SSC CGL Tier 2 (2015) - Quantitative Abilities

Solved Paper

Quantitative Abilities

1. In a school there were 1554 students and the ratio of the number of the boys and girls was 4 : 3. After few days, 30 girls joined the school but few boys left; as a result the ratio of the boys and girls became 7: 6. The number of boys who left the school is
   (1) 86
   (2) 76
   (3) 74
   (4) 84

2. If A : B = 2 : 3 and B : C = 3 : 7, then A + B : B + C : C + A is
   (1) 4:10:9
   (2) 5:10:9
   (3) 5:8:9
   (4) 4:8:9

3. If a hemisphere is melted and four spheres of equal volume are made, the radius of each sphere will be equal to
   (1) $1/4^{th}$ of the radius of the hemisphere
   (2) ½ of the radius of the hemisphere
   (3) Radius of the hemisphere
   (4) $1/6^{th}$ of the radius of the hemisphere

4. A and B have their monthly incomes in the ratio 8:5, while their monthly expenditures are in the ratio 5:3. If they have saved ₹12,000 and ₹10,000 monthly respectively, then the difference in their monthly incomes is
   (1) ₹44,000
   (2) ₹42,000
   (3) ₹52,000
   (4) ₹46,000

5. If $(x^3 - y^3):(x^2 + xy + y^2) = 5:1$ and $(x^2 - y^2):(x - y) = 7:1$, then the ratio 2x:3y equals
   (1) 2:3
   (2) 4:3
   (3) 4:1
   (4) 3:2

6. The marked price of a tape recorder is ₹12,600. A festival discount of 5% is allowed on it. Further for cash payment, a second discount of 2% is given. The cash payment, in rupees, is to be made for buying it is
   (1) 11,730.60
   (2) 11,370.60
   (3) 11,703.60
   (4) 11,073.60

7. Articles are marked at a price which gives a profit of 25%. After allowing a certain discount the profit reduces to 12½%. The discount percent is
   (1) 12½%
   (2) 12%
   (3) 10%
   (4) 11.1%

8. If $\tan\theta - \cot\theta = 0$ and θ is positive acute angle, then the value of $(\tan(\theta+15°))/(\tan(\theta-15°))$ is
   (1) 3
   (2) 1/3
   (3) $1/\sqrt{3}$
   (4) $\sqrt{3}$

9. A number when divided by 361 gives a remainder 47. If the same number is divided by 19, the remainder obtained is
   (1) 8
   (2) 3
   (3) 1
   (4) 9

10. In an examination average marks obtained by the girls of a class is 85 and the average marks obtained by the boys of the same class is 87. If the girls and boys are in the ratio 4:5, average marks of the whole class (approx.) is closest to
   (1) 86.4
   (2) 86.5
   (3) 85.9
   (4) 86.1

11. Water lax is increased by 20% but its consumption is decreased by 20%. Then the increase or decrease in the expenditure of the money is
   (1) 4% increase
   (2) No change
   (3) 4% decrease
   (4) 5% decrease

12. A man sells an article at 5% above its cost price. If he had bought it at 5% less than what he had paid for it and sold it at ₹2 less, he would have gained 10%. The cost price of the article is
   (1) ₹400
   (2) ₹200
   (3) ₹300
   (4) ₹100

13. If 90 men can do a certain job in 16 days, working 12 hours/day, then the part of that work which can be completed by 70 men in 24 days, working 8 hours/day is
   (1) 2/3
   (2) 5/8
   (3) 7/9
   (4) 1/3

14. If $(3x - 2y):(2x + 3y) = 5:6$, then one of the value of $\left(\frac{\sqrt[3]{x} + \sqrt[3]{y}}{\sqrt[3]{x} - \sqrt[3]{y}}\right)^2$ is
   (1) 1/5
   (2) 1/25
   (3) 5
   (4) 25

15. If $\sec\theta - \tan\theta = 1/\sqrt{3}$, the value of $\sec\theta \tan\theta$ is
   (1) $4/\sqrt{3}$
   (2) 2/3
   (3) $1/\sqrt{3}$
   (4) $2/\sqrt{3}$

16. A dealer fixed the price of an article 40% above the cost of production. While selling it he allows a discount of 20% and makes a profit of Rs. 48. The cost of production (in Rs.) of the article is
   (1) 320
   (2) 360
   (3) 400
   (4) 420

17. AB and CD are two parallel chords of a circle of lengths 10 cm and 4 cm respectively. If the chords arc on the same side of the centre and the distance between them is 3 cm, then the diameter of the circle is
(1) $\sqrt{21}$ cm
(2) $\sqrt{29}$ cm
(3) $2\sqrt{21}$ cm
(4) $2\sqrt{29}$ cm

18. If a + b = 1, find the value of $a^3 + b^3 - ab - (a^2 - b^2)^2$
(1) 2
(2) -1
(3) 1
(4) 0

19. If 64 buckets of water are removed from a cubical shaped water tank completely filled with water, 1/3 of the tank remains filled with water. The length of each side of the tank is 1.2 m. Assuming that all buckets are of the same measure, then the volume (in litres) of water contained by each bucket is
(1) 18
(2) 15
(3) 16
(4) 12

20. Given that the ratio of altitudes of two triangles is 4:5, ratio of their areas is 3:2. The ratio of their corresponding bases is
(1) 8:15
(2) 8:5
(3) 5:8
(4) 15:8

21. Pipe A can fill an empty tank in 6 hours and pipe B in 8 hours. If both the pipes are opened and after 2 hours pipe A is closed, how much time B will take to till the remaining tank?
(1) 7 ½ hours
(2) 2 1/3 hours
(3) 3 1/3 hours
(4) 2 2/5 hours

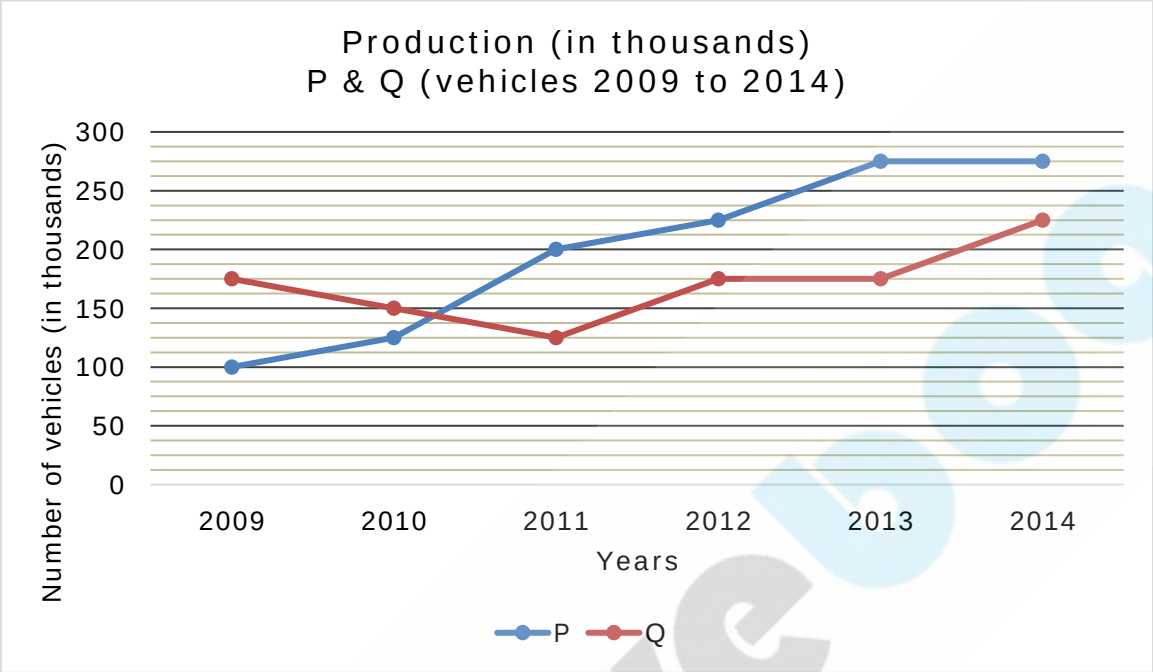
22. P and Q together can do a job in 6 days. Q and R can finish the same job in 60/7 days. P started the work and worked for 3 days. Q and R continued for 6 days. Then the difference of days in which R and P can complete the job is
(1) 15
(2) 8
(3) 12
(4) 10

23. There is a wooden sphere of radius $6\sqrt{3}$ cm. The surface area of the largest possible cube cut out from the sphere will be
(1) 864 cm^2
(2) $646\sqrt{3}$ cm^2
(3) $464\sqrt{3}$ cm^2
(4) 462 cm^2

24. The value of (cosec a - sin a) (sec a - cos a) (tan a + cot a)
(1) 2
(2) 1
(3) 4
(4) 6

25. A manufacturer fixes his selling price at 33% over the cost of production, If cost of production goes up by 12% and manufacturer raises his selling price by 10%, his percentage profit is
(1) 28 3/8%
(2) 36 5/9%
(3) 30 5/8%
(4) 35%

Directions for Questions 26 to 30: The following graph shows production (in thousands) of two types (P and Q) of vehicles by a factory over the year 2009 to 2014. Study the graph and answer five questions:



26. In how many of the given years, was the production of Type P vehicles of the company more than the average production of this type vehicles in the given years?
(1) 4
(2) 2
(3) 5
(4) 3

27. The production of Type Q vehicles in 2010 was approximately what percent of Type P vehicles in 2014?
(1) 75
(2) 54.5
(3) 45.5
(4) 60

28. The ratio of total production of Type P vehicles to total production of Type Q vehicles over the years
(1) 48:41
(2) 8:5
(3) 5:8
(4) 41:48

29. The total production of Type P vehicles in the years 2009 and 2011 is what percent of total production of Type Q vehicles in 2010 and 2014?
(1) 75
(2) 69.25
(3) 80
(4) 81.25

30. Approximate percentage decrease in production of Type Q vehicles from 2010 to 2011 is
(1) 16.7
(2) 10.1
(3) 14.3
(4) 12.5

