28. Given exp. $= -1 + 4 + 3 = 6.$

29. Given exp. $= \dfrac{1}{(7/3)} + \dfrac{1}{(7/4)} = \dfrac{3}{7} + \dfrac{4}{7} = \dfrac{7}{7} = 1.$

30. Let $\dfrac{35}{6} - \dfrac{35}{9} - x = 1.$

Then, $x = \dfrac{35}{6} - \dfrac{35}{9} - 1 = \dfrac{35}{6} - \left(\dfrac{35}{9} + 1\right) = \dfrac{35}{6} - \dfrac{44}{9} = \dfrac{105 - 88}{18} = \dfrac{17}{18}.$

31. $\dfrac{1}{x} = 4 - \left(\dfrac{1}{3} + \dfrac{1}{2}\right) = 4 - \left(\dfrac{2+3}{6}\right) = 4 - \dfrac{5}{6} = \dfrac{24-5}{6} = \dfrac{19}{6} \Rightarrow x = \dfrac{6}{19}.$

32. Given exp. $= \dfrac{\left(-\dfrac{2}{3} - \dfrac{1}{3}\right) + \left(\dfrac{4}{5} + \dfrac{1}{5}\right) + \left(\dfrac{3}{4} - \dfrac{1}{2}\right)}{\left(\dfrac{2}{3} - \dfrac{4}{3} + \dfrac{1}{3}\right) - \left(\dfrac{1}{5} + \dfrac{4}{5}\right) + \dfrac{1}{2}}$

$= \dfrac{-1 + 1 + \dfrac{1}{4}}{-\dfrac{1}{3} - 1 + \dfrac{1}{2}} = \dfrac{\dfrac{1}{4}}{\dfrac{-2-6+3}{6}} = \dfrac{\dfrac{1}{4}}{-\dfrac{5}{6}} = \dfrac{1}{4} \times \left(-\dfrac{6}{5}\right) = \dfrac{-3}{10}.$

33. Given exp. $= 5 - \left[\dfrac{3}{4} + \left\{\dfrac{5}{2} - \left(\dfrac{1}{2} + \dfrac{7-6}{42}\right)\right\}\right] = 5 - \left[\dfrac{3}{4} + \left\{\dfrac{5}{2} - \left(\dfrac{1}{2} + \dfrac{1}{42}\right)\right\}\right]$

$= 5 - \left[\dfrac{3}{4} + \left\{\dfrac{5}{2} - \dfrac{22}{42}\right\}\right] = 5 - \left[\dfrac{3}{4} + \dfrac{83}{42}\right] = 5 - \dfrac{229}{84}$

$= \left(\dfrac{420 - 229}{84}\right) = \dfrac{191}{84} = 2\dfrac{23}{84}.$

34. $\dfrac{\left(\dfrac{1}{2} - \dfrac{1}{4} + \dfrac{1}{5} - \dfrac{1}{6}\right)}{\left(\dfrac{2}{5} - \dfrac{5}{9} + \dfrac{3}{5} - \dfrac{7}{18}\right)} = \dfrac{\left(\dfrac{30 - 15 + 12 - 10}{60}\right)}{\left(\dfrac{2}{5} + \dfrac{3}{5}\right) - \left(\dfrac{5}{9} + \dfrac{7}{18}\right)} = \dfrac{\left(\dfrac{17}{60}\right)}{1 - \dfrac{17}{18}} = \left(\dfrac{17}{60} \times 18\right) = \dfrac{51}{10} = 5\dfrac{1}{10}.$

35. $\left(34 \times 4\dfrac{1}{2}\right) = 34 \times \left(4 + \dfrac{1}{2}\right) = (34 \times 4) + \left(34 \times \dfrac{1}{2}\right)$

$= (30 + 4) \times 4 + \left(34 \times \dfrac{1}{2}\right) = (30 \times 4) + (4 \times 4) + \left(34 \times \dfrac{1}{2}\right).$

36. Given exp. $= \left(\dfrac{3}{5} \times \dfrac{4}{7} \times \dfrac{5}{9} \times \dfrac{21}{24} \times 504\right) = 84.$

37. Given exp. $= \left(\dfrac{41}{6} \times \dfrac{16}{3} + \dfrac{53}{3} \times \dfrac{9}{2}\right) = \left(\dfrac{328}{9} + \dfrac{159}{2}\right) = \dfrac{656 + 1431}{18} = \dfrac{2087}{18} = 115\dfrac{17}{18}.$

38. Let $\dfrac{3}{8}$ of $168 \times 15 \div 5 + x = 549 \div 9 + 235.$

Then, $63 \times 15 \div 5 + x = 61 + 235 \Leftrightarrow 63 \times 3 + x = 296$

$\Leftrightarrow 189 + x = 296 \Leftrightarrow x = 107.$

39. Let $\dfrac{5}{3} \div \dfrac{2}{7} \times \dfrac{x}{7} = \dfrac{5}{4} \times \dfrac{2}{3} \div \dfrac{1}{6}$. Then,

$\dfrac{5}{3} \times \dfrac{7}{2} \times \dfrac{x}{7} = \dfrac{5}{4} \times \dfrac{2}{3} \times 6 \Leftrightarrow \dfrac{5}{6}x = 5 \Leftrightarrow x = \left(\dfrac{5 \times 6}{5}\right) = 6.$

40. Let $5\frac{2}{3} \div x\frac{5}{6} = 2$. Then, $\frac{17}{3} \div x\frac{5}{6} = 2 \Leftrightarrow x\frac{5}{6} = \frac{17}{3} \times \frac{1}{2} = \frac{17}{6} \Leftrightarrow x\frac{5}{6} = 2\frac{5}{6}$.

$\therefore \quad x = 2.$

41. Given equation is : $\frac{(5x+1)}{x} \times \frac{(4y+3)}{4} = 20 \Leftrightarrow (5x+1)(4y+3) = 80x \quad ...(i)$

Clearly, $x = 3$ and $y = 3$ satisfy (i).

42. Required difference $= \frac{19}{16} - \frac{16}{19} = \frac{19^2 - 16^2}{304} = \frac{(19+16)(19-16)}{304} = \frac{35 \times 3}{301} = \frac{105}{304}$.

43. Required number $= \frac{37\frac{1}{2}}{1/8} = \frac{75/2}{1/8} = \frac{75}{2} \times 8 = 300.$

44. Let x of $\frac{1}{12} = \frac{3}{8}$. Then, $\frac{x}{12} = \frac{3}{8} \Leftrightarrow x = \left(\frac{3}{8} \times 12\right) = \frac{9}{2}$.

45. Sum of given fractions $= \frac{7}{4} + \frac{5}{2} + \frac{67}{12} + \frac{10}{3} + \frac{9}{4} = \left(\frac{21+30+67+40+27}{12}\right) = \frac{185}{12}$.

The whole number just less than $\frac{185}{12}$ is 15.

Let $\frac{185}{12} - x = 15$. Then, $x = \left(\frac{185}{12} - 15\right) = \frac{5}{12}$.

46. Clearly, $\frac{x+1}{x}$ is the only fraction in which the numerator is greater than the denominator. So, it is the greatest fraction.

47. $\frac{3}{5}$ of $350 - \frac{4}{7}$ of $210 = 210 - 120 = 90.$

48. $\frac{6}{7/8} - \frac{6/7}{8} = 6 \times \frac{8}{7} - \frac{6}{7} \times \frac{1}{8} = \frac{48}{7} - \frac{6}{56} = \frac{384-6}{56} = \frac{378}{56} = \frac{27}{4} = 6\frac{3}{4}$.

49. Let the value of the estate be Rs. x.

Then, $\frac{4}{5}$ of $x = 16800 \Leftrightarrow x = \left(\frac{16800 \times 5}{4}\right) = 21000 \Leftrightarrow \frac{3}{7}x = \left(\frac{3}{7} \times 21000\right) = 9000.$

50. Let the number be x. Then,

$\frac{2}{5}$ of $\frac{1}{4}$ of $\frac{3}{7}$ of $x = 15 \Leftrightarrow x = \left(15 \times \frac{7}{3} \times 4 \times \frac{5}{2}\right) = 350 \Leftrightarrow \frac{1}{2}x = 175.$

51. Let the number be x. Then,

$\frac{1}{5}x - \frac{1}{7}x = 10 \Leftrightarrow \frac{7x-5x}{35} = 10 \Leftrightarrow \frac{2x}{35} = 10 \Leftrightarrow x = \left(\frac{10 \times 35}{2}\right) = 175.$

52. $9 * 11 = 9^2 + (11)^2 - 9 \times 11 = 81 + 121 - 99 = 103.$

53. $(3 * -1) = \frac{3 \times (-1)}{3 + (-1)} = \frac{-3}{2}$. So, $3 * (3 * -1) = 3 * \left(\frac{-3}{2}\right) = \frac{3 \times \left(\frac{-3}{2}\right)}{3 + \left(\frac{-3}{2}\right)} = \frac{-9}{2} \times \frac{2}{3} = -3.$

54. $3 * 5 + 5 * 3 = (2 \times 3 - 3 \times 5 + 3 \times 5) + (2 \times 5 - 3 \times 3 + 5 \times 3)$

$= (6 + 10 - 9 + 15) = 22.$

55. $4 \oplus (3 \oplus p) = 4 \oplus (3^2 + 2p) = 4 \oplus (9 + 2p) = 4^2 + 2(9 + 2p) = 34 + 4p.$

$\therefore \quad 34 + 4p = 50 \Rightarrow 4p = 50 - 34 = 16 \Rightarrow p = 4.$

56. $(a * b * c) * a * b = \left(\frac{a+b}{c}\right) * a * b = \frac{\left(\frac{a+b}{c}\right)+a}{b} = \frac{a+b+ac}{bc}$.

57. Let the number be x. Then,

$\frac{5(x+7)}{9} - 3 = 12 \Leftrightarrow 5(x+7) - 27 = 108 \Leftrightarrow 5x + 35 = 135 \Leftrightarrow 5x = 100 \Leftrightarrow x = 20$.

58. Given exp. $= \left(\frac{5}{7} \times \frac{19}{13}\right) \div \left(\frac{19}{7} \times \frac{4}{13}\right) = \frac{5 \times 19}{7 \times 13} \times \frac{7 \times 13}{19 \times 4} = \frac{5}{4}$.

59. Given exp. $= \frac{11}{4} \div \frac{8}{3} \div \frac{13}{12} = \frac{11}{4} \times \frac{3}{8} \times \frac{12}{13} = \frac{99}{104}$.

60. Given exp. $= \frac{9}{2} \times \frac{13}{3} - \frac{25}{3} \div \frac{17}{3} = \frac{9}{2} \times \frac{13}{3} - \frac{25}{3} \times \frac{3}{17}$

$= \frac{39}{2} - \frac{25}{17} = \frac{663 - 50}{34} = \frac{613}{34} = 18\frac{1}{34}$.

61. Let $\frac{4335}{x} \div \frac{15}{8} = \frac{289}{528}$. Then,

$\frac{4335}{x} \div \frac{289}{528} \times \frac{15}{8} \Leftrightarrow \frac{4335}{x} = \frac{289 \times 5}{176 \times 8} \Leftrightarrow x = \left(\frac{4335 \times 176 \times 8}{289 \times 5}\right) = 4224$.

$\therefore$ Missing digit = 2.

62. Let $\frac{16}{3} - \frac{11}{3} \div \frac{4}{3} + x + \frac{16}{5} \div \frac{6}{5} = 7$. Then,

$\frac{16}{3} - \frac{11}{3} \times \frac{3}{4} \times \frac{1}{x} + \frac{16}{5} \times \frac{5}{6} = 7 \Leftrightarrow \frac{16}{3} - \frac{11}{4x} + \frac{8}{3} = 7 \Leftrightarrow \frac{24}{3} - \frac{11}{4x} = 7$

$\Leftrightarrow \frac{11}{4x} = 8 - 7 = 1 \Leftrightarrow 4x = 11 \Leftrightarrow x = \frac{11}{4} = 2\frac{3}{4}$.

63. Given exp. $= 9 - \frac{11}{9}$ of $\frac{36}{11} \div \frac{36}{7}$ of $\frac{7}{9} = 9 - 4 \div 4 = 9 - 1 = 8$.

64. Let $\frac{5}{6} + \frac{6}{7} \times x - \frac{8}{9} \div \frac{8}{5} + \frac{3}{4} \times \frac{10}{3} = \frac{25}{9}$. Then,

$\frac{5}{6} \times \frac{7}{6} \times x - \frac{8}{9} \times \frac{5}{8} + \frac{3}{4} \times \frac{10}{3} = \frac{25}{9} \Leftrightarrow \frac{35}{36}x - \frac{5}{9} + \frac{5}{2} = \frac{25}{9}$

$\Leftrightarrow \frac{35}{36}x = \frac{25}{9} + \frac{5}{9} - \frac{5}{2} = \frac{10}{3} - \frac{5}{2} \Leftrightarrow \frac{35}{36}x = \frac{5}{6} \Leftrightarrow x = \left(\frac{5}{6} \times \frac{36}{35}\right) = \frac{6}{7}$.

65. Given exp. $= \frac{3}{4} \div \frac{9}{4}$ of $\frac{2}{3} - \frac{\left(\frac{3-2}{6}\right)}{\left(\frac{3+2}{6}\right)} \times \frac{10}{3} + \frac{5}{6} = \frac{3}{4} \div \frac{3}{2} - \frac{1}{6} \times \frac{6}{5} \times \frac{10}{3} + \frac{5}{6}$

$= \frac{3}{4} \times \frac{2}{3} - \frac{2}{3} + \frac{5}{6} = \left(\frac{1}{2} - \frac{2}{3} + \frac{5}{6}\right) = \left(\frac{3-4+5}{6}\right) = \frac{4}{6} = \frac{2}{3}$.

66. $\frac{\frac{7}{3} + 1\frac{1}{2} \text{ of } \frac{5}{3}}{2 + 1\frac{2}{3}} = \frac{\frac{7}{3} + \frac{3}{2} \text{ of } \frac{5}{3}}{2 + \frac{5}{3}} = \frac{\frac{7}{3} + \frac{5}{2}}{\frac{11}{3}} = \frac{29}{6} \times \frac{3}{11} = \frac{29}{22}$.

$\therefore$ Required answer $= \frac{29}{22} - \frac{1}{4} = \frac{58 - 11}{44} = \frac{47}{44} = 1\frac{3}{44}$.

67. Given exp. $= \dfrac{\frac{1}{3}+\frac{3}{4}\left(\frac{6-5}{15}\right)}{\frac{5}{3}\text{ of }\frac{3}{4}-\frac{1}{5}} = \dfrac{\frac{1}{3}+\frac{3}{4}\times\frac{1}{15}}{\frac{5}{4}-\frac{1}{5}} = \dfrac{\frac{1}{3}+\frac{1}{20}}{\frac{25-4}{20}} = \dfrac{23}{60}\times\dfrac{20}{21} = \dfrac{23}{63}.$

68. Given exp. $= \dfrac{\frac{1}{3}\times 3\times\frac{1}{3}}{\frac{1}{3}\div\frac{1}{9}}-\dfrac{1}{9} = \dfrac{\frac{1}{3}}{\frac{1}{3}\times 9}-\dfrac{1}{9} = \dfrac{1}{3}\times\dfrac{1}{3}-\dfrac{1}{9} = \dfrac{1}{9}-\dfrac{1}{9} = 0.$

69. Given exp. $= \dfrac{\frac{1}{2}+\frac{1}{4}}{\frac{1}{2}+\frac{1}{4}} = \dfrac{\frac{1}{2}\times 4}{\frac{2+1}{4}} = 2\times\dfrac{4}{3} = \dfrac{8}{3} = 2\dfrac{2}{3}.$

70. Given exp. $= \dfrac{\frac{13}{4}-\frac{4}{5}\text{ of }\frac{5}{6}}{\frac{13}{3}\div\frac{1}{5}-\left(\frac{3}{10}+\frac{106}{5}\right)} = \dfrac{\frac{13}{4}-\frac{2}{3}}{\frac{13}{3}\times 5-\frac{215}{10}} = \dfrac{\frac{31}{12}}{\frac{65}{3}-\frac{43}{2}} = \left(\dfrac{31}{12}\times 6\right) = \dfrac{31}{2} = 15\dfrac{1}{2}.$

71. Let $\dfrac{\frac{15}{2}-\frac{23}{4}}{\frac{7}{2}+x}\div\dfrac{\frac{1}{2}+\frac{5}{4}}{\frac{6}{5}+\frac{7}{2}} = \dfrac{6}{10}$. Then, $\left[\dfrac{7}{4}\times\dfrac{2}{(7+2x)}\right]\div\left[\dfrac{7}{4}\times\dfrac{10}{47}\right] = \dfrac{3}{5}$

$\Leftrightarrow \quad \dfrac{7}{2(7+2x)} = \dfrac{3}{5}\times\dfrac{7}{4}\times\dfrac{10}{47} = \dfrac{21}{94} \quad \Leftrightarrow \quad 7+2x = \left(\dfrac{7}{2}\times\dfrac{94}{21}\right) = \dfrac{47}{3}$

$\Leftrightarrow \quad 2x = \dfrac{47}{3}-7 = \dfrac{26}{3} \quad \Leftrightarrow \quad x = \left(\dfrac{26}{3}\times\dfrac{1}{2}\right) = \dfrac{13}{3} = 4\dfrac{1}{3}.$

72. Given exp. $= 3034-\left(\dfrac{1002}{2004}\times 100\right) = 3034-50 = 2984.$

73. Given exp. $= \dfrac{5241.6}{1872}+6.28 = 2.8+6.28 = 9.08.$

74. Let $\dfrac{58}{7}$ of $1568+265.75 = x+2455.60.$

Then, $12992+265.75 = x+2455.60$

$\Leftrightarrow \quad x = 12992+265.75-2455.60 = 13257.75-2455.60 = 10802.15.$

75. Given exp. $= 14.5+4.05+139.25 = 157.80.$

76. Let $8.25-4.20+2.8+\dfrac{4}{x}-2.32 = 5.33.$

Then, $\dfrac{4}{x} = (5.33+4.20+2.32)-(8.25+2.8) = 11.85-11.05 = 0.80 \Leftrightarrow x = \dfrac{4}{0.80} = \dfrac{40}{8} = 5.$

77. Given exp. $= 0.008\times 0.01\times 0.0072\div 0.000048$

$= 0.00008\times\dfrac{0.0072}{0.000048} = \dfrac{8}{48}\times\dfrac{72}{1000} = 0.012.$

78. Given exp. $= 2.375\times\dfrac{522}{87}-0.0285 = 2.375\times 6-0.0285 = 14.25-0.0285 = 14.2215.$

79. Given exp. $= 0.2+0.2-1\times 0.04 = 0.4-0.04 = 0.36.$

80. Given exp. $= 11.6+\dfrac{9280}{464}-\dfrac{28.28}{7} = 11.6+20-4.04 = 27.56.$

81. Given exp. $= 4.59\times\dfrac{18}{36}+0.6-0.2 = \dfrac{4.59}{2}+0.6-0.2 = 2.295+0.6-0.2 = 2.695.$

82. Let $\frac{64.4 - 34.7125}{6.25 \text{ of } x} = 1$. Then, $6.25 \text{ of } x = 29.6875$.

$\therefore \quad x = \frac{29.6875}{6.25} = \frac{2968.75}{625} = 4.75 = 4\frac{3}{4}$.

83. Given exp. $= 2.002 + 7.9\ \{2.8 - 6.3 \times 2.1 + 15.6\}$

$= 2.002 + 7.9\ \{2.8 - 13.23 + 15.6\} = 2.002 + 7.9 \times 5.17$

$= 2.002 + 40.843 = 42.845$.

84. Let $24 - [2.4 - \{.24 \times 2 - (.024 - x)\}] = 22.0584$.

Then, $24 - [2.4 - \{.48 - .024 + x\}] = 22.0584 \Leftrightarrow 24 - [2.4 - 0.456 - x] = 22.0584$

$\Leftrightarrow \quad 24 - 1.944 + x = 22.0584 \Leftrightarrow x = 22.0584 - 22.056 = 0.0024$.

85. Let $3 - \left[1.6 - \left\{3.2 - \left(3.2 + \frac{2.25}{x}\right)\right\}\right] = 0.65$.

Then, $3 - \left[1.6 - \left\{3.2 - 3.2 - \frac{2.25}{x}\right\}\right] = 0.65 \Leftrightarrow 3 - \left[1.6 + \frac{2.25}{x}\right] = 0.65$

$\Leftrightarrow \quad 3 - 1.6 - \frac{2.25}{x} = 0.65 \Leftrightarrow \frac{2.25}{x} = 1.4 - 0.65 \Leftrightarrow x = \frac{2.25}{0.75} = 3$.

86. Let $587.4 + 58.74 \times 2 - \frac{5.874}{x} = 702.744$.

Then, $\frac{5.874}{x} = 587.4 + 117.48 - 702.744 = 2.136 \Leftrightarrow x = \frac{5.874}{2.136} = \frac{5874}{2136} = \frac{11}{4} = 2\frac{3}{4}$.

$\therefore$ Missing digit $= 3$.

87. Let $54.27 - [12.84 - \{x - (6.82 - 1.85)\}] = 38.33$.

Then, $54.27 - [12.84 - \{x - 4.97\}] = 38.33$

$\Leftrightarrow \quad 54.27 - [12.84 - x + 4.97] = 38.33 \Leftrightarrow 54.27 - [17.81 - x] = 38.33$

$\Leftrightarrow \quad 54.27 - 17.81 + x = 38.33 \Leftrightarrow x = 38.33 - 36.46 = 1.87$.

88. Let $\frac{20}{3} \text{ of } \frac{726}{100} \div \frac{45}{100} \text{ of } x = \frac{968}{117}$.

Then, $\frac{242}{5} \div \frac{45x}{100} = \frac{968}{117} \Leftrightarrow \frac{242}{5} \times \frac{100}{45x} = \frac{968}{117} \Leftrightarrow x = \frac{242}{5} \times \frac{100}{45} \times \frac{117}{968} = 13$.

89. $\frac{P+Q}{P-Q} = \frac{\frac{P}{Q}+1}{\frac{P}{Q}-1} = \frac{7+1}{7-1} = \frac{8}{6} = \frac{4}{3}$.

90. $\left(\frac{4}{7} + \frac{2y-x}{2y+x}\right) = \left(\frac{4}{7} + \frac{2-\frac{x}{y}}{2+\frac{x}{y}}\right) = \frac{4}{7} + \frac{2-\frac{4}{5}}{2+\frac{4}{5}} = \frac{4}{7} + \frac{(6/5)}{(14/5)} = \frac{4}{7} + \left(\frac{6}{5} \times \frac{5}{14}\right) = \frac{4}{7} + \frac{3}{7} = \frac{7}{7} = 1$.

