SET 36

SOLVED PAPER
SSC (CGL) TIER-II EXAM

Held on : 25.10.2015 (Test Form No. 1099685)

PAPER-I
QUANTITATIVE ABILITIES

1. 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) $a + \frac{2^{n-1}-1}{n}$

(2) $a + 2\frac{2^{n}-1}{n}$

(3) $a + \frac{2^{n-1}}{n}$

(4) $a + \frac{2^{n}-1}{n}$

2. Let $x = \frac{\sqrt{13}+\sqrt{11}}{\sqrt{13}-\sqrt{11}}$ and $y = \frac{1}{x}$, then the value of $3x^2 - 5xy + 3y^2$ is

(1) 1717 (2) 1177
(3) 1771 (4) 1171

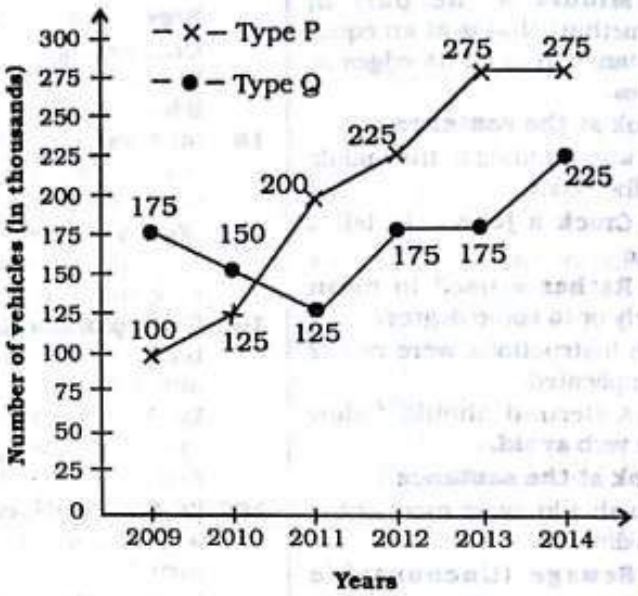
3. A sum of Rs. 7,930 is divided into three parts and given on loan at 5% simple interest to A, B and C for 2, 3 and 4 years respectively. If the amounts of all three are equal after their respective periods of loan, then A received a loan of

(1) Rs. 3,050
(2) Rs. 2,760
(3) Rs. 2,750
(4) Rs. 2,800

4. A number when divided by 361 gives a remainder 47. If the same number is divided by 19, the remainder obtained is

(1) 3 (2) 8
(3) 9 (4) 1

Directions (5–9) : The following graph shows production (in thousands) of two types (P and Q) of vehicles by a factory over the years 2009 to 2014. Study the graph and answer the given questions.



5. 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) 3 (2) 4
(3) 2 (4) 5

6. Approximate percentage decrease in production of Type Q vehicles from 2010 to 2011 is

(1) 10.1 (2) 16.7
(3) 14.3 (4) 12.5

7. 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

8. The ratio of total production of Type P vehicles to total production of type Q vehicles over the years is

(1) 48 : 41 (2) 5 : 8
(3) 8 : 5 (4) 41 : 48

9. The production of Type Q vehicles in 2010 was approximately what percent of Type P vehicles in 2014?

(1) 60 (2) 45.5
(3) 54.5 (4) 75

10. A man starts from a place P and reaches the place Q in 7 hours. He travels $\frac{1}{4}$ th of the distance at 10 km/hour and the remaining distance at 12 km/hour. The distance between P and Q is

(1) 72 km (2) 90 km
(3) 80 km (4) 70 km

11. In triangle ABC, DE || BC where D is a point on AB and E is a point on AC. DE divides the area of Δ ABC into two equal parts. Then DB : AB is equal to

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(1) $\sqrt{2} : (\sqrt{2}+1)$

(2) $\sqrt{2} : (\sqrt{2}-1)$

(3) $(\sqrt{2}-1) : \sqrt{2}$

(4) $(\sqrt{2}+1) : \sqrt{2}$

12. 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) No loss or profit
(3) 1% loss (4) 1% profit

13. If $\tan\theta - \cot\theta = 0$ and θ is positive acute angle, then the value of $\frac{\tan(\theta+15°)}{\tan(\theta-15°)}$ is

(1) 3 (2) $\frac{1}{\sqrt{3}}$

(3) $\frac{1}{3}$ (4) $\sqrt{3}$

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

15. 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 Rs. 12,000 and Rs. 10,000 monthly respectively, then the difference in their monthly incomes is
(1) Rs. 52,000
(2) Rs. 42,000
(3) Rs. 44,000
(4) Rs. 46,000

16. 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 fill the remaining tank?

(1) $7\frac{1}{2}$ hours

(2) $2\frac{2}{5}$ hours

(3) $2\frac{1}{3}$ hours

(4) $3\frac{1}{3}$ hours

17. 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) 1314 cm^3 (2) 1134 cm^3
(3) 1413 cm^3 (4) 1143 cm^3

18. If $(3x-2y) : (2x+3y) = 5 : 6$, then one of the values of

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

(1) $\frac{1}{5}$ (2) 5

(3) 25 (4) $\frac{1}{25}$

19. Articles are marked at a price which gives a profit of 25%. After allowing a certain discount the profit reduces to $12\frac{1}{2}\%$. The discount percent is
(1) 11.1% (2) 10%

(3) $12\frac{1}{2}\%$ (4) 12%

20. The portion of a ditch 48m 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

$\left(\text{Take } \pi = \frac{22}{7}\right)$

(1) $\frac{1}{4}$ Part (2) $\frac{1}{2}$ Part

(3) $\frac{2}{9}$ Part (4) $\frac{1}{9}$ Part

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

22. 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) 81
(3) 80.5 (4) 80

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

24. 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) 8
(3) 12 (4) 24

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

26. If 90 men can do a certain job in 16 days, working 12 hours per day, then the part of that work which can be completed by 70 men in 24 days, working 8 hours per day is

(1) $\frac{1}{3}$ (2) $\frac{2}{3}$

(3) $\frac{7}{9}$ (4) $\frac{5}{8}$

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

28. 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) 7 (2) 5
(3) 6 (4) 4

29. The value of
$\cot 41^\circ . \cot 42^\circ . \cot 43^\circ . \cot 44^\circ . \cot 45^\circ . \cot 46^\circ . \cot 47^\circ . \cot 48^\circ . \cot 49^\circ$
(1) 1 (2) 0
(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{1}{\sqrt{2}}$

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

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

32. 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 Rs. 2 less, he would have gained 10%. The cost price of the article is
(1) Rs. 200 (2) Rs. 400
(3) Rs. 300 (4) Rs. 100

33. P and Q together can do a job in 6 days. Q and R can finish the same job in $\frac{60}{7}$ 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) 10
(3) 8 (4) 12

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

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

36. 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) 64 (2) 60
(3) 54 (4) 42

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

38. A and B are centres 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) 8.5 cm (2) 13 cm
(3) 12 cm (4) 17 cm

39. 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 $\left(\text{Take } \pi = \frac{22}{7}\right)$
(1) 0.528 (2) 528
(3) 52.8 (4) 5.28

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

41. If $\sec\theta - \tan\theta = \frac{1}{\sqrt{3}}$, th value of $\sec\theta . \tan\theta$ is
(1) $\frac{2}{3}$ (2) $\frac{2}{\sqrt{3}}$
(3) $\frac{4}{\sqrt{3}}$ (4) $\frac{1}{\sqrt{3}}$

42. 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) 30 km/hour
(2) 20 km/hour
(3) 60 km/hour
(4) 40 km/hour

43. If 64 buckets of water are removed from a cubical shaped water tank completely filled with water, $\frac{1}{3}$ 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) 12 (2) 16
(3) 15 (4) 18

44. The centroid of a Δ ABC is G. The area of Δ ABC is 60 cm^2. The area of ΔGBC is
(1) 10 cm^2 (2) 30 cm^2
(3) 40 cm^2 (4) 20 cm^2

45. The 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) 460 cm^2
(3) 260 cm^2 (4) 360 cm^2

46. 60 kg of an alloy A is mixed with 100 kg of alloy B. If alloy A has lead and tin in the ratio 3 : 2 and alloy B has tin and copper in the ratio 1 : 4, the amount of tin in the new alloy is

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(1) 53 kg (2) 44 kg
(3) 80 kg (4) 24 kg

47. If $5\cos\theta + 12\sin\theta = 13$, $0° < \theta < 90°$, then the value of $\sin\theta$ is

(1) $\frac{5}{13}$ (2) $-\frac{12}{13}$

(3) $\frac{6}{13}$ (4) $\frac{12}{13}$

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

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

50. In a school there were 1554 students and the ratio of the number of the boys and girls was 4 : 3. After a few days, 30 girls joined the school but a 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) 76 (2) 74
(3) 84 (4) 86