31. The radii of two solid iron spheres are 1 cm and 6 cm respectively. A hollow sphere is made by melting the two spheres. If the external radius of the hollow sphere is 9 cm, then its thickness (in cm) is
(1) 2
(2) 0.5
(3) 1
(4) 1.5

32. If $x = a \sin\theta - b \cos\theta$, $y = a \cos\theta + b \sin\theta$, then which of the following is true?
(1) $(x^2/y^2+a^2/b^2) = 1$
(2) $x^2 + y^2 = a^2 + b^2$
(3) $(x^2/a^2+y^2/b^2)$
(4) $x^2+y^2=a^2-b^2$

33. A plane divides a right circular cone into two parts of equal volume. If the plane is parallel to the base, then the ratio, in which the height of the cone is divided, is
(1) $1 : \sqrt[3]{2}$
(2) $1 : \sqrt[3]{2} + 1$
(3) $1 : \sqrt[3]{2} - 1$
(4) $1 : \sqrt{2}$

34. If $3(a^2+b^2+c^2) = (a+b+c)^2$, then the relation between a, b and c is
(1) $a \neq b = c$
(2) $a \neq b \neq c$
(3) $a = b = c$
(4) $a = b \neq c$

35. The value of $\dfrac{(0.67\times0.67\times0.67)-(0.33\times0.33\times0.33)}{(0.67\times0.67)+(0.67\times0.33)+(0.33\times0.33)}$
(1) 1.1
(2) 0.34
(3) 11
(4) 3.4

36. There is a number consisting of two digits, the digit in the units place is twice that in the tens place and if 2 be subtracted from the sum of the digits, the difference is equal to 1/6th of the number. The number is
(1) 24
(2) 26
(3) 25
(4) 23

37. A sum of money is paid back in two annual instalments of ₹17,640 each, allowing 5% compound interest compounded annually. The sum borrowed was
(1) ₹32,200
(2) ₹32,800
(3) ₹32,400
(4) ₹32,000

38. Two blends of a commodity costing ₹35 and ₹40 per kg respectively are mixed in the ratio 2:3 by weight. If one-fifth of the mixture is sold at ₹46 per kg and the remaining at the rate of ₹55 per kg, the profit percent is
(1) 50
(2) 40
(3) 20
(4) 30

39. 300 grams of sugar solution has 40% of sugar in it. How much sugar should be added to make it 50% in the solution?
(1) 60 gms
(2) 10 gms
(3) 80 gms
(4) 40 gms

40. If 60% of A = 30% of B, B = 40% of C and C = x % of A, then value of x is
(1) 800
(2) 500
(3) 300
(4) 200

41. The diameter of each wheel of a car is 70 cm. If each wheel rotates 400 times per minute, then the speed of the car (in km/hr) is (Take $\pi = 22/7$)
(1) 5.28
(2) 528
(3) 52.8
(4) 0.528

42. A cylinder with base radius 8 cm and height 2 cm is melted to form a cone of height 6 cm. The radius of the cone will be
(1) 4 cm
(2) 6 cm
(3) 5 cm
(4) 8 cm

43. If $5 \cos \theta + 12 \sin \theta = 13$, $0° < \theta < 90°$, then the value of $\sin \theta$ is
(1) 6/13
(2) 12/13
(3) 5/13
(4) −(12/13)

44. If a shopkeeper wants to give 20% discount on a toy, he has to sell it for ₹300. If he sells it at ₹405, then his gain percent is
(1) 8%
(2) 5%
(3) 4%
(4) 6%

45. Let x be the least number, which when divided by 5, 6, 7 and 8 leaves a remainder 3 in each case but when divided by 9 leaves no remainder. The sum of digits of x is
(1) 21
(2) 22
(3) 24
(4) 18

46. The interior angle or a regular polygon exceeds its exterior angle by 108°. The number of sides of the polygon is
(1) 14
(2) 12
(3) 10
(4) 16

47. In triangle ABC, DE||BC where D is a point on AB and E is a point on AC. DE divides the area of ΔABC into two equal parts Then DB:AB is equal to
(1) $\sqrt{2}:(\sqrt{2}-1)$
(2) $\sqrt{2}:(\sqrt{2}+1)$
(3) $(\sqrt{2}-1):\sqrt{2}$
(4) $(\sqrt{2}+1):\sqrt{2}$

48. Let $x = (\sqrt{13}+\sqrt{11})/(\sqrt{13}-\sqrt{11})$ and $y = 1/x$, then the value of $3x^2 - 5xy + 3y^2$ is
(1) 1717
(2) 1177
(3) 1771
(4) 1171

49. ABCD is a cyclic quadrilateral. AB and DC when produced meet at P, if PA = 8cm, PB = 6cm, PC = 4 cm, then the length (in cm) of PD is
(1) 6
(2) 8
(3) 12
(4) 10

50. The unit digit in the product $(2467)^{153} \times (341)^{72}$ is
(1) 1
(2) 9
(3) 3
(4) 7

51. A and B can do a piece of work in 30 and 36 days respectively. They began the work together but A left after some days and B finished the remaining work in 25 days. After how many days did A leave?
(1) 6 days
(2) 11 days
(3) 10 days
(4) 5 days

52. Three glasses of equal volume contains acid mixed with water. The ratio of acid and water in the three glasses are 2:3, 3:4 and 4:5 respectively. Contents of these glasses are poured in a larger vessel. The ratio of acid and water in the large vessel is
(1) 407:560
(2) 411:540
(3) 417:564
(4) 401:544

53. A boat moves downstream at the rate of 1 km in 7.5 minutes and upstream at the rate of 5 km an hour. What is the speed (in km/hour) of the boat in the still water?
(1) 8
(2) 4
(3) 6.5
(4) 3.5

54. The average age of 30 students of a class is 14 years 4 months. After admission of 5 new students in the class the average becomes 13 years 9 months. The youngest one of the five new students is 9 years 11 months old. The average age of the remaining 4 new students is
(1) 11 years 2 months
(2) 13 years 6 months
(3) 10 years 4 months
(4) 12 years 4 months

55. Ram sold two horses at the same price. In one he gets a profit of 10% and in the other he gets a loss of 10%. Then Ram gets
(1) 2% loss
(2) 1% profit
(3) No loss or profit
(4) 1% loss

56. If tan A = n tan B and sin A = m sin B, then the value of $\cos^2 A$ is
(1) $(m^2+1)/(n^2-1)$
(2) $(m^2+1)/(n^2+1)$
(3) $(m^2-1)/(n^2+1)$
(4) $(m^2-1)/(n^2-1)$

57. If $\left(\frac{P^{-1}q^2}{P^3q^{-2}}\right) \div \left(\frac{P^6q^{-3}}{P^{-2}q^3}\right) = p^a q^b$ then the value of a + b, where p and q are different positive primes, is
(1) -2
(2) 1
(3) 0
(4) -1

58. The value of $4 - \cfrac{5}{1 + \cfrac{1}{3 + \cfrac{1}{2 + \frac{1}{4}}}}$
(1) 1/64
(2) 1/32
(3) 1/16
(4) 1/8

59. The simple interest on a sum of money is $(8/25)^{th}$ of the sum. If the number of years is numerically half the rate percent per annum, then the rate percent per annum is
(1) 5
(2) 8
(3) 6 ¼
(4) 4

60. Let x be the smallest number, which when added to 2000 makes the resulting number divisible by 12, 16, 18 and 21. The sum of the digits of x is
(1) 5
(2) 6
(3) 4
(4) 7

61. If a man walks at the rate of 5 km/hour, he misses a train by 7 minutes. However if he walks at the rate of 6 km/hour, he reaches the station 5 minutes before the arrival of the train. The distance covered by him to reach the station is
(1) 4 km
(2) 7 km
(3) 6.25 km
(4) 6 km

62. The portion of a ditch 48 m long, 16.5 m wide and 4 m deep that can be filled with stones and earth available during excavation of a tunnel, cylindrical in shape, of diameter 4 m and length 56 m is
(1) 2/9 part
(2) 1/2 part
(3) 1/9 part
(4) 1/4 part

63. The value of cot 41° cot 42° cot 43° cot 44° cot 45° cot 46° cot 47° cot 48° cot 49°
(1) $\sqrt{3}/2$
(2) $1/\sqrt{2}$
(3) 1
(4) 0

64. AD is perpendicular to the internal bisector of $\angle ABC$ of ΔABC. DE is drawn through D and parallel to BC to meet AC at E. If the length of AC is 12 cm, then the length of AE (in cm) is
(1) 8
(2) 6
(3) 3
(4) 4

65. The perimeter of a rhombus is 60 cm and one of its diagonal is 24 cm. The area (in sq. cm) of the rhombus is
(1) 108
(2) 216
(3) 432
(4) 206

66. A man starts from a place P and reaches the place Q in 7 hours. He travels $1/4^{th}$ of the distance at 10 km/hour and the remaining distance at 12 km/hour. The distance, in kilometer, between P and Q is
(1) 70
(2) 72
(3) 80
(4) 90

67. 60 kg of an alloy A is mixed with 100 kg of another alloy B. If alloy A has lead and tin in the ratio 3:2 and alloy B has tin and copper in the ratio 1:4 respectively, the amount of tin in the new alloy is
(1) 80 kg
(2) 44 kg
(3) 24 kg
(4) 53 kg

68. $\frac{6^2+7^2+8^2+9^2+10^2}{\sqrt{7+4\sqrt{3}}-\sqrt{4+2\sqrt{3}}}$ is equal to
(1) 305
(2) 355
(3) 330
(4) 366

69. Quadrilateral ABCD is circumscribed about a circle. If the lengths of AB, BC, CD are 7 cm, 8.5 cm and 9.2 cm respectively, then the length (in cm) of DA is
(1) 16.2
(2) 7.7
(3) 7.2
(4) 10.7

70. If $\sin A + \sin^2 A = 1$, then the value of $\cos^2 A + \cos^4 A$ is
(1) $1\frac{2}{3}$
(2) 2
(3) $1\frac{1}{2}$
(4) 1

71. A car covers four successive 7 km distances at speeds of 10 km/hour, 20 km/hour, 30 km/hour and 60 km/hour respectively. Its average speed over this distance is
(1) 40 km/hour
(2) 20 km/hour
(3) 30 km/hour
(4) 60 km/hour