91. $\frac{6a+4b}{6a-5b} = \frac{6\left(\frac{a}{b}\right)+4}{6\left(\frac{a}{b}\right)-5} = \frac{6 \times \frac{4}{3}+4}{6 \times \frac{4}{3}-5} = \frac{8+4}{8-5} = \frac{12}{3} = 4$.

92. $\frac{x}{2y} = \frac{6}{7} \Rightarrow \frac{x}{y} = \left(2 \times \frac{6}{7}\right) = \frac{12}{7}$.

$$\therefore \quad \frac{x-y}{x+y}+\frac{14}{19}=\frac{\frac{x}{y}-1}{\frac{x}{y}+1}+\frac{14}{19}=\frac{\frac{12}{7}-1}{\frac{12}{7}+1}+\frac{14}{19}=\frac{(5/7)}{(19/7)}+\frac{14}{19}$$

$$=\left(\frac{5}{7}\times\frac{7}{19}\right)+\frac{14}{19}=\frac{5}{19}+\frac{14}{19}=\frac{19}{19}=1.$$

93. $\frac{a}{b}=\frac{4}{5}$ and $\frac{b}{c}=\frac{15}{16} \Rightarrow \left(\frac{a}{b}\times\frac{b}{c}\right)=\left(\frac{4}{5}\times\frac{15}{16}\right) \Rightarrow \frac{a}{c}=\frac{3}{4}$.

$$\therefore \quad \frac{c^2-a^2}{c^2+a^2}=\frac{1-\left(\frac{a^2}{c^2}\right)}{1+\left(\frac{a^2}{c^2}\right)}=\frac{1-\left(\frac{a}{c}\right)^2}{1+\left(\frac{a}{c}\right)^2}=\frac{1-\frac{9}{16}}{1+\frac{9}{16}}=\frac{(7/16)}{(25/16)}=\frac{7}{25}.$$

94. $(a-b)-(c+d)=6$ and $(c-d)-(a+b)=3$

$\Rightarrow (a-c)-(b+d)=6$ and $(c-a)-(b+d)=3$

$\Rightarrow (b+d)=(a-c)-6$ and $(b+d)=(c-a)-3$

$\Rightarrow (a-c)-6=(c-a)-3 \Rightarrow 2(a-c)=3 \Rightarrow (a-c)=\frac{3}{2}=1.5.$

95. $x=\frac{a}{a-1}=1+\frac{1}{a-1}=1+y.$ $\quad\therefore x>y.$

96. a is positive and $a<1 \Rightarrow \frac{1}{a}>1.$ $\quad\therefore \left(a+\frac{1}{a}\right)>2.$

97. $\frac{a}{x}+\frac{y}{b}=1 \Rightarrow \frac{a}{x}=1-\frac{y}{b}=\frac{b-y}{b} \Rightarrow \frac{x}{a}=\frac{b}{b-y}.$

$\frac{b}{y}+\frac{z}{c}=1 \Rightarrow \frac{z}{c}=1-\frac{b}{y}=\frac{y-b}{y} \Rightarrow \frac{c}{z}=\frac{y}{y-b}=\frac{-y}{(b-y)}.$

$$\therefore \quad \frac{x}{a}+\frac{c}{z}=\frac{b}{(b-y)}-\frac{y}{(b-y)}=\frac{(b-y)}{(b-y)}=1.$$

98. $a^2+b^2=45$ ...(*i*) and $b^2+c^2=40$ ...(*ii*)

Subtracting, we get : $a^2-c^2=5 \Rightarrow (a+c)(a-c)=5.$

$\therefore$ $(a+c)=5$ and $(a-c)=1.$

Solving, we get : $a=3$, $c=2$. Putting $c=2$ in (*ii*), we get $b=6$.

99. $\frac{a}{3}=\frac{b}{4}=\frac{c}{7}=k$ (say). Then, $a=3k$, $b=4k$, $c=7k$.

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

100. $3x+7=7x+5 \Rightarrow 7x-3x=2 \Rightarrow 4x=2 \Rightarrow x=\frac{1}{2}.$

Now, $3x+7=x^2+\mathrm{P} \Rightarrow \frac{3}{2}+7=\frac{1}{4}+\mathrm{P} \Rightarrow \mathrm{P}=\frac{17}{2}-\frac{1}{4}=\frac{33}{4}=8\frac{1}{4}.$

101. $\frac{2a+b}{a+4b}=3 \Rightarrow 2a+b=3(a+4b) \Rightarrow a=-11b.$

$$\therefore \quad \frac{a+b}{a+2b}=\frac{-11b+b}{-11b+2b}=\frac{-10b}{-9b}=\frac{10}{9}.$$

102. $(2a + 3b)(2c - 3d) = (2a - 3b)(2c + 3d)$

$$\Rightarrow \frac{(2a+3b)}{(2a-3b)} = \frac{(2c+3d)}{(2c-3d)} \Rightarrow \frac{2\left(\frac{a}{b}\right)+1}{2\left(\frac{a}{b}\right)-1} = \frac{2\left(\frac{c}{d}\right)+1}{2\left(\frac{c}{d}\right)-1} \Rightarrow \frac{a}{b} = \frac{c}{d}.$$

103. $(a + b + 2c + 3d)(a - b - 2c + 3d) = (a - b + 2c - 3d)(a + b - 2c - 3d)$

$\Rightarrow [(a + b) + (2c + 3d)][(a - b) - (2c - 3d)]$

$= [(a - b) + (2c - 3d)][(a + b) - (2c + 3d)]$

$\Rightarrow (a + b)(a - b) - (a + b)(2c - 3d) + (a - b)(2c + 3d) - (2c + 3d)(2c - 3d)$

$= (a - b)(a + b) - (a - b)(2c + 3d) + (a + b)(2c - 3d) - (2c + 3d)(2c - 3d)$

$\Rightarrow (a + b)(2c - 3d) = (a - b)(2c + 3d)$

$\Rightarrow 2ac - 3ad + 2bc - 3bd = 2ac + 3ad - 2bc - 3bd$

$\Rightarrow 4bc = 6ad \Rightarrow 2bc = 3ad.$

104. Given exp. $= \dfrac{1}{2+\dfrac{1}{2+\dfrac{1}{(3/2)}}} = \dfrac{1}{2+\dfrac{1}{2+\dfrac{2}{3}}} = \dfrac{1}{2+\dfrac{1}{(8/3)}} = \dfrac{1}{2+\dfrac{3}{8}} = \dfrac{1}{(19/8)} = \dfrac{8}{19}.$

105. $x = 2 - \dfrac{1}{1+\dfrac{1}{(13/4)}} = 2 - \dfrac{1}{1+\dfrac{4}{13}} = 2 - \dfrac{1}{(17/13)} = 2 - \dfrac{13}{17} = \dfrac{21}{17}.$

106. $x = \dfrac{2+\dfrac{1}{(19/5)}}{2+\dfrac{1}{3+\dfrac{1}{(5/4)}}} = \dfrac{2+\dfrac{5}{19}}{2+\dfrac{1}{3+\dfrac{4}{5}}} = \dfrac{2+\dfrac{5}{19}}{2+\dfrac{1}{(19/5)}} = \dfrac{2+\dfrac{5}{19}}{2+\dfrac{5}{19}} = 1.$

107. Given exp. $= 8 - 8 \times \dfrac{\frac{11}{5} - \frac{9}{7}}{2 - \dfrac{1}{(35/6)}} = 8 - 8 \times \dfrac{\frac{32}{35}}{2 - \frac{6}{35}} = 8 - 8 \times \dfrac{32}{35} \times \dfrac{35}{64} = 8 - 4 = 4.$

108. Given exp. $= \dfrac{2}{2+\dfrac{2}{3+\dfrac{2}{(11/3)}} \times 0.39} = \dfrac{2}{2+\dfrac{2}{3+\frac{6}{11}} \times 0.39} = \dfrac{2}{2+\dfrac{2}{(39/11)} \times 0.39}$

$= \dfrac{2}{2+\dfrac{22}{39} \times \dfrac{39}{100}} = \dfrac{2}{2+\frac{22}{100}} = \dfrac{2}{2+\frac{11}{50}} = \dfrac{2}{(111/50)} = \dfrac{100}{111}.$

109. Given exp. $= \dfrac{1}{1+\dfrac{\frac{2}{3}}{\frac{5}{3}+\dfrac{\frac{8}{9}}{(1/3)}}} = \dfrac{1}{1+\dfrac{2/3}{\frac{5}{3}+\frac{8}{9}\times 3}} = \dfrac{1}{1+\dfrac{2/3}{(13/3)}} = \dfrac{1}{1+\frac{2}{13}} = \dfrac{13}{15}.$

110. $2 + \dfrac{1}{x+\dfrac{1}{y+\frac{1}{z}}} = \dfrac{37}{13} = 2\dfrac{11}{13} = 2 + \dfrac{11}{13} \Rightarrow \dfrac{1}{x+\dfrac{1}{y+\frac{1}{z}}} = \dfrac{11}{13} \Rightarrow x + \dfrac{1}{y+\frac{1}{z}} = \dfrac{13}{11}$

$\Rightarrow x + \dfrac{1}{y+\frac{1}{z}} = 1 + \dfrac{2}{11} \Rightarrow x = 1,\ y + \dfrac{1}{z} = \dfrac{11}{2} = 5\dfrac{1}{2} = 5 + \dfrac{1}{2} \Rightarrow x = 1,\ y = 5,\ z =$

111. $x = y \Leftrightarrow 1 - q = 2q + 1 \Leftrightarrow 3q = 0 \Leftrightarrow q = 0.$

112. $\frac{x}{5} - \frac{x}{6} = 4 \Leftrightarrow \frac{6x - 5x}{30} = 4 \Leftrightarrow x = 120.$

113. $\frac{3x}{2y} = \frac{21}{22} \Rightarrow \frac{x}{y} = \left(\frac{21}{22} \times \frac{2}{3}\right) = \frac{7}{11} \Rightarrow x = \frac{7}{11}y.$

$4x + 5y = 83 \Rightarrow 4 \times \frac{7}{11}y + 5y = 83 \Rightarrow \frac{28}{11}y + 5y = 83 \Rightarrow 83y = 83 \times 11 \Rightarrow y = 11.$

$\therefore \quad x = \frac{7}{11}y = \left(\frac{7}{11} \times 11\right) = 7.$

So, $y - x = 11 - 7 = 4.$

114. $3x + y = 19 \quad ...(i)$ and $x - y = 9 \quad ...(ii)$

Adding (i) and (ii), we get : $4x = 28$ or $x = 7$. Putting $x = 7$ in (i), we get : $y = -2$.

115. $a + b = 5 \quad ...(i)$ and $3a + 2b = 20 \quad ...(ii)$

Multiplying (i) by 2 and subtracting from (ii), we get : $a = 10$.

Putting $a = 10$ in (i), we get : $b = -5$.

$\therefore \quad (3a + b) = 3 \times 10 + (-5) = 30 - 5 = 25.$

116. $(2p + 3q) + (2p - q) = 18 + 2 \Rightarrow 4p + 2q = 20 \Rightarrow 2(2p + q) = 20$

$\Rightarrow 2p + q = 10.$

117. $2x + y = 5 \quad ...(i)$ and $3x - 4y = 2 \quad ...(ii)$

Multiplying (i) by 4 and adding (ii) to it, we get : $11x = 22$ or $x = 2$.

Putting $x = 2$ in (i), we get : $y = 1$. So, $2xy = 2 \times 2 \times 1 = 4$.

118. $3x - 5y = 5 \quad ...(i)$ and $\frac{x}{x + y} = \frac{5}{7} \Rightarrow 7x = 5x + 5y \Rightarrow 2x - 5y = 0 \quad ...(ii)$

Subtracting (ii) from (i), we get : $x = 5$.

Putting $x = 5$ in (i), we get : $y = 2$. So, $x - y = 5 - 2 = 3$.

119. $4x + 3y = 18xy \quad ...(i)$ and $2x - 5y = -4xy \quad ...(ii)$

Dividing (i) and (ii) by xy, we get : $\frac{3}{x} + \frac{4}{y} = 18 \quad ...(iii)$ and $\frac{5}{x} - \frac{2}{y} = 4 \quad ...(iv)$

Multiplying (iv) by 2 and adding (iii) to it, we get : $\frac{13}{x} = 26$ or $x = \frac{1}{2}$.

Putting $x = \frac{1}{2}$ in (iii), we get : $y = \frac{1}{3}$.

120. $2x + y = 17 \quad ...(i)$; $y + 2z = 15 \quad ...(ii)$ and $x + y = 9 \quad ...(iii)$

Subtracting (iii) from (i), we get : $x = 8$.

Putting $x = 8$ in (i), we get : $y = 1$. Putting $y = 1$ in (ii), we get : $2z = 14$ or $z = 7$.

$\therefore \quad 4x + 3y + z = 4 \times 8 + 3 \times 1 + 7 = 42.$

121. $3x - 4y + z = 7 \quad ...(i)$; $2x + 3y - z = 19 \quad ...(ii)$ and $x + 2y + 2z = 24 \quad ...(iii)$

Adding (i) and (ii), we get : $5x - y = 26 \quad ...(iv)$

Subtracting (i) from (ii) and adding to (iii), we get : $9y = 36$ or $y = 4$.

Putting $y = 4$ in (iv), we get : $5x = 30$ or $x = 6$.

Putting $x = 6$, $y = 4$ in (iii), we get : $2z = 10$ or $z = 5$.

122. $2x + y = 15 \quad ...(i)$; $2y + z = 25 \quad ...(ii)$ and $2z + x = 26 \quad ...(iii)$

Adding (i), (ii) and (iii), we get : $3(x + y + z) = 66$ or $x + y + z = 22 \quad ...(iv)$

From (ii), we have : $y = \frac{25 - z}{2}$. From (iii), we have : $x = 26 - 2z$.

$\therefore \quad (26 - 2z) + \left(\frac{25 - z}{2}\right) + z = 22 \Leftrightarrow 77 - 3z = 44 \Leftrightarrow 3z = 33 \Leftrightarrow z = 11.$

123. $2x + 3y = 31$ ...(*i*) ; $y - z = 4$ ...(*ii*) and $x + 2z = 11$ ...(*iii*)
Multiplying (*iii*) by 2 and subtracting from (*i*), we get : $3y - 4z = 9$ ...(*iv*)
Solving (*ii*) and (*iv*), we get : $y = 7$, $z = 3$. Putting $y = 7$ in (*i*), we get : $x = 5$.
$\therefore \quad x + y + z = (5 + 7 + 3) = 15.$

124. Given exp. $= \left(\frac{3}{4} \times \frac{4}{3} \times \frac{5}{3} \times \frac{3}{5} \times \frac{13}{7} \times \frac{1}{13}\right) = \frac{1}{7}.$

125. Given exp. $= \frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \ldots\ldots \times \frac{(n-1)}{n} = \frac{1}{n}.$

126. Given exp. $= \frac{3}{2} \times \frac{4}{3} \times \frac{5}{4} \times \ldots\ldots \times \frac{121}{120} = \frac{121}{2} = 60.5.$

127. Given exp. $= \frac{5}{3} \times \frac{7}{5} \times \frac{9}{7} \times \ldots\ldots \times \frac{1003}{1001} = \frac{1003}{3}.$

128. Given exp. $= \left(1 - \frac{1}{2}\right) + \left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{3} - \frac{1}{4}\right) + \left(\frac{1}{4} - \frac{1}{5}\right) + \ldots\ldots + \left(\frac{1}{11} - \frac{1}{12}\right) = \left(1 - \frac{1}{12}\right) = \frac{11}{12}.$

129. Clearly, sum of first 6 terms is zero. So, sum of first 30 terms = 0.
$\therefore$ Required sum $= \left(\frac{1}{2} + \frac{1}{3} - \frac{1}{4} - \frac{1}{2} - \frac{1}{3}\right) = -\frac{1}{4}.$

130. Given exp. $= \left(1000 - \frac{4}{999}\right) \times 999 = 999000 - 4 = 998996.$

131. Given exp.

$$= \left(1000 - \frac{6}{7}\right) + \left(1000 - \frac{5}{7}\right) + \left(1000 - \frac{4}{7}\right) + \left(1000 - \frac{3}{7}\right) + \left(1000 - \frac{2}{7}\right) + \left(1000 - \frac{1}{7}\right)$$

$$= 6000 - \left(\frac{6}{7} + \frac{5}{7} + \frac{4}{7} + \frac{3}{7} + \frac{2}{7} + \frac{1}{7}\right) = 6000 - \frac{21}{7} = 6000 - 3 = 5997.$$

132. Given exp. $= \frac{4 \times 3^3 + 3^2 + 3 + 1}{4 \times 3^3} = \frac{108 + 9 + 3 + 1}{108} = \frac{121}{108}.$

133. Given exp. $= \frac{4 \cdot 5 \cdot 6 + 5 \cdot 6 + 2 \cdot 6 + 2 \cdot 3}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6} = \frac{120 + 30 + 12 + 6}{720} = \frac{168}{720} = \frac{7}{30}.$

134. Given exp. $= \left(\frac{1}{1^2} - \frac{1}{2^2}\right) + \left(\frac{1}{2^2} - \frac{1}{3^2}\right) + \left(\frac{1}{3^2} - \frac{1}{4^2}\right) + \left(\frac{1}{4^2} - \frac{1}{5^2}\right) + \ldots\ldots + \left(\frac{1}{9^2} - \frac{1}{10^2}\right)$

$$= \left(\frac{1}{1^2} - \frac{1}{10^2}\right) = \left(1 - \frac{1}{100}\right) = \frac{99}{100}.$$

135. Number of pieces $= \left(\frac{42.5 \times 100}{85}\right) = \frac{4250}{85} = 50.$

136. Income after 1 year = Rs. (4×2^1) lakhs.
Income after 2 years = Rs. $(4 \times 2 \times 2)$ lakhs = Rs. (4×2^2) lakhs
$\therefore$ Income after 5 years = Rs. (4×2^5) lakhs = Rs. 128 lakhs = Rs. 1.28 crores.

137. Total number of children = $(30 \times 16) = 480$.
$\therefore$ Number of columns of 24 children each $= \left(\frac{480}{24}\right) = 20.$

138. Original number of sections = $(16 - 3) = 13$.
Original number of students = $(24 \times 13) = 312$.
Present number of students = $(21 \times 16) = 336$.
Number of new students admitted = $(336 - 312) = 24$.

139. Time between 10 a.m. and 13.27 hours = 3 hrs. 27 min. = 207 min.
For three periods in between free time = 15 min.
Remaining time = (207 − 15) min. = 192 min.

$\therefore$ Duration of each of the 4 periods = $\left(\frac{192}{4}\right)$ min. = 48 min.

140.

	Hrs.	Min.	Sec.
	3	17	49
(−)	1	54	50
	1	22	59

Total time = (1 × 60 + 22) min. + 59 sec. = (82 × 60 + 59) sec. = 4979 sec.

$\therefore$ Number of times the light is seen = $\left(\frac{4979}{13}+1\right)$ = 384.

141. Money earned in 2 days = Rs. (20 − 15) = Rs. 5.

Money earned in 16 days = Rs. $\left(\frac{5}{2}\times 16\right)$ = Rs. 40.

On 17th day, money in hand = Rs. (40 + 20) = Rs. 60.

142. Required cost = Rs. [1000 × x + (z − 1000) × y] = Rs. (1000x + zy − 1000y)
= Rs. [1000 (x − y) + yz].

143. 26 trees have 25 gaps between them. Hence, required distance = $\left(\frac{225}{25}\right)$ m = 9 m.

144. Let the number be x. Then, $52x - 25x = 324 \Leftrightarrow 27x = 324 \Leftrightarrow x = 12$.

145. Among the given numbers, only 60489 is a multiple of 423.

146. Let the monthly salary of a man be Rs. x.
Then, monthly salary of a woman = Rs. (x + 500).
$\therefore$ $4x + 2(x + 500) = 46000 \Leftrightarrow 6x = 45000 \Leftrightarrow x = 7500$.
Monthly salary of a woman = x + 500 = Rs. 8000.

147. Let marks in History = x. Then, marks in English = $\frac{5}{2}x$.

$\therefore$ $x + \frac{5}{2}x = 140 \Leftrightarrow \frac{7}{2}x = 140 \Leftrightarrow x = \left(\frac{140\times 2}{7}\right) = 40$.

Hence, marks in English = $\frac{5}{2}x = \left(\frac{5}{2}\times 40\right) = 100$.

148. Let the number of pineapples and watermelons be x and y respectively.

Then, $7x + 5y = 38$ or $5y = (38 - 7x)$ or $y = \frac{38-7x}{5}$.

Clearly, y is a whole number, only when $(38 - 7x)$ is divisible by 5. This happens when $x = 4$.

149. Let number of boys = x. Then, number of girls = 5x.
Total number of children = (x + 5x) = 6x.
Thus, the total number of children must be a multiple of 6.

150. Let F and C denote the temperatures in Fahrenheit and Celsius respectively.

Then, $\frac{F-32}{212-32} = \frac{C-0}{100-0} \Leftrightarrow \frac{F-32}{180} = \frac{C}{100}$.

If C = 35, then F = $\left(\frac{35}{100}\times 180\right) + 32 = 63 + 32 = 95$.

151. Let D's share = Rs. x. Then, C's share = Rs. x.
B's share = Rs. $(x + 125)$. A's share = Rs. $(x + x + 125)$ = Rs. $(2x + 125)$
$\therefore$ $(2x + 125) + (x + 125) + x + x = 750 \Leftrightarrow 5x = 500 \Leftrightarrow x = 100$.
Hence, A's share = $2x + 125$ = Rs. $(2 \times 100 + 125)$ = Rs. 325.

152. Let Gagan's share = Rs. x.
Then, Sachin's share = Rs. $\left(\frac{x}{5}\right)$ and Rohit's share = Rs. $\left(\frac{2x}{5}\right)$.
$\therefore$ $\frac{2x}{5} + \frac{x}{5} + x = 1000 \Leftrightarrow 8x = 5000 \Leftrightarrow x = 625$.

153. Total number of digits = (No. of digits in 1-digit page nos. + No. of digits in 2-digit page nos. + No. of digits in 3-digit page nos.)
$= (1 \times 9 + 2 \times 90 + 3 \times 267) = (9 + 180 + 801) = 990$.

