done by B in 1 hour} = \frac{1}{24}.$$

From II & III, we get the same answer.

From III & I, we get :

$$A's 1 \text{ hour work} = 150\% \text{ of } \frac{1}{24} = \left(\frac{1}{24} \times \frac{150}{100} \right) = \frac{1}{16}.$$

Thus, from III & I, we get the same answer.

\therefore Correct answer is (e).

$$6. \text{ II. Part of the tank filled by A in 1 hour} = \frac{1}{4}.$$

$$\text{III. Part of the tank filled by B in 1 hour} = \frac{1}{6}.$$

$$(A + B)'s 1 \text{ hour's work} = \left(\frac{1}{4} + \frac{1}{6} \right) = \frac{5}{12}.$$

\therefore When both A and B are opened together, they will fill the tank in $\frac{12}{5}$ hrs = 2 hrs 24 min.

So, II and III are needed.

\therefore Correct answer is (b).

17. TIME AND DISTANCE

IMPORTANT FACTS AND FORMULAE

1. Speed = $\left(\frac{\text{Distance}}{\text{Time}}\right)$, Time = $\left(\frac{\text{Distance}}{\text{Speed}}\right)$, Distance = (Speed \times Time)
2. $x \text{ km/hr} = \left(x \times \frac{5}{18}\right) \text{ m/sec}$
3. $x \text{ m/sec} = \left(x \times \frac{18}{5}\right) \text{ km/hr}$
4. If the ratio of the speeds of A and B is $a : b$, then the ratio of the times taken by them to cover the same distance is $\frac{1}{a} : \frac{1}{b}$ or $b : a$.
5. Suppose a man covers a certain distance at $x \text{ km/hr}$ and an equal distance at $y \text{ km/hr}$. Then, the average speed during the whole journey is $\left(\frac{2xy}{x+y}\right) \text{ km/hr}$.

SOLVED EXAMPLES

Ex. 1. How many minutes does Aditya take to cover a distance of 400 m, if he runs at a speed of 20 km/hr ?
(Bank P.O. 2000)

Sol. Aditya's speed = 20 km/hr = $\left(20 \times \frac{5}{18}\right) \text{ m/sec} = \frac{50}{9} \text{ m/sec.}$

∴ Time taken to cover 400 m = $\left(400 \times \frac{9}{50}\right) \text{ sec} = 72 \text{ sec} = 1\frac{12}{60} \text{ min} = 1\frac{1}{5} \text{ min.}$

Ex. 2. A cyclist covers a distance of 750 m in 2 min 30 sec. What is the speed in km/hr of the cyclist ?
(R.R.B. 2002)

Sol. Speed = $\left(\frac{750}{150}\right) \text{ m/sec} = 5 \text{ m/sec} = \left(5 \times \frac{18}{5}\right) \text{ km/hr} = 18 \text{ km/hr.}$

Ex. 3. A dog takes 4 leaps for every 5 leaps of a hare but 3 leaps of a dog are equal to 4 leaps of the hare. Compare their speeds.

Sol. Let the distance covered in 1 leap of the dog be x and that covered in 1 leap of the hare be y .

Then, $3x = 4y \Rightarrow x = \frac{4}{3}y \Rightarrow 4x = \frac{16}{3}y.$

∴ Ratio of speeds of dog and hare = Ratio of distances covered by them in the same time
= $4x : 5y = \frac{16}{3}y : 5y = \frac{16}{3} : 5 = 16 : 15.$

Ex. 4. While covering a distance of 24 km, a man noticed that after walking for 1 hour and 40 minutes, the distance covered by him was $\frac{5}{7}$ of the remaining distance. What was his speed in metres per second ?
(R.R.B. 2002)