72. If $x = a^{1/2} + a^{-1/2}$, $y = a^{1/2} - a^{-1/2}$, then value of $(x^4 - x^2y^2-1)+(y^4-x^2y^2+1)$
(1) 12
(2) 13
(3) 14
(4) 16

73. If $x-\sqrt{3}-\sqrt{2}=0$ and $y-\sqrt{3}+\sqrt{2}=0$, then value of $(x^3-20\sqrt{2})-(y^3+2\sqrt{2})$
(1) 0
(2) 2
(3) 3
(4) 1

74. The average of five consecutive positive integers is n. If the next two integers are also included, the average of all these integers will
(1) increase by 1
(2) increase by 1.5
(3) remains the same
(4) increase by 2

75. A telegraph pole is bent at a point above the ground due to storm. Its top just touches the ground at a distance of $10\sqrt{3}$ metres from its foot and makes an angle of 30° with the horizontal. Then height (in metres) of the telegraph pole is
(1) 20
(2) 30
(3) 25
(4) 24

76. Average of n numbers is a. The first number is increased by 2, second one is increased by 4, the third one is increased by 8 and so on. The average of the new numbers is
(1) $a + 2^{n+1}/n$
(2) $a + (2^n - 1)/n$
(3) $a + 2(2^n-1)/n$
(4) $a + (2^{n+1}-1)/n$

77. A man purchases some oranges at the rate of 3 oranges for Rs. 40 and the same quantity at 5 oranges for Rs. 60. If he sells all the oranges at the rate of 3 oranges for Rs. 50, find his gain or loss percent (to the nearest integer).
(1) 34% loss
(2) 32% profit
(3) 31% profit
(4) 31% loss

78. If $a - \frac{1}{a-3} = 5$, then the value $(a-3)^3 - \frac{1}{(a-3)^3}$ is
(1) 5
(2) 14
(3) 2
(4) 7

79. The greatest number among 3^{50}, 4^{40}, 5^{30} and 6^{20} is
(1) 3^{50}
(2) 4^{40}
(3) 5^{30}
(4) 6^{20}

80. If $x^2 + y^2 + z^2 = xy + yz + zx$, then the value of $(3x^4+7y^4+5z^4)/(5x^2y^2+7y^2z^2+3z^2x^2)$ is
(1) 1
(2) -1
(3) 2
(4) 0

81. A, B and C can do a work separately in 16, 32 and 48 days respectively. They started the work together but B leaving off 8 days and C leaving 6 days before the completion of the work. In what time is the work finished?
(1) 14 days
(2) 12 days
(3) 9 days
(4) 10 days

82. The centroid of ΔABC is G. The area of ΔABC is 60 cm^2. The area of ΔGBC is
(1) 30 cm^2
(2) 40 cm^2
(3) 10 cm^2
(4) 20 cm^2

83. A and B can do a given piece of work in 8 days, B and C can do the same work in 12 days and A, B, C complete it in 6 days. Number of days required to finish the work by A and C is
(1) 16
(2) 12
(3) 8
(4) 24

84. Three Science classes A, B and C take a Life Science test. The average score of class A is 83. The average score of class B is 76. The average score of class C is 85. The average score of class A and B is 79 and average score of class B and C is 81. Then the average score of classes A, B and C is
(1) 81.5
(2) 80
(3) 80.5
(4) 81

85. The area of an isosceles trapezium is 176 cm^2 and the height is $2/11^{th}$ of the sum of its parallel sides. If the ratio of the length of the parallel sides is 4:7, then the length of a diagonal (in cm) is
(1) 28
(2) $2\sqrt{137}$
(3) 24
(4) $\sqrt{137}$

86. A right prism has a triangular base whose sides are 13 cm, 20 cm and 21 cm. If the altitude of the prism is 9 cm, then its volume is
(1) 1134 cm^3
(2) 1314 cm^3
(3) 1413 cm^3
(4) 1143 cm^3

87. In an office, 40% of the staff is female. 70% of the female staff and 50% of the male staff are married. The percentage of the unmarried staff in the office is
(1) 54
(2) 60
(3) 42
(4) 64

88. A and B are centers of two circles of radii 11 cm and 6 cm respectively. PQ is a direct common tangent to the circles. If $\overline{AB}$ = 13 cm. then length of $\overline{PQ}$ will be
(1) 13 cm
(2) 12 cm
(3) 8.5 cm
(4) 17 cm

89. A sum of ₹7,930 is divided into 3 parts and given on loan at 5% simple interest to A, B and C for 2, 3 and 4 years respectively. If the amounts of all three are equal after their respective periods of loan, then, the A received a loan of
(1) ₹3,050
(2) ₹2,760
(3) ₹2,800
(4) ₹2,750

90. Two places P and Q are 162 km apart. A train leaves P for Q and simultaneously another train leaves Q for P. They meet at the end of 6 hours. If the former train travels 8 km/hour faster than the other, then speed of train starting from Q is
(1) $9\frac{1}{2}$ km/hour
(2) $8\frac{1}{2}$ km/hour
(3) $10\frac{5}{6}$ km/hour
(4) $12\frac{5}{6}$ km/hour

91. Base of a right pyramid is a square of side 10 cm. If the height of the pyramid is 12 cm, then its total surface area is
(1) 400 cm^2
(2) 360 cm^2
(3) 260 cm^2
(4) 460 cm^2

92. A sum of money placed at compound interest doubles itself in 5 years. It will amount to eight times itself at the same rate of interest in
(1) 12 years
(2) 10 years
(3) 20 years
(4) 15 years

93. In trapezium ABCD, AB||CD and AB = 2CD. Its diagonals intersect at O. If the area of ΔAOB = 84 cm^2, then the area of ΔCOD is equal to
(1) 26 cm^2
(2) 72 cm^2
(3) 21 cm^2
(4) 42 cm^2

94. If $7\sin^2\theta + 3\cos^2\theta = 4$,then the value of $\tan\theta$ is (θ is acute)
(1) 1
(2) $1/\sqrt{3}$
(3) $\sqrt{3}$
(4) $1/\sqrt{2}$

95. If $a + 1/b = b + 1/c = c + 1/a$, where $a \neq b \neq c \neq 0$, then the value of $a^2b^2c^2$ is
(1) 1
(2) -1
(3) abc
(4) 0

96. If O is the circumcenter of a triangle ABC lying inside the triangle, then $\angle OBC + \angle BAC$ is equal to
(1) 110°
(2) 90°
(3) 120°
(4) 60°

97. The H.C.F. and L.C.M. of two numbers are 21 and 84 respectively. If the ratio of the two numbers is 1:4, then the larger of the two numbers is
(1) 48
(2) 108
(3) 84
(4) 12

98. There would be a 10% loss, if rice is sold at ₹54 per kg. To earn a profit of 20%, the price of rice per kg will be
(1) ₹65
(2) ₹70
(3) ₹63
(4) ₹72

99. In ΔABC, $\angle BAC$ is 90° and $AD \perp BC$. If BD = 3cm and CD = 4cm, then the length (in cm) of AD is
(1) 5
(2) 3.5
(3) $3\sqrt{2}$
(4) 6

100. The numerical values of the volume and the area of the lateral surface of a right circular cone are equal. If the height of the cone be h and radius be r, the value of $1/h^2 + 1/r^2$ is
(1) 3/1
(2) 1/9
(3) 9/1
(4) 1/3

Answer keys:

1) 2	2) 2	3) 2	4) 2	5) 3	6) 1	7) 3	8) 1	9) 4	10) 4
11) 3	12) 1	13) 3	14) 4	15) 2	16) 3	17) 2	18) 4	19) 1	20) 4
21) 3	22) 4	23) 1	24) 2	25) 3	26) 4	27) 2	28) 1	29) 3	30) 1
31) 3	32) 2	33) 3	34) 3	35) 2	36) 1	37) 2	38) 2	39) 1	40) 2
41) 3	42) 4	43) 2	44) 1	45) 4	46) 3	47) 3	48) 1	49) 3	50) 4
51) 4	52) 4	53) 3	54) 3	55) 4	56) 4	57) 1	58) 4	59) 2	60) 4
61) 4	62) 1	63) 3	64) 2	65) 2	66) 3	67) 2	68) 3	69) 2	70) 4
71) 2	72) 4	73) 1	74) 1	75) 2	76) 3	77) 2	78) 4	79) 2	80) 1
81) 2	82) 4	83) 3	84) 1	85) 2	86) 1	87) 3	88) 2	89) 2	90) 1
91) 2	92) 4	93) 3	94) 2	95) 1	96) 2	97) 3	98) 4	99) 3	100) 2

Solutions:

1. 2
   Ratio between boys and girls = 4:3
   No. of boys = 4/7 * 1554 = 888
   No. of girls = 3/7 * 1554 = 666
   As per question few boys left and 30 girls joined.
   Let the no. of boys who left the school be 'a'
   Now total no. of boys left = 888 - a
   Now total no. of girls = 666 + 30 = 696
   New ratio = 7:6
   So, (888-a)/696 = 7/6
   On solving we get a = 76

2. 2
   A/B = 2/3 and B/c = 3/7
   We can say that A: B: C = 2:3:7
   Considering a= 2; b= 3; c= 7
   a+b= 2+3= 5
   b+c= 3+7= 10
   c+a= 7+2= 9
   Ratio = 5:10:9

3. 2
   Let the radius of the hemisphere be 'r'
   Volume of hemisphere = 2/3(π r^3) ..... (1)
   Let the radius of the sphere be 't'
   No. of such spheres = 4
   Volume of spheres = 4 * (4/3) (πt^3) ..... (2)
   According to the question
   Volume of hemisphere = volume of 4 spheres
   Comparing 1 and 2 we get
   2/3 π r^3 = 16/3 πt^3
   ⇒ t = r/2
   Radius of each sphere is ½ the radius of hemisphere.