51. 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) 15 : 8
(3) 5 : 8 (4) 8 : 5

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

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

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

55. 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}

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

57. The area of an isosceles trapezium is 176 cm^2 and the height is $\frac{2}{11}$ 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) $\sqrt{137}$
(3) $2\sqrt{137}$ (4) 24

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

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

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

61. 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 1.5
(2) increase by 1
(3) remain the same
(4) increase by 2

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

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

64. 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) 12 years 4 months
(4) 10 years 4 months

65. AD is perpendicular to the internal bisector of $\angle ABC$ of Δ ABC. 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) 3 (2) 8
(3) 4 (4) 6

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

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67. 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 cm² (2) $464\sqrt{3}$ cm²

(3) 462 cm² (4) $646\sqrt{3}$ cm²

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

(1) –1 (2) 1

(3) 0 (4) 2

69. If $7\sin^2\theta + 3\cos^2\theta = 4$, then the value of tan θ is (θ is acute)

(1) $\frac{1}{\sqrt{3}}$ (2) $\frac{1}{\sqrt{2}}$

(3) $\sqrt{3}$ (4) 1

70. 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) 6 cm (2) 8 cm

(3) 4 cm (4) 5 cm

71. The perimeter of a rhombus is 60 cm and one of its diagonal is 24 cm. The area of the rhombus is

(1) 108 sq. cm.

(2) 216 sq. cm.

(3) 432 sq. cm.

(4) 206 sq. cm.

72. If $a + \frac{1}{b} = b + \frac{1}{c} = c + \frac{1}{a}$, where $a \neq b \neq c \neq 0$, then the value of $a^2 b^2 c^2$ is

(1) –1 (2) abc

(3) 0 (4) 1

73. A, B and C can do a work separately in 16, 32 and 48 days respectively. They started the work together but B left off 8 days and C six days before the completion of the work. In what time is the work finished?

(1) 10 days (2) 9 days

(3) 12 days (4) 14 days

74. Two blends of a commodity costing Rs. 35 and Rs. 40 per kg. respectively are mixed in the ratio 2 : 3 by weight. If one-fifth of the mixture is sold at Rs. 46 per kg and the remaining at the rate of Rs. 55 per kg. the profit percent is

(1) 50 (2) 30

(3) 40 (4) 20

75. The value of (cosec a – sin a) (sec a – cos a) (tan a + cot a) is

(1) 1 (2) 6

(3) 2 (4) 4

76. 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) 4 : 1 (2) 2 : 3

(3) 4 : 3 (4) 3 : 2

77. 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) 6 km (2) 7 km

(3) 6.25 km (4) 4 km

78. 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) $1 : \sqrt{2}$

(3) $1 : \sqrt[3]{2} + 1$ (4) $1 : \sqrt[3]{2} - 1$

79. If $x = a^{\frac{1}{2}} + a^{-\frac{1}{2}}, y = a^{\frac{1}{2}} - a^{-\frac{1}{2}}$ then value of $(x^4 - x^2y^2 - 1) + (y^4 - x^2y^2 + 1)$ is

(1) 16 (2) 13

(3) 12 (4) 14

80. 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) 360 (2) 420

(3) 320 (4) 400

81. The simple interest on a sum of money is $\frac{8}{25}$ 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) $6\frac{1}{4}$ (4) 4

82. If $x^2 + y^2 + z^2 = xy + yz + zx$, then the value of $\frac{3x^4 + 7y^4 + 5z^4}{5x^2y^2 + 7y^2z^2 + 3z^2x^2}$ is

(1) 2 (2) 1

(3) 0 (4) –1

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

(1) 0 (2) 1

(3) 3 (4) 2

84. 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 from Q is

(1) $12\frac{5}{6}$ km/hour

(2) $10\frac{5}{6}$ km/hour

(3) $9\frac{1}{2}$ km/hour

(4) $8\frac{1}{2}$ km/hour

85. If $3(a^2 + b^2 + c^2) = (a + b + c)^2$, then the relation between a, b and c is

(1) $a \neq b \neq c$ (2) $a = b \neq c$

(3) $a \neq b = c$ (4) $a = b = c$

86. 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) 1.5

(3) 0.5 (4) 1

87. 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

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and boys are in the ratio 4 : 5, average marks of the whole class (approximately) is closest to

(1) 85.9 (2) 86.1
(3) 86.4 (4) 86.5

88. If $\sin A + \sin^2 A = 1$, then the value of $\cos^2 A + \cos^4 A$ is

(1) 2 (2) $1\frac{2}{3}$
(3) $1\frac{1}{2}$ (4) 1

89. The marked price of a tape recorder is Rs. 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, is to be made for buying it, is

(1) Rs. 11,703.60
(2) Rs. 11,730.60
(3) Rs. 11,370.60
(4) Rs. 11,073.60

90. 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) 18 (4) 24

91. The value of

$$4-\cfrac{1}{1+\cfrac{1}{3+\cfrac{1}{2+\cfrac{1}{4}}}}$$ is

(1) $\frac{1}{8}$ (2) $\frac{1}{64}$
(3) $\frac{1}{16}$ (4) $\frac{1}{32}$

92. 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) $28\frac{3}{8}\%$ (2) $30\frac{5}{8}\%$
(3) $36\frac{5}{9}\%$ (4) 35%

93. 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 $\frac{1}{6}$ th of the number. The number is

(1) 26 (2) 25
(3) 24 (4) 23

94. AB and CD are two parallel chords of a circle of lengths 10 cm and 4 cm respectively. If the chords are on the same side of the centre and the distance between them is 3 cm, then the diameter of the circle is

(1) $2\sqrt{21}$ cm. (2) $\sqrt{21}$ cm.
(3) $2\sqrt{29}$ cm. (4) $\sqrt{29}$ cm.

95. 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 $\frac{1}{h^2}+\frac{1}{r^2}$ is

(1) $\frac{1}{3}$ (2) $\frac{1}{9}$
(3) $\frac{9}{1}$ (4) $\frac{3}{1}$

96. $\dfrac{6^2+7^2+8^2+9^2+10^2}{\sqrt{7+4\sqrt{3}}-\sqrt{4+2\sqrt{3}}}$

is equal to

(1) 330 (2) 305
(3) 355 (4) 366

97. If $\tan A = n \tan B$ and $\sin A = m \sin B$, then the value of $\cos^2 A$ is

(1) $\frac{m^2-1}{n^2+1}$ (2) $\frac{m^2+1}{n^2-1}$
(3) $\frac{m^2+1}{n^2+1}$ (4) $\frac{m^2-1}{n^2-1}$

98. 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) 40 gram (2) 10 gram
(3) 60 gram (4) 80 gram

99. 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) 10 days (2) 6 days
(3) 5 days (4) 11 days

100. A boat moves downstream at the rate of 1 km in $7\frac{1}{2}$ minutes and upstream at the rate of 5 km an hour. What is the speed of the boat in the still water?

(1) $3\frac{1}{2}$ km/hour
(2) $6\frac{1}{2}$ km/hour
(3) 4 km/hour
(4) 8 km/hour

ANSWERS

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

EXPLANATIONS

1. (2) Sum of new numbers
$= na + (2 + 4 + 8 + 16 \ldots\ldots$ to n terms)
Now, $S = 2 + 4 + 8 + 16 + \ldots\ldots$ to n terms
Here, a = first term $= 2$

r = common ratio $= \frac{4}{2} = 2$

It is a geometric series.

$$\therefore S = \frac{a(r^n - 1)}{r - 1} = \frac{2(2^n - 1)}{2 - 1}$$

$$= 2(2^n - 1)$$

$\therefore$ Required average

$$= \frac{na + 2(2^n - 1)}{n}$$

$$= a + \frac{2(2^n - 1)}{n}$$

2. (1) $x = \frac{\sqrt{13} + \sqrt{11}}{\sqrt{13} - \sqrt{11}}$

On rationalising the denominator,

$$= \frac{\sqrt{13} + \sqrt{11}}{\sqrt{13} - \sqrt{11}} \times \frac{\sqrt{13} + \sqrt{11}}{\sqrt{13} + \sqrt{11}}$$

$$= \frac{(\sqrt{13} + \sqrt{11})^2}{(\sqrt{13})^2 - (\sqrt{11})^2}$$

$$= \frac{13 + 11 + 2\sqrt{143}}{13 - 11}$$

$$= \frac{24 + 2\sqrt{143}}{2} = 12 + \sqrt{143}$$

$$\therefore y = \frac{1}{x} = \frac{1}{12 + \sqrt{143}}$$

$$= \frac{1}{12 + \sqrt{143}} \times \frac{12 - \sqrt{143}}{12 - \sqrt{143}}$$

$$= \frac{12 - \sqrt{143}}{144 - 143} = 12 - \sqrt{143}$$

$\therefore x - y = 12 + \sqrt{143} - 12 + \sqrt{143} = 2\sqrt{143}$ and

$$xy = (12 + \sqrt{143})(12 - \sqrt{143})$$

$$= 144 - 143 = 1$$

$\therefore 3x^2 - 5xy + 3y^2 = 3x^2 - 6xy + 3y^2 + xy$

$$= 3(x - y)^2 + xy$$

$$= 3(2\sqrt{143})^2 + 1$$

$$= 3 \times 4 \times 143 + 1 = 1716 + 1$$

$$= 1717$$

3. (2) Let the loans taken by A, B and C be Rs. x, Rs. y and Rs. z respectively.
$\therefore x + y + z =$ Rs. 7930

$$\text{S.I.} = \frac{\text{Principal} \times \text{Time} \times \text{Rate}}{100}$$