Sol. Let the speed be $x \text{ km/hr.}$

Then, distance covered in 1 hr 40 min. i.e., $1\frac{2}{3} \text{ hrs} = \frac{5x}{3} \text{ km.}$

$$\text{Remaining distance} = \left(24 - \frac{5x}{3}\right) \text{ km.}$$

$$\frac{5x}{3} = \frac{5}{7} \left(24 - \frac{5x}{3}\right) \Leftrightarrow \frac{5x}{3} = \frac{5}{7} \left(\frac{72 - 5x}{3}\right) \Leftrightarrow 7x = 72 - 5x$$

$$\Leftrightarrow 12x = 72 \Leftrightarrow x = 6$$

$$\text{Hence, speed} = 6 \text{ km/hr} = \left(6 \times \frac{5}{18}\right) \text{ m/sec} = \frac{5}{3} \text{ m/sec} = 1\frac{2}{3} \text{ m/sec.}$$

Ex. 5. Peter can cover a certain distance in 1 hr 24 min. by covering two-third of the distance at 4 kmph and the rest at 5 kmph. Find the total distance.

Sol. Let the total distance be x km. Then,

$$\frac{\frac{2}{3}x}{4} + \frac{\frac{1}{3}x}{5} = \frac{7}{5} \Leftrightarrow \frac{x}{6} + \frac{x}{15} = \frac{7}{5} \Leftrightarrow 7x = 42 \Leftrightarrow x = 6.$$

∴ Total distance = 6 km.

Ex. 6. A man travelled from the village to the post-office at the rate of 25 kmph and walked back at the rate of 4 kmph. If the whole journey took 5 hours 48 minutes, find the distance of the post-office from the village. (S.S.C. 2004)

$$\text{Sol. Average speed} = \left(\frac{2xy}{x+y}\right) \text{ km/hr} = \left(\frac{2 \times 25 \times 4}{25+4}\right) \text{ km/hr} = \frac{200}{29} \text{ km/hr.}$$

$$\text{Distance travelled in } 5 \text{ hours } 48 \text{ minutes i.e., } 5\frac{4}{5} \text{ hrs} = \left(\frac{200}{29} \times \frac{29}{5}\right) \text{ km} = 40 \text{ km.}$$

$$\therefore \text{Distance of the post-office from the village} = \left(\frac{40}{2}\right) = 20 \text{ km.}$$

Ex. 7. An aeroplane flies along the four sides of a square at the speeds of 200, 400, 600 and 800 km/hr. Find the average speed of the plane around the field.

Sol. Let each side of the square be x km and let the average speed of the plane around the field be y km/hr. Then,

$$\frac{x}{200} + \frac{x}{400} + \frac{x}{600} + \frac{x}{800} = \frac{4x}{y} \Leftrightarrow \frac{25x}{2400} = \frac{4x}{y} \Leftrightarrow y = \left(\frac{2400 \times 4}{25}\right) = 384.$$

∴ Average speed = 384 km/hr.

Ex. 8. Walking at $\frac{5}{6}$ of its usual speed, a train is 10 minutes too late. Find its usual time to cover the journey.

Sol. New speed = $\frac{5}{6}$ of the usual speed

∴ New time taken = $\frac{6}{5}$ of the usual time

$$\text{So, } \left(\frac{6}{5} \text{ of the usual time}\right) - (\text{usual time}) = 10 \text{ min.}$$

$$\Rightarrow \frac{1}{5} \text{ of the usual time} = 10 \text{ min.} \Rightarrow \text{usual time} = 50 \text{ min.}$$

Ex. 9. If a man walks at the rate of 5 kmph, he misses a train by 7 minutes. However, if he walks at the rate of 6 kmph, he reaches the station 5 minutes before the arrival of the train. Find the distance covered by him to reach the station.

Sol. Let the required distance be x km.

$$\text{Difference in the times taken at two speeds} = 12 \text{ min} = \frac{1}{5} \text{ hr.}$$

$$\therefore \frac{x}{5} - \frac{x}{6} = \frac{1}{5} \Leftrightarrow 6x - 5x = 6 \Leftrightarrow x = 6.$$

Hence, the required distance is 6 km.