4. 2
   Let their monthly incomes be 8m and 5m and their expenditures be 5n and 3n
   Savings of A = 8m-5n= 12000 ..... (1)
   Savings of B = 5m-3n= 10000 ..... (2)
   On solving (1) and (2) we get
   M = 14000, N = 20000
   Difference in their monthly incomes = 3m = 3 x 14000 = Rs. 42000

5. 3
   Expanding equation (1)
   (x-y)(x^2 + xy + y^2) / (x^2 + xy + y^2) = 5/1
   (x-y) = 5 ..... (a)
   Expanding equation 2
   (x+y) (x-y) / (x-y) = 7 /1
   (x+y) = 7 ..... (b)
   On solving a and b we get
   x = 6; y= 1
   2x: 3y= 2*6: 3*1 = 12: 3 = 4: 1

6. 1
A single discount for two successive discounts = x + y − (xy/ 100) = 5 + 2 − (5*2/100) = 6.9 %
Marked price of tape recorder = 12,600
Amount to be paid after discount = {(100-6.9) / 100} * 12600 = Rs 11730.60

7. 3
Let us say the CP of article be Rs 100
Article is marked at a profit of 25% so the MP of the article = Rs 125
Given: profit is reduced to 12.5%
New MP of article = Rs 112.5
Difference between previous and new MP = 125 − 112.5 = Rs 12.5 which is the discounted price
Discount percentage = (12.5/125) * 100 = 10%

8. 1
Tan θ - cot θ = 0
Tan θ = cot θ
Only $\theta = 45^0$ satisfies this equation.
Tan (θ + 15) = tan (45 + 15) = tan 60 = $\sqrt{3}$ ..... (1)
Tan (θ - 15) = tan (45 - 15) = tan 30 = $1/\sqrt{3}$ ..... (2)
Dividing 1 by 2 we get
$\sqrt{3}$ / $1/\sqrt{3}$ = 3

9. 4
Let the no. be 361k + 47
Taking 19 common
= 19(19 k+ 2) + 9
The first part of the equation is divisible by 19
Hence the remainder is 9

10. 4
Let the no. of girls and boys in the class be 4n and 5n
Total marks obtained by the girls of the class = 85 x 4n = 340n
Total marks obtained by the boys of the class = 87 x 5n = 435n
Total marks obtained by both girls and boys = (340 + 435) n = 775n
Average marks of the whole class = 775n / (4n +5n) = 775n / 9n = 86.1

11. 3
Let the initial water tax be Rs 100
And initial consumption of water be 100L
Initial expenditure of money = 100 x 100 = Rs 10000
New tax (increase by 20%) = Rs 120
New consumption (decrease by 20%) = 80 L
New expenditure of money = 120 x 80 = 9600L
Decrease in expenditure of money = 10000 − 9600 = Rs 400
Percentage decrease = (400/10000) x 100 = 4%

12. 1
Let the cost price of the article be 'a'
So selling price will be (105/100) x a
According to the question if he had bought it at 5% less and sold it at Rs 2 less
New cost price = (95/100) x a
New selling price = (105/100) x a − 2
New gain = (105/100) x a − 2 - (95/100) x a
Which is equal to Gain percentage given in the question = 10%
So (105/100) x a − 2 - (95/100) x a = 10/100 x (95/100) x a
On solving we get a = Rs 400

13. 3

Let the part of the work which can be completed be 'a'
By the equation
$M_1 D_1 H_1 / W_1 = M_2 D_2 H_2 / W_2$
Putting values we get
(90 x 16 x 12) / 1 = (70 x 24 x 8) / a
A= 7/9

14. 4

(3x − 2y): (2x + 3y) = 5:6
18x − 12y = 10x + 15y
8x = 27y
x/y = 27/8
$(x/y)^{1/3} = 3/2$
To find

$$\left(\frac{\sqrt[3]{x}+\sqrt[3]{y}}{\sqrt[3]{x}-\sqrt[3]{y}}\right)^2$$

Dividing by $y^{1/3}$ in numerator and denominator
$= [\{(x/y)^{1/3} + 1\} / \{(x/y)^{1/3} - 1\}]^2$
Substituting the value $(x/y)^{1/3}$ in the above equation
$= [\{3/2 +1\} / \{3/2 - 1\}]^2$
$= [\{5/2\} / \{1/2\}]^2$
$=5^2 =25$

15. 2

We know that $\sec^2\theta - \tan^2\theta = 1$
$\Rightarrow \sec\theta + \tan\theta = 1/(\sec\theta - \tan\theta) = \sqrt{3}$
We are already given, $\sec\theta - \tan\theta = 1/\sqrt{3}$
Solving the above two equations, we get
$\sec\theta = ½ (\sqrt{3} + 1/\sqrt{3})$
$\tan\theta = ½ (\sqrt{3} - 1/\sqrt{3})$
$\Rightarrow \sec\theta \tan\theta = ¼ (3 - 1/3) = 2/3$

16. 3

Let the cost price of the article be 100
As per the question the fixed price of the article will be 140
A discount of 20% is allowed
So selling price = 140 x 80) / 100 = 112
Profit = 112 - 100 = 12
Which is equal to Rs 48
So 12 = 48
1 = 48 / 12
Similarly 100 = (48 /12) x 100 = Rs 400

17. 2

Let the perpendicular distance from the centre to the bigger chord be 'a'
According to the property of circle the perpendicular distance from the centre to the chord bisects the chord.
In Δ OBA
$OA^2 = OB^2 + BA^2$
$R^2 = a^2 + 25$ ..... (1)
In Δ ODC
$OD^2 + DC^2 = OC^2$
$(a + 3)^2 + 4 = r^2$ (since OC is the radius)
$a^2 + 9 + 6a + 4 = r^2$
Substituting the value of r^2 from equation (1)
$A^2 + 9 + 6a + 4 = a^2 + 25$
a = 2
Putting value of a in equation (1)
$r = \sqrt{29}$

18. 4

$a^3 + b^3 - ab - (a^2 - b^2)^2$
Applying expansion of $a^3 + b^3$ and $a^2 - b^2$
$= (a+b)(a^2 - ab + b^2) - ab - \{(a+b)(a-b)\}^2$
Given a+b = 1
So, the expression is $a^2 - ab + b^2 - ab - (a-b)^2$
$= a^2 + b^2 - 2ab - a^2 - b^2 + 2ab$
= 0

19. 1

Volume of tank = $1.2^3 = 1.728\ m^3 = 1728$ L ($1m^3 = 1000$ L)
Given when 64 buckets are removed 1/3 of the tank remains filled that means 2/3 of the tank is emptied
2/3 of the tank = 2/3 x 1728 = 1152 L
Since the buckets are of equal volume.
Therefore the total volume of 64 buckets will be equal to 1152 L
Let the volume of each bucket be 'a'
So 64 a = 1152
A = 18
Volume of each bucket is 18 L

20. 4

Area of triangle = ½ x base x altitude
Let the two altitudes be L1 and L2, areas be A1 and A2 and bases be B1 and B2
According to equation A1 / A2 = (½ x B1 x L1) / (½ x B2 x L2)
Putting values in the equation:
3/2 = B1 x 4 / B2 x5
B1: B2 = 15: 8

21. 3

Part of tank filled by both pipes in 1 hour when opened simultaneously = 1/6 + 1/8 = 7/24
Part of tank filled by both pipes in 2 hours = 14/24
Remaining part = 1- (14/24) = 10/24
As pipe A is closed after 2 hours the remaining part of tank is filled by pipe B
Let the time taken by pipe B to fill the remaining part be 'a'
10/24 = a x 1/8
A=10/3 = $3\ ^1/_3$ hours.

22. 4

Let us say P completes the job in 'p' no. of days
P and Q can do a job in 6 days
Hence part of work completed by Q in 1 day = (1/6 − 1/p)
Q and R complete the same job in 60/7 days
Hence part of work completed by R in 1 day = 7/60 - (1/6 − 1/p) = 1/p − 1/20
P started the work and worked for 3 days and Q and R continued for 6 days
So part of work done by P in 3 days = 3/p
Remaining work = 1 − (3/p) which is completed by Q and R in 6 days
So 1 − (3/p) = 6 x (7/60)
On solving we get p = 10 days
No. of days taken by R alone to complete the same job = 20p / (20 − p) = 20 x 10 / (20 − 10) = 20 days
The difference of days in which R and P can complete the job = 20 -10 = 10 days

23. 1

The largest possible cube that can be cut from the sphere will have diagonal equal to the diameter of sphere
We know diagonal of cube = √3 a (where a is the side of cube)
Diameter of sphere = 12√3
So √3a = 12√3
A= 12
Surface area of cube = $6a^2$ = 6 x 144 = 864 cm^2

24. 2

Sin a = 1/cosec a; cos a = 1/sec a; tan a = 1/cot a
Applying these relations in the equation
= (1 − $\sin^2$ a) / sin a x (1 − $\cos^2$ a) / cos a x ($\tan^2$ a + 1) / tan a
= ($\cos^2$ a / sin a) x ($\sin^2$ a / cos a) x ($\sec^2$ a / tan a)
= (cos a x sin a) / (cos a x sin a) = 1

25. 3

Let us say the cost of production be Rs 100
Its selling price will be = Rs 133 (33% over the cost of production)
Given: cost of production goes up by 12% and selling price is increased by 10%
New cost of production = Rs 112
New selling price = 133 x 110 /100 = Rs 146.30
Profit = 146.30 − 112 = 34.30
Profit percentage = 34.30 / 112 x 100 = 30 5/8%

Solutions for Questions 26 to 30:
From the graphs, we have;

Year	P	Q
2009	100	175
2010	125	150
2011	200	125
2012	225	175
2013	275	175
2014	275	225
Total production	1200	1025
Average production	200	170.8

26. 4

Average production of Type P vehicles = 200
In three years, 2012, 2013 and 2014, the production was more.