According to the question,

$$x + \frac{x \times 2 \times 5}{100} = y + \frac{y \times 3 \times 5}{100}$$

$$= z + \frac{z \times 4 \times 5}{100}$$

$$\Rightarrow \frac{100x + 10x}{100}$$

$$= \frac{100y + 15y}{100} = \frac{100z + 20z}{100}$$

$$\Rightarrow 110x = 115y = 120z$$

$$\Rightarrow 22x = 23y = 24z$$

$$\Rightarrow \frac{22x}{6072} = \frac{23y}{6072} = \frac{24z}{6072}$$

[LCM of 22, 23 and 24 = 6072]

$$\Rightarrow \frac{x}{276} = \frac{y}{264} = \frac{z}{253}$$

$\therefore x : y : z = 276 : 264 : 253$
Sum of terms of ratio
$= 276 + 264 + 253 = 793$

$$\therefore \text{A's loan} = \frac{276}{793} \times 7930$$

$=$ Rs. 2760

4. (3) Here, the first divisor (361) is a multiple of second divisor (19).
$\therefore$ Required remainder = Remainder obtained on dividing 47 by 19 = 9

5. (1) Average production of type P vehicles

$$= \frac{100 + 125 + 200 + 225 + 275 + 275}{6}$$

$$= \frac{1200}{6} = 200 \text{ thousands}$$

Required years
$\Rightarrow$ 2012, 2013 and 2014

6. (2) Required percentage decrease

$$= \left(\frac{150 - 125}{150}\right) \times 100$$

$$= \frac{25}{150} \times 100 = \frac{50}{3}$$

$= 16.7\%$

7. (3) Total production of type P vechicles in 2009 and 2011
$= 100 + 200 = 300$ thousands
Total production of type Q vehicles in 2010 and 2014
$= 150 + 225 = 375$ thousands
$\therefore$ Required percent

$$= \frac{300}{375} \times 100 = 80\%$$

8. (1) Total production of type P vehicles = 1200 thousands
Total production of type Q vehicles
$= 175 + 150 + 125 + 175 + 175 + 225 = 1025$
$\therefore$ Required ratio
$= 1200 : 1025 = 48 : 41$

9. (3) Required percent

$$= \frac{150}{275} \times 100 = 54.5\%$$

10. (3) Let the total distance be $4x$ km.

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

According to the question,

$$\frac{x}{10} + \frac{3x}{12} = 7$$

$$\Rightarrow \frac{x}{10} + \frac{x}{4} = 7$$

$$\Rightarrow \frac{2x + 5x}{20} = 7$$

$$\Rightarrow 7x = 7 \times 20$$

$$\therefore x = \frac{7 \times 20}{7} = 20 \text{ km.}$$

$\therefore$ PQ $= 4x = 4 \times 20 = 80$ km

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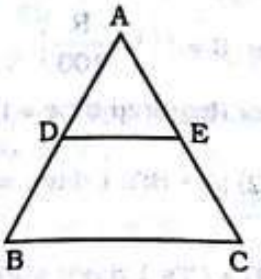
11. (3)



DE ∥ BC

Area of ΔADE = Area of quadrilateral BDEC

⇒ Area of Δ ABC = 2 × Area of Δ ADE

In Δ ADE and Δ ABC,

∠D = ∠B ; ∠E = ∠C

∴ ΔADE ~ ΔABC

$$\therefore \frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta ADE} = \frac{AB^2}{AD^2}$$

$$\Rightarrow \frac{AB^2}{AD^2} = 2 \Rightarrow AB = \sqrt{2}\,AD$$

$$\Rightarrow AB = \sqrt{2}\,(AB - DB)$$

$$\Rightarrow \sqrt{2}\,AB - AB = \sqrt{2}\,DB$$

$$\Rightarrow AB(\sqrt{2}-1) = \sqrt{2}\,DB$$

$$\Rightarrow \frac{DB}{AB} = \frac{\sqrt{2}-1}{\sqrt{2}}$$

12. (3) Here, selling prices are same, Profit-loss percent are same.

In such transactions, there is always loss.

$$\text{Loss percent} = \frac{10 \times 10}{100} = 1\%$$

13. (1) $\tan\theta - \cot\theta = 0$

$\Rightarrow \tan\theta = \cot\theta$

$\Rightarrow \tan\theta = \tan(90° - \theta)$

$\Rightarrow \theta = 90° - \theta$

$\Rightarrow 2\theta = 90°$

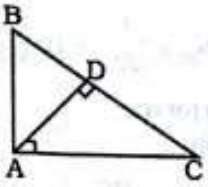
$\Rightarrow \theta = 45°$

$$\therefore \frac{\tan(\theta+15°)}{\tan(\theta-15°)}$$

$$= \frac{\tan(45°+15°)}{\tan(45°-15°)} = \frac{\tan 60°}{\tan 30°}$$

$$= \frac{\sqrt{3}}{\frac{1}{\sqrt{3}}} = \sqrt{3} \times \sqrt{3} = 3$$

14. (3)



BD = 3 cm

CD = 4 cm

In Δ ABC,

$AB^2 + AC^2 = 7^2$

$\Rightarrow AB^2 + AC^2 = 49$ ....(i)

In Δ ABD,

$AB^2 = AD^2 + 3^2 = AD^2 + 9$ ....(ii)

In Δ ADC,

$AC^2 = AD^2 + 16$ ....(iii)

On adding equations (ii) and (iii),

$AB^2 + AC^2 = AD^2 + 9 + AD^2 + 16$

$\Rightarrow 49 = 2AD^2 + 25$

$\Rightarrow 2AD^2 = 49 - 25 = 24$

$\Rightarrow AD^2 = 12$

$\Rightarrow AD = \sqrt{12} = 2\sqrt{3}$ cm.

15. (2) A's monthly income = Rs. $8x$

A's monthly expenditure = Rs. $5y$

B's monthly income = Rs. $5x$

B's monthly expenditure = Rs. $3y$

According to the question,

$8x - 5y = 12000$ ....(i)

$5x - 3y = 10000$ ....(ii)

By equation (i) × 3 − (ii) × 5,

$24x - 15y = 36000$

$25x - 15y = 50000$

\- + −

$-x = -14000$

$\Rightarrow x = 14000$

Difference between monthly incomes of A and B = $8x - 5x$

= Rs. $3x$ = Rs. (3 × 14000)

= Rs. 42000

16. (4) Part of tank filled by pipes A and B in 2 hours

$$= 2\left(\frac{1}{6}+\frac{1}{8}\right)$$

$$= 2\left(\frac{4+3}{24}\right) = \frac{7}{12}$$

Remaining part = $1 - \frac{7}{12} = \frac{5}{12}$

This part is filled by pipe B.

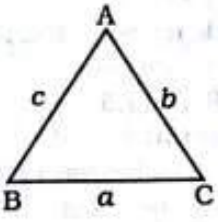
$$\therefore \text{Required time} = \frac{5}{12} \times 8$$

$$= \frac{10}{3} \text{ hours}$$

$$= 3\frac{1}{3} \text{ hours}$$

17. (2) In Δ ABC,

$a = 13$ cm., $b = 20$ cm., $c = 21$ cm.



$$\text{Semi-perimeter} = s = \frac{a+b+c}{2}$$

$$= \left(\frac{13+20+21}{2}\right) \text{cm.}$$

$$= \frac{54}{2} = 27 \text{ cm.}$$

∴ Area of ΔABC = Area of the base of prism

$$= \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{27(27-13)(27-20)(27-21)}$$

$$= \sqrt{27 \times 14 \times 7 \times 6}$$

$$= \sqrt{3 \times 3 \times 3 \times 2 \times 7 \times 7 \times 2 \times 3}$$

$= 3 \times 3 \times 2 \times 7 = 126$ sq. cm.