Ex. 10. *A and B are two stations 390 km apart. A train starts from A at 10 a.m. and travels towards B at 65 kmph. Another train starts from B at 11 a.m. and travels towards A at 35 kmph. At what time do they meet?*

Sol. Suppose they meet x hours after 10 a.m. Then,

$$(\text{Distance moved by first in } x \text{ hrs}) + (\text{Distance moved by second in } (x-1) \text{ hrs}) = 390.$$

$$\therefore 65x + 35(x-1) = 390 \Rightarrow 100x = 425 \Rightarrow x = 4\frac{1}{4}$$

So, they meet 4 hrs. 15 min. after 10 a.m. i.e., at 2.15 p.m.

Ex. 11. *A goods train leaves a station at a certain time and at a fixed speed. After 6 hours, an express train leaves the same station and moves in the same direction at a uniform speed of 90 kmph. This train catches up the goods train in 4 hours. Find the speed of the goods train.*

Sol. Let the speed of the goods train be x kmph.

$$\begin{aligned} \text{Distance covered by goods train in 10 hours} &= \text{Distance covered by express train in 4 hours} \\ \therefore 10x &= 4 \times 90 \text{ or } x = 36. \end{aligned}$$

So, speed of goods train = 36 kmph.

Ex. 12. *A thief is spotted by a policeman from a distance of 100 metres. When the policeman starts the chase, the thief also starts running. If the speed of the thief be 8 km/hr and that of the policeman 10 km/hr, how far the thief will have run before he is overtaken?*

Sol. Relative speed of the policeman = $(10 - 8)$ km/hr = 2 km/hr.

$$\text{Time taken by policeman to cover 100 m} = \left(\frac{100}{1000} \times \frac{1}{2} \right) \text{ hr} = \frac{1}{20} \text{ hr.}$$

$$\text{In } \frac{1}{20} \text{ hrs, the thief covers a distance of } \left(8 \times \frac{1}{20} \right) \text{ km} = \frac{2}{5} \text{ km} = 400 \text{ m.}$$

Ex. 13. *I walk a certain distance and ride back taking a total time of 37 minutes. I could walk both ways in 55 minutes. How long would it take me to ride both ways?*

Sol. Let the distance be x km. Then,

$$(\text{Time taken to walk } x \text{ km}) + (\text{Time taken to ride } x \text{ km}) = 37 \text{ min.}$$

$$\Rightarrow (\text{Time taken to walk } 2x \text{ km}) + (\text{Time taken to ride } 2x \text{ km}) = 74 \text{ min.}$$

But, time taken to walk $2x$ km = 55 min.

$$\therefore \text{Time taken to ride } 2x \text{ km} = (74 - 55) \text{ min} = 19 \text{ min.}$$

EXERCISE 17

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (\checkmark) against the correct answer:

1. A car moves at the speed of 80 km/hr. What is the speed of the car in metres per second?
(Hotel Management, 2002)
(a) 8 m/sec (b) $20\frac{1}{9}$ m/sec (c) $22\frac{2}{9}$ m/sec (d) None of these
2. An athlete runs 200 metres race in 24 seconds. His speed is :
(S.S.C. 2002)
(a) 20 km/hr (b) 24 km/hr (c) 28.5 km/hr (d) 30 km/hr