27. 2
Production of Type Q vehicles in 2010 = 150
Production of Type P vehicles in 2014 = 275
Percent = 150/275 x 100 = 54.5%

28. 1
Total production of Type P vehicles = 1200
Total production of Type Q vehicles = 1025
Ratio = 1200/1025 = 48/41

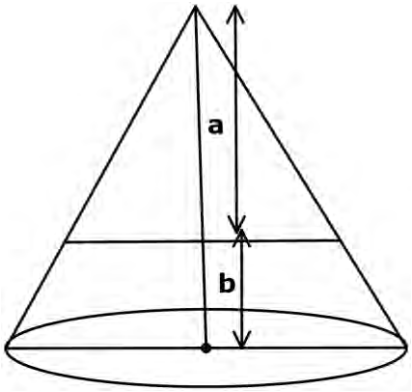
29. 3
Production of Type P vehicles in 2009 = 100
Production of Type P vehicles in 2011 = 200
Total production of Type P vehicles in both years = 300
Production of Type Q vehicles in 2010 = 150
Production of Type Q vehicles in 2014 = 225
Total production of Type Q vehicles in both years = 375
Percent = 300/375 x 100 = 80%

30. 1
Production of Type Q vehicles in 2010 =150
Production of Type Q vehicles in 2011 = 125
Decrease in production = 150 − 125 = 25
Percent decrease= 25/150 x 100 = 16.7%

31. 3
Volume of sphere with radius 1cm = $4/3\ (\pi\ r^3) = 4/3\ \pi$
Volume of sphere with radius 6cm = $4/3\ (\pi\ r^3) = 216\ \pi$
Total volume of both spheres = $4/3\pi\ (216 + 1) = 217\ (4/3\ \pi)$
Given the external radius of the hollow sphere = 9cm
Let the internal radius of the hollow sphere be 'a'
According to the question:
Volume of hollow sphere = total volume of both spheres
$4/3\ \pi\ (9^3 - a^3) = 4/3\pi\ (217)$
$\Rightarrow a^3 = 512$
$\Rightarrow a = 8cm$
Thickness = 9 − 8 = 1cm

32. 2
$x^2 = (a \sin \theta - b \cos \theta)^2 = a^2 \sin^2 \theta + b^2 \cos^2 \theta - 2ab \sin \theta \cos \theta$
$y^2 = (a \cos \theta + b \sin \theta)^2 = a^2 \cos^2 \theta + b^2 \sin^2 \theta + 2ab \sin \theta \cos \theta$
Adding, we get $x^2 + y^2 = a^2 (\sin^2 \theta + \cos^2 \theta) + b^2 (\sin^2 \theta + \cos^2 \theta) = a^2 + b^2$

33. 3



Let the heights of the smaller cone be a and that of the bigger cone be (a+b) units.
We are given that the plane is parallel to the base so the ratio of radii is the same as the ratio of the heights.
Let the radii of the two cones be ak and (a+b)k respectively.
Volume of smaller cone = ½ Volume of bigger cone
Hence, $1/3\ \pi\ (ak)^2\ a = ½ \times 1/3\ \pi\ (a+b)^2k^2\ (a+b)$
$\Rightarrow a3 = ½\ (a+b)^3$
$\Rightarrow a+b = \sqrt[3]{2}\ a$
The required ratio is a:b = $1 : \sqrt[3]{2} - 1$

34. 3

Expanding equation
$3a^2+ 3b^2+ 3c^2 = a^2+b^2+c^2 + 2(ab +bc +ca)$
$2a^2+2b^2+2c^2 = 2(ab +bc +ca)$
$a^2+b^2+c^2 = ab + bc +ca$
This condition can only be satisfied when a = b =c

35. 2

This can be represented in the form $(a^3 - b^3) / (a^2 + ab + b^2)$
Now expanding a3 − b3
$(a-b)\ (a^2+ab+b^2) / (a^2+ab+b^2)$
= (a-b)
= 0.67-0.33 = 0.34

36. 1

Let the number be (10a+b)
As per the given condition b=2a
The number = 10a + 2a = 12a
Sum of digits = a+2a=3a
As per the given condition 3a − 2 = 1/6(12a)
A=2 so b= 4
Number = 2x10 + 4 = 24

37. 2

Using the formula (for two years)
$I / (1 + r/100) + i/ (1 + r/100)^2$ = sum (I is the instalment made each year and r is the rate of compound interest)
$17640[(1 + 5/100) + (1 + 5/100)^2]$ = sum
17640 [20/21 + 400/441] = sum
Sum = Rs 32800

38. 2
Let the weight of the commodity be 2kg and 3 kg respectively
Combined cost of mixture = (35 x 2 + 40 x 3) = Rs 190
One fifth of 5 kgs = 1 kg; remaining = 5 − 1 = 4 kgs
Given one fifth of the mixture is sold at Rs 46 and the remaining at Rs 55
Total cost of selling the mixture = (46 x 1 + 4 x 55) = Rs 266
Profit = 266 − 190 = Rs 76
Profit percent = 76/190 x 100 = 40%

39. 1
300 grams of sugar solution has 40% of sugar in it
Amount of sugar = 40% of 300 = 120 grams
Let the sugar which is to be added be 'a' grams
New quantity of sugar solution = 300 +a
New quantity of sugar = 120 + a
According to the question the quantity of sugar in the new solution should be 50%
So 50% of (300 +a) = 120 +a
150 + a/2 = 120 + a
A= 60 grams

40. 2
60% of A = 30% of B
60 x A = 30 x B
B = 2A
A: B = 1: 2
B = 40% of C
10 B = 4 C
2 C = 5 B
B: C = 2: 5
A: B: C = 2:4:10 = 1:2:5
Given C is x% of A
From the above equation we get
X = 5/1 x 100 = 500%

41. 3
Circumference of wheel = $2\pi r$ = 2x22/7x70/2 = 220cm = 2.2m
Distance covered per minute = 400 x 2.2 = 880m
Distance covered per second = 880/60 m/s
Speed of car (in km/hr) = 880/60 x 18/5 = 52.8 km/hr

42. 4
Volume of cylinder = $\pi r^2 h$ (where r is the base radius and h is the height of cylinder)
= $\pi (8)^2$ x 2 = 128 π
Volume of cone = 1/3 π $r^2 h$ (where r is the base radius and h is the height of cone)
= 1/3 π r^2 x 6 (given height = 6cm)
According to the question:
Volume of cylinder = volume of cone
128 π = 1/3 π r^2 x 6
r^2 = 64
r = $\pm$ 8
Since r cannot be negative
r = 8 cm

43. 2
Dividing the equation by 13
5/13 cosθ + 12/13 sinθ = 1
Comparing the equation with $\cos^2 \theta + \sin^2 \theta = 1$
We get cos θ = 5/13 and sin θ = 12/13
Therefore value of sin θ = 12/13

44. 1

Let the cost price of the article be 'a'
Selling price of toy after discount of 20% = rs300
So the cost price a= 300 x 100 / 80 = rs375
New selling price = rs405
Gain = 405 − 375 = rs30
Gain percentage = 30/375 x 100 = 8%

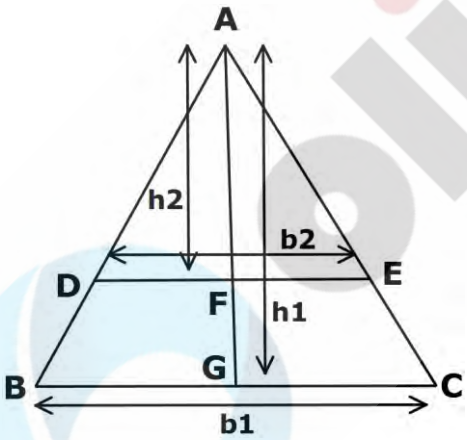
45. 4

The least number which will be exactly divisible by 5, 6, 7, and 8 will be their L.C.M
Which is 840 and the number which will leave 3 as remainder when divided by 5, 6, 7 and 8 will be 840 + 3 = 843
Given this number leaves no remainder when divided by 9
Let us say this no. is (840k +3)
Putting k=1 we get 843
Dividing 843 by 9 leaves remainder 6.
Next putting k=2
= (1680+3) = 1683
Which is exactly divisible by 9.
So the no. is 1683
Sum of digits = 1+6+8+3 = 18

46. 3

Let each interior angle of the polygon be 'i' and each exterior angle be 'e'
In a polygon i + e = 180
Given i − e = 108
On solving both equations we get
I = 144°
In a regular polygon each interior angle = {(n-2) x 180} / n
So {(n-2) x 180} / n = 144
⇒ n = 10

47. 3



Area of ADE = ½ area of ABC
⇒ ½ b2 h2 = ½ x ½ b1 h1
⇒ b2 h2 = ½ b1 h1
We know that b2/b1 = h2/h1 = k
⇒ b2 = kb1 and h2 = kh1
So the above equation becomes, k^2 b1 h1 = ½ b1 h1
⇒ k = 1/√2
Now, DB:AB = FG:AG = (h1-h2):h1
= 1 − h2/h1 = 1 − k = 1 - 1/√2 = (√2-1):√2

48. 1

$x = (\sqrt{13}+\sqrt{11})/ (\sqrt{13}-\sqrt{11})$

Multiplying and dividing by $(\sqrt{13}+\sqrt{11})$

$x= (24 + 2\sqrt{143}) / 2 = 12 + \sqrt{143}$

$y = 1/x = 1/ (12 + \sqrt{143})$; multiplying and dividing by $(12 - \sqrt{143})$

$y = 12 - \sqrt{143}$

Putting the values of x and y in the equation $3x^2 - 5xy + 3y^2$

$= 3 \times (12 + \sqrt{143})^2 - 5 \times (12 + \sqrt{143}) \times (12 - \sqrt{143}) + 3 \times (12 - \sqrt{143})^2$

$= 3 \times (12 + \sqrt{143})^2 - 5 + 3 \times (12 - \sqrt{143})^2$

$= 3 \times \{(12 + \sqrt{143})^2 + (12 - \sqrt{143})^2\} - 5$

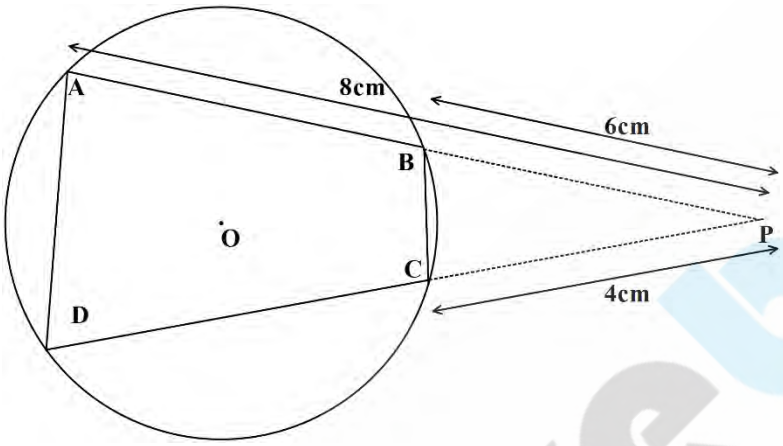
$= 3 \times \{144 + 143 + 2x144x\sqrt{143} + 144 + 143 - 2x144x\sqrt{143}\} - 5$