154. No. of digits in 1-digit page nos. = $1 \times 9 = 9$.
No. of digits in 2-digit page nos. = $2 \times 90 = 180$.
No. of digits in 3-digit page nos. = $3 \times 900 = 2700$.
No. of digits in 4-digit page nos. = $3189 - (9 + 180 + 2700) = 3189 - 2889 = 300$.
$\therefore$ No. of pages with 4-digit page nos. = $\left(\frac{300}{4}\right) = 75$.
Hence, total number of pages = $(999 + 75) = 1074$.

155. Each row contains 12 plants.
Leaving 2 corner plants, 10 plants in between have (10×2) metres and 1 metre on each side is left.
$\therefore$ Length = $(20 + 2)$ m = 22 m.

156. Required fraction = $\frac{1 \text{ sec.}}{1 \text{ hr.}} = \frac{1 \text{ sec.}}{(1 \times 60 \times 60) \text{ sec.}} = \frac{1}{3600}$.

157. Height at the third bounce = $\left[32 \times \left(\frac{3}{4}\right)^3\right]$ m = $\left(32 \times \frac{27}{64}\right)$ m = $\frac{27}{2}$ m = $13\frac{1}{2}$ m.

158. Suppose Sanket earns Rs. x in each of the other eleven months.
Then, Sanket's earning in March = Rs. $(2x)$.
Sanket's annual earning = Rs. $(11x + 2x)$ = Rs. $(13x)$.
$\therefore$ Required fraction = $\frac{2x}{13x} = \frac{2}{13}$.

159. Let the capacity of the tank be x litres. Then, $\frac{1}{3}x = 80 \Leftrightarrow x = 240 \Leftrightarrow \frac{1}{2}x = 120$.

160. Distance travelled on foot = $\left[\frac{7}{2} - \left(\frac{5}{3} + \frac{7}{6}\right)\right]$ km = $\left(\frac{7}{2} - \frac{17}{6}\right)$ km = $\frac{2}{3}$ km.
$\therefore$ Required fraction = $\frac{(2/3)}{(7/2)} = \left(\frac{2}{3} \times \frac{2}{7}\right) = \frac{4}{21}$.

161. Let the required fraction be x. Then,
$\frac{4}{7}x + \frac{4}{7} = \frac{15}{14} \Leftrightarrow \frac{4}{7}x = \left(\frac{15}{14} - \frac{4}{7}\right) = \frac{7}{14} = \frac{1}{2} \Leftrightarrow x = \left(\frac{1}{2} \times \frac{7}{4}\right) = \frac{7}{8}$.

162. Required fraction = $\frac{\frac{2}{3} \text{ of } \frac{1}{4} \text{ of Rs. } 25.20}{\frac{3}{2} \text{ of Rs. } 36} = \frac{\text{Rs. } 4.20}{\text{Rs. } 54} = \frac{42}{540} = \frac{7}{90}$.

163. Let the length of longer piece be x cm. Then, length of shorter piece $= \left(\frac{2}{5}x\right)$ cm.

$\therefore \quad x + \frac{2}{5}x = 70 \Leftrightarrow \frac{7x}{5} = 70 \Leftrightarrow x = \left(\frac{70 \times 5}{7}\right) = 50.$

Hence, length of shorter piece $= \frac{2}{5}x = \left(\frac{2}{5} \times 50\right)$ cm $= 20$ cm.

164. Let the whole amount be Rs. x. Then, A's share $=$ Rs. $\left(\frac{3}{16}x\right)$; B's share $=$ Rs. $\left(\frac{x}{4}\right)$;

and C's share $=$ Rs. $\left[x - \left(\frac{3x}{16} + \frac{x}{4}\right)\right] =$ Rs. $\left(\frac{9x}{16}\right)$.

$\therefore \quad \frac{9x}{16} = 81 \Leftrightarrow x = \left(\frac{81 \times 16}{9}\right) = 144.$

Hence, B's share $=$ Rs. $\left(\frac{144}{4}\right) =$ Rs. 36.

165. Green portion $= \left[1 - \left(\frac{1}{10} + \frac{1}{20} + \frac{1}{30} + \frac{1}{40} + \frac{1}{50} + \frac{1}{60}\right)\right]$

$= \left[1 - \frac{1}{10}\left(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6}\right)\right] = 1 - \frac{1}{10} \times \frac{147}{60} = 1 - \frac{147}{600} = \frac{453}{600}.$

Let the length of the pole be x metres.

Then, $\frac{453}{600}x = 12.08 \Leftrightarrow x = \left(\frac{12.08 \times 600}{453}\right) = 16.$

166. Let the number be x. Then,

$\frac{3}{4}x - \frac{3}{14}x = 150 \Leftrightarrow 21x - 6x = 150 \times 28 \Leftrightarrow 15x = 150 \times 28 \Leftrightarrow x = 280.$

167. Let the sum be Rs. x. Then,

$\frac{8}{3}x - \frac{3}{8}x = 55 \Leftrightarrow 64x - 9x = 55 \times 24 \Leftrightarrow x = \left(\frac{55 \times 24}{55}\right) = 24.$

$\therefore$ Correct answer $=$ Rs. $\left(\frac{3}{8} \times 24\right) =$ Rs. 9.

168. Let the fraction be $\frac{a}{b}$. Then,

$\left(\frac{a}{b} \times \frac{a}{b}\right) \div \frac{b}{a} = \frac{512}{27} \Leftrightarrow \frac{a}{b} \times \frac{a}{b} \times \frac{a}{b} = \frac{512}{27} \Leftrightarrow \left(\frac{a}{b}\right)^3 = \left(\frac{8}{3}\right)^3 \Leftrightarrow \frac{a}{b} = \frac{8}{3} = 2\frac{2}{3}.$

169. Maximum internal assessment score $= \left(\frac{47}{50} \times 10\right) = 9.4.$

Minimum internal assessment score $= \left(\frac{14}{50} \times 10\right) = 2.8.$

$\therefore$ Required difference $= (9.4 - 2.8) = 6.6.$

170. Let savings in N.S.C. and P.P.F. be Rs. x and Rs. $(150000 - x)$ respectively. Then,

$\frac{1}{3}x = \frac{1}{2}(150000 - x) \Leftrightarrow \frac{x}{3} + \frac{x}{2} = 75000 \Leftrightarrow \frac{5x}{6} = 75000 \Leftrightarrow x = \left(\frac{75000 \times 6}{5}\right) = 90000.$

$\therefore$ Savings in Public Provident Fund $=$ Rs. $(150000 - 90000) =$ Rs. 60000.

171. Let there be $(x + 1)$ members. Then,

Father's share $= \frac{1}{4}$, share of each other member $= \frac{3}{4x}$.

$\therefore \quad 3\left(\frac{3}{4x}\right) = \frac{1}{4} \Leftrightarrow 4x = 36 \Leftrightarrow x = 9.$

Hence, total number of family members = 10.

172. Let salary = Rs. x. Then, tips = Rs. $\left(\frac{5}{4}x\right)$.

Total income = Rs. $\left(x + \frac{5}{4}x\right)$ = Rs. $\left(\frac{9x}{4}\right)$.

$\therefore$ Required fraction $= \left(\frac{5x}{4} \times \frac{4}{9x}\right) = \frac{5}{9}$.

173. Let C's share = Rs. x. Then, B's share = Rs. $\left(\frac{x}{4}\right)$, A's share = Rs. $\left(\frac{2}{3} \times \frac{x}{4}\right)$ = Rs. $\frac{x}{6}$.

$\therefore \quad \frac{x}{6} + \frac{x}{4} + x = 1360 \Leftrightarrow \frac{17x}{12} = 1360 \Leftrightarrow x = \left(\frac{1360 \times 12}{17}\right)$ = Rs. 960.

Hence, B's share = Rs. $\left(\frac{960}{4}\right)$ = Rs. 240.

174. Let Tanya's share = Rs. x. Then, Veena's share = Rs. $\left(\frac{x}{2}\right)$,

Amita's share = Rs. $\left(\frac{2}{3} \times \frac{x}{2}\right)$ = Rs. $\left(\frac{x}{3}\right)$. Total bill = Rs. $\left(x + \frac{x}{2} + \frac{x}{3}\right)$ = Rs. $\left(\frac{11x}{6}\right)$.

$\therefore$ Required fraction $= \left(\frac{x}{2} \times \frac{6}{11x}\right) = \frac{3}{11}$.

175. Let the capacity of the tank be x litres. Then, $\frac{1}{4}x = 135 \Leftrightarrow x = 135 \times 4 = 540$.

$\therefore$ Required fraction $= \left(\frac{180}{540}\right) = \frac{1}{3}$.

176. Let the capacity of the tank be x litres.

Then, $\frac{6}{7}x - \frac{2}{5}x = 16 \Leftrightarrow 30x - 14x = 16 \times 35 \Leftrightarrow 16x = 560 \Leftrightarrow x = 35$.

177. Let the capacity of the bucket be x litres. Then,

Capacity of 1 large bottle $= \frac{x}{4}$; Capacity of 1 small bottle $= \frac{x}{7}$.

Fluid left in large bottle $= \left(\frac{x}{4} - \frac{x}{7}\right) = \frac{3x}{28}$.

$\therefore$ Required fraction $= \left(\frac{3x/28}{x/4}\right) = \left(\frac{3x}{28} \times \frac{4}{x}\right) = \frac{3}{7}$.

178. Let the capacity of 1 bucket = x. Then, capacity of tank = $25x$.

New capacity of bucket $= \frac{2}{5}x$.

$\therefore$ Required number of buckets $= \frac{25x}{(2x/5)} = \left(25x \times \frac{5}{2x}\right) = \frac{125}{2} = 62\frac{1}{2}$.

179. Suppose initially Peter had Rs. x. Then,

Amount received by Michael = Rs. $\left(\frac{x}{4}\right)$.

Amount remaining with Peter = Rs. $\left(x - \frac{x}{4}\right)$ = Rs. $\left(\frac{3x}{4}\right)$.

Amount received by Sam = Rs. $\left(\frac{1}{2} \times \frac{x}{4}\right)$ = Rs. $\left(\frac{x}{8}\right)$.

$\therefore \quad \frac{3x}{4} - \frac{x}{8} = 500 \iff 5x = 4000 \iff x = 800.$

Hence, amount received by Michael = $(x/4)$ = Rs. 200.

180. A's share = $\frac{1}{3}$. Remainder = $\left(1 - \frac{1}{3}\right) = \frac{2}{3}$.

B's share = $\frac{2}{5}$ of $\frac{2}{3} = \frac{4}{15}$. Rest = $\left(\frac{2}{3} - \frac{4}{15}\right) = \frac{6}{15} = \frac{2}{5}$.

C's share = D's share = $\frac{1}{2}$ of $\frac{2}{5} = \frac{1}{5}$.

181. Part read on first day = $\frac{3}{8}$. Remaining part = $\left(1 - \frac{3}{8}\right) = \frac{5}{8}$.

Part read on second day = $\frac{4}{5}$ of $\frac{5}{8} = \frac{1}{2}$. Unread part = $\left[1 - \left(\frac{3}{8} + \frac{1}{2}\right)\right] = \frac{1}{8}$.

Let the number of pages be x. Then, $\frac{1}{8}x = 30$ or $x = 30 \times 8 = 240$.

182. Wife's share = $\frac{1}{2}$. Remaining part = $\left(1 - \frac{1}{2}\right) = \frac{1}{2}$.

Share of 3 sons = $\left(\frac{2}{3} \text{ of } \frac{1}{2}\right) = \frac{1}{3}$. Remaining part = $\left(\frac{1}{2} - \frac{1}{3}\right) = \frac{1}{6}$.

Each daughter's share = $\frac{1}{4} \times \frac{1}{6} = \frac{1}{24}$.

Let the total money be Rs. x. Then, $\frac{1}{24}x = 20000 \iff x = 20000 \times 24 = 480000$.

$\therefore$ Each son's share = Rs. $\left[\frac{1}{3} \times \left(\frac{1}{3} \times 480000\right)\right]$ = Rs. 53,333.33.

183. Out of 5 girls, 1 took part in fete. Out of 8 boys, 1 took part in fete.

$\therefore$ Out of 13 students, 2 took part in fete.

Hence, $\frac{2}{13}$ of the total number took part in fete.

184. French men = $\frac{1}{5}$; French women = $\left(\frac{1}{5} + \frac{2}{3} \times \frac{1}{5}\right) = \frac{5}{15} = \frac{1}{3}$.

French people = $\left(\frac{1}{5} + \frac{1}{3}\right) = \frac{8}{15}$. $\therefore$ Not-French = $\left(1 - \frac{8}{15}\right) = \frac{7}{15}$.

185. Girls = $\frac{3}{5}$; Boys = $\left(1-\frac{3}{5}\right)=\frac{2}{5}$.

Fraction of students absent = $\frac{2}{9}$ of $\frac{3}{5}+\frac{1}{4}$ of $\frac{2}{5}=\frac{6}{45}+\frac{1}{10}=\frac{21}{90}=\frac{7}{30}$.

$\therefore$ Fraction of students present = $\left(1-\frac{7}{30}\right)=\frac{23}{30}$.

186. Number of boys who participate = 100.

$\therefore$ $\frac{1}{3}$ of boys = 100 or total number of boys = 300.

Number of girls who participate = 200.

$\therefore$ $\frac{1}{2}$ of girls = 200 or total number of girls = 400.

Hence, total number of students = (300 + 400) = 700.

187. Let the number of votes cast be x. Then, number of votes required = $\frac{3x}{4}$.

Counted votes = $\frac{2x}{3}$. Uncounted votes = $\left(x-\frac{2x}{3}\right)=\frac{x}{3}$.

Votes won by the candidate = $\frac{5}{6}$ of $\frac{3x}{4}=\frac{5x}{8}$.

Remaining votes required = $\left(\frac{3x}{4}-\frac{5x}{8}\right)=\frac{x}{8}$.

$\therefore$ Required fraction = $\frac{(x/8)}{(x/3)}=\left(\frac{x}{8}\times\frac{3}{x}\right)=\frac{3}{8}$.

188. Let the total number of staff members be x.

Then, the number who can type or take shorthand = $\left(x-\frac{3x}{4}\right)=\frac{x}{4}$.

Let A and B represent the sets of persons who can type and take shorthand respectively.

Then, $n(A\cup B)=\frac{x}{4}$, $n(A)=\frac{x}{5}$ and $n(B)=\frac{x}{3}$.

$n(A\cap B)=n(A)+n(B)-n(A\cup B)=\left(\frac{x}{5}+\frac{x}{3}-\frac{x}{4}\right)=\left(\frac{12x+20x-15x}{60}\right)=\frac{17x}{60}$.

189. Hire charges = Rs. $\left(60\times4+60\times5+\frac{8}{5}\times200\right)$ = Rs. 860.

Suppose Rohit had Rs. x with him initially. Then, $x-860=\frac{1}{4}\times860 \Leftrightarrow x=1075$.

190. Let the total number of shots be x. Then,

Shots fired by A = $\frac{5}{8}x$; Shots fired by B = $\frac{3}{8}x$.

Killing shots by A = $\frac{1}{3}$ of $\frac{5}{8}x=\frac{5x}{24}$; Shots missed by B = $\frac{1}{2}$ of $\frac{3}{8}x=\frac{3}{16}x$.

$\therefore$ $\frac{3x}{16}=27$ or $x=\left(\frac{27\times16}{3}\right)=144$. Birds killed by A = $\frac{5x}{24}=\left(\frac{5}{24}\times144\right)=30$.

191. Number of alterations required in 1 shirt = $\left(\frac{2}{3}+\frac{3}{4}+\frac{4}{5}\right)=\frac{133}{60}$.

$\therefore$ Number of alterations required in 60 shirts = $\left(\frac{133}{60}\times60\right)=133$.

192. Let the largest fraction be x and the smallest be y. Then, $\frac{x}{y} = \frac{7}{6}$ or $y = \frac{6}{7}x$.

Let the middle one be z. Then, $x + \frac{6}{7}x + z = \frac{59}{24}$ or $z = \left(\frac{59}{24} - \frac{13x}{7}\right)$.

$\therefore \quad \frac{59}{24} - \frac{13x}{7} + \frac{1}{3} = \frac{7}{6} \Leftrightarrow \frac{13x}{7} = \frac{59}{24} + \frac{1}{3} - \frac{7}{6} = \frac{39}{24} \Leftrightarrow x = \left(\frac{39}{24} \times \frac{7}{13}\right) = \frac{7}{8}$.

So, $x = \frac{7}{8}$, $y = \frac{6}{7} \times \frac{7}{8} = \frac{3}{4}$ and $z = \frac{59}{24} - \frac{13}{7} \times \frac{7}{8} = \frac{20}{24} = \frac{5}{6}$.

Hence, the fractions are $\frac{7}{8}$, $\frac{5}{6}$ and $\frac{3}{4}$.

193. Suppose each tube contains x grams initially. Then,

$4\left[\frac{1}{3}(x + 20)\right] = x + \frac{2}{3}(x + 20) \Leftrightarrow \frac{2}{3}(x + 20) = x \Leftrightarrow \frac{x}{3} = \frac{40}{3} \Leftrightarrow x = 40.$

194. Let the total number of apples be x. Then,

Apples sold to 1st customer $= \left(\frac{x}{2} + 1\right)$. Remaining apples $= x - \left(\frac{x}{2} + 1\right) = \left(\frac{x}{2} - 1\right)$.

Apples sold to 2nd customer $= \frac{1}{3}\left(\frac{x}{2} - 1\right) + 1 = \frac{x}{6} - \frac{1}{3} + 1 = \left(\frac{x}{6} + \frac{2}{3}\right)$.

Remaining apples $= \left(\frac{x}{2} - 1\right) - \left(\frac{x}{6} + \frac{2}{3}\right) = \left(\frac{x}{2} - \frac{x}{6}\right) - \left(1 + \frac{2}{3}\right) = \left(\frac{x}{3} - \frac{5}{3}\right)$.

Apples sold to 3rd customer $= \frac{1}{5}\left(\frac{x}{3} - \frac{5}{3}\right) + 1 = \left(\frac{x}{15} + \frac{2}{3}\right)$.

Remaining apples $= \left(\frac{x}{3} - \frac{5}{3}\right) - \left(\frac{x}{15} + \frac{2}{3}\right) = \left(\frac{x}{3} - \frac{x}{15}\right) - \left(\frac{5}{3} + \frac{2}{3}\right) = \left(\frac{4x}{15} - \frac{7}{3}\right)$.

$\therefore \quad \frac{4x}{15} - \frac{7}{3} = 3 \Leftrightarrow \frac{4x}{15} = \frac{16}{3} \Leftrightarrow x = \left(\frac{16}{3} \times \frac{15}{4}\right) = 20.$

195. Given exp. $= \frac{(a+b)^2 + (a-b)^2}{a^2 + b^2}$, where $a = 856$, $b = 167$

$= \frac{2(a^2 + b^2)}{(a^2 + b^2)} = 2.$

196. Given exp. $= \frac{(a+b)^2 - (a-b)^2}{ab} = \frac{4ab}{ab} = 4$ (where $a = 469$, $b = 174$).

197. $2ab = (a^2 + b^2) - (a - b)^2 = 29 - 9 = 20 \Rightarrow ab = 10.$

198. $\frac{x^2 - 1}{x + 1} = 4 \Leftrightarrow \frac{(x+1)(x-1)}{x+1} = 4 \Leftrightarrow x - 1 = 4 \Leftrightarrow x = 5.$

199. If $a = 3\frac{2}{3}$, $b = 2\frac{1}{2}$, $c = 4\frac{3}{4}$, $d = 3\frac{1}{3}$, then

Given exp. $= \frac{(a^2 - b^2)}{(c^2 - d^2)} + \frac{(a-b)}{(c-d)} = \frac{(a^2 - b^2)}{(c^2 - d^2)} \times \frac{(c-d)}{(a-b)} = \frac{(a+b)}{(c+d)}$

$= \frac{3\frac{2}{3} + 2\frac{1}{2}}{4\frac{3}{4} + 3\frac{1}{3}} = \frac{\frac{11}{3} + \frac{5}{2}}{\frac{19}{4} + \frac{10}{3}} = \frac{37}{6} \times \frac{12}{97} = \frac{74}{97}.$

200. Given exp. $= \dfrac{a^2-b^2}{a+b} = a-b = \left(1+\dfrac{1}{1+\dfrac{1}{100}}\right) - \left(1-\dfrac{1}{1+\dfrac{1}{100}}\right)$

$= 2 \times \dfrac{1}{(101/100)} = 2 \times \dfrac{100}{101} = \dfrac{200}{101}.$

201. $(a+b+c)^2 = a^2+b^2+c^2+2(ab+bc+ca)$

$\Rightarrow \quad 2(ab+bc+ca) = (a+b+c)^2 - (a^2+b^2+c^2) = 169 - 69 = 100$

$\Rightarrow \quad ab+bc+ca = 50.$

202. Given : $x^2+y^2+z^2-64 = -2(xy-yz-zx)$ ...(*i*)

Now, $[x+y+(-z)]^2 = x^2+y^2+z^2+2(xy-yz-zx)$

$\Rightarrow \quad (3z-z)^2 = x^2+y^2+z^2+2(xy-yz-zx)$

$\Rightarrow \quad -2(xy-yz-zx) = (x^2+y^2+z^2)-(2z)^2$ ...(*ii*)

From (*i*) and (*ii*), we get : $(2z)^2 = 64 \Leftrightarrow 4z^2 = 64 \Leftrightarrow z^2 = 16 \Leftrightarrow z = 4.$

203. Given exp. $= \left(\dfrac{a^3+b^3}{a^2+b^2-ab}\right) = (a+b)$, where $a = 785$, $b = 435$

$= (785+435) = 1220.$

204. Given exp. $= \left(\dfrac{a^2+ab+b^2}{a^3-b^3}\right) = \left(\dfrac{1}{a-b}\right)$, where $a = 147$, $b = 143$

$= \left(\dfrac{1}{147-143}\right) = \dfrac{1}{4}.$

205. Let $\dfrac{13^3+7^3}{13^2+7^2-x} = 20$. Then,

$\dfrac{13^3+7^3}{13+7} = 13^2+7^2-x \Leftrightarrow 13^2+7^2-13\times 7 = 13^2+7^2-x \Leftrightarrow x = 13\times 7 = 91.$

206. Given exp. $= \dfrac{a^3-b^3}{a^2-b^2} = \dfrac{(a-b)(a^2+ab+b^2)}{(a-b)(a+b)} = \dfrac{(a^2+ab+b^2)}{(a+b)}$

$= \dfrac{\left(\dfrac{3}{5}\right)^2+\left(\dfrac{3}{5}\times\dfrac{2}{5}\right)+\left(\dfrac{2}{5}\right)^2}{\left(\dfrac{3}{5}+\dfrac{2}{5}\right)} = \dfrac{9}{25}+\dfrac{6}{25}+\dfrac{4}{25} = \dfrac{19}{25}.$

207. Given exp. $= \dfrac{a^3+b^3+c^3-3abc}{a^2+b^2+c^2-ab-bc-ca} = a+b+c = (38+34+28) = 100.$

208. Since $(x-y)+(y-z)+(z-x) = 0$, so $(x-y)^3+(y-z)^3+(z-x)^3$

$= 3(x-y)(y-z)(z-x).$

$\therefore$ Given exp. $= \dfrac{3(x-y)(y-z)(z-x)}{9(x-y)(y-z)(z-x)} = \dfrac{1}{3}.$

209. Let total score be x. Then, highest score $= \dfrac{3x}{11}$.

Remainder $= \left(x-\dfrac{3x}{11}\right) = \dfrac{8x}{11}$. Next highest score $= \dfrac{3}{11}$ of $\dfrac{8x}{11} = \dfrac{24x}{121}$.