3. Which of the following trains is the fastest ?
 (a) 25 m/sec (b) 1500 m/min (c) 90 km/hr (d) None of these
4. A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour ?
 (a) 3.6 (b) 7.2 (c) 8.4 (d) 10 (R.R.B. 2003)
5. A man walking at the rate of 5 km/hr crosses a bridge in 15 minutes. The length of the bridge (in metres) is :
 (a) 600 (b) 750 (c) 1000 (d) 1250 (S.S.C. 2000)
6. How long will a boy take to run round a square field of side 35 metres, if he runs at the rate of 9 km/hr ?
 (a) 50 sec (b) 52 sec (c) 54 sec (d) 56 sec (S.S.C. 1999)
7. A car is running at a speed of 108 kmph. What distance will it cover in 15 seconds ?
 (a) 45 metres (b) 55 metres (c) 450 metres
 (d) Cannot be determined (e) None of these (R.B.I. 2003)
8. One of the two buses completes a journey of 300 km in $7\frac{1}{2}$ hours and the other a journey of 450 km in 9 hours. The ratio of their average speeds is : (R.R.B. 2001)
 (a) 2 : 3 (b) 3 : 4 (c) 4 : 5 (d) 8 : 9
9. A truck covers a distance of 550 metres in 1 minute whereas a bus covers a distance of 33 kms in 45 minutes. The ratio of their speeds is : (S.S.C. 2004)
 (a) 3 : 4 (b) 4 : 3 (c) 3 : 5 (d) 50 : 3
10. The ratio between the speeds of two trains is 7 : 8. If the second train runs 400 kms in 4 hours, then the speed of the first train is : (I.M.T. 2002)
 (a) 70 km/hr (b) 75 km/hr (c) 84 km/hr (d) 87.5 km/hr
11. A train travels at an average of 50 miles per hour for $2\frac{1}{2}$ hours and then travels at a speed of 70 miles per hour for $1\frac{1}{2}$ hours. How far did the train travel in the entire 4 hours ? (IGNOU, 2003)
 (a) 120 miles (b) 150 miles (c) 200 miles (d) 230 miles
12. A man in a train notices that he can count 21 telephone posts in one minute. If they are known to be 50 metres apart, then at what speed is the train travelling ?
 (a) 55 km/hr (b) 57 km/hr (c) 60 km/hr (d) 63 km/hr
13. Sound is said to travel in air at about 1100 feet per second. A man hears the axe striking the tree, $\frac{11}{5}$ seconds after he sees it strike the tree. How far is the man from the wood chopper ? (M.B.A. 2002)
 (a) 2197 ft (b) 2420 ft (c) 2500 ft (d) 2629 ft
14. An express train travelled at an average speed of 100 km/hr, stopping for 3 minutes after every 75 km. How long did it take to reach its destination 600 km from the starting point ? (M.A.T. 2003)
 (a) 6 hrs 21 min (b) 6 hrs 24 min (c) 6 hrs 27 min (d) 6 hrs 30 min
15. A certain distance is covered by a cyclist at a certain speed. If a jogger covers half the distance in double the time, the ratio of the speed of the jogger to that of the cyclist is :
 (a) 1 : 2 (b) 2 : 1 (c) 1 : 4 (d) 4 : 1
16. A motor car starts with the speed of 70 km/hr with its speed increasing every two hours by 10 kmph. In how many hours will it cover 345 kms ? (Bank P.O. 2003)
 (a) $2\frac{1}{4}$ hrs (b) 4 hrs 5 min (c) $4\frac{1}{2}$ hrs
 (d) Cannot be determined (e) None of these