$= 3 \times \{288 + 286\} - 5$

$= 1722 - 5$

$= 1717$

49. 3



By the property PA x PB = PD x PC

8 x 6 = PD x 4

PD = 12cm

50. 4

$(2467)^{153}$: dividing the power by 4 : remainder is 1

So $7^1 = 7$

$(341)^{72}$: dividing the power by 4 remainder is 0

So $1^0 = 1$

Product for the unit digit will be 7 x 1 = 7

51. 4

A alone can do total work in 30 days. So work done in one day = (1/30) part

B alone can do total work in 36 days. So work done in one day = (1/36) part

Together in one day they can do (1/30) + (1/36) part of work, that is (11/180) part

Let us take A left after x days, so for x number of days, work done by both A and B = x*(11/180) part

B could complete rest of the work in 25 days, so total work done by B in those 25 days = 25*(1/36) part

Total is a unit of work, so equation becomes

x*(11/180) + (25/36) = 1

x = 5

52. 4
Let the total volume of all the three glasses be L units each.
Amount of acid in glass 1 = (2/5)L
Amount of acid in glass 2 = (3/7)L
Amount of acid in glass 3 = (4/9)L
Similarly, amount of water in the three glasses are (3/5)L, (4/7)L and (5/9)L respectively.
Ratio of acid to water in the larger vessel = $(\frac{2L}{5}+\frac{3L}{7}+\frac{4L}{9})/(\frac{3L}{5}+\frac{4L}{7}+\frac{5L}{9})$
This gives the ratio 401:544

53. 3
Let the speed of boat in still water be b km/hour and speed of stream be s km/hour
Speed of boat downstream = b+s km/hour
Speed of boat upstream = b-s km/hour
b+s = 1/(7.5/60) = 8 km/hour
b-s = 5 km/hour
Solving, b = 6.5 km/hour

54. 3
Initial total age of students in the class = $30*14\frac{1}{3}$ = 430 years
Final total age of the class with 35 students = (1925/4) years
Total age of five new students = 1925/4 − 430 = 205/4 years
Given the youngest age, so total age of the remaining four = 124/3 years
Hence average would be = 124/12 = 10 years 4 months

55. 4
Let the SP of both the horses be S.
CP of 1st horse = S/1.1
CP of 2nd horse = S/0.9
Total CP = S/1.1 + S/0.9 = 2S/0.99
Loss = SP − CP = 2S - 2S/0.99 = -2S/99
Loss % = 2S/99 x 0.99/2S x 100 = 1%

56. 4
tan A/tan B = n
Using sin A/sin B = m, above equation becomes $\cos^2B = n^2\cos^2A/m^2$
$\sin^2B = \sin^2A/m^2$
Using $\sin^2B + \cos^2B = 1$, we get $m^2 = n^2\cos^2A + \sin^2A$
Solving, $m^2 - 1 = \cos^2A\,(n^2 - 1)$
So, $\cos^2A = m^2\text{-}1/n^2\text{-}1$

57. 1
Solving the numerator, $p^{(-1-3)}q^{(2-(-2))} = p^{-4}q^4$
Solving the denominator, $p^{(6-(-2))}q^{(-3-3)} = p^8q^{-6}$
The expression becomes, $p^{(-4-8)}q^{(4-(-6))} = p^{-12}q^{10} = p^aq^b$
Hence, a + b = -2

58. 4
2 + 1/4 = 9/4
1/(9/4) = 4/9
3 + 4/9 = 31/9
1/(31/9) = 9/31
1+ 9/31 = 40/31
5/(40/31) = 31/8
4 − 31/8 = 1/8

59. 2
Let the sum of money be P
(8/25)P = P*T*R/100
Given numerical value of T = R/2
Equation becomes, 8/25 = R*R/200
R^2 = 64
Therefore R = 8%

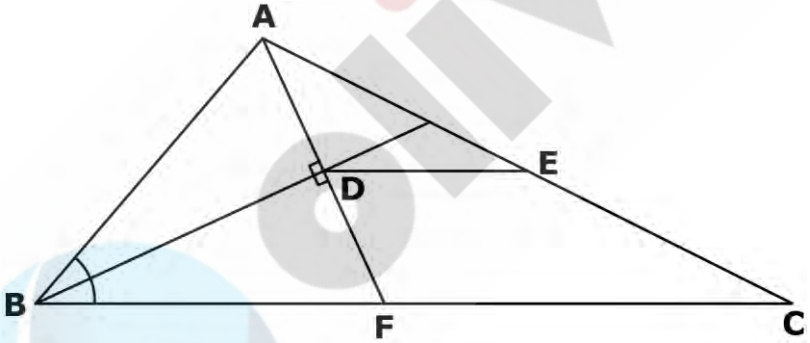
60. 4
12 = 2*2*3, 16 = 2*2*2*2, 18 = 2*3*3, 21 = 3*7
LCM of 12, 16, 18 and 21 = 2*2*2*2*3*3*7 = 1008
Smallest multiple of 1008 which is more than 2000 is 2016. So 16 must be added. Sum of its digits = 7.

61. 4
Let the time he should take to reach the station at correct time be X hours.
Let the distance he should travel be D km.
X + 7/60 = D/5, equation for when he reaches late
X − 5/50 = D/6, equation for when he reaches early
Solving both, D = 6 km.

62. 1
Volume of ditch = 48*16.5*4 m^3
Volume of tunnel = ∏*4*56 m^3
The part of ditch filled = (∏*4*56)/(48*16.5*4)
Using ∏=22/7, part of ditch filled = 2/9

63. 3
cot 41° = tan 49°, cot 42° = tan 48°, cot 43° = tan 47°, cot 44° = tan 46°
Product of cot a° and tan a° is 1. So the value of expression becomes 1.

64. 2
Extend AD to meet BC at F.



In ABD and FBD,
BD = BD (common)
∠ABD = ∠FBD (angle bisectors)
∠ADB = ∠FDB (90°)
Hence the triangles are congruent and so AD = DF
Now, in triangles ADE and AFC, DE is parallel to FC and A is a common vertex.
Hence the triangles are similar.
AD/DF = AE/EC
⇒ AE = EC
Or AE = ½ AC = 6 cm

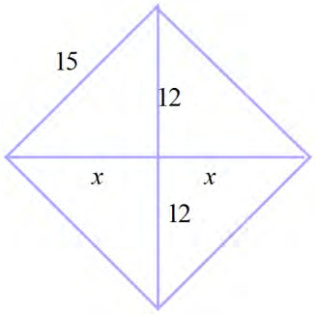
65. 2

Diagonals of a rhombus bisect each other at right angles. So the second diagonal can be found out by Pythagoras theorem.

x = 9 cm. So, the length of diagonal = 18 cm.

Area of a rhombus = (diagonal$_1$*diagonal$_2$)/2

Area = 18*24/2 = 216 sq. cm



66. 3

Let one-fourth of the distance between P and Q be x km.

Time taken for first one-fourth distance = x/10 km/hour

Time taken for the remaining distance = 3x/12 km/hour

Total time taken is 7 hours.

So, 7 = x/10 + 3x/12

On solving, x = 20 km

Total distance = 4x = 80 km.

67. 2

Amount of tin in alloy A = (2/(3+2))×60 = 24 kg

Amount of tin in alloy B = (1/(1+4))×100 = 20 kg

Total amount of tin in new alloy = 44 kg

68. 3

Solving numerator:

It is in the form of sum of squares of first 'n' consecutive natural numbers. Formula is $\frac{n(n+1)(2n+1)}{6}$

Sum of squares of first 10 natural numbers, i.e., from 1 to 10 = 10(10+1)(20+1)/6 --- (1)

Sum of squares of first 5 natural numbers, i.e., from 1 to 5 = 5(5+1)(10+1)/6 --- (2)

(1) − (2) gives the value of the numerator. On solving, we get 10*11*21/6 − 5*6*11/6 = 330

Solving denominator:

$7 + 4\sqrt{3} = 4 + 3 + 2*2*\sqrt{3} = 2^2 + (\sqrt{3})^2 + 2*2*\sqrt{3} = (2 + \sqrt{3})^2$

So, $\sqrt{(7 + 4\sqrt{3})} = \sqrt{(2 + \sqrt{3})^2} = 2 + \sqrt{3}$

$4 + 2\sqrt{3} = 1 + 3 + 2*1*\sqrt{3} = 1^2 + \sqrt{3}^2 + 2*1*\sqrt{3} = (1 + \sqrt{3})^2$

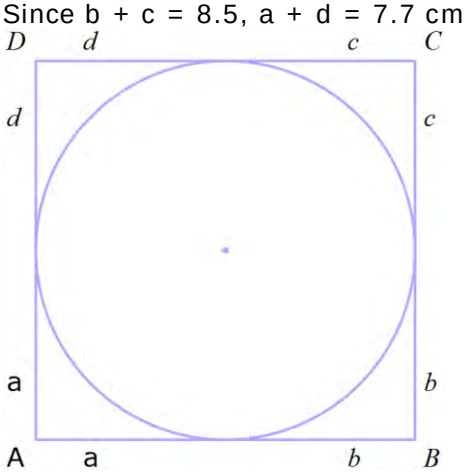
So, $\sqrt{(4 + 2\sqrt{3})} = 1 + \sqrt{3}$

$\sqrt{(7 + 4\sqrt{3})} - \sqrt{(4 + 2\sqrt{3})} = 2 + \sqrt{3} - (1 + \sqrt{3}) = 1$

Hence, the final value = numerator/denominator = 330/1 = 330

69. 2

Given AB = 7 cm, so a + b = 7 ---- (1)
BC = 8.5 cm, so b +c = 8.5 ---- (2)
CD = 9.2 cm, so c + d = 9.2 ---- (3)
DA = a + d
From (1) and (2), a − c = -1.5 ---- (4)
From (2) and (3), b − d = -0.7 ---- (5)
From (4) and (5), a + d − (c + b) = -0.8
Since b + c = 8.5, a + d = 7.7 cm



70. 4

$\sin A = 1 - \sin^2 A$
$\sin A = \cos^2 A$ --- (1)
Taking the expression, $\cos^2 A + \cos^4 A$ and substituting (1) in it we get,
$\cos^2 A + \cos^4 A = \sin A + \sin^2 A$, which is equal to 1.