$\therefore \quad \dfrac{3x}{11}-\dfrac{24x}{121} = 9 \Leftrightarrow 33x-24x = 9\times 121 \Leftrightarrow 9x = 9\times 121 \Leftrightarrow x = 121.$

210. $X + 3X \times 0.50 + 14 \times 0.10 + 4X \times 0.05 = 50$
$\Leftrightarrow X + 1.5X + 1.40 + 0.2X = 50 \Leftrightarrow 2.7X = 48.60 \Leftrightarrow X = 18.$

211. Suppose their paths cross after x minutes.

Then, $11 + 57x = 51 - 63x \Leftrightarrow 120x = 40 \Leftrightarrow x = \frac{1}{3}$.

Number of floors covered by David in $(1/3)$ min. $= \left(\frac{1}{3} \times 57\right) = 19$.

So, their paths cross at $(11 + 19)$ *i.e.* 30th floor.

212. $N \times 50 = (325000 - 300000) = 25000 \Leftrightarrow N = 500.$

213. Let total number of children be x. Then, $x \times \frac{1}{8}x = \frac{x}{2} \times 16 \Leftrightarrow x = 64.$

$\therefore$ Number of notebooks $= \frac{1}{8}x^2 = \left(\frac{1}{8} \times 64 \times 64\right) = 512.$

214. Let number of boys $= x$. Then, number of girls $= x$.
Now, $2(x - 8) = x$ or $x = 16$.
$\therefore$ Total number of students $= 2x = (2 \times 16) = 32$.

215. Let the total number of sweets be $(25x + 8)$.
Then, $(25x + 8) - 22$ is divisible by 28
$\Leftrightarrow (25x - 14)$ is divisible by 28 $\Leftrightarrow 28x - (3x + 14)$ is divisible by 28
$\Leftrightarrow (3x + 14)$ is divisible by 28 $\Leftrightarrow x = 14$.
$\therefore$ Total number of sweets $= (25 \times 14 + 8) = 358$.

216. Suppose the man works overtime for x hours.
Now, working hours in 4 weeks $= (5 \times 8 \times 4) = 160$.
$\therefore 160 \times 2.40 + x \times 3.20 = 432 \Leftrightarrow 3.20x = 432 - 384 = 48 \Leftrightarrow x = 15.$
Hence, total hours of work $= (160 + 15) = 175$.

217. Let number of boys $= x$. Then, number of girls $= (100 - x)$.
$\therefore 3.60x + 2.40(100 - x) = 312 \Leftrightarrow 1.20x = 312 - 240 = 72 \Leftrightarrow x = 60.$
Hence, number of girls $= (100 - x) = 40$.

218. Let number of boys $= x$. Then, number of girls $= (60 - x)$.
$\therefore x(60 - x) + (60 - x)x = 1600 \Leftrightarrow 60x - x^2 + 60x - x^2 = 1600$
$\Leftrightarrow 2x^2 - 120x + 1600 = 0 \Leftrightarrow x^2 - 60x + 800 = 0$
$\Leftrightarrow (x - 40)(x - 20) = 0 \Leftrightarrow x = 40$ or $x = 20$.
So, we are not definite. Hence, data is inadequate.

219. Let the distance covered by taxi be x km. Then, distance covered by car $= (80 - x)$ km.
$\therefore 1.5x + 0.5(80 - x) = 50 \Leftrightarrow x = 50 - 40 = 10$ km.

220. Let the number of correct answers be x. Number of incorrect answers $= (60 - x)$.
$\therefore 4x - (60 - x) = 130 \Leftrightarrow 5x = 190 \Leftrightarrow x = 38.$

221. Let number of matches lost $= x$. Then, number of matches won $= x + 3$.
$\therefore 2(x + 3) - x = 23 \Leftrightarrow x = 17.$
Hence, total number of matches played $= x + (x + 3) = 2x + 3 = 37$.

222. Let the number of 20-paise coins be x. Then, number of 25-paise coins $= (324 - x)$.
$\therefore 0.20 \times x + 0.25(324 - x) = 71 \Leftrightarrow 20x + 25(324 - x) = 7100$
$\Leftrightarrow 5x = 1000 \Leftrightarrow x = 200.$
Hence, number of 25-paise coins $= (324 - x) = 124$.

223. Let number of notes of each denomination be x.
Then, $x + 5x + 10x = 480 \Leftrightarrow 16x = 480 \Leftrightarrow x = 30.$
Hence, total number of notes $= 3x = 90$.

224. Original share of 1 person = $\frac{1}{8}$. New share of 1 person = $\frac{1}{7}$.

Increase = $\left(\frac{1}{7}-\frac{1}{8}\right)=\frac{1}{56}$.

$\therefore$ Required fraction = $\frac{(1/56)}{(1/8)}=\left(\frac{1}{56}\times 8\right)=\frac{1}{7}$.

225. Let total number of sweets be x. Then,

$\frac{x}{140}-\frac{x}{175}=4 \Leftrightarrow 5x-4x=4\times 700 \Leftrightarrow x=2800.$

226. Let the number of persons be x. Then,

$\frac{96}{x-4}-\frac{96}{x}=4 \Leftrightarrow \frac{1}{x-4}-\frac{1}{x}=\frac{4}{96} \Leftrightarrow \frac{x-(x-4)}{x(x-4)}=\frac{1}{24}$

$\Leftrightarrow x^2-4x-96=0 \Leftrightarrow (x-12)(x+8)=0 \Leftrightarrow x=12.$

227. Let the number of balls purchased be x.

Then, $\frac{450}{x}-\frac{450}{x+5}=15 \Leftrightarrow \frac{1}{x}-\frac{1}{x+5}=\frac{15}{450} \Leftrightarrow \frac{x+5-x}{x(x+5)}=\frac{1}{30}$

$\Leftrightarrow x^2+5x-150=0 \Leftrightarrow (x+15)(x-10)=0 \Leftrightarrow x=10.$

228. Let the length of the piece be x metres. Then, cost of 1 m of piece = Rs. $\left(\frac{35}{x}\right)$.

$\therefore (x+4)\left(\frac{35}{x}-1\right)=35 \Leftrightarrow 35-x+\frac{140}{x}-4=35 \Leftrightarrow \frac{140}{x}-x=4$

$\Leftrightarrow x^2+4x-140=0 \Leftrightarrow (x+14)(x-10)=0 \Leftrightarrow x=10.$

229. Let the cost of a chair and that of a table be Rs. x and Rs. y respectively.

Then, $10x=4y$ or $y=\frac{5}{2}x$.

$\therefore 15x+2y=4000 \Leftrightarrow 15x+2\times\frac{5}{2}x=4000 \Leftrightarrow 20x=4000 \Leftrightarrow x=200.$

So, $y=\left(\frac{5}{2}\times 200\right)=500.$

Hence, cost of 12 chairs and 3 tables = $12x+3y$ = Rs. (2400 + 1500) = Rs. 3900.

230. Cost of 4 mangoes = Cost of 9 lemons = Rs. $\left(\frac{4.80}{3}\times 9\right)$ = Rs. 14.40.

Cost of 1 mango = Rs. $\left(\frac{14.40}{4}\right)$ = Rs. 3.60.

Cost of 5 apples = Cost of 3 mangoes = Rs. (3.60 × 3) = Rs. 10.80.
Cost of 9 oranges = Cost of 5 apples = Rs. 10.80.

$\therefore$ Cost of 1 orange = Rs. $\left(\frac{10.80}{9}\right)$ = Rs. 1.20.

231. Let the price of a saree and a shirt be Rs. x and Rs. y respectively.

Then, $2x+4y=1600$ ...(*i*) and $x+6y=1600$ ...(*ii*)

Solving (*i*) and (*ii*), we get : $x=400$, $y=200$.

$\therefore$ Cost of 12 shirts = Rs. (12 × 200) = Rs. 2400.

232. Let the cost of a table and that of a chair be Rs. x and Rs. y respectively.

Then, $2x+3y=3500$ ...(*i*) and $3x+2y=4000$ ...(*ii*)

Solving (*i*) and (*ii*), we get : $x=1000$ and $y=500$.

233. Let the fixed charge be Rs. x and variable charge be Rs. y per km.
Then, $x + 16y = 156$ ...(*i*) and $x + 24y = 204$ ...(*ii*)
Solving (*i*) and (*ii*), we get : $x = 60$, $y = 6$.
$\therefore$ Cost of travelling 30 km = Rs. $(60 + 30 \times 6)$ = Rs. 240.

234. Let the number of benches in the class be x. Then, $6(x + 1) = 7x - 5 \Leftrightarrow x = 11$.
Hence, number of students in the class = $6(x + 1) = 6 \times 12 = 72$.

235. Let the number of students in rooms A and B be x and y respectively. Then,
$x - 10 = y + 10 \Rightarrow x - y = 20$ ...(*i*) and $x + 20 = 2(y - 20) \Rightarrow x - 2y = -60$ ...(*ii*)
Solving (*i*) and (*ii*), we get : $x = 100$, $y = 80$.

236. Let the number of buffaloes be x and the number of ducks be y.
Then, $4x + 2y = 2(x + y) + 24 \Leftrightarrow 2x = 24 \Leftrightarrow x = 12$.

237. Let the number of hens be x and the number of cows be y. Then,
$x + y = 48$ ...(*i*) and $2x + 4y = 140 \Rightarrow x + 2y = 70$ ...(*ii*)
Solving (*i*) and (*ii*), we get : $x = 26$, $y = 22$.

238. Suppose, Sanya and Vidushi donate money to x and $(x + 5)$ people respectively.

Then, $\frac{100}{x} - \frac{100}{x+5} = 1 \Leftrightarrow 100(x + 5) - 100x = x(x + 5) \Leftrightarrow x^2 + 5x - 500 = 0$

$\Leftrightarrow (x - 20)(x + 25) = 0 \Leftrightarrow x = 20$.

$\therefore$ Total number of recipients of charity = $x + (x + 5) = 2x + 5 = 45$.

5. SQUARE ROOTS AND CUBE ROOTS

IMPORTANT FACTS AND FORMULAE

Square Root : If $x^2 = y$, we say that the square root of y is x and we write, $\sqrt{y} = x$.

Thus, $\sqrt{4} = 2$, $\sqrt{9} = 3$, $\sqrt{196} = 14$.

Cube Root : The cube root of a given number x is the number whose cube is x. We denote the cube root of x by $\sqrt[3]{x}$.

Thus, $\sqrt[3]{8} = \sqrt[3]{2\times2\times2} = 2$, $\sqrt[3]{343} = \sqrt[3]{7\times7\times7} = 7$ etc.

Note :

1. $\sqrt{xy} = \sqrt{x} \times \sqrt{y}$

2. $\sqrt{\frac{x}{y}} = \frac{\sqrt{x}}{\sqrt{y}} = \frac{\sqrt{x}}{\sqrt{y}} \times \frac{\sqrt{y}}{\sqrt{y}} = \frac{\sqrt{xy}}{y}$.

SOLVED EXAMPLES

Ex. 1. ***Evaluate $\sqrt{6084}$ by factorization method.***

Sol. **Method :** Express the given number as the product of prime factors. Now, take the product of these prime factors choosing one out of every pair of the same primes. This product gives the square root of the given number.

Thus, resolving 6084 into prime factors, we get :

$6084 = 2^2 \times 3^2 \times 13^2$

$\therefore \quad \sqrt{6084} = (2\times3\times13) = 78.$

2	6084
2	3042
3	1521
3	507
13	169
	13

Ex. 2. ***Find the square root of 1471369.***

Sol. **Explanation :** In the given number, mark off the digits in pairs starting from the unit's digit. Each pair and the remaining one digit is called a period.

Now, $1^2 = 1$. On subtracting, we get 0 as remainder.

Now, bring down the next period *i.e.*, 47.

Now, trial divisor is $1 \times 2 = 2$ and trial dividend is 47.

So, we take 22 as divisor and put 2 as quotient.

The remainder is 3.

Next, we bring down the next period which is 13.

Now, trial divisor is $12 \times 2 = 24$ and trial dividend is 313. So, we take 241 as dividend and 1 as quotient.

The remainder is 72.

Bring down the next period *i.e.*, 69.

Now, the trial divisor is $121 \times 2 = 242$ and the trial dividend is 7269. So, we take 3 as quotient and 2423 as divisor. The remainder is then zero.

Hence, $\sqrt{1471369} = 1213$.

1	$\overline{14}\,\overline{71}\,\overline{69}$	(1213
	1	
22	47	
	44	
241	313	
	241	
2423	7269	
	7269	
	×	

Ex. 3. ***Evaluate*** $: \sqrt{248+\sqrt{51+\sqrt{169}}}$.

Sol. Given expression $= \sqrt{248+\sqrt{51+13}} = \sqrt{248+\sqrt{64}} = \sqrt{248+8} = \sqrt{256} = 16.$

Ex. 4. ***If*** $a*b*c = \dfrac{\sqrt{(a+2)(b+3)}}{c+1}$, ***then find the value of*** $6*15*3$.

Sol. $6*15*3 = \dfrac{\sqrt{(6+2)(15+3)}}{3+1} = \dfrac{\sqrt{8\times 18}}{4} = \dfrac{\sqrt{144}}{4} = \dfrac{12}{4} = 3.$

Ex. 5. ***Find the value of*** $\sqrt{1\dfrac{9}{16}}$.

Sol. $\sqrt{1\dfrac{9}{16}} = \sqrt{\dfrac{25}{16}} = \dfrac{\sqrt{25}}{\sqrt{16}} = \dfrac{5}{4} = 1\dfrac{1}{4}.$

Ex. 6. ***What is the square root of 0.0009 ?***

Sol. $\sqrt{0.0009} = \sqrt{\dfrac{9}{10000}} = \dfrac{\sqrt{9}}{\sqrt{10000}} = \dfrac{3}{100} = 0.03.$

Ex. 7. ***Evaluate*** $\sqrt{175.2976}$.

Sol. **Method :** We make even number of decimal places by affixing a zero, if necessary. Now, we mark off periods and extract the square root as shown.

$\therefore \sqrt{175.2976} = 13.24.$

```
 1   | 1̄75.2̄9̄76 ( 13.24
     | 1
-----+-----------
 23  |  75
     |  69
-----+-----------
 262 |  629
     |  524
-----+-----------
2644 |  10576
     |  10576
-----+-----------
     |   ×
-----+-----------
```

Ex. 8. ***What will come in place of question mark in each of the following questions?***

(*i*) $\sqrt{\dfrac{32.4}{?}} = 2$ (*ii*) $\sqrt{86.49}+\sqrt{5+(?)^2} = 12.3.$ **(R.R.B. 2002)**

Sol. (*i*) Let $\sqrt{\dfrac{32.4}{x}} = 2$. Then, $\dfrac{32.4}{x} = 4 \Leftrightarrow 4x = 32.4 \Leftrightarrow x = 8.1.$

(*ii*) Let $\sqrt{86.49}+\sqrt{5+x^2} = 12.3.$

Then, $9.3+\sqrt{5+x^2} = 12.3 \Leftrightarrow \sqrt{5+x^2} = 12.3-9.3 = 3$

$\Leftrightarrow 5+x^2 = 9 \Leftrightarrow x^2 = 9-5 = 4 \Leftrightarrow x = \sqrt{4} = 2.$

Ex. 9. ***Find the value of*** $\sqrt{\dfrac{0.289}{0.00121}}$. **(IGNOU, 2003)**

Sol. $\sqrt{\dfrac{0.289}{0.00121}} = \sqrt{\dfrac{0.28900}{0.00121}} = \sqrt{\dfrac{28900}{121}} = \dfrac{170}{11}.$

Ex. 10. ***If*** $\sqrt{1+\dfrac{x}{144}} = \dfrac{13}{12}$, ***then find the value of*** x.

Sol. $\sqrt{1+\frac{x}{144}} = \frac{13}{12} \Rightarrow \left(1+\frac{x}{144}\right) = \left(\frac{13}{12}\right)^2 = \frac{169}{144} \Rightarrow \frac{x}{144} = \frac{169}{144} - 1$

$\Rightarrow \frac{x}{144} = \frac{25}{144} \Rightarrow x = 25.$

Ex. 11. ***Find the value of $\sqrt{3}$ upto three places of decimal.***

Sol.

1	$\overline{3.00}\,\overline{00}\,\overline{00}$ (1.732
	1
27	200
	189
343	1100
	1029
3462	7100
	6924

$\therefore \sqrt{3} = 1.732.$

Ex. 12. ***If $\sqrt{3} = 1.732$, find the value of $\sqrt{192} - \frac{1}{2}\sqrt{48} - \sqrt{75}$ correct to 3 places of decimal.*** (S.S.C. 2004)

Sol. $\sqrt{192} - \frac{1}{2}\sqrt{48} - \sqrt{75} = \sqrt{64\times 3} - \frac{1}{2}\sqrt{16\times 3} - \sqrt{25\times 3} = 8\sqrt{3} - \frac{1}{2}\times 4\sqrt{3} - 5\sqrt{3}$

$= 3\sqrt{3} - 2\sqrt{3} = \sqrt{3} = 1.732.$

Ex. 13. ***Evaluate :*** $\sqrt{\frac{9.5\times .0085\times 18.9}{.0017\times 1.9\times 0.021}}$.

Sol. Given exp. $= \sqrt{\frac{9.5\times .0085\times 18.900}{.0017\times 1.9\times 0.021}}$.

Now, since the sum of decimal places in the numerator and denominator under the radical sign is the same, we remove the decimal.

$\therefore$ Given exp. $= \sqrt{\frac{95\times 85\times 18900}{17\times 19\times 21}} = \sqrt{5\times 5\times 900} = 5\times 30 = 150.$

Ex. 14. ***Simplify :*** $\sqrt{[(12.1)^2 - (8.1)^2] \div [(0.25)^2 + (0.25)(19.95)]}$. (C.B.I. 2003)

Sol. Given exp. $= \sqrt{\frac{(12.1+8.1)(12.1-8.1)}{(0.25)(0.25+19.95)}} = \sqrt{\frac{20.2\times 4}{0.25\times 20.2}}$

$= \sqrt{\frac{4}{0.25}} = \sqrt{\frac{400}{25}} = \sqrt{16} = 4.$

Ex. 15. ***If $x = 1+\sqrt{2}$ and $y = 1-\sqrt{2}$, find the value of (x^2+y^2).***

Sol. $x^2 + y^2 = (1+\sqrt{2})^2 + (1-\sqrt{2})^2 = 2[(1)^2 + (\sqrt{2})^2] = 2\times 3 = 6.$

Ex. 16. ***Evaluate $\sqrt{0.9}$ upto 3 places of decimal.*** (R.R.B. 2003)

Sol.

9	$0.\overline{90}\,\overline{00}\,\overline{00}$ (.948
	81
184	900
	736
1888	16400
	15104

$\therefore \sqrt{0.9} = 0.948.$

Ex. 17. *If $\sqrt{15} = 3.88$, find the value of $\sqrt{\frac{5}{3}}$.* (S.S.C. 2003)

Sol. $\sqrt{\frac{5}{3}} = \sqrt{\frac{5\times 3}{3\times 3}} = \frac{\sqrt{15}}{3} = \frac{3.88}{3} = 1.2933..... = 1.29\overline{3}.$

Ex. 18. *Find the least square number which is exactly divisible by 10, 12, 15 and 18.*

Sol. L.C.M. of 10, 12, 15, 18 = 180. Now, $180 = 2 \times 2 \times 3 \times 3 \times 5 = 2^2 \times 3^2 \times 5$.

To make it a perfect square, it must be multiplied by 5.

$\therefore$ Required number $= (2^2 \times 3^2 \times 5^2) = 900$.

Ex. 19. *Find the greatest number of five digits which is a perfect square.* (R.R.B. 1998)

Sol. Greatest number of 5 digits is 99999.

```
 3 | 99 99 99 ( 316
   | 9
---+-----------
61 | 99
   | 61
---+-----------
626| 3899
   | 3756
---+-----------
   | 143
```

$\therefore$ Required number $= (99999 - 143) = 99856$.

Ex. 20. *Find the smallest number that must be added to 1780 to make it a perfect square.*

Sol.

```
 4 | 17 80 (42
   | 16
---+-----------
82 | 180
   | 164
---+-----------
   | 16
```

$\therefore$ Number to be added $= (43)^2 - 1780 = 1849 - 1780 = 69$.

Ex. 21. *If $\sqrt{2} = 1.4142$, find the value of $\frac{\sqrt{2}}{(2+\sqrt{2})}$.*

Sol. $\frac{\sqrt{2}}{(2+\sqrt{2})} = \frac{\sqrt{2}}{(2+\sqrt{2})} \times \frac{(2-\sqrt{2})}{(2-\sqrt{2})} = \frac{2\sqrt{2}-2}{(4-2)} = \frac{2(\sqrt{2}-1)}{2} = (\sqrt{2}-1) = (1.4142 - 1) = 0.4142.$

Ex. 22. *If $x = \left(\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}\right)$ and $y = \left(\frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}\right)$, find the value of $(x^2 + y^2)$.*

Sol. $x = \frac{(\sqrt{5}+\sqrt{3})}{(\sqrt{5}-\sqrt{3})} \times \frac{(\sqrt{5}+\sqrt{3})}{(\sqrt{5}+\sqrt{3})} = \frac{(\sqrt{5}+\sqrt{3})^2}{(5-3)} = \frac{5+3+2\sqrt{15}}{2} = 4 + \sqrt{15}.$

$y = \frac{(\sqrt{5}-\sqrt{3})}{(\sqrt{5}+\sqrt{3})} \times \frac{(\sqrt{5}-\sqrt{3})}{(\sqrt{5}-\sqrt{3})} = \frac{(\sqrt{5}-\sqrt{3})^2}{(5-3)} = \frac{5+3-2\sqrt{15}}{2} = 4 - \sqrt{15}.$

$\therefore \quad x^2 + y^2 = (4+\sqrt{15})^2 + (4-\sqrt{15})^2 = 2[(4)^2 + (\sqrt{15})^2] = 2 \times 31 = 62.$

Ex. 23. ***Find the cube root of 2744.***

Sol. **Method :** Resolve the given number as the product of prime factors and take the product of prime factors, choosing one out of three of the same prime factors. Resolving 2744 as the product of prime factors, we get :

$2744 = 2^3 \times 7^3$.