29. A car driver travels from the plains to the hill station, which are 200 km apart at an average speed of 40 km/hr. In the return trip, he covers the same distance at an average speed of 20 km/hr. The average speed of the car over the entire distance of 400 km is :
 (a) 25 km/hr (b) 26.67 km/hr (c) 28.56 km/hr (d) 30 km/hr
30. Mac travels from A to B a distance of 250 miles in $5\frac{1}{2}$ hours. He returns to A in 4 hours 30 minutes. His average speed is :
 (a) 44 mph (b) 46 mph (c) 48 mph (d) 50 mph
31. A boy goes to his school from his house at a speed of 3 km/hr and returns at a speed of 2 km/hr. If he takes 5 hours in going and coming, the distance between his house and school is : (S.S.C. 2004)
 (a) 5 km (b) 5.5 km (c) 6 km (d) 6.5 km
32. The average speed of a train in the onward journey is 25% more than that in the return journey. The train halts for one hour on reaching the destination. The total time taken for the complete to and fro journey is 17 hours, covering a distance of 800 km. The speed of the train in the onward journey is :
 (a) 45 km/hr (b) 47.5 km/hr (c) 52 km/hr (d) 56.25 km/hr
33. I started on my bicycle at 7 a.m. to reach a certain place. After going a certain distance, my bicycle went out of order. Consequently, I rested for 35 minutes and came back to my house walking all the way. I reached my house at 1 p.m. If my cycling speed is 10 kmph and my walking speed is 1 kmph, then on my bicycle I covered a distance of :
 (a) $4\frac{61}{66}$ km (b) $13\frac{4}{9}$ km (c) $14\frac{3}{8}$ km (d) $15\frac{10}{21}$ km
34. A, B and C are on a trip by a car. A drives during the first hour at an average speed of 50 km/hr. B drives during the next 2 hours at an average speed of 48 km/hr. C drives for the next 3 hours at an average speed of 52 km/hr. They reached their destination after exactly 6 hours. Their mean speed was :
 (a) 50 km/hr (b) $50\frac{1}{3}$ km/hr (c) $51\frac{1}{3}$ km/hr (d) 52 km/hr
35. A man on tour travels first 160 km at 64 km/hr and the next 160 km at 80 km/hr. The average speed for the first 320 km of the tour is : (R.R.B. 2003)
 (a) 35.55 km/hr (b) 36 km/hr (c) 71.11 km/hr (d) 71 km/hr
36. A boy rides his bicycle 10 km at an average speed of 12 km/hr and again travels 12 km at an average speed of 10 km/hr. His average speed for the entire trip is approximately : (S.S.C. 1999)
 (a) 10.4 km/hr (b) 10.8 km/hr (c) 11 km/hr (d) 12.2 km/hr
37. A man travels 600 km by train at 80 km/hr, 800 km by ship at 40 km/hr, 500 km by aeroplane at 400 km/hr and 100 km by car at 50 km/hr. What is the average speed for the entire distance ? (S.S.C. 2000)
 (a) 60 km/hr (b) $60\frac{5}{123}$ km/hr (c) 62 km/hr (d) $65\frac{5}{123}$ km/hr
38. A car travels the first one-third of a certain distance with a speed of 10 km/hr, the next one-third distance with a speed of 20 km/hr, and the last one-third distance with a speed of 60 km/hr. The average speed of the car for the whole journey is :
 (a) 18 km/hr (b) 24 km/hr (c) 30 km/hr (d) 36 km/hr

(Civil Services, 2003)