∴ Volume of prism = Area of base × height

= 126 × 9 = 1134 cu. cm.

18. (3) $\frac{3x-2y}{2x+3y} = \frac{5}{6}$

$\Rightarrow 18x - 12y = 10x + 15y$

$\Rightarrow 18x - 10x = 12y + 15y$

$\Rightarrow 8x = 27y$

$$\Rightarrow \frac{x}{y} = \frac{27}{8}$$

On taking cube root of both sides,

$$\frac{\sqrt[3]{x}}{\sqrt[3]{y}} = \sqrt[3]{\frac{27}{8}} = \frac{3}{2}$$

By componendo and dividendo,

$$\frac{\sqrt[3]{x}+\sqrt[3]{y}}{\sqrt[3]{x}-\sqrt[3]{y}} = \frac{3+2}{3-2} = \frac{5}{1}$$

On squaring both sides,

$$\left(\frac{\sqrt[3]{x}+\sqrt[3]{y}}{\sqrt[3]{x}-\sqrt[3]{y}}\right)^2 = 5 \times 5 = 25$$

19. (3) Let the C.P. of each article be Rs. 100.

$\therefore$ Marked price = Rs. 125

On giving discount,

S.P. = Rs. 112.5

$\therefore$ Discount

$= 125 - 112.5 =$ Rs. 12.5

i.e., $12\frac{1}{2}\%$

20. (3) Volume of earth and stones taken out from the tunnel

$= \pi r^2 h$

$= \left(\frac{22}{7} \times 2 \times 2 \times 56\right)$ cu. metre

$= 704$ cu. metre

Volume of ditch

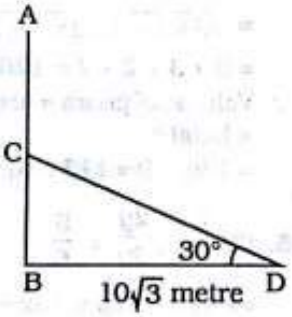
$= (48 \times 16.5 \times 4)$ cu. metre

$= 3168$ cu. metre

$\therefore$ Part of ditch filled

$= \frac{704}{3168} = \frac{2}{9}$ parts

21. (1)



AB = Telegraph post

AC = CD = bent part

BD = $10\sqrt{3}$ metre

In Δ BCD,

$\tan 30° = \frac{BC}{BD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{BC}{10\sqrt{3}}$

$\Rightarrow BC = \frac{1}{\sqrt{3}} \times 10\sqrt{3}$

$= 10$ metre

Again,

$\sin 30° = \frac{BC}{CD}$

$\Rightarrow \frac{1}{2} = \frac{10}{CD}$

$\Rightarrow CD = 20$ metre

$\therefore AB = BC + CD$

$= (10 + 20)$ metre

$= 30$ metre

22. (1) Students in class A $\Rightarrow x$

Students in class B $\Rightarrow y$

Students in class C $\Rightarrow z$

For classes A and B,

$$\frac{83x+76y}{x+y} = 79$$

$\Rightarrow 83x + 76y = 79x + 79y$

$\Rightarrow 83x - 79x = 79y - 76y$

$\Rightarrow 4x = 3y$

For classes B and C

$$\frac{76y+85z}{y+z} = 81$$

$\Rightarrow 76y + 85z = 81y + 81z$

$\Rightarrow 5y = 4z$

$\therefore 20x = 15y = 12z$

$\Rightarrow \frac{20x}{60} = \frac{15y}{60} = \frac{12z}{60}$

$\Rightarrow \frac{x}{3} = \frac{y}{4} = \frac{z}{5}$

$\therefore$ Required average

$$= \frac{83\times3+76\times4+85\times5}{3+4+5}$$

$$= \frac{249+304+425}{12} = \frac{978}{12}$$

$= 81.5$

23. (4) $A = P\left(1+\frac{R}{100}\right)^n$

$\Rightarrow 2P = P\left(1+\frac{R}{100}\right)^5$

On cubing both sides,

$2^3 = \left(1+\frac{R}{100}\right)^{5\times3}$

$\Rightarrow 8 = 1\left(1+\frac{R}{100}\right)^{15}$

$\therefore$ Required time = 15 years

24. (2) (A + B)'s 1 day's work = $\frac{1}{8}$

(B + C)'s 1 day's work = $\frac{1}{12}$

(A + B + C)'s 1 day's work = $\frac{1}{6}$

$\therefore$ C's 1 day's work = $\frac{1}{6} - \frac{1}{8}$

$= \frac{4-3}{24} = \frac{1}{24}$

A's 1 day's work

$= \frac{1}{6} - \frac{1}{12} = \frac{2-1}{12} = \frac{1}{12}$

$\therefore$ (A + C)'s 1 day's work

$= \frac{1}{12} + \frac{1}{24} = \frac{2+1}{24} = \frac{1}{8}$

$\therefore$ Required time = 8 days

25. (1) Sum borrowed = Present worth of Rs. 17640 due 1 year hence + Present worth of Rs. 17640 due 2 years hence

$$= \text{Rs.}\left(\frac{17640}{\left(1+\frac{5}{100}\right)} + \frac{17640}{\left(1+\frac{5}{100}\right)^2}\right)$$

$$= \text{Rs.}\left(17640\times\frac{20}{21} + 17640\times\frac{20}{21}\times\frac{20}{21}\right)$$

$= \text{Rs.}\,(16800 + 16000)$

$= \text{Rs.}\,32800$

26. (3) $\frac{M_1D_1T_1}{W_1} = \frac{M_2D_2T_2}{W_2}$

$$\Rightarrow \frac{90\times16\times12}{1} = \frac{70\times24\times8}{W_2}$$

$$\Rightarrow W_2 = \frac{70\times24\times8}{90\times16\times12} = \frac{7}{9} \text{ parts}$$

27. (1) Let the man buy in all 3 oranges.

$\therefore$ C.P. of 15 oranges at 3 f

Rs. $40 = \frac{40}{3} \times 15 =$ Rs. 200

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Again, C.P. of 15 oranges at 5 for Rs. 60 = $\frac{60}{5} \times 15$ = Rs. 180

∴ Total C.P. = Rs. (200 + 180) = Rs. 380

S.P. of 30 oranges = $\frac{50}{3} \times 30$ = Rs. 500

∴ Profit = Rs. (500 – 380) = Rs. 120

∴ Profit % = $\frac{120}{380} \times 100$

= 31.58% ≈ 32%

28. (1)

2	12, 16, 18, 21
2	6, 8, 9, 21
3	3, 4, 9, 21
	1, 4, 3, 7

∴ LCM = 2 × 2 × 3 × 4 × 3 × 7 = 1008

Multiple of 1008 = 2016

∴ Required number = 2016 – 2000 = 16 = x

∴ Sum of digits of x = 1 + 6 = 7

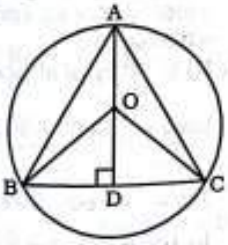
29. (1) Expression = (cot 41° . cot 49°) . (cot 42° . cot 48°) (cot 43° . cot 47°) . (cot 44° . cot 46°) . cot 45°

= cot 41° . tan (90° – 49°) . cot 42° . tan (90° – 48°) . cot 43° . tan (90° – 47°) . cot 44° . tan (90° – 46°).1

= (cot 41° . tan 41°) (cot 42° . tan 42°) . (cot 43° . tan 43°). (cot 44° . tan 44°) . 1 = 1

[∵ tan (90° – θ) = cotθ; tanθ. cotθ = 1]

30. (1)



In Δ OBC ∵ OB = OC

∴ ∠OBC = ∠OCB

∴ ∠BOC = 180° – 2 ∠OBC

In Δ OBD,

∠OBD = ∠OBC = 90° – ∠BOD

Angle subtended by an arc at the centre is twice to that subtended at the circumference.