$\therefore \quad \sqrt[3]{2744} = 2 \times 7 = 14.$

2	2744
2	1372
2	686
7	343
7	49
	7

Ex. 24. ***By what least number 4320 be multiplied to obtain a number which is a perfect cube ?***

Sol. Clearly, $4320 = 2^3 \times 3^3 \times 2^2 \times 5$.

To make it a perfect cube, it must be multiplied by 2×5^2 *i.e.*, 50.

EXERCISE 5

(OBJECTIVE TYPE QUESTIONS)

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

1. $\sqrt{53824} = ?$ **(Bank P.O. 2003)**
   (a) 202 (b) 232 (c) 242 (d) 332

2. The square root of 64009 is : **(R.R.B. 2003)**
   (a) 253 (b) 347 (c) 363 (d) 803

3. The value of $\sqrt{10 + \sqrt{25 + \sqrt{108 + \sqrt{154 + \sqrt{225}}}}}$ is : **(S.S.C. 1998)**
   (a) 4 (b) 6 (c) 8 (d) 10

4. Evaluate : $\sqrt{41 - \sqrt{21 + \sqrt{19 - \sqrt{9}}}}$. **(C.B.I. 1997)**
   (a) 3 (b) 5 (c) 6 (d) 6.4

5. $\sqrt{176 + \sqrt{2401}}$ is equal to :
   (a) 14 (b) 15 (c) 18 (d) 24

6. $\left(\frac{\sqrt{625}}{11} \times \frac{14}{\sqrt{25}} \times \frac{11}{\sqrt{196}}\right)$ is equal to : **(S.S.C. 2000)**
   (a) 5 (b) 6 (c) 8 (d) 11

7. $\left(\sqrt{\frac{225}{729}} - \sqrt{\frac{25}{144}}\right) \div \sqrt{\frac{16}{81}} = ?$
   (a) $\frac{1}{48}$ (b) $\frac{5}{48}$ (c) $\frac{5}{16}$ (d) None of these

8. The square root of $(272^2 - 128^2)$ is : **(S.S.C. 2000)**
   (a) 144 (b) 200 (c) 240 (d) 256

9. If $x * y = x + y + \sqrt{xy}$, the value of $6 * 24$ is : **(C.B.I. 1998)**
   (a) 41 (b) 42 (c) 43 (d) 44

10. If $y = 5$, then what is the value of $10y\sqrt{y^3 - y^2}$? **(R.R.B. 1998)**
    (a) $50\sqrt{2}$ (b) 100 (c) $200\sqrt{5}$ (d) 500

11. $\sqrt{110\frac{1}{4}} = ?$

(a) 10.25 (b) 10.5 (c) 11.5 (d) 19.5

12. $\sqrt{\frac{25}{81} - \frac{1}{9}} = ?$ **(Hotel Management, 2002)**

(a) $\frac{2}{3}$ (b) $\frac{4}{9}$ (c) $\frac{16}{81}$ (d) $\frac{25}{81}$

13. The digit in the unit's place in the square root of 15876 is : **(S.S.C. 2000)**

(a) 2 (b) 4 (c) 6 (d) 8

14. How many two-digit numbers satisfy this property : The last digit (unit's digit) of the square of the two-digit number is 8 ? **(R.R.B. 2001)**

(a) 1 (b) 2 (c) 3 (d) None of these

15. What is the square root of 0.16 ? **(P.C.S. 1998)**

(a) 0.004 (b) 0.04 (c) 0.4 (d) 4

16. The value of $\sqrt{0.000441}$ is : **(S.S.C. 2002)**

(a) 0.00021 (b) 0.0021 (c) 0.021 (d) 0.21

17. $\sqrt{0.00004761}$ equals : **(C.B.I. 2003)**

(a) 0.00069 (b) 0.0069 (c) 0.0609 (d) 0.069

18. $1.5^2 \times \sqrt{0.0225} = ?$ **(Bank P.O. 2002)**

(a) 0.0375 (b) 0.3375 (c) 3.275 (d) 32.75

19. $\sqrt{0.01 + \sqrt{0.0064}} = ?$

(a) 0.03 (b) 0.3 (c) 0.42 (d) None of these

20. The value of $\sqrt{0.01} + \sqrt{0.81} + \sqrt{1.21} + \sqrt{0.0009}$ is : **(S.S.C. 2002)**

(a) 2.03 (b) 2.1 (c) 2.11 (d) 2.13

21. $\sqrt{.0025} \times \sqrt{2.25} \times \sqrt{.0001} = ?$ **(Hotel Management, 1998)**

(a) .000075 (b) .0075 (c) .075 (d) None of these

22. $\sqrt{1.5625} = ?$ **(S.B.I.P.O. 2003)**

(a) 1.05 (b) 1.25 (c) 1.45 (d) 1.55

23. If $\sqrt{.00000676} = .0026$, the square root of 67,60,000 is :

(a) $\frac{1}{26}$ (b) 26 (c) 260 (d) 2600

24. If $\sqrt{18225} = 135$, then the value of $(\sqrt{182.25} + \sqrt{1.8225} + \sqrt{0.018225} + \sqrt{0.00018225})$ is :

(a) 1.49985 (b) 14.9985 (c) 149.985 (d) 1499.85

25. Given that $\sqrt{13} = 3.605$ and $\sqrt{130} = 11.40$, find the value of $\sqrt{1.3} + \sqrt{1300} + \sqrt{0.013}$.

(a) 36.164 (b) 36.304 (c) 37.164 (d) 37.304 **(S.S.C. 1999)**

26. If $\frac{52}{x} = \sqrt{\frac{169}{289}}$, the value of x is : **(C.B.I. 1998)**

(a) 52 (b) 58 (c) 62 (d) 68

27. For what value of * the statement $\left(\frac{*}{15}\right)\left(\frac{*}{135}\right) = 1$ is true ? **(S.S.C. 2002)**

(a) 15 (b) 25 (c) 35 (d) 45

28. Which number can replace both the question marks in the equation $\frac{4\frac{1}{2}}{?} = \frac{?}{32}$.

(a) 1 (b) 7 (c) $7\frac{1}{2}$ (d) None of these

(Hotel Management, 2000)

29. What should come in place of both the question marks in the equation $\frac{?}{\sqrt{128}} = \frac{\sqrt{162}}{?}$.

(a) 12 (b) 14 (c) 144 (d) 196

(Bank P.O. 1999)

30. If $0.13 \div p^2 = 13$, then p equals : **(S.S.C. 2000)**

(a) 0.01 (b) 0.1 (c) 10 (d) 100

31. What number should be divided by $\sqrt{0.25}$ to give the result as 25 ?

(a) 12.5 (b) 25 (c) 50 (d) 125

(C.B.I. 2003)

32. If $\sqrt{3^n} = 729$, then the value of n is : **(Section Officers', 2003)**

(a) 6 (b) 8 (c) 10 (d) 12

33. If $\sqrt{18 \times 14 \times x} = 84$, then x equals :

(a) 22 (b) 24 (c) 28 (d) 32

34. $28\sqrt{?} + 1426 - \frac{3}{4}$ of 2872 **(B.S.R.B. 1998)**

(a) 576 (b) 676 (c) 1296 (d) 1444

35. $\sqrt{\frac{?}{169}} = \frac{54}{39}$

(a) 108 (b) 324 (c) 2916 (d) 4800

36. If $\sqrt{x} \div \sqrt{441} = 0.02$, then the value of x is : **(S.S.C. 1999)**

(a) 0.1764 (b) 1.764 (c) 1.64 (d) 2.64

37. $\sqrt{\frac{.0196}{?}} = 0.2$ **(Hotel Management, 1999)**

(a) 0.49 (b) 0.7 (c) 4.9 (d) None of these

38. $\sqrt{0.0169 \times ?} = 1.3$ **(Hotel Management, 2001)**

(a) 10 (b) 100 (c) 1000 (d) None of these

39. If $\sqrt{1369} + \sqrt{.0615 + x} = 37.25$, then x is equal to : **(Hotel Management, 1998)**

(a) 10^{-1} (b) 10^{-2} (c) 10^{-3} (d) None of these

40. If $\sqrt{(x-1)(y+2)} = 7$, x and y being positive whole numbers, then the values of x and y respectively are :

(a) 8, 5 (b) 15, 12 (c) 22, 19 (d) None of these

41. If $\sqrt{.04 \times .4 \times a} = .004 \times .4 \times \sqrt{b}$, then $\frac{a}{b}$ is :

(a) 16×10^{-3} (b) 16×10^{-4} (c) 16×10^{-5} (d) None of these

42. Three-fifth of the square of a certain number is 126.15. What is the number ?
(a) 14.5 (b) 75.69 (c) 145 (d) 210.25
(S.S.C. 2002)

43. $\sqrt{\frac{0.361}{0.00169}} = ?$
(a) $\frac{1.9}{13}$ (b) $\frac{19}{13}$ (c) $\frac{1.9}{130}$ (d) $\frac{190}{13}$

44. $\sqrt{\frac{48.4}{0.289}}$ is equal to : **(S.S.C. 2004)**
(a) $1\frac{5}{17}$ (b) $12\frac{1}{17}$ (c) $12\frac{16}{17}$ (d) $129\frac{7}{17}$

45. If $\sqrt{1+\frac{x}{169}} = \frac{14}{13}$, then x is equal to :
(a) 1 (b) 13 (c) 27 (d) None of these

46. If $\sqrt{1+\frac{55}{729}} = 1+\frac{x}{27}$, then the value of x is : **(C.D.S. 2003)**
(a) 1 (b) 3 (c) 5 (d) 7

47. The value of $\sqrt{2}$ upto three places of decimal is :
(a) 1.410 (b) 1.412 (c) 1.413 (d) 1.414

48. $(2\sqrt{27} - \sqrt{75} + \sqrt{12})$ is equal to :
(a) $\sqrt{3}$ (b) $2\sqrt{3}$ (c) $3\sqrt{3}$ (d) $4\sqrt{3}$

49. By how much does $\sqrt{12} + \sqrt{18}$ exceed $\sqrt{3} + \sqrt{2}$? **(S.S.C. 1999)**
(a) $\sqrt{2} - 4\sqrt{3}$ (b) $\sqrt{3} + 2\sqrt{2}$ (c) $2(\sqrt{3} - \sqrt{2})$ (d) $3(\sqrt{3} - \sqrt{2})$

50. $\frac{\sqrt{24} + \sqrt{216}}{\sqrt{96}} = ?$
(a) $2\sqrt{6}$ (b) 2 (c) $6\sqrt{2}$ (d) $\frac{2}{\sqrt{6}}$

51. The value of $\frac{\sqrt{80} - \sqrt{112}}{\sqrt{45} - \sqrt{63}}$ is : **(S.S.C. 2000)**
(a) $\frac{3}{4}$ (b) $1\frac{1}{3}$ (c) $1\frac{7}{9}$ (d) $1\frac{3}{4}$

52. If $3\sqrt{5} + \sqrt{125} = 17.88$, then what will be the value of $\sqrt{80} + 6\sqrt{5}$?
(a) 13.41 (b) 20.46 (c) 21.66 (d) 22.35
(Bank P.O. 2000)

53. $\sqrt{50} \times \sqrt{98}$ is equal to :
(a) 63.75 (b) 65.95 (c) 70 (d) 70.25

54. Given $\sqrt{2} = 1.414$. The value of $\sqrt{8} + 2\sqrt{32} - 3\sqrt{128} + 4\sqrt{50}$ is : **(S.S.C. 2003)**
(a) 8.426 (b) 8.484 (c) 8.526 (d) 8.876

55. The approximate value of $\frac{3\sqrt{12}}{2\sqrt{28}} \div \frac{2\sqrt{21}}{\sqrt{98}}$ is : **(Section Officers', 2003)**
(a) 1.0605 (b) 1.0727 (c) 1.6007 (d) 1.6026

56. $\sqrt{\frac{.081 \times .484}{.0064 \times 6.25}}$ is equal to : (N.I.F.T. 1997)

(a) 0.9 (b) 0.99 (c) 9 (d) 99

57. $\sqrt{\frac{0.204 \times 42}{0.07 \times 3.4}}$ is equal to :

(a) $\frac{1}{6}$ (b) 0.06 (c) 0.6 (d) 6

58. $\sqrt{\frac{0.081 \times 0.324 \times 4.624}{1.5625 \times 0.0289 \times 72.9 \times 64}}$ is equal to :

(a) 0.024 (b) 0.24 (c) 2.4 (d) 24

59. $\sqrt{\frac{9.5 \times .085}{.0017 \times .19}}$ equals :

(a) .05 (b) 5 (c) 50 (d) 500

60. The value of $\sqrt{\frac{(0.03)^2 + (0.21)^2 + (0.065)^2}{(0.003)^2 + (0.021)^2 + (0.0065)^2}}$ is : (S.S.C. 2002)

(a) 0.1 (b) 10 (c) 10^2 (d) 10^3

61. The square root of $(7 + 3\sqrt{5})(7 - 3\sqrt{5})$ is : (S.S.C. 2004)

(a) $\sqrt{5}$ (b) 2 (c) 4 (d) $3\sqrt{5}$

62. $\left(\sqrt{3} - \frac{1}{\sqrt{3}}\right)^2$ simplifies to : (R.R.B. 2000)

(a) $\frac{3}{4}$ (b) $\frac{4}{\sqrt{3}}$ (c) $\frac{4}{3}$ (d) None of these

63. $\left(\sqrt{2} + \frac{1}{\sqrt{2}}\right)^2$ is equal to :

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

64. If $a = 0.1039$, then the value of $\sqrt{4a^2 - 4a + 1} + 3a$ is : (C.B.I. 2003)

(a) 0.1039 (b) 0.2078 (c) 1.1039 (d) 2.1039

65. The square root of $\frac{(0.75)^3}{1 - 0.75} + [0.75 + (0.75)^2 + 1]$ is : (S.S.C. 1999)

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

66. If $3a = 4b = 6c$ and $a + b + c = 27\sqrt{29}$, then $\sqrt{a^2 + b^2 + c^2}$ is :

(a) $3\sqrt{29}$ (b) 81 (c) 87 (d) None of these

(Hotel Management, 1999)

67. The square root of $0.\overline{4}$ is : (S.S.C. 2004)

(a) $0.\overline{6}$ (b) $0.\overline{7}$ (c) $0.\overline{8}$ (d) $0.\overline{9}$

68. Which one of the following numbers has rational square root ?

(a) 0.4 (b) 0.09 (c) 0.9 (d) 0.025

69. The value of $\sqrt{0.4}$ is :

(a) 0.02 (b) 0.2 (c) 0.51 (d) 0.63

70. The value of $\sqrt{0.121}$ is :
(a) 0.011 (b) 0.11 (c) 0.347 (d) 1.1

71. The value of $\sqrt{0.064}$ is :
(a) 0.008 (b) 0.08 (c) 0.252 (d) 0.8

72. The value of $\sqrt{\frac{0.16}{0.4}}$ is : **(IGNOU, 2003)**
(a) 0.02 (b) 0.2 (c) 0.63 (d) None of these

73. The value of $\frac{1+\sqrt{0.01}}{1-\sqrt{0.1}}$ is close to : **(C.B.I. 1997)**
(a) 0.6 (b) 1.1 (c) 1.6 (d) 1.7

74. If $\sqrt{5} = 2.236$, then the value of $\frac{1}{\sqrt{5}}$ is :
(a) .367 (b) .447 (c) .745 (d) None of these

75. If $\sqrt{24} = 4.899$, the value of $\sqrt{\frac{8}{3}}$ is :
(a) 0.544 (b) 1.333 (c) 1.633 (d) 2.666

76. If $\sqrt{6} = 2.449$, then the value of $\frac{3\sqrt{2}}{2\sqrt{3}}$ is :
(a) 0.6122 (b) 0.8163 (c) 1.223 (d) 1.2245

77. If $\sqrt{5} = 2.236$, then the value of $\frac{\sqrt{5}}{2} - \frac{10}{\sqrt{5}} + \sqrt{125}$ is equal to : **(M.B.A. 1998)**
(a) 5.59 (b) 7.826 (c) 8.944 (d) 10.062

78. If $2*3 = \sqrt{13}$ and $3*4 = 5$, then the value of $5*12$ is :
(a) $\sqrt{17}$ (b) $\sqrt{29}$ (c) 12 (d) 13

79. The least perfect square number divisible by 3, 4, 5, 6 and 8 is :
(a) 900 (b) 1200 (c) 2500 (d) 3600

80. The least perfect square, which is divisible by each of 21, 36 and 66, is :
(a) 213444 (b) 214344 (c) 214434 (d) 231444
(C.B.I. 2003)

81. The least number by which 294 must be multiplied to make it a perfect square, is :
(a) 2 (b) 3 (c) 6 (d) 24

82. Find the smallest number by which 5808 should be multiplied so that the product becomes a perfect square. **(S.S.C. 1999)**
(a) 2 (b) 3 (c) 7 (d) 11

83. The least number by which 1470 must be divided to get a number which is a perfect square, is :
(a) 5 (b) 6 (c) 15 (d) 30

84. What is the smallest number to be subtracted from 549162 in order to make it a perfect square ?
(a) 28 (b) 36 (c) 62 (d) 81

85. What is the least number which should be subtracted from 0.000326 to make it a perfect square ? **(S.S.C. 2003)**
(a) 0.000002 (b) 0.000004 (c) 0.02 (d) 0.04

86. The smallest number added to 680621 to make the sum a perfect square is :
(a) 4 (b) 5 (c) 6 (d) 8 (S.S.C. 2002)

87. The greatest four-digit perfect square number is : (Hotel Management, 2003)
(a) 9000 (b) 9801 (c) 9900 (d) 9981

88. The least number of 4 digits which is a perfect square, is :
(a) 1000 (b) 1016 (c) 1024 (d) 1036

89. Given $\sqrt{5} = 2.2361$, $\sqrt{3} = 1.7321$, then $\frac{1}{\sqrt{5}-\sqrt{3}}$ is equal to : (S.S.C. 2000)
(a) 1.98 (b) 1.984 (c) 1.9841 (d) 2

90. $\frac{1}{(\sqrt{9}-\sqrt{8})} - \frac{1}{(\sqrt{8}-\sqrt{7})} + \frac{1}{(\sqrt{7}-\sqrt{6})} - \frac{1}{(\sqrt{6}-\sqrt{5})} + \frac{1}{(\sqrt{5}-\sqrt{4})}$ is equal to :
(a) 0 (b) $\frac{1}{3}$ (c) 1 (d) 5

91. $\left(2+\sqrt{2}+\frac{1}{2+\sqrt{2}}+\frac{1}{\sqrt{2}-2}\right)$ simplifies to : (S.S.C. 2000)
(a) $2-\sqrt{2}$ (b) 2 (c) $2+\sqrt{2}$ (d) $2\sqrt{2}$

92. If $\sqrt{2} = 1.4142$, the value of $\frac{7}{(3+\sqrt{2})}$ is :
(a) 1.5858 (b) 3.4852 (c) 3.5858 (d) 4.4142

93. $\left[\frac{3\sqrt{2}}{\sqrt{6}-\sqrt{3}} - \frac{4\sqrt{3}}{\sqrt{6}-\sqrt{2}} - \frac{6}{\sqrt{8}-\sqrt{12}}\right] = ?$ (R.R.B. 2001)
(a) $\sqrt{3}-\sqrt{2}$ (b) $\sqrt{3}+\sqrt{2}$ (c) $5\sqrt{3}$ (d) 1

94. $\frac{\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}}$ is equal to : (Section Officers', 2001)
(a) 1 (b) 2 (c) $6-\sqrt{35}$ (d) $6+\sqrt{35}$

95. If $\frac{5+2\sqrt{3}}{7+4\sqrt{3}} = a+b\sqrt{3}$, then : (R.R.B. 2001)
(a) $a=-11, b=-6$ (b) $a=-11, b=6$ (c) $a=11, b=-6$ (d) $a=6, b=11$

96. If $\sqrt{2} = 1.414$, the square root of $\frac{\sqrt{2}-1}{\sqrt{2}+1}$ is nearest to : (C.B.I. 2003)
(a) 0.172 (b) 0.414 (c) 0.586 (d) 1.414

97. $\frac{3+\sqrt{6}}{5\sqrt{3}-2\sqrt{12}-\sqrt{32}+\sqrt{50}} = ?$ (I.A.F. 2002)
(a) 3 (b) $3\sqrt{2}$ (c) 6 (d) None of these

98. $\left(\frac{2+\sqrt{3}}{2-\sqrt{3}}+\frac{2-\sqrt{3}}{2+\sqrt{3}}+\frac{\sqrt{3}-1}{\sqrt{3}+1}\right)$ simplifies to : (S.S.C. 2000)
(a) $16-\sqrt{3}$ (b) $4-\sqrt{3}$ (c) $2-\sqrt{3}$ (d) $2+\sqrt{3}$

99. If $x = (7 - 4\sqrt{3})$, then the value of $\left(x + \frac{1}{x}\right)$ is : (S.S.C. 2000)

(a) $3\sqrt{3}$ (b) $8\sqrt{3}$ (c) 14 (d) $14 + 8\sqrt{3}$

100. If $x = \frac{\sqrt{3}+1}{\sqrt{3}-1}$ and $y = \frac{\sqrt{3}-1}{\sqrt{3}+1}$, then the value of $(x^2 + y^2)$ is : (S.S.C. 2003)

(a) 10 (b) 13 (c) 14 (d) 15

101. If $a = \frac{\sqrt{5}+1}{\sqrt{5}-1}$ and $b = \frac{\sqrt{5}-1}{\sqrt{5}+1}$, the value of $\left(\frac{a^2 + ab + b^2}{a^2 - ab + b^2}\right)$ is :

(a) $\frac{3}{4}$ (b) $\frac{4}{3}$ (c) $\frac{3}{5}$ (d) $\frac{5}{3}$

102. A man plants 15376 apple trees in his garden and arranges them so that there are as many rows as there are apples trees in each row. The number of rows is :

(a) 124 (b) 126 (c) 134 (d) 144

103. A General wishes to draw up his 36581 soldiers in the form of a solid square. After arranging them, he found that some of them are left over. How many are left ?