39. A motorist covers a distance of 39 km in 45 minutes by moving at a speed of x kmph for the first 15 minutes, then moving at double the speed for the next 20 minutes and then again moving at his original speed for the rest of the journey. Then, x is equal to :
 (a) 31.2 (b) 36 (c) 40 (d) 52
40. Mary jogs 9 km at a speed of 6 km per hour. At what speed would she need to jog during the next 1.5 hours to have an average of 9 km per hour for the entire jogging session ?
 (a) 9 kmph (b) 10 kmph (c) 12 kmph (d) 14 kmph
41. A car travelling with $\frac{5}{7}$ of its actual speed covers 42 km in 1 hr 40 min 48 sec. Find the actual speed of the car. (S.S.C. 2002)
 (a) $17\frac{6}{7}$ km/hr (b) 25 km/hr (c) 30 km/hr (d) 35 km/hr
42. A train running at $\frac{7}{11}$ of its own speed reached a place in 22 hours. How much time could be saved if the train would have run at its own speed ?
 (a) 7 hours (b) 8 hours (c) 14 hours (d) 16 hours
43. A man can reach a certain place in 30 hours. If he reduces his speed by $\frac{1}{15}$ th, he goes 10 km less in that time. Find his speed. (S.S.C. 2002)
 (a) 4 km/hr (b) 5 km/hr (c) $5\frac{1}{2}$ km/hr (d) 6 km/hr
44. Walking $\frac{6}{7}$ th of his usual speed, a man is 12 minutes too late. The usual time taken by him to cover that distance is : (R.R.B. 2001)
 (a) 1 hour (b) 1 hr 12 min. (c) 1 hr 15 min. (d) 1 hr 20 min
45. Starting from his house one day, a student walks at a speed of $2\frac{1}{2}$ kmph and reaches his school 6 minutes late. Next day he increases his speed by 1 kmph and reaches the school 6 minutes early. How far is the school from his house ? (S.S.C. 2004)
 (a) 1 km (b) $1\frac{1}{2}$ km (c) $1\frac{3}{4}$ km (d) 2 km
46. A train when moves at an average speed of 40 kmph, reaches its destination on time. When its average speed becomes 35 kmph, then it reaches its destination 15 minutes late. Find the length of journey. (Bank P.O. 2003)
 (a) 30 km (b) 40 km (c) 70 km (d) 80 km
47. Robert is travelling on his cycle and has calculated to reach point A at 2 P.M. if he travels at 10 kmph; he will reach there at 12 noon if he travels at 15 kmph. At what speed must he travel to reach A at 1 P.M.? (D.M.R.C. 2003)
 (a) 8 kmph (b) 11 kmph (c) 12 kmph (d) 14 kmph
48. If a train runs at 40 kmph, it reaches its destination late by 11 minutes but if it runs at 50 kmph, it is late by 5 minutes only. The correct time for the train to complete its journey is :
 (a) 13 min. (b) 15 min. (c) 19 min. (d) 21 min
49. A man covered a certain distance at some speed. Had he moved 3 kmph faster, he would have taken 40 minutes less. If he had moved 2 kmph slower, he would have taken 40 minutes more. The distance (in km) is : (S.S.C. 2003)
 (a) 35 (b) $36\frac{2}{3}$ (c) $37\frac{1}{2}$ (d) 40

50. A car travels from P to Q at a constant speed. If its speed were increased by 10 km/hr, it would have taken one hour lesser to cover the distance. It would have taken further 45 minutes lesser if the speed was further increased by 10 km/hr. What is the distance between the two cities ?
 (a) 420 km (b) 540 km (c) 600 km (d) 650 km
51. A train can travel 50% faster than a car. Both start from point A at the same time and reach point B 75 kms away from A at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is :
 (a) 100 kmph (b) 110 kmph (c) 120 kmph (d) 130 kmph
 (M.A.T. 2003)
52. Excluding stoppages, the speed of a bus is 54 kmph and including stoppages, it is 45 kmph. For how many minutes does the bus stop per hour ? (N.I.E.T. 2002)
 (a) 9 (b) 10 (c) 12 (d) 20
53. A car covers a distance of 715 km at a constant speed. If the speed of the car would have been 10 km/hr more, then it would have taken 2 hours less to cover the same distance. What is the original speed of the car ?
 (a) 45 km/hr (b) 50 km/hr (c) 55 km/hr (d) 65 km/hr
54. In covering a certain distance, the speeds of A and B are in the ratio of 3 : 4. A takes 30 minutes more than B to reach the destination. The time taken by A to reach the destination is : (S.S.C. 1999)
 (a) 1 hour (b) $1\frac{1}{2}$ hours (c) 2 hours (d) $2\frac{1}{2}$ hours
55. In covering a distance of 30 km, Abhay takes 2 hours more than Sameer. If Abhay doubles his speed, then he would take 1 hour less than Sameer. Abhay's speed is :
 (a) 5 kmph (b) 6 kmph (c) 6.25 kmph (d) 7.5 kmph
 (M.A.T. 2003)
56. Three persons are walking from a place A to another place B. Their speeds are in the ratio of 4 : 3 : 5. The time ratio to reach B by these persons will be :
 (a) 4 : 3 : 5 (b) 5 : 3 : 4 (c) 15 : 9 : 20 (d) 15 : 20 : 12
57. With a uniform speed a car covers the distance in 8 hours. Had the speed been increased by 4 km/hr, the same distance could have been covered in $7\frac{1}{2}$ hours. What is the distance covered ? (Bank P.O. 2003)
 (a) 420 km (b) 480 km (c) 640 km
 (d) Cannot be determined (e) None of these
58. Two men start together to walk to a certain destination, one at 3 kmph and another at 3.75 kmph. The latter arrives half an hour before the former. The distance is :
 (a) 6 km (b) 7.5 km (c) 8 km (d) 9.5 km
59. If a person walks at 14 km/hr instead of 10 km/hr, he would have walked 20 km more. The actual distance travelled by him is : (R.R.B. 2000)
 (a) 50 km (b) 56 km (c) 70 km (d) 80 km
60. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight is : (M.A.T. 2002)
 (a) 1 hour (b) 2 hours (c) 3 hours (d) 4 hours
61. It takes eight hours for a 600 km journey, if 120 km is done by train and the rest by car. It takes 20 minutes more, if 200 km is done by train and the rest by car. The ratio of the speed of the train to that of the car is : (M.B.A. 2001)
 (a) 2 : 3 (b) 3 : 2 (c) 3 : 4 (d) 4 : 3