∴ ∠BAC = $\frac{1}{2}$ ∠BOC

= $\frac{1}{2}$ (180° – 2 ∠OBC)

= 90° – ∠OBC

∴ ∠BAC + ∠OBC = 90°

31. (4) $x = a \sin\theta - b \cos\theta$ --- (i)

$y = a \cos\theta + b \sin\theta$ --- (ii)

On squaring and adding both the equations,

$x^2 + y^2 = (a \sin\theta - b \cos\theta)^2 + (a \cos\theta + b \sin\theta)^2$

$= a^2 \sin^2\theta + b^2 \cos^2\theta - 2ab \sin\theta . \cos\theta + a^2 \cos^2\theta + b^2 \sin^2\theta + 2ab \sin\theta . \cos\theta$

$= a^2 (\sin^2\theta + \cos^2\theta) + b^2 (\cos^2\theta + \sin^2\theta)$

$= a^2 + b^2$

[∵ $\sin^2\theta + \cos^2\theta = 1$]

32. (2) C.P. of article = Rs. x (let)

S.P. at 5% profit

= Rs. $\left(\frac{105x}{100}\right)$ = Rs. $\frac{21x}{20}$

New C.P. of article = $\frac{95x}{100}$

= Rs. $\frac{19x}{20}$

S.P. = Rs. $\left(\frac{19x}{20} \times \frac{110}{100}\right)$

= Rs. $\left(\frac{209x}{200}\right)$

According to the question,

$\frac{21x}{20} - \frac{209x}{200} = 2$

$\Rightarrow \frac{210x - 209x}{200} = 2$

$\Rightarrow \frac{x}{200} = 2$

$\Rightarrow x$ = Rs. 400

33. (2) (P + Q)'s 1 day's work = $\frac{1}{6}$

(Q + R)'s 1 day's work = $\frac{7}{60}$

Let P alone do the work in x days.

According to the question,

$\frac{3}{x} + \frac{6 \times 7}{60} = 1$

$\Rightarrow \frac{3}{x} = 1 - \frac{7}{10} = \frac{3}{10}$

$\Rightarrow x = 10$ days

∴ Q's 1 day's work

= $\frac{1}{6} - \frac{1}{10} = \frac{5-3}{30} = \frac{1}{15}$

R's 1 day's work

= $\frac{7}{60} - \frac{1}{15} = \frac{7-4}{60} = \frac{1}{20}$

∴ Time taken by R = 20 days

∴ Required answer = 20 – 10 = 10 days

34. (4) HCF of numbers = 21

∴ Numbers = $21x$ and $21y$ Where x and y are prime to each other.

Ratio of numbers = 1 : 4

∴ Larger number = 21 × 4 = 84

35. (2) According to the question,

$\frac{60A}{100} = \frac{30B}{100}$

$\Rightarrow \frac{3A}{5} = \frac{3B}{10} = \frac{3}{10} \times \frac{40}{100}$ C

$\Rightarrow \frac{3A}{5} = \frac{3C}{25} = \frac{3}{25} \times A \times \frac{x}{100}$

$\Rightarrow \frac{3}{5} = \frac{3x}{2500}$

$\Rightarrow 5x = 2500$

$\Rightarrow x = \frac{2500}{5} = 500$

36. (4) Total staff strength in the office = 100 (let)

Females = 40

Males = 60

Married females = $\frac{40 \times 70}{100}$ = 28

Unmarried females = 40 – 28 = 12

Unmarried males = 30

∴ Unmarried staff = 30 + 12 = 42

i.e. 42%

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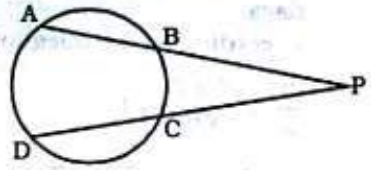
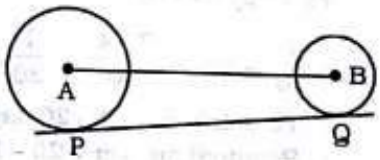
37. (4)



Clearly,
$AP \times BP = PD \times PC$
$\Rightarrow 8 \times 6 = PD \times 4$

$\Rightarrow PD = \frac{8 \times 6}{4} = 12$ cm.

38. (3)



$PQ = \sqrt{AB^2 - (r_1 - r_2)^2}$

$= \sqrt{13^2 - (11-6)^2}$

$= \sqrt{13^2 - 5^2} = \sqrt{169 - 25}$

$= \sqrt{144} = 12$ cm.

39. (3) Circumference of the wheel of car $= \pi \times d$

$= \frac{22}{7} \times 70 = 220$ cm.

= Distance covered in one rotation

∴ Distance covered by car in 1 minute = (400 × 220) cm.

∴ Distance covered by car in 1 hour = (400 × 220 × 60) cm.

$= \left(\frac{400 \times 220 \times 60}{1000 \times 100}\right)$ km.

= 52.8 km.

∴ Speed of car = 52.8 kmph

40. (2) Percentage effect

$= \left(20 - 20 + \frac{20 \times -20}{100}\right)\%$

$= -4\%$

Negative sign shows decrease.

41. (1) $\sec\theta - \tan\theta = \frac{1}{\sqrt{3}}$ ....(i)

$\because \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$\Rightarrow \sec\theta + \tan\theta = \sqrt{3}$ ....(ii)

On adding equations (i) and (ii),

$2\sec\theta = \sqrt{3} + \frac{1}{\sqrt{3}}$

$= \frac{3+1}{\sqrt{3}} = \frac{4}{\sqrt{3}}$

$\Rightarrow \sec\theta = \frac{2}{\sqrt{3}}$

Again, by equation (ii) – (i),

$2\tan\theta = \sqrt{3} - \frac{1}{\sqrt{3}}$

$= \frac{3-1}{\sqrt{3}} = \frac{2}{\sqrt{3}}$

$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$

$\therefore \sec\theta \cdot \tan\theta$

$= \frac{2}{\sqrt{3}} \times \frac{1}{\sqrt{3}} = \frac{2}{3}$

42. (2) Total distance
$= 7 \times 4 = 28$ km.
Total time

$= \left(\frac{7}{10} + \frac{7}{20} + \frac{7}{30} + \frac{7}{60}\right)$ hours

$= \left(\frac{42+21+14+7}{60}\right)$ hours

$= \frac{84}{60}$ hours $= \frac{7}{5}$ hours

∴ Average speed

$= \frac{\text{Total distance}}{\text{Total time}} = \left(\frac{28}{\frac{7}{5}}\right)$ kmph

$= \frac{28 \times 5}{7} = 20$ kmph

43. (4) Volume of tank $= (1.2)^3$ cubic metre
$= 1.728$ cubic metre
∴ 64 × Volume of 1 bucket

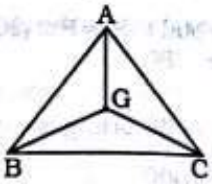
$= \frac{2 \times 1.728}{3}$ cubic metre

∴ Volume of 1 bucket

$= \left(\frac{1.728 \times 2}{3 \times 64}\right)$ cubic metre

= 0.018 cubic metre
= (0.018 × 1000) litres
= 18 litres

44. (4)

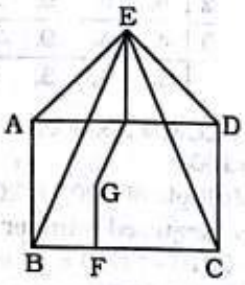


$\Delta GBC = \Delta ACG = \Delta AGB$
∴ Area of ΔGBC

$= \frac{1}{3} \times$ Area of ΔABC

$= \frac{1}{3} \times 60 = 20$ sq.cm.

45. (4)



Slant height = BE $= \sqrt{12^2 + 5^2}$

$= \sqrt{144 + 25} = \sqrt{169} = 13$ cm.

∴ Lateral surface of pyramid

$= \frac{1}{2} \times$ perimeter of base × slant height

$= \frac{1}{2} \times 40 \times 13 = 260$ sq. cm.

Area of base = 10 × 10
= 100 sq. cm.
∴ Total surface area
= (260 + 100) sq. cm.
= 360 sq. cm.

46. (2) In 60 kg of alloy A,

Lead $= \frac{3}{5} \times 60 = 36$ kg.

Tin $= \frac{2}{5} \times 60 = 24$ kg.

In 100 kg of alloy B,

Tin $= \frac{1}{5} \times 100 = 20$ kg.

In 160 kg of new alloy,
Tin = 24 + 20 = 44 kg.

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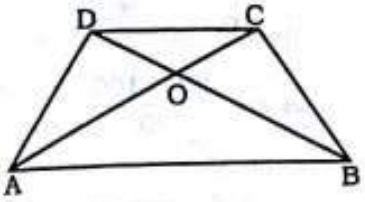
47. (4) $5\cos\theta + 12\sin\theta = 13$

$\Rightarrow \frac{5}{13}\cos\theta + \frac{12}{13}\sin\theta = 1$

$\because \sin^2\theta + \cos^2\theta = 1$

$\therefore \sin\theta = \frac{12}{13}, \cos\theta = \frac{5}{13}$

48. (2)



DC || AB

$\angle DCA = \angle CAB$

$\angle CDB = \angle DBA$

$\therefore \Delta COD \sim \Delta AOB$

$\therefore \frac{\text{Area of } \Delta COD}{\text{Area of } \Delta AOB}$

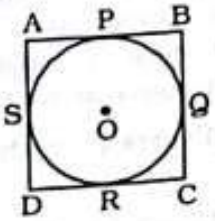
$= \frac{CD^2}{AB^2} = \frac{CD^2}{4\,CD^2} = \frac{1}{4}$

$\therefore$ Area of Δ COD

$= \frac{1}{4} \times 84$

$= 21$ sq. cm.