(a) 65 (b) 81 (c) 100 (d) None of these

104. A group of students decided to collect as many paise from each member of the group as is the number of members. If the total collection amounts to Rs. 59.29, the number of members in the group is :

(a) 57 (b) 67 (c) 77 (d) 87

105. The cube root of .000216 is :

(a) .6 (b) .06 (c) .006 (d) None of these

106. $\sqrt[3]{4\frac{12}{125}} = ?$

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

107. $\sqrt[3]{.000064} = ?$

(a) .02 (b) .2 (c) 2 (d) None of these

108. The largest four-digit number which is a perfect cube, is :

(a) 8000 (b) 9261 (c) 9999 (d) None of these

109. By what least number 675 be multiplied to obtain a number which is a perfect cube ?

(a) 5 (b) 6 (c) 7 (d) 8

110. What is the smallest number by which 3500 be divided to make it a perfect cube ?

(a) 9 (b) 50 (c) 300 (d) 450.

ANSWERS

1. (b)	2. (a)	3. (a)	4. (c)	5. (b)	6. (a)	7. (c)	8. (c)	9. (b)
10. (d)	11. (b)	12. (b)	13. (c)	14. (d)	15. (c)	16. (c)	17. (b)	18. (b)
19. (b)	20. (d)	21. (d)	22. (b)	23. (d)	24. (b)	25. (d)	26. (d)	27. (d)
28. (d)	29. (a)	30. (b)	31. (a)	32. (d)	33. (c)	34. (b)	35. (b)	36. (a)

37. (a)	**38.** (b)	**39.** (c)	**40.** (a)	**41.** (c)	**42.** (a)	**43.** (d)	**44.** (c)	**45.** (c)
46. (a)	**47.** (d)	**48.** (c)	**49.** (b)	**50.** (b)	**51.** (b)	**52.** (d)	**53.** (c)	**54.** (b)
55. (a)	**56.** (b)	**57.** (d)	**58.** (a)	**59.** (c)	**60.** (b)	**61.** (b)	**62.** (c)	**63.** (c)
64. (c)	**65.** (b)	**66.** (c)	**67.** (a)	**68.** (b)	**69.** (d)	**70.** (c)	**71.** (c)	**72.** (c)
73. (c)	**74.** (b)	**75.** (c)	**76.** (d)	**77.** (b)	**78.** (d)	**79.** (d)	**80.** (a)	**81.** (c)
82. (b)	**83.** (d)	**84.** (d)	**85.** (a)	**86.** (a)	**87.** (b)	**88.** (c)	**89.** (c)	**90.** (d)
91. (b)	**92.** (a)	**93.** (c)	**94.** (d)	**95.** (c)	**96.** (b)	**97.** (d)	**98.** (a)	**99.** (c)
100. (c)	**101.** (b)	**102.** (a)	**103.** (c)	**104.** (c)	**105.** (b)	**106.** (b)	**107.** (b)	**108.** (b)
109. (a)	**110.** (d)							

SOLUTIONS

1.

2	$\overline{53}\,\overline{824}$	(232
	4	
43	138	
	129	
462	924	
	924	
	×	

$\therefore \quad \sqrt{53824} = 232.$

2.

2	$\overline{64}\,\overline{09}$	(253
	4	
45	240	
	225	
503	1509	
	1509	
	×	

$\therefore \quad \sqrt{64009} = 253.$

3. Given exp. $= \sqrt{10+\sqrt{25+\sqrt{108+\sqrt{154+15}}}} = \sqrt{10+\sqrt{25+\sqrt{108+\sqrt{169}}}}$

$= \sqrt{10+\sqrt{25+\sqrt{108+13}}} = \sqrt{10+\sqrt{25+\sqrt{121}}}$

$= \sqrt{10+\sqrt{25+11}} = \sqrt{10+\sqrt{36}} = \sqrt{10+6} = \sqrt{16} = 4.$

4. Given exp. $= \sqrt{41-\sqrt{21+\sqrt{19-3}}} = \sqrt{41-\sqrt{21+\sqrt{16}}} = \sqrt{41-\sqrt{21+4}}$

$= \sqrt{41-\sqrt{25}} = \sqrt{41-5} = \sqrt{36} = 6.$

5. Given exp. $= \sqrt{176+49} = \sqrt{225} = 15.$

4	$\overline{24}\,\overline{01}$	(49
	16	
89	801	
	801	
	×	

6. Given exp. $= \frac{25}{11} \times \frac{14}{5} \times \frac{11}{14} = 5.$

7. Given exp. $= \left(\frac{\sqrt{225}}{\sqrt{729}} - \frac{\sqrt{25}}{\sqrt{144}}\right) \div \frac{\sqrt{16}}{\sqrt{81}} = \left(\frac{15}{27} - \frac{5}{12}\right) \div \frac{4}{9} = \left(\frac{15}{108} \times \frac{9}{4}\right) = \frac{5}{16}.$

8. $\sqrt{(272)^2-(128)^2} = \sqrt{(272+128)(272-128)} = \sqrt{400 \times 144} = \sqrt{57600} = 240.$

9. $6*24 = 6+24+\sqrt{6 \times 24} = 30+\sqrt{144} = 30+12 = 42.$

10. $10y\sqrt{y^3-y^2} = 10 \times 5\sqrt{5^3-5^2} = 50 \times \sqrt{125-25} = 50 \times \sqrt{100} = 50 \times 10 = 500.$

11. $\sqrt{110\frac{1}{4}} = \sqrt{\frac{441}{4}} = \frac{\sqrt{441}}{\sqrt{4}} = \frac{21}{2} = 10.5.$

12. $\sqrt{\frac{25}{81} - \frac{1}{9}} = \sqrt{\frac{25-9}{81}} = \sqrt{\frac{16}{81}} = \frac{\sqrt{16}}{\sqrt{81}} = \frac{4}{9}.$

13.

1	$\overline{1}\,\overline{58}\,\overline{76}$	(126
	1	
22	58	
	44	
246	1476	
	1476	
	×	

$\therefore \sqrt{15876} = 126.$

14. A number ending in 8 can never be a perfect square.

15. $\sqrt{0.16} = \sqrt{\frac{16}{100}} = \frac{\sqrt{16}}{\sqrt{100}} = \frac{4}{10} = 0.4.$

16. $\sqrt{0.000441} = \sqrt{\frac{441}{10^6}} = \frac{\sqrt{441}}{\sqrt{10^6}} = \frac{21}{10^3} = \frac{21}{1000} = 0.021.$

17. $\sqrt{0.00004761} = \sqrt{\frac{4761}{10^8}} = \frac{\sqrt{4761}}{\sqrt{10^8}} = \frac{69}{10^4} = \frac{69}{10000} = 0.0069.$

18. $1.5^2 \times \sqrt{0.0225} = 1.5^2 \times \sqrt{\frac{225}{10000}} = 2.25 \times \frac{15}{100} = 2.25 \times 0.15 = 0.3375.$

19. $\sqrt{0.01 + \sqrt{0.0064}} = \sqrt{0.01 + \sqrt{\frac{64}{10000}}} = \sqrt{0.01 + \frac{8}{100}} = \sqrt{0.01 + 0.08} = \sqrt{0.09} = 0.3.$

20. Given exp. $= \sqrt{\frac{1}{100}} + \sqrt{\frac{81}{100}} + \sqrt{\frac{121}{100}} + \sqrt{\frac{9}{10000}} = \frac{1}{10} + \frac{9}{10} + \frac{11}{10} + \frac{3}{100}$

$= 0.1 + 0.9 + 1.1 + 0.03 = 2.13.$

21. Given exp. $= \sqrt{\frac{25}{10000}} \times \sqrt{\frac{225}{100}} \times \sqrt{\frac{1}{10000}} = \frac{5}{100} \times \frac{15}{10} \times \frac{1}{100} = \frac{75}{100000} = 0.00075.$

22.

1	$\overline{1}.\overline{56}\,\overline{25}$	(1.25
	1	
22	56	
	44	
245	1225	
	1225	
	×	

$\therefore \sqrt{1.5625} = 1.25.$

23. $\sqrt{6760000} = \sqrt{0.00000676 \times 10^{12}} = \sqrt{0.00000676} \times \sqrt{10^{12}} = .0026 \times 10^6 = 2600.$

24. Given exp. $= \sqrt{\frac{18225}{10^2}} + \sqrt{\frac{18225}{10^4}} + \sqrt{\frac{18225}{10^6}} + \sqrt{\frac{18225}{10^8}}$

$= \frac{\sqrt{18225}}{10} + \frac{\sqrt{18225}}{10^2} + \frac{\sqrt{18225}}{10^3} + \frac{\sqrt{18225}}{10^4} = \frac{135}{10} + \frac{135}{100} + \frac{135}{1000} + \frac{135}{10000}$

$= 13.5 + 1.35 + 0.135 + 0.0135 = 14.9985.$

25. Given exp. $= \sqrt{1.30} + \sqrt{1300} + \sqrt{0.0130} = \sqrt{\frac{130}{100}} + \sqrt{13 \times 100} + \sqrt{\frac{130}{10000}}$

$= \frac{\sqrt{130}}{10} + \sqrt{13} \times 10 + \frac{\sqrt{130}}{100} = \frac{11.40}{10} + 3.605 \times 10 + \frac{11.40}{100}$

$= 1.14 + 36.05 + 0.114 = 37.304.$

26. $\frac{52}{x} = \sqrt{\frac{169}{289}} \Leftrightarrow \frac{52}{x} = \frac{13}{17} \Leftrightarrow x = \left(\frac{52 \times 17}{13}\right) = 68.$

27. Let the missing number be x.

Then, $x^2 = 15 \times 135 \Leftrightarrow x = \sqrt{15 \times 135} = \sqrt{15^2 \times 3^2} = 15 \times 3 = 45.$

28. Let $\frac{4\frac{1}{2}}{x} = \frac{x}{32}$. Then, $x^2 = 32 \times \frac{9}{2} = 144 \Leftrightarrow x = \sqrt{144} = 12.$

29. Let $\frac{x}{\sqrt{128}} = \frac{\sqrt{162}}{x}$.

Then, $x^2 = \sqrt{128 \times 162} = \sqrt{64 \times 2 \times 18 \times 9} = \sqrt{8^2 \times 6^2 \times 3^2} = 8 \times 6 \times 3 = 144.$

$\therefore \quad x = \sqrt{144} = 12.$

30. $\frac{0.13}{p^2} = 13 \Leftrightarrow p^2 = \frac{0.13}{13} = \frac{1}{100} \Leftrightarrow p = \sqrt{\frac{1}{100}} = \frac{1}{100} = \frac{1}{10} = 0.1.$

31. Let the required number be x. Then, $\frac{x}{\sqrt{0.25}} = 25 \Leftrightarrow \frac{x}{0.5} = 25 \Leftrightarrow x = 25 \times 0.5 = 12.5.$

32. $\sqrt{3^n} = 729 = 3^6 \Leftrightarrow (\sqrt{3^n})^2 = (3^6)^2 \Leftrightarrow 3^n = 3^{12} \Leftrightarrow n = 12.$

33. $\sqrt{18 \times 14 \times x} = 84 \Leftrightarrow 18 \times 14 \times x = 84 \times 84 \Leftrightarrow x = \frac{84 \times 84}{18 \times 14} = 28.$

34. Let $28\sqrt{x} + 1426 = 3 \times 718.$

Then, $28\sqrt{x} = 2154 - 1426 \Leftrightarrow 28\sqrt{x} = 728 \Leftrightarrow \sqrt{x} = 26 \Leftrightarrow x = (26)^2 = 676.$

35. Let $\sqrt{\frac{x}{169}} = \frac{54}{39}$. Then, $\frac{\sqrt{x}}{13} = \frac{54}{39} \Leftrightarrow \sqrt{x} = \left(\frac{54}{39} \times 13\right) = 18 \Leftrightarrow x = (18)^2 = 324.$

36. $\frac{\sqrt{x}}{\sqrt{441}} = 0.02 \Leftrightarrow \frac{\sqrt{x}}{21} = 0.02 \Leftrightarrow \sqrt{x} = 0.02 \times 21 = 0.42 \Leftrightarrow x = (0.42)^2 = 0.1764.$

37. Let $\sqrt{\frac{.0196}{x}} = 0.2$. Then, $\frac{.0196}{x} = 0.04 \Leftrightarrow x = \frac{.0196}{.04} = \frac{1.96}{4} = .49.$

38. Let $\sqrt{0.0169 \times x} = 1.3$. Then, $0.0169x = (1.3)^2 = 1.69 \Leftrightarrow x = \frac{1.69}{0.0169} = 100.$

39. $37 + \sqrt{.0615 + x} = 37.25 \Leftrightarrow \sqrt{.0615 + x} = 0.25$

$\Leftrightarrow .0615 + x = (0.25)^2 = 0.0625 \Leftrightarrow x = .001 = \frac{1}{10^3} = 10^{-3}.$

40. $\sqrt{(x-1)(y+2)} = 7 \Rightarrow (x-1)(y+2) = (7)^2 \Rightarrow (x-1) = 7$ and $(y+2) = 7$

$\Rightarrow x = 8$ and $y = 5$.

41. $\dfrac{\sqrt{a}}{\sqrt{b}} = \dfrac{.004 \times .4}{\sqrt{.04 \times .4}} \Rightarrow \dfrac{a}{b} = \dfrac{.004 \times .4 \times .004 \times .4}{.04 \times .4} = \dfrac{.0000064}{.04}$

$\therefore \dfrac{a}{b} = \dfrac{.00064}{4} = .00016 = \dfrac{16}{10^5} = 16 \times 10^{-5}$.

42. Let the number be x. Then,

$\dfrac{3}{5}x^2 = 126.15 \Leftrightarrow x^2 = \left(126.15 \times \dfrac{5}{3}\right) = 210.25 \Leftrightarrow x = \sqrt{210.25} = 14.5$.

43. $\sqrt{\dfrac{0.361}{0.00169}} = \sqrt{\dfrac{0.36100}{0.00169}} = \sqrt{\dfrac{36100}{169}} = \dfrac{190}{13}$.

44. $\sqrt{\dfrac{48.4}{0.289}} = \sqrt{\dfrac{48.400}{0.289}} = \sqrt{\dfrac{48400}{289}} = \dfrac{220}{17} = 12\dfrac{16}{17}$.

45. $\sqrt{1+\dfrac{x}{169}} = \dfrac{14}{13} \Rightarrow 1+\dfrac{x}{169} = \dfrac{196}{169} \Rightarrow \dfrac{x}{169} = \left(\dfrac{196}{169} - 1\right) = \dfrac{27}{169} \Rightarrow x = 27$.

46. $\sqrt{1+\dfrac{55}{729}} = 1+\dfrac{x}{27} \Rightarrow \sqrt{\dfrac{784}{729}} = \dfrac{27+x}{27} \Rightarrow \dfrac{28}{27} = \dfrac{27+x}{27} \Rightarrow 27+x = 28 \Rightarrow x = 1$.

47.

1	$\overline{2.00}\,\overline{00}\,\overline{00}$ (1.414
	1
24	100
	96
281	400
	281
2824	11900
	11296

$\therefore \sqrt{2} = 1.414$.

48. $2\sqrt{27} - \sqrt{75} + \sqrt{12} = 2\sqrt{9 \times 3} - \sqrt{25 \times 3} + \sqrt{4 \times 3} = 6\sqrt{3} - 5\sqrt{3} + 2\sqrt{3} = 3\sqrt{3}$.

49. $(\sqrt{12} + \sqrt{18}) - (\sqrt{3} + \sqrt{2}) = (\sqrt{4 \times 3} + \sqrt{9 \times 2}) - (\sqrt{3} + \sqrt{2}) = (2\sqrt{3} + 3\sqrt{2}) - (\sqrt{3} + \sqrt{2})$

$= (2\sqrt{3} - \sqrt{3}) + (3\sqrt{2} - \sqrt{2}) = \sqrt{3} + 2\sqrt{2}$.

50. $\dfrac{\sqrt{24} + \sqrt{216}}{\sqrt{96}} = \dfrac{\sqrt{4 \times 6} + \sqrt{36 \times 6}}{\sqrt{16 \times 6}} = \dfrac{2\sqrt{6} + 6\sqrt{6}}{4\sqrt{6}} = \dfrac{8\sqrt{6}}{4\sqrt{6}} = 2$.

51. $\dfrac{\sqrt{80} - \sqrt{112}}{\sqrt{45} - \sqrt{63}} = \dfrac{\sqrt{16 \times 5} - \sqrt{16 \times 7}}{\sqrt{9 \times 5} - \sqrt{9 \times 7}} = \dfrac{4\sqrt{5} - 4\sqrt{7}}{3\sqrt{5} - 3\sqrt{7}} = \dfrac{4(\sqrt{5} - \sqrt{7})}{3(\sqrt{5} - \sqrt{7})} = \dfrac{4}{3} = 1\dfrac{1}{3}$.

52. $3\sqrt{5} + \sqrt{125} = 17.88 \Rightarrow 3\sqrt{5} + \sqrt{25 \times 5} = 17.88$

$\Rightarrow 3\sqrt{5} + 5\sqrt{5} = 17.88 \Rightarrow 8\sqrt{5} = 17.88 \Rightarrow \sqrt{5} = 2.235$.

$\therefore \sqrt{80} + 6\sqrt{5} = \sqrt{16 \times 5} + 6\sqrt{5} = 4\sqrt{5} + 6\sqrt{5} = 10\sqrt{5} = (10 \times 2.235) = 22.35$.

53. $\sqrt{50} \times \sqrt{98} = \sqrt{50 \times 98} = \sqrt{4900} = 70$.

54. Given exp. $= \sqrt{4\times2} + 2\sqrt{16\times2} - 3\sqrt{64\times2} + 4\sqrt{25\times2}$

$= 2\sqrt{2} + 8\sqrt{2} - 24\sqrt{2} + 20\sqrt{2} = 6\sqrt{2} = 6\times1.414 = 8.484.$

55. Given exp. $= \dfrac{3\sqrt{12}}{2\sqrt{28}} \times \dfrac{\sqrt{98}}{2\sqrt{21}} = \dfrac{3\sqrt{4\times3}}{2\sqrt{4\times7}} \times \dfrac{\sqrt{49\times2}}{2\sqrt{21}} = \dfrac{6\sqrt{3}}{4\sqrt{7}} \times \dfrac{7\sqrt{2}}{2\sqrt{21}} = \dfrac{21\sqrt{6}}{4\sqrt{7\times21}} = \dfrac{21\sqrt{6}}{28\sqrt{3}}$

$= \dfrac{3}{4}\sqrt{2} = \dfrac{3}{4}\times1.414 = 3\times0.3535 = 1.0605.$

56. Sum of decimal places in the numerator and denominator under the radical sign being the same, we remove the decimal.

$\therefore$ Given exp. $= \sqrt{\dfrac{81\times484}{64\times625}} = \dfrac{9\times22}{8\times25} = 0.99.$

57. Given exp. $= \sqrt{\dfrac{204\times42}{7\times34}} = \sqrt{36} = 6.$

58. Given exp. $= \sqrt{\dfrac{81\times324\times4624}{15625\times289\times729\times64}} = \dfrac{9\times18\times68}{125\times17\times27\times8} = \dfrac{3}{125} = 0.024.$

59. Given exp. $= \sqrt{\dfrac{9.5\times.08500}{.19\times.0017}} = \sqrt{\dfrac{95\times8500}{19\times17}} = \sqrt{5\times500} = \sqrt{2500} = 50.$

60. Given exp. $= \sqrt{\dfrac{(0.03)^2 + (0.21)^2 + (0.065)^2}{\left(\dfrac{0.03}{10}\right)^2 + \left(\dfrac{0.21}{10}\right)^2 + \left(\dfrac{0.065}{10}\right)^2}}$

$= \sqrt{\dfrac{100\,[(0.03)^2 + (0.21)^2 + (0.065)^2]}{(0.03)^2 + (0.21)^2 + (0.065)^2}} = \sqrt{100} = 10.$

61. $\sqrt{(7+3\sqrt{5})(7-3\sqrt{5})} = \sqrt{(7)^2 - (3\sqrt{5})^2} = \sqrt{49-45} = \sqrt{4} = 2.$

62. $\left(\sqrt{3} - \dfrac{1}{\sqrt{3}}\right)^2 = (\sqrt{3})^2 + \left(\dfrac{1}{\sqrt{3}}\right)^2 - 2\times\sqrt{3}\times\dfrac{1}{\sqrt{3}} = 3 + \dfrac{1}{3} - 2 = 1 + \dfrac{1}{3} = \dfrac{4}{3}.$

63. $\left(\sqrt{2} + \dfrac{1}{\sqrt{2}}\right)^2 = (\sqrt{2})^2 + \left(\dfrac{1}{\sqrt{2}}\right)^2 + 2\times\sqrt{2}\times\dfrac{1}{\sqrt{2}} = 2 + \dfrac{1}{2} + 2 = 4 + \dfrac{1}{2} = 4\dfrac{1}{2}.$

64. $\sqrt{4a^2 - 4a + 1} + 3a = \sqrt{(1)^2 + (2a)^2 - 2\times1\times2a} + 3a$

$= \sqrt{(1-2a)^2} + 3a = (1-2a) + 3a = (1+a) = (1 + 0.1039) = 1.1039.$

65. $\sqrt{\dfrac{(0.75)^3}{(1-0.75)} + [0.75 + (0.75)^2 + 1]} = \sqrt{\dfrac{(0.75)^3 + (1-0.75)\,[(1)^2 + (0.75)^2 + 1\times0.75]}{1-0.75}}$

$= \sqrt{\dfrac{(0.75)^3 + [(1)^3 - (0.75)^3]}{1-0.75}} = \sqrt{\dfrac{1}{0.25}} = \sqrt{\dfrac{100}{25}} = \sqrt{4} = 2.$

66. $4b = 6c \Rightarrow b = \dfrac{3}{2}c$ and $3a = 4b \Rightarrow a = \dfrac{4}{3}b = \dfrac{4}{3}\left(\dfrac{3}{2}c\right) = 2c.$

$a + b + c = 27\sqrt{29} \Rightarrow 2c + \dfrac{3}{2}c + c = 27\sqrt{29} \Rightarrow \dfrac{9}{2}c = 27\sqrt{29} \Rightarrow c = 6\sqrt{29}.$

$$\therefore \quad \sqrt{a^2+b^2+c^2} = \sqrt{(a+b+c)^2 - 2(ab+bc+ca)}$$

$$= \sqrt{(27\sqrt{29})^2 - 2\left(2c \times \frac{3}{2}c + \frac{3}{2}c \times c + c \times 2c\right)}$$

$$= \sqrt{(729 \times 29) - 2\left(3c^2 + \frac{3}{2}c^2 + 2c^2\right)} = \sqrt{(729 \times 29) - 2 \times \frac{13}{2}c^2}$$

$$= \sqrt{(729 \times 29) - 13 \times (6\sqrt{29})^2} = \sqrt{29(729 - 468)}$$

$$= \sqrt{29 \times 261} = \sqrt{29 \times 29 \times 9} = 29 \times 3 = 87.$$

67. $\sqrt{0.\overline{4}} = \sqrt{\frac{4}{9}} = \frac{2}{3} = 0.666..... = 0.\overline{6}.$

68. $\sqrt{0.09} = \sqrt{\frac{9}{100}} = \frac{3}{10} = 0.3$, which is rational.