62. A is twice as fast as B and B is thrice as fast as C is. The journey covered by C in 54 minutes will be covered by B in :
 (a) 18 min (b) 27 min (c) 38 min (d) 9 min
63. Two men starting from the same place walk at the rate of 5 kmph and 5.5 kmph respectively. What time will they take to be 8.5 km apart, if they walk in the same direction ?
 (a) 4 hrs 15 min (b) 8 hrs 30 min (c) 16 hrs (d) 17 hrs
64. A walks around a circular field at the rate of one round per hour while B runs around it at the rate of six rounds per hour. They start in the same direction from the same point at 7.30 a.m. They shall first cross each other at : (Civil Services, 2003)
 (a) 7.42 a.m. (b) 7.48 a.m. (c) 8.10 a.m. (d) 8.30 a.m.
65. A walks at 4 kmph and 4 hours after his start, B cycles after him at 10 kmph. How far from the start does B catch up with A ?
 (a) 16.7 km (b) 18.6 km (c) 21.5 km (d) 26.7 km
66. A thief is noticed by a policeman from a distance of 200 m. The thief starts running and the policeman chases him. The thief and the policeman run at the rate of 10 km and 11 km per hour respectively. What is the distance between them after 6 minutes ?
 (a) 100 m (b) 150 m (c) 190 m (d) 200 m (S.S.C. 2000)
67. A thief steals a car at 2.30 p.m. and drives it at 60 kmph. The theft is discovered at 3 p.m. and the owner sets off in another car at 75 kmph. When will he overtake the thief ? (R.R.B. 2002)
 (a) 4.30 p.m. (b) 4.45 p.m. (c) 5 p.m. (d) 5.15 p.m.
68. Two guns were fired from the same place at an interval of 10 minutes and 30 seconds, but a person in the train approaching the place hears the second shot 10 minutes after the first. The speed of the train (in km / hr), supposing that sound travels at 330 metres per second, is :
 (a) 19.8 (b) 58.6 (c) 59.4 (d) 111.80
69. Two cyclists start from the same place in opposite directions. One goes towards north at 18 kmph and the other goes towards south at 20 kmph. What time will they take to be 47.5 km apart ?
 (a) $1\frac{1}{4}$ hrs (b) $2\frac{1}{4}$ hrs (c) 2 hrs. 23 min. (d) $2\frac{1}{2}$ hrs
70. The distance between two cities A and B is 330 km. A train starts from A at 8 a.m. and travels towards B at 60 km / hr. Another train starts from B at 9 a.m. and travels towards A at 75 km / hr. At what time do they meet ? (L.I.C.A.A.O. 2003)
 (a) 10 a.m. (b) 10.30 a.m. (c) 11 a.m. (d) 11.30 a.m.
71. The jogging track in a sports complex is 726 metres in circumference. Deepak and his wife start from the same point and walk in opposite directions at 4.5 km / hr and 3.75 km / hr respectively. They will meet for the first time in : (M.A.T. 2003)
 (a) 4.9 min (b) 5.28 min (c) 5.5 min (d) 6 min
72. A and B walk around a circular track. They start at 8 a.m. from the same point in the opposite directions. A and B walk at a speed of 2 rounds per hour and 3 rounds per hour respectively. How many times shall they cross each other before 9.30 a.m. ?
 (a) 5 (b) 6 (c) 7 (d) 8 (U.P.S.C. 2002)
73. Two cars P and Q start at the same time from A and B which are 120 km apart. If the two cars travel in opposite directions, they meet after one hour and if they travel in same direction (from A towards B), then P meets Q after 6 hours. What is the speed of car P ? (S.B.I.P.O. 2000)
 (a) 60 kmph (b) 70 kmph (c) 120 kmph
 (d) Data inadequate (e) None of these