49. (1)



Since tangents drawn from an exterior point to a circle are equal in length.

$\therefore$ AP = AS

BP = BQ

CR = CQ

DR = DS

On adding all these,

AP + BP + CR + DR = AS + BQ + CQ + DS

$\Rightarrow$ (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)

$\Rightarrow$ AB + CD = BC + DA

$\Rightarrow 7 + 9.2 = 8.5 + DA$

$\Rightarrow 16.2 = 8.5 + DA$

$\Rightarrow DA = 16.2 - 8.5 = 7.7$ cm.

50. (1) In the school,

Boys $\Rightarrow \frac{4}{7} \times 1554 = 888$

Girls $\Rightarrow \frac{3}{7} \times 1554 = 666$

After 30 days,

Girls = 666 + 30 = 696

If x boys leave the school, then,

According to the question,

$\frac{888 - x}{696} = \frac{7}{6}$

$\Rightarrow \frac{888 - x}{116} = 7$

$\Rightarrow 888 - x = 116 \times 7 = 812$

$\Rightarrow x = 888 - 812 = 76$

51. (2) Area of triangle = $\frac{1}{2}$ × base × height

$= \frac{1}{2} \times b \times h$

$\therefore$ According to the question,

$\frac{\frac{1}{2} \times b_1 h_1}{\frac{1}{2} b_2 h_2} = \frac{3}{2}$

$\Rightarrow \frac{b_1}{b_2} \times \frac{4}{5} = \frac{3}{2}$

$\Rightarrow \frac{b_1}{b_2} = \frac{3}{2} \times \frac{5}{4} = \frac{15}{8}$

52. (3) A : B = 2 : 3

B : C = 3 : 7

$\therefore$ A : B : C = 2 : 3 : 7

$\therefore$ A = 2k, B = 3k, C = 7k

$\therefore$ A + B = 5k; B + C = 10k, C + A = 9k

$\therefore$ Required ratio = 5k : 10k : 9k = 5 : 10 : 9

53. (4) $a - \frac{1}{(a-3)} = 5$

$\Rightarrow (a-3) - \frac{1}{(a-3)} = 2$

On cubing both sides,

$\left\{(a-3) - \frac{1}{(a-3)}\right\}^3 = 8$

$\Rightarrow (a-3)^3 - \left(\frac{1}{a-3}\right)^3 - 3 \times (a-3)\left(\frac{1}{a-3}\right)\left((a-3) - \frac{1}{(a-3)}\right) = 8$

$[\because (a-b)^3 = a^3 - b^3 - 3ab(a-b)]$

$\Rightarrow (a-3)^3 - \left(\frac{1}{a-3}\right)^3 - 3 \times 2 = 8$

$\Rightarrow (a-3)^3 - \left(\frac{1}{a-3}\right)^3 = 8 + 6$

$= 14$

54. (4) Let, 0.67 = a and 0.33 = b

$\therefore$ Expression $= \frac{a^3 - b^3}{(a^2 + ab + b^2)}$

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

$= a - b = 0.67 - 0.33 = 0.34$

55. (2) $3^{50} = (3^5)^{10} = (243)^{10}$

$4^{40} = (4^4)^{10} = (256)^{10}$

$5^{30} = (5^3)^{10} = (125)^{10}$

$6^{20} = (6^2)^{10} = (36)^{10}$

$\therefore$ Largest number = 4^{40}

56. (4) Let the number of sides of regular polygon be n.

According to the question,

$\frac{(2n-4) \times 90°}{n} - \frac{360°}{n} = 108$

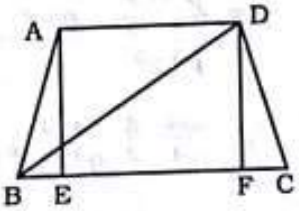
$\Rightarrow \frac{(2n-4) \times 5}{n} - \frac{20}{n} = 6$

$\Rightarrow 10n - 20 - 20 = 6n$

$\Rightarrow 10n - 6n = 40$

$\Rightarrow 4n = 40 \Rightarrow n = 40 \div 4 = 10$

57. (3)



BC = 7x cm.

AD = 4x cm.

AB = DC ; AE $\perp$ BC ; DF $\perp$ BC

Area of trapezium ABCD

$= \frac{1}{2} \times (AD + BC) \times AE$

$\Rightarrow 176 = \frac{1}{2} \times 11x \times \frac{2}{11} \times 11x$

$\Rightarrow 176 = 11x^2$

$\Rightarrow x^2 = \frac{176}{11} = 16$

$\Rightarrow x = \sqrt{16} = 4$

$\therefore$ BC = 7 × 4 = 28 cm.

AD = 4 × 4 = 16 cm.

$\therefore$ BE = FC = $\frac{1}{2}$ (28 – 16) cm.

= 6 cm.

$\therefore$ BF = 16 + 6 = 22 cm.

$\therefore$ DF = $\frac{2}{11} \times 11x = 2x$

= 8 cm.

$\therefore$ Diagonal BD = $\sqrt{BF^2 + FD^2}$

$= \sqrt{22^2 + 8^2}$

$= \sqrt{484 + 64}$

$= \sqrt{548} = \sqrt{4 \times 137}$

$= 2\sqrt{137}$ cm.

58. (•) $\left(\frac{p^{-1}q^2}{p^3q^{-2}}\right)^{\frac{1}{3}} \div \left(\frac{p^6q^{-3}}{p^{-2}q^3}\right)^{\frac{1}{3}}$

$= p^a q^b$

$\Rightarrow \left(p^{-1-3}\ q^{2+2}\right)^{\frac{1}{3}} \div \left(p^{6+2}\ q^{-3-3}\right)^{\frac{1}{3}}$

$= p^a q^b$

$\Rightarrow \left(p^{-4}q^4\right)^{\frac{1}{3}} \div \left(p^8q^{-6}\right)^{\frac{1}{3}} = p^a q^b$

$\Rightarrow \frac{p^{\frac{-4}{3}}q^{\frac{4}{3}}}{p^{\frac{8}{3}}q^{\frac{-6}{3}}} = p^a q^b$

$\Rightarrow p^{\frac{-4}{3}-\frac{8}{3}}\ q^{\frac{4}{3}+\frac{6}{3}} = p^a q^b$

$\Rightarrow p^{-4}\ q^{\frac{10}{3}} = p^a q^b$

$\Rightarrow a = -4, b = \frac{10}{3}$

$\therefore a + b = -4 + \frac{10}{3} = \frac{-2}{3}$

59. (2) Let the capacity of each glass be 1 litre.

On mixing all three mixtures together,

Acid $\Rightarrow \frac{2}{5} + \frac{3}{7} + \frac{4}{9}$

$= \frac{126+135+140}{315}$

$= \frac{401}{315}$ litre

Water $\Rightarrow \frac{3}{5} + \frac{4}{7} + \frac{5}{9}$

$= \frac{189+180+175}{315} = \frac{544}{315}$

$\therefore$ Required ratio

$= \frac{401}{315} : \frac{544}{315}$

= 401 : 544

60. (4) C.P. of rice per kg

$= \frac{54 \times 100}{90}$ = Rs. 60

For 20% profit,

S.P. per kg.

$= \frac{60 \times 120}{100}$ = Rs. 72

61. (2) Five consecutive integers are :

$x, x+1, x+2, x+3$ and $x+4$

$\therefore$ Their average

$= \frac{x+x+1+x+2+x+3+x+4}{5}$

$= \frac{5x+10}{5} = x+2$

New average

$= \frac{(5x+10)+x+5+x+6}{7}$

$= \frac{7x+21}{7} = x+3$

Difference = $x + 3 - x - 2 = 1$

62. (3)

Volume of hemisphere

$= \frac{2}{3}\pi R^3$ cu. units

Volume of newphere

$= \frac{4}{3}\pi r^3$ cu. units

According to the question,

$\frac{2}{3}\pi R^3 = 4 \times \frac{4}{3}\pi r^3$

$\Rightarrow R^3 = 8r^3$

$\Rightarrow R = 2r$ units

63. (3) Marked price of toy = Rs

A discount of 20% is given

$\therefore \frac{80x}{100} = 300$

$\Rightarrow x = \frac{300 \times 100}{80}$

= Rs. 375

$\therefore$ Profit percent

$= \left(\frac{405 - 375}{375}\right) \times 100 = 8\%$

64. (4) Total age of initial 30 students

= 14 years 4 months × 30

= 430 years

Total age of 35 students

= 13 years 9 months × 35

= (455 + 26) years 3 months

= 481 years 3 months

$\therefore$ Total age of 4 new students

= 481 years 3 months – 43 years – 9 years 11 months

= 481 years 3 months – 43 years 11 months

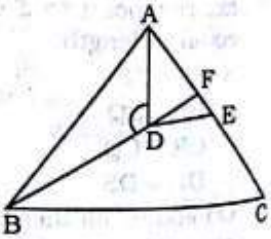
= 41 years 4 months

$\therefore$ Required average

$= \frac{41 \text{ years } 4 \text{ months}}{4}$

= 10 years 4 months

65. (4)



DE || BC

and E is the mid-point of AC.