$\therefore$ 0.09 has rational square root.

69.

6	$0.\overline{40}\,\overline{00}\,\overline{00}$	(.63
	36	
123	400	
	369	

70.

3	$0.\overline{12}\,\overline{10}\,\overline{00}$	(.347
	9	
64	310	
	256	
687	5400	
	4809	

71.

2	$0.\overline{06}\,\overline{40}\,\overline{00}$	(.252
	4	
45	240	
	225	
502	1500	
	1006	

72. $\sqrt{\frac{0.16}{0.4}} = \sqrt{\frac{0.16}{0.40}} = \sqrt{\frac{16}{40}} = \sqrt{\frac{4}{10}} = \sqrt{0.4} = 0.63.$

73. $\frac{1+\sqrt{0.01}}{1-\sqrt{0.1}} = \frac{1+0.1}{1-0.316} = \frac{1.1}{0.684}$

$= \frac{1100}{684} = 1.6.$

3	$0.\overline{10}\,\overline{00}\,\overline{00}$	(.316
	9	
61	100	
	61	
62	3900	
	3756	

74. $\frac{1}{\sqrt{5}} = \frac{1}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{5}}{5} = \frac{2.236}{5} = 0.447.$

75. $\sqrt{\frac{8}{3}} = \sqrt{\frac{8 \times 3}{3 \times 3}} = \frac{\sqrt{24}}{3} = \frac{4.899}{3} = 1.633.$

76. $\frac{3\sqrt{2}}{2\sqrt{3}} = \frac{3\sqrt{2}}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{6}}{2 \times 3} = \frac{\sqrt{6}}{2} = \frac{2.449}{2} = 1.2245.$

77. $\frac{\sqrt{5}}{2} - \frac{10}{\sqrt{5}} + \sqrt{125} = \frac{(\sqrt{5})^2 - 20 + 2\sqrt{5} \times 5\sqrt{5}}{2\sqrt{5}} = \frac{5 - 20 + 50}{2\sqrt{5}}$

$= \frac{35}{2\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{35\sqrt{5}}{10} = \frac{7}{2} \times 2.236 = 7 \times 1.118 = 7.826.$

78. Clearly, $a * b = \sqrt{a^2 + b^2}$.

$\therefore \quad 5 * 12 = \sqrt{5^2 + 12^2} = \sqrt{25 + 144} = \sqrt{169} = 13.$

79. L.C.M. of 3, 4, 5, 6, 8 is 120. Now, $120 = 2 \times 2 \times 2 \times 3 \times 5$.
To make it a perfect square, it must be multiplied by $2 \times 3 \times 5$.
So, required number $= 2^2 \times 2^2 \times 3^2 \times 5^2 = 3600$.

80. L.C.M. of 21, 36, 66 = 2772. Now, $2772 = 2 \times 2 \times 3 \times 3 \times 7 \times 11$.
To make it a perfect square, it must be multiplied by 7×11.
So, required number $= 2^2 \times 3^2 \times 7^2 \times 11^2 = 213444$.

81. $294 = 7 \times 7 \times 2 \times 3$.
To make it a perfect square, it must be multiplied by 2×3 *i.e.*, 6.
$\therefore$ Required number = 6.

82. $5808 = 2 \times 2 \times 2 \times 2 \times 3 \times 11 \times 11 = 2^2 \times 2^2 \times 3 \times 11^2$.
To make it a perfect square, it must be multiplied by 3.

83. $1470 = 7 \times 7 \times 5 \times 6$. To make it a perfect square, it must be divided by 5×6, *i.e.*, 30.

84.

7	$\overline{54}\,\overline{91}\,\overline{62}$ (741
	49
144	591
	576
1481	1562
	1481
	81

$\therefore$ Required number to be subtracted = 81.

85. $0.000326 = \frac{326}{10^6}$.

$\therefore$ Required number to be subtracted $= \frac{2}{10^6} = 0.000002.$

1	$\overline{3}\,\overline{26}$ (18
	1
28	226
	224
	2

86.

8	$\overline{68}\,\overline{06}\,\overline{21}$ (824
	64
162	406
	324
1644	8221
	6576
	1645

$\therefore$ Number to be added $= (825)^2 - 680621 = 680625 - 680621 = 4.$

87. Greatest number of four digits is 9999.

9	$\overline{99}\,\overline{99}$ (99
	81
189	1899
	1701
	198

$\therefore$ Required number $= (9999 - 198) = 9801.$

88. Least number of 4 digits is 1000.

$$\begin{array}{r|l} 3 & \overline{10}\,\overline{00}\ (31 \\ & 9 \\ \hline 61 & 100 \\ & 61 \\ \hline & 39 \end{array}$$

$\therefore\ (31)^2 < 1000 < (32)^2$. Hence, required number $= (32)^2 = 1024$.

89. $\dfrac{1}{(\sqrt{5}-\sqrt{3})} = \dfrac{1}{(\sqrt{5}-\sqrt{3})} \times \dfrac{(\sqrt{5}+\sqrt{3})}{(\sqrt{5}+\sqrt{3})} = \dfrac{(\sqrt{5}+\sqrt{3})}{(5-3)} = \dfrac{(2.2361+1.7321)}{2} = \dfrac{3.9682}{2} = 1.9841.$

90. Given exp. $= \dfrac{1}{(\sqrt{9}-\sqrt{8})} \times \dfrac{(\sqrt{9}+\sqrt{8})}{(\sqrt{9}+\sqrt{8})} - \dfrac{1}{(\sqrt{8}-\sqrt{7})} \times \dfrac{(\sqrt{8}+\sqrt{7})}{(\sqrt{8}+\sqrt{7})} + \dfrac{1}{(\sqrt{7}-\sqrt{6})} \times \dfrac{(\sqrt{7}+\sqrt{6})}{(\sqrt{7}+\sqrt{6})}$

$$- \frac{1}{(\sqrt{6}-\sqrt{5})} \times \frac{(\sqrt{6}+\sqrt{5})}{(\sqrt{6}+\sqrt{5})} + \frac{1}{(\sqrt{5}-\sqrt{4})} \times \frac{(\sqrt{5}+\sqrt{4})}{(\sqrt{5}+\sqrt{4})}$$

$$= \frac{(\sqrt{9}+\sqrt{8})}{(9-8)} - \frac{(\sqrt{8}+\sqrt{7})}{(8-7)} + \frac{(\sqrt{7}+\sqrt{6})}{(7-6)} - \frac{(\sqrt{6}+\sqrt{5})}{(6-5)} + \frac{(\sqrt{5}+\sqrt{4})}{(5-4)}$$

$$= (\sqrt{9}+\sqrt{8}) - (\sqrt{8}+\sqrt{7}) + (\sqrt{7}+\sqrt{6}) - (\sqrt{6}+\sqrt{5}) + (\sqrt{5}+\sqrt{4}) = (\sqrt{9}+\sqrt{4}) = 3+2 = 5.$$

91. Given exp. $= (2+\sqrt{2}) + \dfrac{1}{(2+\sqrt{2})} \times \dfrac{(2-\sqrt{2})}{(2-\sqrt{2})} - \dfrac{1}{(2-\sqrt{2})} \times \dfrac{(2+\sqrt{2})}{(2+\sqrt{2})}$

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

92. $\dfrac{7}{(3+\sqrt{2})} = \dfrac{7}{(3+\sqrt{2})} \times \dfrac{(3-\sqrt{2})}{(3-\sqrt{2})} = \dfrac{7(3-\sqrt{2})}{(9-2)} = (3-\sqrt{2}) = (3-1.4142) = 1.5858.$

93. Given exp. $= \dfrac{3\sqrt{2}}{(\sqrt{6}-\sqrt{3})} \times \dfrac{(\sqrt{6}+\sqrt{3})}{(\sqrt{6}+\sqrt{3})} - \dfrac{4\sqrt{3}}{(\sqrt{6}-\sqrt{2})} \times \dfrac{(\sqrt{6}+\sqrt{2})}{(\sqrt{6}+\sqrt{2})} - \dfrac{6}{2(\sqrt{2}-\sqrt{3})}$

$$= \frac{3\sqrt{2}(\sqrt{6}+\sqrt{3})}{(6-3)} - \frac{4\sqrt{3}(\sqrt{6}+\sqrt{2})}{(6-2)} + \frac{3}{(\sqrt{3}-\sqrt{2})} \times \frac{(\sqrt{3}+\sqrt{2})}{(\sqrt{3}+\sqrt{2})}$$

$$= \sqrt{2}(\sqrt{6}+\sqrt{3}) - \sqrt{3}(\sqrt{6}+\sqrt{2}) + 3(\sqrt{3}+\sqrt{2})$$

$$= \sqrt{12} + \sqrt{6} - \sqrt{18} - \sqrt{6} + 3\sqrt{3} + 3\sqrt{2}$$

$$= 2\sqrt{3} - 3\sqrt{2} + 3\sqrt{3} + 3\sqrt{2} = 5\sqrt{3}.$$

94. $\dfrac{\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}} = \dfrac{(\sqrt{7}+\sqrt{5})}{(\sqrt{7}-\sqrt{5})} \times \dfrac{(\sqrt{7}+\sqrt{5})}{(\sqrt{7}+\sqrt{5})} = \dfrac{(\sqrt{7}+\sqrt{5})^2}{(7-5)} = \dfrac{7+5+2\sqrt{35}}{2} = \dfrac{12+2\sqrt{35}}{2} = 6+\sqrt{35}.$

95. $a+b\sqrt{3} = \dfrac{(5+2\sqrt{3})}{(7+4\sqrt{3})} \times \dfrac{(7-4\sqrt{3})}{(7-4\sqrt{3})} = \dfrac{35-20\sqrt{3}+14\sqrt{3}-24}{(7)^2-(4\sqrt{3})^2} = \dfrac{11-6\sqrt{3}}{49-48} = 11-6\sqrt{3}.$

$\therefore\ a = 11,\ b = -6.$

96. $\dfrac{\sqrt{2}-1}{\sqrt{2}+1} = \dfrac{(\sqrt{2}-1)}{(\sqrt{2}+1)} \times \dfrac{(\sqrt{2}-1)}{(\sqrt{2}-1)} = (\sqrt{2}-1)^2.$

$\therefore\ \sqrt{\dfrac{\sqrt{2}-1}{\sqrt{2}+1}} = (\sqrt{2}-1) = (1.414-1) = 0.414.$

97. Given exp. $= \dfrac{3+\sqrt{6}}{5\sqrt{3}-4\sqrt{3}-4\sqrt{2}+5\sqrt{2}} = \dfrac{(3+\sqrt{6})}{(\sqrt{3}+\sqrt{2})}$

$= \dfrac{(3+\sqrt{6})}{(\sqrt{3}+\sqrt{2})} \times \dfrac{(\sqrt{3}-\sqrt{2})}{(\sqrt{3}-\sqrt{2})} = \dfrac{3\sqrt{3}-3\sqrt{2}+3\sqrt{2}-2\sqrt{3}}{(3-2)} = \sqrt{3}.$

98. Given exp. $= \dfrac{(2+\sqrt{3})}{(2-\sqrt{3})} \times \dfrac{(2+\sqrt{3})}{(2+\sqrt{3})} + \dfrac{(2-\sqrt{3})}{(2+\sqrt{3})} \times \dfrac{(2-\sqrt{3})}{(2-\sqrt{3})} + \dfrac{(\sqrt{3}-1)}{(\sqrt{3}+1)} \times \dfrac{(\sqrt{3}-1)}{(\sqrt{3}-1)}$

$= \dfrac{(2+\sqrt{3})^2}{(4-3)} + \dfrac{(2-\sqrt{3})^2}{(4-3)} + \dfrac{(\sqrt{3}-1)^2}{(3-1)} = [(2+\sqrt{3})^2 + (2-\sqrt{3})^2] + \dfrac{4-2\sqrt{3}}{2}$

$= 2(4+3) + 2 - \sqrt{3} = 16 - \sqrt{3}.$

99. $x + \dfrac{1}{x} = (7-4\sqrt{3}) + \dfrac{1}{(7-4\sqrt{3})} \times \dfrac{(7+4\sqrt{3})}{(7+4\sqrt{3})} = (7-4\sqrt{3}) + \dfrac{(7+4\sqrt{3})}{(49-48)}$

$= (7-4\sqrt{3}) + (7+4\sqrt{3}) = 14.$

100. $x = \dfrac{(\sqrt{3}+1)}{(\sqrt{3}-1)} \times \dfrac{(\sqrt{3}+1)}{(\sqrt{3}+1)} = \dfrac{(\sqrt{3}+1)^2}{(3-1)} = \dfrac{3+1+2\sqrt{3}}{2} = 2+\sqrt{3}.$

$y = \dfrac{(\sqrt{3}-1)}{(\sqrt{3}+1)} \times \dfrac{(\sqrt{3}-1)}{(\sqrt{3}-1)} = \dfrac{(\sqrt{3}-1)^2}{(3-1)} = \dfrac{3+1-2\sqrt{3}}{2} = 2-\sqrt{3}.$

$\therefore \quad x^2 + y^2 = (2+\sqrt{3})^2 + (2-\sqrt{3})^2 = 2(4+3) = 2 \times 7 = 14.$

101. $a = \dfrac{(\sqrt{5}+1)}{(\sqrt{5}-1)} \times \dfrac{(\sqrt{5}+1)}{(\sqrt{5}+1)} = \dfrac{(\sqrt{5}+1)^2}{(5-1)} = \dfrac{5+1+2\sqrt{5}}{4} = \left(\dfrac{3+\sqrt{5}}{2}\right).$

$b = \dfrac{(\sqrt{5}-1)}{(\sqrt{5}+1)} \times \dfrac{(\sqrt{5}-1)}{(\sqrt{5}-1)} = \dfrac{(\sqrt{5}-1)^2}{(5-1)} = \dfrac{5+1-2\sqrt{5}}{4} = \left(\dfrac{3-\sqrt{5}}{2}\right).$

$\therefore \quad a^2 + b^2 = \dfrac{(3+\sqrt{5})^2}{4} + \dfrac{(3-\sqrt{5})^2}{4} = \dfrac{(3+\sqrt{5})^2 + (3-\sqrt{5})^2}{4} = \dfrac{2(9+5)}{4} = 7.$

Also, $ab = \dfrac{(3+\sqrt{5})}{2} \cdot \dfrac{(3-\sqrt{5})}{2} = \dfrac{(9-5)}{4} = 1.$

$\therefore \quad \dfrac{a^2+ab+b^2}{a^2-ab+b^2} = \dfrac{(a^2+b^2)+ab}{(a^2+b^2)-ab} = \dfrac{7+1}{7-1} = \dfrac{8}{6} = \dfrac{4}{3}.$

102.

1	$\overline{15}\,\overline{37}\,\overline{6}$	(124
	1	
22	53	
	44	
244	976	
	976	
	×	

$\therefore$ Number of rows = 124.

103.

1	$\overline{3}\,\overline{65}\,\overline{81}$	(191
	1	
29	265	
	261	
381	481	
	381	
	100	

$\therefore$ Number of men left = 100.

104. Money collected = (59.29 × 100) paise = 5929 paise.

$\therefore$ Number of members $= \sqrt{5929} = 77.$

105. $(.000216)^{1/3} = \left(\dfrac{216}{10^6}\right)^{1/3} = \left(\dfrac{6 \times 6 \times 6}{10^2 \times 10^2 \times 10^2}\right)^{1/3} = \dfrac{6}{10^2} = \dfrac{6}{100} = .06.$

106. $\sqrt[3]{4\frac{12}{125}} = \sqrt[3]{\frac{512}{125}} = \left(\frac{8\times8\times8}{5\times5\times5}\right)^{1/3} = \frac{8}{5} = 1\frac{3}{5}$.

107. $\sqrt{.000064} = \sqrt{\frac{64}{10^6}} = \frac{8}{10^3} = \frac{8}{1000} = .008$.

$\therefore \sqrt[3]{\sqrt{.000064}} = \sqrt[3]{.008} = \sqrt[3]{\frac{8}{1000}} = \frac{2}{10} = 0.2$.

108. Clearly, 9261 is a perfect cube satisfying the given property.

109. $675 = 5 \times 5 \times 3 \times 3 \times 3$.

To make it a perfect cube, it must be multiplied by 5.

110. $3600 = 2^3 \times 5^2 \times 3^2 \times 2$.

To make it a perfect cube, it must be divided by $5^2 \times 3^2 \times 2$ *i.e.*, 450.

6. AVERAGE

IMPORTANT FACTS AND FORMULAE

1. Average $= \left(\dfrac{\text{Sum of observations}}{\text{Number of observations}}\right)$.
2. Suppose a man covers a certain distance at x kmph and an equal distance at y kmph. Then, the average speed during the whole journey is $\left(\dfrac{2xy}{x+y}\right)$ kmph.

SOLVED EXAMPLES

Ex. 1. ***Find the average of all prime numbers between 30 and 50.***

Sol. There are five prime numbers between 30 and 50.

They are 31, 37, 41, 43 and 47.

$\therefore$ Required average $= \left(\dfrac{31+37+41+43+47}{5}\right) = \dfrac{199}{5} = 39.8.$

Ex. 2. ***Find the average of first 40 natural numbers.***

Sol. Sum of first n natural numbers $= \dfrac{n(n+1)}{2}$.

So, sum of first 40 natural numbers $= \dfrac{40 \times 41}{2} = 820.$

$\therefore$ Required average $= \dfrac{820}{40} = 20.5.$

Ex. 3. ***Find the average of first 20 multiples of 7.***

Sol. Required average $= \dfrac{7(1+2+3+\ldots..+20)}{20} = \left(\dfrac{7 \times 20 \times 21}{20 \times 2}\right) = \left(\dfrac{147}{2}\right) = 73.5.$

Ex. 4. ***The average of four consecutive even numbers is 27. Find the largest of these numbers.***

Sol. Let the numbers be x, $x+2$, $x+4$ and $x+6$. Then,

$$\frac{x+(x+2)+(x+4)+(x+6)}{4} = 27 \Rightarrow \frac{4x+12}{4} = 27 \Rightarrow x+3 = 27 \Rightarrow x = 24.$$

$\therefore$ Largest number $= (x+6) = 24 + 6 = 30.$

Ex. 5. ***There are two sections A and B of a class, consisting of 36 and 44 students respectively. If the average weight of section A is 40 kg and that of section B is 35 kg, find the average weight of the whole class.***

Sol. Total weight of $(36 + 44)$ students $= (36 \times 40 + 44 \times 35)$ kg $= 2980$ kg.

$\therefore$ Average weight of the whole class $= \left(\dfrac{2980}{80}\right)$ kg $= 37.25$ kg.

Ex. 6. ***Nine persons went to a hotel for taking their meals. Eight of them spent Rs. 12 each on their meals and the ninth spent Rs. 8 more than the average expenditure of all the nine. What was the total money spent by them ?***

Sol. Let the average expenditure of all the nine be Rs. x.

Then, $12 \times 8 + (x + 8) = 9x$ or $8x = 104$ or $x = 13$.

$\therefore$ Total money spent $= 9x$ = Rs. (9×13) = Rs. 117.

Ex. 7. ***Of the three numbers, second is twice the first and is also thrice the third. If the average of the three numbers is 44, find the largest number.***

Sol. Let the third number be x. Then, second number $= 3x$. First number $= \frac{3x}{2}$.

$\therefore$ $x + 3x + \frac{3x}{2} = (44 \times 3)$ or $\frac{11x}{2} = 44 \times 3$ or $x = 24$.

So, largest number = 2nd number $= 3x = 72$.

Ex. 8. ***The average of 25 results is 18. The average of first twelve of them is 14 and that of last twelve is 17. Find the thirteenth result.***

Sol. Clearly, thirteenth result = (sum of 25 results) – (sum of 24 results)

$= (18 \times 25) - [(14 \times 12) + (17 \times 12)]$

$= 450 - (168 + 204) = 450 - 372 = 78$.

Ex. 9. ***The average of 11 results is 60. If the average of first six results is 58 and that of the last six is 63, find the sixth result.***

Sol. Sixth result $= (58 \times 6 + 63 \times 6 - 60 \times 11) = 66$.

Ex. 10. ***The average weight of A, B, C is 45 kg. If the average weight of A and B be 40 kg and that of B and C be 43 kg, find the weight of B.***

Sol. Let A, B and C represent their individual weights. Then,

$A + B + C = (45 \times 3)$ kg = 135 kg.

$A + B = (40 \times 2)$ kg = 80 kg and $B + C = (43 \times 2)$ kg = 86 kg.

$\therefore$ $B = (A + B) + (B + C) - (A + B + C) = (80 + 86 - 135)$ kg = 31 kg.

Ex. 11. ***The average age of a class of 39 students is 15 years. If the age of the teacher be included, then the average increases by 3 months. Find the age of the teacher.***

Sol. Total age of 39 persons $= (39 \times 15)$ years = 585 years.

Average age of 40 persons = 15 years 3 months $= \frac{61}{4}$ years.

Total age of 40 persons $= \left(\frac{61}{4} \times 40\right)$ years = 610 years.

$\therefore$ Age of the teacher $= (610 - 585)$ years = 25 years.

Ex. 12. ***The average weight of 10 oarsmen in a boat is increased by 1.8 kg when one of the crew, who weighs 53 kg is replaced by a new man. Find the weight of the new man.***

Sol. Total weight increased $= (1.8 \times 10)$ kg = 18 kg.

$\therefore$ Weight of the new man $= (53 + 18)$ kg = 71 kg.

Ex. 13. ***There were 35 students in a hostel. Due to the admission of 7 new students, the expenses of the mess were increased by Rs. 42 per day while the average expenditure per head diminished by Re 1. What was the original expenditure of the mess ?***

Sol. Let the original average expenditure be Rs. x. Then,

$42(x - 1) - 35x = 42 \Leftrightarrow 7x = 84 \Rightarrow x = 12$.

$\therefore$ Original expenditure = Rs. (35×12) = Rs. 420.