71. 2

Time taken at 10 km/hour = 7/10 hour
Time taken at 20 km/hour = 7/20 hour
Time taken at 30 km/hour = 7/30 hour
Time taken at 60 km/hour = 7/60 hour
Total time taken = 7/10 + 7/20 + 7/30 + 7/60 = 7/5 hour
Average speed = 7*4/(7/5) = 20 km/hour

72. 4

$x^2 = a + 1/a + 2$
Similarly, $y^2 = a + 1/a - 2$
$\Rightarrow x^2 - y^2 = 4$
The given expression is: $x^2(x^2 - y^2) + y^2(y^2 - x^2)$
$= 4(a + 1/a + 2) - 4(a + 1/a - 2)$
$= 8 + 8 = 16$

73. 1

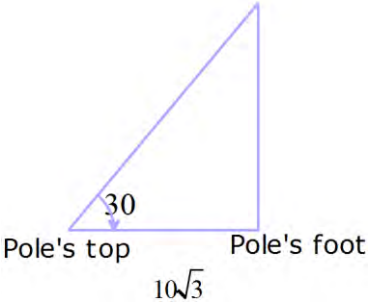
$x-\sqrt{3}-\sqrt{2}=0$ --- (1)
$y-\sqrt{3}+\sqrt{2}=0$ --- (2)
(1) + (2) gives $x+y=2\sqrt{3}$ --- (3)
(1) − (2) gives $x-y=2\sqrt{2}$ --- (4)
Solving (3) and (4) gives, $x=\sqrt{3}+\sqrt{2}$ and $y=\sqrt{3}-\sqrt{2}$
$X^2=5+2\sqrt{6}$, $y^2=5-2\sqrt{6}$, $xy=1$
From expression $(x^3 - 20\sqrt{2})-(y^3+2\sqrt{2}) = (x^3-y^3) - 22\sqrt{2} = (x-y)(x^2+xy+y^2) - 22\sqrt{2}$
On solving, $x^3-y^3=22\sqrt{2}$
Hence final value = 0.

74. 1

Let the five consecutive integers be x-2, x-1, x, x+1, x+2.
Next two integers will be (x+3) and (x+4).
Initial average of five numbers = (x-2 + x-1 + x + x+1 + x+2)/5 = x
But given the average = n. So, x = n.
Average of final seven integers = (x-2 + x-1 + x + x+1 + x+2 + x+3 + x+4)/7 = x+1
So the average increases by 1.

75. 2

tan30° = The height of the pole still standing vertical/10√3
Since, tan30° = 1/√3, The height of the pole still standing vertical = 10 metres
sin30° = 1/2, The length of the hypotenuse in the diagram = opposite side/sin30°
So, the length of the fallen part of the pole = 20 metres
Total length of the pole = 10+20 = 30 metres



76. 3

Let the numbers be p, q, r, s and so on.
New numbers will be (p+2), (q+4), (r+8), (s+16), and so on.
Average of initial numbers = (p+q+r+s+...)/n = a
Average of new numbers = ((p+2)+(q+4)+(r+8)+(s+16)+...)/n = (p+q+r+s+...)/n + (2+4+8+16...)/n
= a + sum of n terms in a GP/n
= a + (2(2^n-1)/(2-1))/n
= a + 2(2^n-1)/n

77. 2

Cost price of one orange when he buys 3 oranges for Rs. 40 = Rs. 40/3
Let us assume he buys n oranges. So total cost price = Rs. 40n/3
Cost price of one orange when he buys 5 oranges for Rs. 60 = Rs. 60/5 = Rs. 12
So total cost price for n oranges in this case = Rs. 12n
Selling price of one orange = Rs. 50/3
Selling price of 2*n oranges = Rs. 100n/3
S.P − C.P = 100n/3 − (40n/3 + 12n)
= 60n/3 - 12n
= 24n/3 = 8n, which is a positive value and hence, it is profit
Profit percentage = (S.P − C.P)*100/C.P = $8n * \frac{100}{\frac{76n}{3}}$ = 31.58% = 32%

78. 4

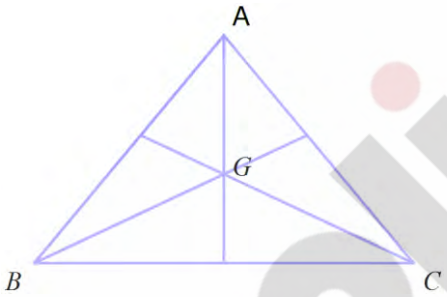
$a - \frac{1}{a-3} = 5$
a − 5 = 1/(a-3) --- (1)
On solving we get, a^2 - 8a + 14 = 0 --- (2)
$(a-3)^3 - \frac{1}{(a-3)^3}$ = (a − 3)³ − (a − 5)³ (obtained by substituting (1) in the expression)
On solving we get, (a − 3)³ − (a − 5)³ = 3a^2 − 24a + 49 --- (3)
(2)×3 gives 3a^2 − 24a + 42 = 0. Substituting in (3), we get the value of expression as 7.

79. 2
$3^{50} = 243^{10}$, $4^{40} = 256^{10}$, $5^{30} = 125^{10}$, $6^{20} = 36^{10}$
Hence the largest number is 256^{10}, which is 4^{40}.

80. 1
The given case is possible only when x = y = z.
$(3x^4+7y^4+5z^4)/(5x^2y^2+7y^2z^2+3z^2x^2) = (3x^4+7x^4+5x^4)/(5x^4+7x^4+3x^4) = 15x^4/15x^4 = 1$

81. 2
In one day, A can do 1/16th part of the whole work. B can do 1/32nd part of the whole work. C can do 1/48th part of the whole work.
Amount of work all three of them can do in one day = (1/16 + 1/32 + 1/48) of the total work
On solving, we get that they all together can do 5/48th part of work in one day.
Let us assume, it takes 'n' days for completion.
B works for (n-8) days. So, B does (n-8)/32 part of work.
C works for (n-6) days. So, C does (n-6)/48 part of work.
A works for n days. So, A does n/16 part of work.
Total work = n/16 + (n-8)/32 + (n-6)/48 = 1
6n/96 + (3n-24)/96 + (2n-12)/96 = 1
$\Rightarrow$ (11n − 36)/96 = 1
$\Rightarrow$ 11n = 132
$\Rightarrow$ n = 12 days

82. 4
All the three medians of a triangle divide it in to six smaller triangles of equal area.
So area of one such smaller triangle = $\left(\frac{1}{6}\right) area\ of\ original\ triangle$
Hence, area of ΔGBC = $2 * \left(\frac{1}{6}\right) area\ of\ original\ triangle$
Area of ΔGBC = (1/3)*area ΔABC
= 20 cm^2



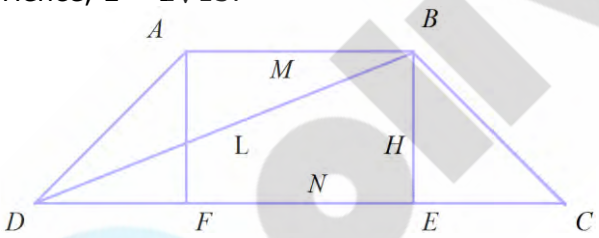
83. 3
If A and B can do a piece of work in 8 days, then in one day they can do 1/8th part of that work.
Let in one day A can do 1/A part of work and B can do 1/B part of work.
Then, 1/A + 1/B = 1/8 --- (1)
Similarly, for B and C, 1/B + 1/C = 1/12 --- (2)
Given A, B and C can do the work in 6 days. So, 1/A + 1/B + 1/C = 1/6
1/B = 1/6 − (1/A + 1/C) --- (3)
(1) + (2) gives, 1/A + 2/B + 1/C = 1/8 + 1/12
2/B = 5/24 − (1/A + 1/C) --- (4)
Substituting (3) in (4), we get 5/24 − (1/A + 1/C) = 2/6 − 2(1/A + 1/C)
1/A + 1/C = 2/6 − 5/24 = 1/8
So A and C can do the work in 8 days.

84. 1

Let the number of students in classes A, B and C be a, b and c respectively.
So total score of class A = average*number of students = 83*a
Similarly total scores of classes B and C are 76*b and 85*c respectively.
Average of class A and B = 79. So, (83a + 76b)/(a+b) = 79
On solving, 4a = 3b --- (1)
Average of class B and C = 81. So, (76b + 85c)/(b+c) = 81
On solving, 5b = 4c --- (2)
From (1) and (2), we get 5a = 3c --- (3)
Average of classes A, B and C = (83a + 76b + 85c)/(a + b +c)
Using (1) and (3), expression can be converted only in terms of 'a'.
Average = $\frac{\frac{249a + 304a + 425a}{3}}{\frac{12a}{3}}$ = 81.5

85. 2

Let the lengths of parallel sides be M cm and N cm.
Let the height be H cm, and diagonal be L cm.
Area of a trapezium = (sum of parallel sides)*height/2
Therefore, 176 = (M+N)*H/2 --- (1)
Also given, H = (2/11)*(M+N)
Putting this value of H in (1) we get, $176 = \left(\frac{1}{2}\right) * \left(\frac{2}{11}\right) * (M+N)^2$
On solving, M+N = 44 cm
So, H = (2/11)*44 = 8 cm
Since the trapezium is isosceles,
DF = EC, where AF and BE are altitudes
DF + EC = (N − M)
As DF = EC, 2*DF = (N − M)
DF = (N − M)/2
DE = DF + FE. So, DE = (N − M)/2 + M
DE = (N + M)/2 = 22 cm
$L^2 = H^2 + DE^2$
Substituting values of H and DE, $L^2 = 64 + 484$
Hence, $L = 2\sqrt{137}$



86. 1

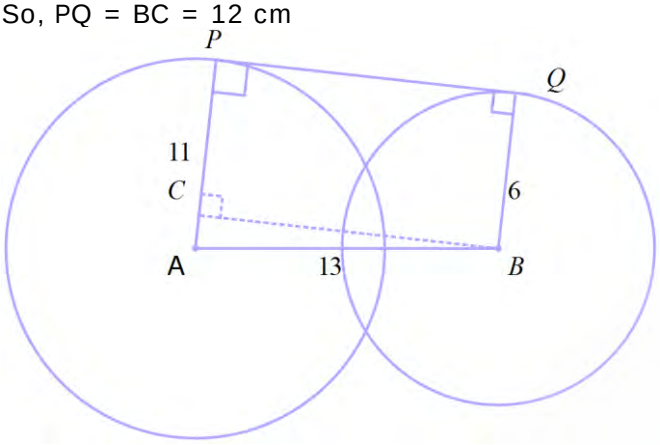
Area of the triangular base = √(s(s-a)(s-b)(s-c)) , where s is the semi-perimeter
s = (sum of sides of the triangle)/2 = 54/2 = 27 cm
Area of the triangular base = √(27(27-13)(27-20)(27-21)) = √(27*14*7*6) = $\sqrt{(3^4*7^2*2^2)}$ = $126cm^2$
Volume of the prism = height*area of base = 9*126 = 1134 cm^3.