74. Two trains starting at the same time from two stations 200 km apart and going in opposite directions cross each other at a distance of 110 km from one of the stations. What is the ratio of their speeds ?
 (a) 9 : 20 (b) 11 : 9 (c) 11 : 20 (d) None of these
75. Two trains start from P and Q respectively and travel towards each other at a speed of 50 km/hr and 40 km/hr respectively. By the time they meet, the first train has travelled 100 km more than the second. The distance between P and Q is :
 (a) 500 km (b) 630 km (c) 660 km (d) 900 km
 (S.S.C. 2000)
76. Bombay Express left Delhi for Bombay at 14.30 hrs, travelling at a speed of 60 kmph and Rajdhani Express left Delhi for Bombay on the same day at 16.30 hrs, travelling at a speed of 80 kmph. How far away from Delhi will the two trains meet ?
 (a) 120 km (b) 360 km (c) 480 km (d) 500 km
77. A train M leaves Meerut at 5 a.m. and reaches Delhi at 9 a.m. Another train leaves Delhi at 7 a.m. and reaches Meerut at 10.30 a.m. At what time do the two trains cross each other ?
 (a) 7.36 a.m. (b) 7.56 a.m. (c) 8 a.m. (d) 8.26 a.m.
78. A man takes 5 hours 45 min. in walking to a certain place and riding back. He would have gained 2 hours by riding both ways. The time he would take to walk both ways, is :
 (a) 3 hrs 45 min (b) 7 hrs 30 min
 (c) 7 hrs 45 min (d) 11 hrs 45 min

ANSWERS

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

SOLUTIONS

1. Speed = $\left(80 \times \frac{5}{18}\right)$ m/sec = $\frac{200}{9}$ m/sec = $22\frac{2}{9}$ m/sec.

2. Speed = $\frac{200}{24}$ m/sec = $\frac{25}{3}$ m/sec = $\left(\frac{25}{3} \times \frac{18}{5}\right)$ km/hr = 30 km/hr.

3. 25 m/sec = $\left(25 \times \frac{18}{5}\right)$ km/hr = 90 km/hr.

And, 25 m/sec = (25×60) m/min = 1500 m/min.

So, all the three speeds are equal.

4. Speed = $\left(\frac{600}{5 \times 60}\right)$ m/sec = 2 m/sec = $\left(2 \times \frac{18}{5}\right)$ km/hr = 7.2 km/hr.