$\therefore$ AE = $\frac{1}{2}$ AC

$= \frac{1}{2} \times 12 = 6$ cm.

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66. (1) $7^1 = 7$, $7^2 = 49$, $7^3 = 343$, $7^4 = 2401$, $7^5 = 16807$

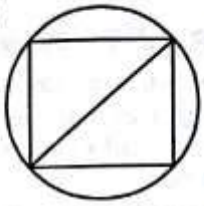
i.e. after index 4, the unit's digit is repeated.

∴ On dividing 153 by 4, remainder = 1

∴ Unit's digit in the expansion of $(2467)^{153} = 7^1 = 7$ and unit's digit in the expansion of $(341)^{72} = 1$

∴ Required unit's digit $= 7 \times 1 = 7$

67. (1)



Diagonal of cube = Diameter of sphere

$= 6\sqrt{3} \times 2 = 12\sqrt{3}$ cm.

∴ Edge of cube $= \dfrac{12\sqrt{3}}{\sqrt{3}}$

$= 12$ cm.

∴ Surface area of cube

$= 6 \times (\text{edge})^2$

$= (6 \times 12 \times 12)$ sq. cm.

$= 864$ sq. cm.

68. (3) $a + b = 1$ (Given)

Expression $= a^3 + b^3 - ab - (a^2 - b^2)^2$

$= (a+b)(a^2 - ab + b^2) - ab - (a^2 - b^2)^2$

$= (a^2 - ab + b^2) - ab - (a+b)^2 (a-b)^2$

$= a^2 - ab + b^2 - ab - (a^2 - 2ab + b^2)$

$= a^2 - 2ab + b^2 - a^2 + 2ab - b^2 = 0$

69. (1) $7\sin^2\theta + 3\cos^2\theta = 4$

On dividing both sides by $\cos^2\theta$,

$$7\frac{\sin^2\theta}{\cos^2\theta} + \frac{3\cos^2\theta}{\cos^2\theta} = \frac{4}{\cos^2\theta}$$

$\Rightarrow 7\tan^2\theta + 3 = 4\sec^2\theta$

$\Rightarrow 7\tan^2\theta + 3 = 4(1 + \tan^2\theta)$

$\Rightarrow 7\tan^2\theta + 3 = 4 + 4\tan^2\theta$

$\Rightarrow 7\tan^2\theta - 4\tan^2\theta = 4 - 3$

$\Rightarrow 3\tan^2\theta = 1 \Rightarrow \tan^2\theta = \dfrac{1}{3}$

$\Rightarrow \tan\theta = \dfrac{1}{\sqrt{3}}$

70. (2) Volume of cylinder $= \pi r^2 h$

$= (\pi \times 8 \times 8 \times 2)$ cu. cm.

$= 128\pi$ cu. cm.

If the radius of the base of cone be R cm. then

$$\frac{1}{3}\pi R^2 H = 128\pi$$

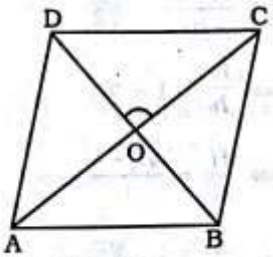
$\Rightarrow R^2 \times 6 = 128 \times 3$

$\Rightarrow R^2 = \dfrac{128 \times 3}{6} = 64$

$\Rightarrow R = \sqrt{64} = 8$ cm.

71. (2) Side of rhombus

$= \dfrac{\text{Perimeter}}{4} = \dfrac{60}{4} = 15$ cm.



$d_1 = AC = 24$ cm.

$OC = 12$ cm.

$CD = 15$ cm.

$\angle COD = 90°$

∴ In ΔOCD,

$OD = \sqrt{CD^2 - OC^2}$

$= \sqrt{15^2 - 12^2} = \sqrt{225 - 144}$

$= \sqrt{81} = 9$ cm.

∴ $d_2 = BD = 2 \times 9 = 18$ cm.

∴ Area of rhombus

$= \dfrac{1}{2} d_1 d_2 = \dfrac{1}{2} \times 24 \times 18$

$= 216$ sq. cm.

72. (*) $a + \dfrac{1}{b} = b + \dfrac{1}{c} = c + \dfrac{1}{a}$

$$\Rightarrow \frac{abc + c}{bc} = \frac{abc + a}{ac}$$

$$= \frac{abc + b}{ab}$$

$$\Rightarrow \frac{c}{bc} = \frac{a}{ac} = \frac{b}{ab}$$

$$\Rightarrow \frac{1}{b} = \frac{1}{c} = \frac{1}{a}$$

$\Rightarrow a = b = c = 1$

∴ $a^2 b^2 c^2 = 1$

73. (3) Let the work be completed in x days.

According to the question,

$$\frac{x}{16} + \frac{x-8}{32} + \frac{x-6}{48} = 1$$

$$\Rightarrow \frac{6x + 3x - 24 + 2x - 12}{96} = 1$$

$\Rightarrow 11x - 36 = 96$

$\Rightarrow 11x = 96 + 36 = 132$

$\Rightarrow x = \dfrac{132}{11} = 12$ days

74. (3) Let 5 kg of mixture be prepared.

∴ C.P. of 5 kg of mixture

$= \text{Rs.}\ (2 \times 35 + 3 \times 40)$

$= \text{Rs.}\ (70 + 120)$

$= \text{Rs.}\ 190$

Total S.P. of this mixture

$= \text{Rs.}\ (46 + 4 \times 55)$

$= \text{Rs.}\ (46 + 220) = \text{Rs.}\ 266$

∴ Profit per cent

$$= \left(\frac{266 - 190}{190}\right) \times 100$$

$$= \frac{7600}{190} = 40\%$$

75. (1) Expression

$= (\text{cosec}\,a - \sin a)(\sec a - \cos a)(\tan a + \cot a)$

$$= \left(\frac{1}{\sin a} - \sin a\right)\left(\frac{1}{\cos a} - \cos a\right)\left(\frac{\sin a}{\cos a} + \frac{\cos a}{\sin a}\right)$$

$$= \left(\frac{1 - \sin^2 a}{\sin a}\right)\left(\frac{1 - \cos^2 a}{\cos a}\right) \cdot \frac{\sin^2 a + \cos^2 a}{\cos a . \sin a}$$

$$= \frac{\cos^2 a}{\sin a} \times \frac{\sin^2 a}{\cos a} \times \frac{1}{\cos a . \sin a}$$

$= 1$

76. (1) $\dfrac{x^3 - y^3}{x^2 + xy + y^2} = \dfrac{5}{1}$

$$\Rightarrow \frac{(x-y)(x^2 + xy + y^2)}{x^2 + xy + y^2} = 5$$

$\Rightarrow x - y = 5$ ....(i)

Again,

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$$\frac{x^2-y^2}{x-y}=7$$

$$\Rightarrow \frac{(x+y)(x-y)}{x-y}=7$$

$\Rightarrow x+y=7$ ....(ii)

On adding equations (i) and (ii),

$2x=12 \Rightarrow x=6$

From equation (ii),

$x+y=7 \Rightarrow y=7-6=1$

$$\therefore \frac{2x}{3y}=\frac{2\times6}{3\times1}=4:1$$

77. (1) Let the required distance be x km.

Difference of time $= 7+5=12$ minutes $= \frac{1}{5}$ hour

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

According to the question,

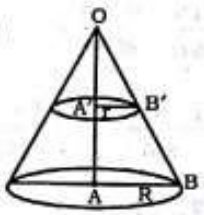
$$\frac{x}{5}-\frac{x}{6}=\frac{1}{5}$$

$$\Rightarrow \frac{6x-5x}{30}=\frac{1}{5}$$

$$\Rightarrow \frac{x}{30}=\frac{1}{5}$$

$$\Rightarrow x=\frac{30}{5}=6 \text{ km.}$$

78. (4)



$OA' = h$ units

$AA' = H$ units

$AB = R$ units

$A'B' = r$ units.