Ex. 14. ***A batsman makes a score of 87 runs in the 17th inning and thus increases his average by 3. Find his average after 17th inning.***

Sol. Let the average after 17th inning = x.

Then, average after 16th inning = $(x - 3)$.

$\therefore$ $16(x - 3) + 87 = 17x$ or $x = (87 - 48) = 39$.

Ex. 15. ***Distance between two stations A and B is 778 km. A train covers the journey from A to B at 84 km per hour and returns back to A with a uniform speed of 56 km per hour. Find the average speed of the train during the whole journey.***

Sol. Required average speed $= \left(\frac{2xy}{x+y}\right)$ km/hr $= \frac{2 \times 84 \times 56}{(84+56)}$ km/hr

$= \left(\frac{2 \times 84 \times 56}{140}\right)$ km/hr $= 67.2$ km/hr.

EXERCISE 6A

(OBJECTIVE TYPE QUESTIONS)

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

1. David obtained 76, 65, 82, 67 and 85 marks (out of 100) in English, Mathematics, Physics, Chemistry and Biology. What are his average marks ? **(Bank P.O. 2003)**

   (*a*) 65 (*b*) 69 (*c*) 72

   (*d*) 76 (*e*) None of these

2. In Arun's opinion, his weight is greater than 65 kg but less than 72 kg. His brother does not agree with Arun and he thinks that Arun's weight is greater than 60 kg but less than 70 kg. His mother's view is that his weight cannot be greater than 68 kg. If all of them are correct in their estimation, what is the average of different probable weights of Arun ? **(S.B.I.P.O. 2000)**

   (*a*) 67 kg (*b*) 68 kg (*c*) 69 kg

   (*d*) Data inadequate (*e*) None of these

3. The average of 20 numbers is zero. Of them, at the most, how many may be greater than zero ? **(Hotel Management, 2002)**

   (*a*) 0 (*b*) 1 (*c*) 10 (*d*) 19

4. Find the average of all the numbers between 6 and 34 which are divisible by 5.

   (*a*) 18 (*b*) 20 (*c*) 24 (*d*) 30 **(C.B.I. 1997)**

5. The average of first five multiples of 3 is : **(Assistant Grade, 1998)**

   (*a*) 3 (*b*) 9 (*c*) 12 (*d*) 15

6. The average of the first nine prime numbers is : **(C.B.I. 2003)**

   (*a*) 9 (*b*) 11 (*c*) $11\frac{1}{9}$ (*d*) $11\frac{2}{9}$

7. A student was asked to find the arithmetic mean of the numbers 3, 11, 7, 9, 15, 13, 8, 19, 17, 21, 14 and x. He found the mean to be 12. What should be the number in place of x ? **(Section Officers', 2003)**

   (*a*) 3 (*b*) 7 (*c*) 17 (*d*) 31

8. The average of 2, 7, 6 and x is 5 and the average of 18, 1, 6, x and y is 10. What is the value of y ?

   (*a*) 5 (*b*) 10 (*c*) 20 (*d*) 30

9. If the mean of 5 observations x, $x+2$, $x+4$, $x+6$ and $x+8$ is 11, then the mean of the last three observations is : **(C.D.S. 2003)**
(a) 11 (b) 13 (c) 15 (d) 17

10. If the mean of a, b, c is M and $ab + bc + ca = 0$, then the mean of a^2, b^2, c^2 is :
(a) M^2 (b) $3M^2$ (c) $6M^2$ (d) $9M^2$
(IITTM, 2003)

11. The average of the two-digit numbers, which remain the same when the digits interchange their positions, is : **(C.D.S. 2003)**
(a) 33 (b) 44 (c) 55 (d) 66

12. The average of first 50 natural numbers is :
(a) 12.25 (b) 21.25 (c) 25 (d) 25.5

13. The mean of 1^2, 2^2, 3^2, 4^2, 5^2, 6^2, 7^2 is :
(a) 10 (b) 20 (c) 30 (d) 40

14. The average of all odd numbers upto 100 is :
(a) 49 (b) 49.5 (c) 50 (d) 51

15. If a, b, c, d, e are five consecutive odd numbers, their average is :
(a) $5(a+4)$ (b) $\frac{abcde}{5}$
(c) $5(a+b+c+d+e)$ (d) None of these

16. The average of a non-zero number and its square is 5 times the number. The number is : **(S.S.C. 2003)**
(a) 9 (b) 17 (c) 29 (d) 295

17. The average of 7 consecutive numbers is 20. The largest of these numbers is :
(a) 20 (b) 22 (c) 23 (d) 24
(S.S.C. 2000)

18. The average of five consecutive odd numbers is 61. What is the difference between the highest and lowest numbers ? **(Bank P.O. 2003)**
(a) 2 (b) 5 (c) 8
(d) Cannot be determined (e) None of these

19. The sum of three consecutive odd numbers is 38 more than the average of these numbers. What is the first of these numbers ? **(Bank P.O. 1998)**
(a) 13 (b) 17 (c) 19
(d) Data inadequate (e) None of these

20. The average age of the boys in a class is 16 years and that of the girls is 15 years. The average age for the whole class is : **(S.S.C. 2003)**
(a) 15 years (b) 15.5 years (c) 16 years
(d) Cannot be computed with the given information

21. The average annual income (in Rs.) of certain agricultural workers is S and that of other workers is T. The number of agricultural workers is 11 times that of other workers. Then the average monthly income (in Rs.) of all the workers is :
(a) $\frac{S+T}{2}$ (b) $\frac{S+11T}{2}$ (c) $\frac{1}{11S}+T$ (d) $\frac{11S+T}{12}$
(S.S.C. 2004)

22. A family consists of grandparents, parents and three grandchildren. The average age of the grandparents is 67 years, that of the parents is 35 years and that of the grandchildren is 6 years. What is the average age of the family ? **(R.R.B. 2003)**
(a) $28\frac{4}{7}$ years (b) $31\frac{5}{7}$ years (c) $32\frac{1}{7}$ years (d) None of these

23. A library has an average of 510 visitors on Sundays and 240 on other days. The average number of visitors per day in a month of 30 days beginning with a Sunday is : **(M.A.T. 2003)**

(a) 250 (b) 276 (c) 280 (d) 285

24. If the average marks of three batches of 55, 60 and 45 students respectively is 50, 55 and 60, then the average marks of all the students is : **(C.B.I. 2003)**

(a) 53.33 (b) 54.68 (c) 55 (d) None of these

25. The average weight of 16 boys in a class is 50.25 kgs and that of the remaining 8 boys is 45.15 kgs. Find the average weight of all the boys in the class. **(I.M.T. 2002)**

(a) 47.55 kgs (b) 48 kgs (c) 48.55 kgs (d) 49.25 kgs

26. A car owner buys petrol at Rs 7.50, Rs. 8 and Rs. 8.50 per litre for three successive years. What approximately is the average cost per litre of petrol if he spends Rs. 4000 each year ? **(M.A.T. 2001)**

(a) Rs. 7.98 (b) Rs. 8 (c) Rs. 8.50 (d) Rs. 9

27. The average of six numbers is x and the average of three of these is y. If the average of the remaining three is z, then : **(Hotel Management, 2001)**

(a) $x = y + z$ (b) $2x = y + z$ (c) $x = 2y + 2z$ (d) None of these

28. Out of 9 persons, 8 persons spent Rs. 30 each for their meals. The ninth one spent Rs. 20 more than the average expenditure of all the nine. The total money spent by all of them was : **(C.B.I. 1998)**

(a) Rs. 260 (b) Rs. 290 (c) Rs. 292.50 (d) Rs. 400.50

29. The average of 50 numbers is 30. If two numbers, 35 and 40 are discarded, then the average of the remaining numbers is nearly : **(R.R.B. 2002)**

(a) 28.32 (b) 28.78 (c) 29.27 (d) 29.68

30. The average of five numbers is 27. If one number is excluded, the average becomes 25. The excluded number is : **(Section Officers', 2003)**

(a) 25 (b) 27 (c) 30 (d) 35

31. The average age of 35 students in a class is 16 years. The average age of 21 students is 14. What is the average age of remaining 14 students ? **(S.B.I.P.O. 1997)**

(a) 15 years (b) 17 years (c) 18 years (d) 19 years

32. 16 children are to be divided into two groups A and B of 10 and 6 children. The average percent marks obtained by the children of group A is 75 and the average percent marks of all the 16 children is 76. What is the average percent marks of children of group B ? **(B.S.R.B. 2003)**

(a) $77\frac{1}{3}$ (b) $77\frac{2}{3}$ (c) $78\frac{1}{3}$ (d) $78\frac{2}{3}$

33. The average score of a cricketer for ten matches is 38.9 runs. If the average for the first six matches is 42, then find the average for the last four matches.

(a) 33.25 (b) 33.5 (c) 34.25 (d) 35

(IGNOU, 2003)

34. The average of six numbers is 3.95. The average of two of them is 3.4, while the average of the other two is 3.85. What is the average of the remaining two numbers ?

(a) 4.5 (b) 4.6 (c) 4.7 (d) 4.8

(Bank P.O. 2003)

35. The batting average for 40 innings of a cricket player is 50 runs. His highest score exceeds his lowest score by 172 runs. If these two innings are excluded, the average of the remaining 38 innings is 48 runs. The highest score of the player is :

(a) 165 runs (b) 170 runs (c) 172 runs (d) 174 runs

36. The average price of 10 books is Rs. 12 while the average price of 8 of these books is Rs. 11.75. Of the remaining two books, if the price of one book is 60% more than the price of the other, what is the price of each of these two books ?
(*a*) Rs. 5, Rs. 7.50 (*b*) Rs. 8, Rs. 12 (*c*) Rs. 10, Rs. 16 (*d*) Rs. 12, Rs. 14
(Assistant Grade, 1997)

37. The average of runs of a cricket player of 10 innings was 32. How many runs must he make in his next innings so as to increase his average of runs by 4 ?
(*a*) 2 (*b*) 4 (*c*) 70 (*d*) 76
(S.S.C. 2004)

38. A grocer has a sale of Rs. 6435, Rs. 6927, Rs. 6855, Rs. 7230 and Rs. 6562 for 5 consecutive months. How much sale must he have in the sixth month so that he gets an average sale of Rs. 6500 ? **(S.S.C. 2003)**
(*a*) Rs. 4991 (*b*) Rs. 5991 (*c*) Rs. 6001 (*d*) Rs. 6991

39. A company produces on an average 4000 items per month for the first 3 months. How many items it must produce on an average per month over the next 9 months, to average 4375 items per month over the whole ? **(S.S.C. 1999)**
(*a*) 4500 (*b*) 4600 (*c*) 4680 (*d*) 4710

40. In the first 10 overs of a cricket game, the run rate was only 3.2. What should be the run rate in the remaining 40 overs to reach the target of 282 runs ? **(M.A.T. 2002)**
(*a*) 6.25 (*b*) 6.5 (*c*) 6.75 (*d*) 7

41. The average price of three items of furniture is Rs. 15000. If their prices are in the ratio 3 : 5 : 7, the price of the cheapest item is :
(*a*) Rs. 9000 (*b*) Rs. 15000 (*c*) Rs. 18000 (*d*) Rs. 21000

42. Of the four numbers, the first is twice the second, the second is one-third of the third and the third is 5 times the fourth. The average of the numbers is 24.75. The largest of these numbers is : **(Hotel Management, 1998)**
(*a*) 9 (*b*) 25 (*c*) 30 (*d*) None of these

43. Of the four numbers, whose average is 60, the first is one-fourth of the sum of the last three. The first number is : **(S.S.C. 2000)**
(*a*) 15 (*b*) 45 (*c*) 48 (*d*) 60.25

44. Of the three numbers, the first is twice the second and the second is twice the third. The average of the reciprocal of the numbers is $\frac{7}{72}$. The numbers are :
(*a*) 16, 8, 4 (*b*) 20, 10, 5 (*c*) 24, 12, 6 (*d*) 36, 18, 9
(C.B.I. 1997)

45. Of the three numbers, the average of the first and the second is greater than the average of the second and the third by 15. What is the difference between the first and the third of the three numbers ? **(S.B.I.P.O. 2000)**
(*a*) 15 (*b*) 45 (*c*) 60
(*d*) Data inadequate (*e*) None of these

46. The average of 8 numbers is 20. The average of first two numbers is $15\frac{1}{2}$ and that of the next three is $21\frac{1}{3}$. If the sixth number be less than the seventh and eighth numbers by 4 and 7 respectively, then the eighth number is : **(S.S.C. 2004)**
(*a*) 18 (*b*) 22 (*c*) 25 (*d*) 27

47. If the arithmetic mean of seventy-five numbers is calculated, it is 35. If each number is increased by 5, then mean of new numbers is : **(Assistant Grade, 1998)**
(*a*) 30 (*b*) 40 (*c*) 70 (*d*) 90

48. The average of ten numbers is 7. If each number is multiplied by 12, then the average of the new set of numbers is :
(*a*) 7 (*b*) 19 (*c*) 82 (*d*) 84

49. Average of ten positive numbers is $\bar{x}$. If each number is increased by 10%, then $\bar{x}$:
(*a*) remains unchanged (*b*) may decrease
(*c*) may increase (*d*) is increased by 10%
(I.M.T. 2002)

50. The mean of 50 observations was 36. It was found later that an observation 48 was wrongly taken as 23. The corrected new mean is : **(S.S.C. 2003)**
(*a*) 35.2 (*b*) 36.1 (*c*) 36.5 (*d*) 39.1

51. A pupil's marks were wrongly entered as 83 instead of 63. Due to that the average marks for the class got increased by half. The number of pupils in the class is :
(*a*) 10 (*b*) 20 (*c*) 40 (*d*) 73
(C.B.I. 1998)

52. The average age of 15 students of a class is 15 years. Out of these, the average age of 5 students is 14 years and that of the other 9 students is 16 years. The age of the 15th student is : **(S.S.C. 2003)**
(*a*) 11 years (*b*) 14 years (*c*) 15 years (*d*) $15\frac{2}{7}$ years

53. The average of 11 numbers is 10.9. If the average of the first six numbers is 10.5 and that of the last six numbers is 11.4, then the middle number is :
(*a*) 11 (*b*) 11.3 (*c*) 11.4 (*d*) 11.5

54. The average weight of three boys A, B and C is $54\frac{1}{3}$ kg, while the average weight of three boys B, D and E is 53 kg. What is the average weight of A, B, C, D and E ?
(*a*) 52.4 kg (*b*) 53.2 kg (*c*) 53.8 kg
(*d*) Data inadequate (*e*) None of these
(S.B.I.P.O. 2002)

55. The average temperature of the town in the first four days of a month was 58 degrees. The average for the second, third, fourth and fifth days was 60 degrees. If the temperatures of the first and fifth days were in the ratio 7 : 8, then what is the temperature on the fifth day ? **(NMIMS, 2003)**
(*a*) 64 degrees (*b*) 62 degrees (*c*) 56 degrees (*d*) None of these.

56. The average weight of A, B and C is 45 kg. If the average weight of A and B be 40 kg and that of B and C be 43 kg, then the weight of B is : **(S.S.C. 2004)**
(*a*) 17 kg (*b*) 20 kg (*c*) 26 kg (*d*) 31 kg

57. The average monthly income of P and Q is Rs. 5050. The average monthly income of Q and R is Rs. 6250 and the average monthly income of P and R is Rs. 5200. The monthly income of P is : **(R.R.B. 2004)**
(*a*) Rs. 3500 (*b*) Rs. 4000 (*c*) Rs. 4050 (*d*) Rs. 5000

58. The average age of 36 students in a group is 14 years. When teacher's age is included to it, the average increases by one. What is the teacher's age in years ?
(*a*) 31 (*b*) 36 (*c*) 51
(*d*) Cannot be determined (*e*) None of these **(R.B.I. 2003)**

59. The average monthly salary of 20 employees in an organisation is Rs. 1500. If the manager's salary is added, then the average salary increases by Rs. 100. What is the manager's monthly salary ? **(R.R.B. 2002)**
(*a*) Rs. 2000 (*b*) Rs. 2400 (*c*) Rs. 3600 (*d*) Rs. 4800

60. The average weight of a class of 24 students is 35 kg. If the weight of the teacher be included, the average rises by 400 g. The weight of the teacher is : **(S.S.C. 2003)**
(*a*) 45 kg (*b*) 50 kg (*c*) 53 kg (*d*) 55 kg

61. The average age of the mother and her six children is 12 years which is reduced by 5 years if the age of the mother is excluded. How old is the mother ?
(*a*) 40 years (*b*) 42 years (*c*) 48 years (*d*) 50 years

62. The captain of a cricket team of 11 members is 26 years old and the wicket keeper is 3 years older. If the ages of these two are excluded, the average age of the remaining players is one year less than the average age of the whole team. What is the average age of the team ? **(N.I.F.T. 2000)**
(*a*) 23 years (*b*) 24 years (*c*) 25 years (*d*) None of these

63. The average height of 25 boys is 1.4 m. When 5 boys leave the group, then the average height increases by 0.15 m. What is the average height of the 5 boys who leave ?
(a) 0.8 m (*b*) 0.9 m (*c*) 0.95 m (*d*) 1.05 m

64. The average weight of 8 persons increases by 2.5 kg when a new person comes in place of one of them weighing 65 kg. What might be the weight of the new person ?
(*a*) 76 kg (*b*) 76.5 kg (*c*) 85 kg
(*d*) Data inadequate (*e*) None of these **(Bank P.O. 2000)**

65. The average weight of 45 students in a class is 52 kg. Five of them whose average weight is 48 kg leave the class and other 5 students whose average weight is 54 kg join the class. What is the new average weight (in kg) of the class ? **(R.R.B. 2002)**
(*a*) $52\frac{1}{3}$ (*b*) $52\frac{1}{2}$ (*c*) $52\frac{2}{3}$ (*d*) None of these

66. The average age of 8 men is increased by 2 years when two of them whose ages are 21 years and 23 years are replaced by two new men. The average age of the two new men is : **(S.S.C. 2002)**
(*a*) 22 years (*b*) 24 years (*c*) 28 years (*d*) 30 years

67. The average of five consecutive numbers is *n*. If the next two numbers are also included, the average will :
(*a*) remain the same (*b*) increase by 1
(*c*) increase by 1.4 (*d*) increase by 2

68. A cricketer has a certain average for 10 innings. In the eleventh inning, he scored 108 runs, thereby increasing his average by 6 runs. His new average is :
(*a*) 48 runs (*b*) 52 runs (*c*) 55 runs (*d*) 60 runs
(A.A.O. Exam, 2003)

69. A cricketer whose bowling average is 12.4 runs per wicket takes 5 wickets for 26 runs and thereby decreases his average by 0.4. The number of wickets taken by him till the last match was : **(S.S.C. 2000)**
(*a*) 64 (*b*) 72 (*c*) 80 (*d*) 85

70. A team of 8 persons joins in a shooting competition. The best marksman scored 85 points. If he had scored 92 points, the average score for the team would have been 84. The number of points, the team scored was :
(*a*) 588 (*b*) 645 (*c*) 665 (*d*) 672

71. A motorist travels to a place 150 km away at an average speed of 50 km / hr and returns at 30 km / hr. His average speed for the whole journey in km / hr is :
(*a*) 35 (*b*) 37 (*c*) 37.5 (*d*) 40

72. The average weight of 3 men A, B and C is 84 kg. Another man D joins the group and the average now becomes 80 kg. If another man E, whose weight is 3 kg more than that of D, replaces A, then the average weight of B, C, D and E becomes 79 kg. The weight of A is : **(Bank P.O. 2003)**
(*a*) 70 kg (*b*) 72 kg (*c*) 75 kg (*d*) 80 kg

73. The average age of a husband and his wife was 23 years at the time of their marriage. After five years they have a one-year old child. The average age of the family now is :
(a) 19 years (b) 23 years (c) 28.5 years (d) 29.3 years
(Assistant Grade., 1998)

74. Three years ago, the average age of A and B was 18 years. With C joining them, the average age becomes 22 years. How old is C now ?
(a) 24 years (b) 27 years (c) 28 years (d) 30 years

75. The average age of husband, wife and their child 3 years ago was 27 years and that of wife and the child 5 years ago was 20 years. The present age of the husband is :
(a) 35 years (b) 40 years (c) 50 years (d) None of these
(Hotel Management, 2003)

76. 3 years ago, the average age of a family of 5 members was 17 years. A baby having been born, the average age of the family is the same today. The present age of the baby is
(S.S.C. 2004)
(a) 1 year (b) $1\frac{1}{2}$ years (c) 2 years (d) 3 years

77. 10 years ago, the average age of a family of 4 members was 24 years. Two children having been born (with age difference of 2 years), the present average age of the family is the same. The present age of the youngest child is :
(S.S.C. 2003)
(a) 1 year (b) 2 years (c) 3 years (d) 5 years

78. After replacing an old member by a new member, it was found that the average age of five members of a club is the same as it was 3 years ago. What is the difference between the ages of the replaced and the new member ?
(a) 2 years (b) 4 years (c) 8 years (d) 15 years

79. The average age of 3 children in a family is 20% of the average age of the father and the eldest child. The total age of the mother and the youngest child is 39 years. If the father's age is 26 years, what is the age of second child ?
(a) 15 years (b) 18 years (c) 20 years (d) Cannot be determined

80. The average age of a group of persons going for picnic is 16 years. Twenty new persons with an average age of 15 years join the group on the spot due to which their average age becomes 15.5 years. The number of persons initially going for picnic is :
(a) 5 (b) 10 (c) 20 (d) 30

81. A certain factory employed 600 men and 400 women and the average wage was Rs. 25.50 per day. If a woman got Rs. 5 less than a man, then what are their daily wages ?
(a) Man : Rs. 25; Woman : Rs. 20 (b) Man : Rs. 27.50, Woman : Rs. 22.50
(c) Man : Rs. 30, Woman : Rs. 25 (d) Man : Rs. 32.50, Woman : Rs. 27.50

82. The arithmetic mean of the scores of a group of students in a test was 52. The brightest 20% of them secured a mean score of 80 and the dullest 25% a mean score of 31. The mean score of remaining 55% is :
(S.S.C. 2000)
(a) 45 (b) 50 (c) 51.4 approx. (d) 54.6 approx.

83. The average salary of all the workers in a workshop is Rs. 8000. The average salary of 7 technicians is Rs. 12000 and the average salary of the rest is Rs. 6000. The total number of workers in the workshop is :
(S.S.C. 2003)
(a) 20 (b) 21 (c) 22 (d) 23

84. In a school with 600 students, the average age of the boys is 12 years and that of the girls is 11 years. If the average age of the school is 11 years 9 months, then the number of girls in the school is :
(a) 150 (b) 250 (c) 350 (d) 450