87. 3

Let the total number of staff be 100 people
Number of female staff = 40% of total = 40
So, the number of male staff = 60
Married female = 70% of 40 = 28
Married male = 50% of 60 = 30
So total unmarried staff = 100 − (28 + 30) = 42
Hence, percentage unmarried staff = (42/100)*100 = 42

88. 2

Line segment drawn from the centre of the circle to the point of contact of tangent with the circle, is perpendicular to the tangent.
Hence, AP is perpendicular to PQ, and BQ is perpendicular to QP.
On drawing a perpendicular line segment BC to PA, BCPQ forms a rectangle as all the angles are right angles in the quadrilateral BCPQ.
In right angled triangle BCA, $BC^2 = AB^2 - AC^2$
AC = 11 − 6 = 5 cm
On solving, BC = 12 cm
In rectangle, opposite sides are equal.
So, PQ = BC = 12 cm



89. 2

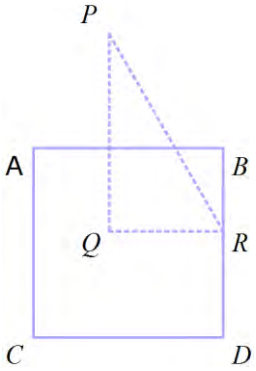
Let us take the loan is divided to A, B and C in amounts ₹A, ₹B and ₹C respectively.
Simple interest earned from A = (A*2*5)/100 = 10A/100
Similarly from B and C are 15B/100 and 20C/100 respectively.
Total amount earned from A, B and C are (A + 10A/100), (B + 15B/100) and (C + 20C/100)
Given all the three amounts are equal. So, 110A/100 = 115B/100 = 120C/100
On solving, A:B:C = 276:264:253
276x+264x+253x = 7930
793x = 7930
X = 10
Hence, A received a loan of 276*10 = ₹2760

90. 1

Given the distance between P and Q = 162 km
Let the speed of train starting from Q be x km/hour
Then speed of train starting from P = x+8 km/hour
Distances travelled for 6 hours by trains starting from P and Q are 6(x+8) and 6x km respectively.
So, 162 = 6(x+8) + 6x
12x = 162 − 48
12x = 114
$x = 9\frac{1}{2}$ km/hour

91. 2

Let ABCD be the square base of the pyramid.
Let PQ be the height of the pyramid.
Let PR be on the lateral face of the pyramid, and PR is the altitude on that lateral face of the pyramid which is also a triangle (ΔPDB).
Given side of the square = 10 cm. QR = CD/2 = 5 cm.
Given PQ = 12 cm. So, PR = $\sqrt{(PQ^2 + QR^2)}$
That gives PR = 13 cm.
In ΔPDB, PR is an altitude (since ΔPRB and ΔPRD are congruent triangles)
So area of ΔPDB = (1/2)*PR*BD = (1/2)*13*10 = 65 cm^2
Total surface area of the pyramid = lateral surface area + area of base = 4*65 + 100
= 260 + 100 = 360 cm^2

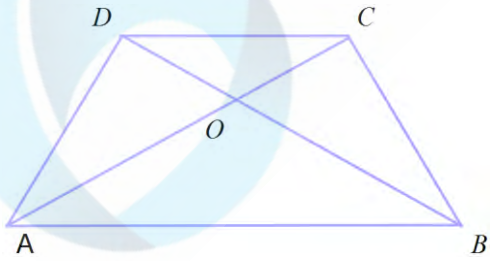


92. 4

Given, the sum of money doubles itself in 5 years at compound interest.
So, 2 = $(1 + r/100)^5$ --- (1)
In second case, amount becomes 8 times in let 'x' years
So, 8 = $(1 + r/100)^x$ --- (2)
$(1)^3$ gives 8 = $(1 + r/100)^{15}$ --- (3)
Comparing (2) and (3), LHS (left hand side) of both the equations are equal. So RHS must be equal too.
That gives x = 15 years

93. 3

Considering triangles ΔDOC and ΔBOA, ∠CDO = ∠OBA, ∠DCO = ∠OAD (alternate opposite angles between two parallel lines are equal) and ∠DOC = ∠BOA. Hence, ΔDOC ~ ΔBOA.
In two similar triangles, ratio of areas of triangles = ratio of squares of the corresponding sides
Hence area ΔDOC/area ΔBOA = $(CD/AB)^2$
= $(CD/2CD)^2$
= 1/4
Given area of ΔAOB = 84 cm^2, then area ΔCOD = area ΔAOB/4
= 21 cm^2



94. 2

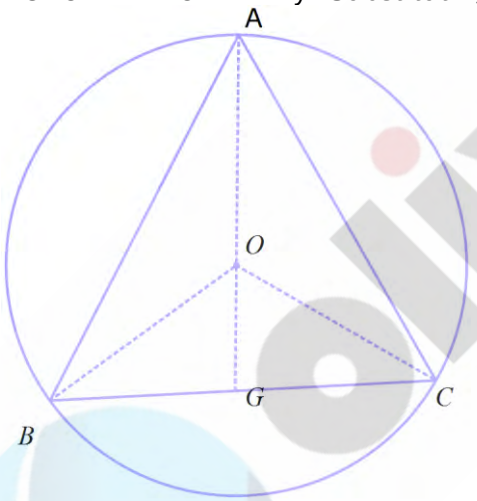
$7\sin^2\theta + 3\cos^2\theta = 4$
$4\sin^2\theta + 3\sin^2\theta + 3\cos^2\theta = 4$
$4\sin^2\theta + 3(\sin^2\theta + \cos^2\theta) = 4$
$4\sin^2\theta + 3 = 4$
$4\sin^2\theta = 1$
$\sin^2\theta = 1/4$
$\sin\theta = \pm 1/2$
But given that θ is acute angle, so θ=30°
Therefore $\tan\theta = \tan 30° = 1/\sqrt{3}$

95. 1

$a + 1/b = b + 1/c$
$\Rightarrow a - b = 1/c - 1/b = (b-c)/bc$ (1)
Similarly, $b - c = (c - a)/ca$ (2)
And, $c - a = (a - b)/ab$ (3)
Multiplying (1), (2) and (3), we get
$(a-b)(b-c)(c-a) = (a-b)(b-c)(c-a)/a^2b^2c^2$
Since, $a \neq b \neq c \neq 0$, we get $a^2b^2c^2 = (a-b)(b-c)(c-a)/(a-b)(b-c)(c-a) = 1$

96. 2

OB and OC are radii. So, ∠OBC = ∠OCB. Let both of them are represented by 'x°'
Let ∠BAC = y°
∠BOC = 2*∠BAC = 2y (because the angle subtended by an arc at the centre of a circle is twice the angle subtended by the same arc at any other point on the remaining part of the circle)
From ΔOBC, 2x + 2y = 180°
So, x + y = 90° --- (1)
∠OBC + ∠BAC = x + y. Substituting (1) in this expression gives OBC + BAC = 90°



97. 3

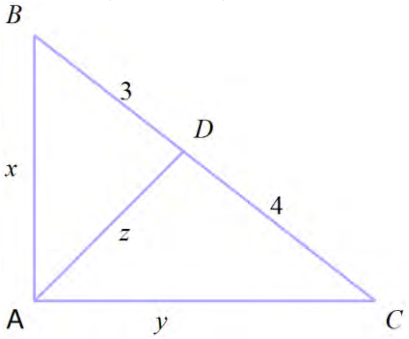
Let the numbers be n and 4n.
Hence their HCF and LCM are n and 4n respectively.
$\Rightarrow n = 21$
Hence the larger number = 4n = 21 x 4 = 84

98. 4

Loss = 10%
So, S.p = 0.9C.p
C.p = 54*10/9 = ₹60
When profit = 20%,
S.p = 1.2*C.p
S.p = 1.2*60 = ₹72

99. 3

Given ΔABC is right angled triangle with right angle at A.
Let the values of AB, AC and AD be x, y and z respectively.
From ΔADB, $x^2 - 9 = z^2$ --- (1)
From ΔADC, $y^2 - 4 = z^2$ --- (2)
On adding (1) and (2), we get $x^2 + y^2 - 13 = 2z^2$ --- (3)
However from ΔABC, $x^2 + y^2 = 49$.
Substituting the above value in (3), we get $49 - 13 = 2z^2$
$36 = 2z^2$
$18 = z^2$
So $z = \sqrt{18} = 3\sqrt{2}$



100. 2

Let L be the slant height of the cone
Given lateral surface area = volume
So, $\prod rL = \prod r^2h/3$
On solving, $L = r*h/3$ --- (1)
In the right circular cone, $L^2 = r^2 + h^2$ --- (2)
$1/h^2 + 1/r^2 = (h^2 + r^2)/h^2*r^2$
Using (1) and (2) in the above expression, we get $L^2/(h*r)^2 = L^2/(3L)^2 = 1/9$

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