$A'B' \parallel AB$

$\angle OA'B' = \angle OAB$

$\angle OB'A' = \angle OBA$

$\therefore \Delta OAB \sim \Delta OA'B'$

$$\therefore \frac{OA'}{OA}=\frac{A'B'}{AB}$$

$$\Rightarrow \frac{h}{H+h}=\frac{r}{R}$$

According to the question,

$$\frac{1}{3}\pi r^2h=\frac{1}{3}\pi R^2(H+h)-\frac{1}{3}\pi r^2h$$

$$\Rightarrow \frac{2}{3}\pi r^2h=\frac{1}{3}\pi R^2(H+h)$$

$$\Rightarrow 2\frac{r^2}{R^2}=\frac{H+h}{h}$$

$$\Rightarrow 2.\frac{h^2}{(H+h)^2}=\frac{H+h}{h}$$

$$\Rightarrow \frac{(H+h)^3}{h^3}=2$$

$$\Rightarrow \frac{H+h}{h}=\sqrt[3]{2}$$

$$\Rightarrow \frac{H}{h}+1=\sqrt[3]{2}$$

$$\Rightarrow \frac{H}{h}=\frac{\sqrt[3]{2}-1}{1}$$

$$\therefore \frac{h}{H}=1:\sqrt[3]{2}-1$$

79. (1) $x=a^{\frac{1}{2}}+a^{\frac{-1}{2}}$

$y=a^{\frac{1}{2}}-a^{\frac{-1}{2}}$

$\therefore x^2-y^2=4a^{\frac{1}{2}}.a^{\frac{-1}{2}}=4$

$[\because (a+b)^2-(a-b)^2=4ab]$

Again, $y^2-x^2=-4.a^{\frac{1}{2}}.a^{\frac{-1}{2}}=-4$

Expression

$= (x^4-x^2y^2-1)+(y^4-x^2y^2+1)$

$x^2(x^2-y^2)-1+y^2(y^2-x^2)+1$

$= 4x^2-1-4y^2+1$

$= 4(x^2-y^2)=4\times4=16$

80. (4) Cost of production of article = Rs. 100 (let)

$\therefore$ Marked price = Rs. 140

$$\text{S.P.}=\frac{140\times80}{100}=\text{Rs. } 112$$

$\therefore$ Profit $= 112-100=$ Rs. 12

$\because$ When Profit = Rs. 12

Cost of production = Rs. 100

$\therefore$ When profit = Rs. 48

$$\text{Cost of production}=\frac{100}{12}\times48$$

$=$ Rs. 400

81. (2) Rate = R% per annum

$$\therefore \text{Time}=\frac{R}{2} \text{ years}$$

$$\therefore \text{Rate}=\frac{\text{S.I.}\times100}{\text{Principal}\times\text{Time}}$$

$$\Rightarrow R=\frac{8}{25}\times\frac{100}{\frac{R}{2}}$$

$$\Rightarrow R^2=\frac{8\times200}{25}=64$$

$\Rightarrow R=\sqrt{64}=8\%$ per annum

82. (2) $x^2+y^2+z^2=xy+yz+zx$

$\Rightarrow x^2+y^2+z^2-xy-yz-zx=0$

$\Rightarrow 2x^2+2y^2+2z^2-2xy-2yz-2zx=0$

$\Rightarrow x^2+y^2-2xy+y^2+z^2-2yz+x^2+z^2-2zx=0$

$\Rightarrow (x-y)^2+(y-z)^2+(z-x)^2=0$

$\therefore x-y=0 \Rightarrow x=y$

$y-z=0 \Rightarrow y=z$

$z-x=0 \Rightarrow z=x$

$\therefore x=y=z$

[If $a^2+b^2+c^2=0$, then $a=0$, $b=0$, $c=0$]

$\therefore$ Expression

$$=\frac{3x^4+7y^4+5z^4}{5x^2y^2+7y^2z^2+3z^2x^2}$$

$$=\frac{3x^4+7x^4+5x^4}{5x^4+7x^4+3x^4}$$

$$=\frac{15x^4}{15x^4}=1$$

83. (1) $x-\sqrt{3}-\sqrt{2}=0$

$\Rightarrow x=\sqrt{3}+\sqrt{2}$

Again,

$y-\sqrt{3}+\sqrt{2}=0$

$\Rightarrow y=\sqrt{3}-\sqrt{2}$

$\therefore x-y=\sqrt{3}+\sqrt{2}-\sqrt{3}+\sqrt{2}$

$=2\sqrt{2}$

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

$=3-2=1$

$\therefore$ Expression

$=x^3-20\sqrt{2}-y^3-2\sqrt{2}$

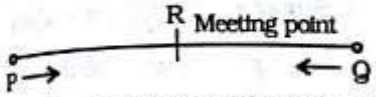
$= x^3 - y^3 - 22\sqrt{2}$

$= (x-y)^3 + 3xy(x-y) - 22\sqrt{2}$

$= \left(2\sqrt{2}\right)^3 + 3\left(2\sqrt{2}\right) - 22\sqrt{2}$

$= 16\sqrt{2} + 6\sqrt{2} - 22\sqrt{2} = 0$

84. (3)



Speed of train starting from Q = x kmph

∴ Speed of train starting from P = $(x+8)$ kmph

According to the question,

PR + RQ = PQ

$\Rightarrow (x+8) \times 6 + x \times 6 = 162$

[Distance = Speed × Time]

$\Rightarrow 6x + 48 + 6x = 162$

$\Rightarrow 12x = 162 - 48 = 114$

$\Rightarrow x = \frac{114}{12} = \frac{19}{2}$

$= 9\frac{1}{2}$ kmph

85. (4) $3a^2 + 3b^2 + 3c^2 = (a+b+c)^2$

$\Rightarrow 3a^2 + 3b^2 + 3c^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$

$\Rightarrow 3a^2 + 3b^2 + 3c^2 - a^2 - b^2 - c^2 - 2ab - 2bc - 2ac = 0$

$\Rightarrow 2a^2 + 2b^2 + 2c^2 - 2ab - 2bc - 2ac = 0$

$\Rightarrow a^2 + b^2 - 2ab + b^2 + c^2 - 2bc + a^2 + c^2 - 2ac = 0$

$\Rightarrow (a-b)^2 + (b-c)^2 + (c-a)^2 = 0$

$\Rightarrow a - b = 0 \Rightarrow a = b$

$b - c = 0 \Rightarrow b = c$

$c - a = 0 \Rightarrow c = a$

$\therefore a = b = c$

86. (4) Volume of sphere = $\frac{4}{3}\pi r^3$

∴ Total volume of both spheres

$= \frac{4}{3}\pi (r_1^3 + r_2^3)$

$= \frac{4}{3}\pi (1^3 + 6^3)$

$= \frac{4}{3}\pi (1 + 216)$

$= \left(\frac{4\pi}{3} \times 217\right)$ cu. cm.

If the internal radius of hollow sphere = r cm, then

∴ Volume of the iron of this sphere = $\frac{4}{3}\pi (9^3 - r^3)$ cu.cm.

According to the question,

$\frac{4}{3}\pi (9^3 - r^3) = \frac{4\pi}{3} \times 217$

$\Rightarrow 729 - r^3 = 217$

$\Rightarrow r^3 = 729 - 217 = 512$

$\Rightarrow r^3 = (8)^3$

$\Rightarrow r = 8$ cm

∴ Required thickness $= 9 - r = 9 - 8 = 1$ cm.

87. (2) Number of girls = $4x$

Number of boys = $5x$

∴ Required average marks

$= \frac{4x \times 85 + 5x \times 87}{4x + 5x}$

$= \frac{340 + 435}{9} = \frac{775}{9} = 86.1$

88. (4) $\sin A + \sin^2 A = 1$

$\Rightarrow \sin A = 1 - \sin^2 A = \cos^2 A$

∴ $\cos^2 A + \cos^4 A$

$= \cos^2 A + (\cos^2 A)^2$

$= \cos^2 A + \sin^2 A = 1$

89. (2) Amount of cash payment

$= \text{Rs.} \left(12600 \times \frac{95}{100} \times \frac{98}{100}\right)$

= Rs. 11730.60

90. (3) LCM of 5, 6, 7 and 8 = 840

2	5, 6, 7, 8
	5, 3, 7, 4

∴ LCM = $2 \times 5 \times 3 \times 7 \times 4 = 840$

∴ Required number = $840x + 3$ which is divisible by 9 for a certain least value of x.

Now,

$840x + 3 = 93x \times 9 + 3x + 3$

$3x + 3$, is divisible by 9 for $x = 2$

∴ Required number = $840 \times 2 + 3$

$= 1680 + 3 = 1683$

∴ Sum of digits = $1 + 6 + 8 + 3 = 18$

91. (1) Expression

$= 4 - \cfrac{5}{1 + \cfrac{1}{3 + \cfrac{1}{\cfrac{8+1}{4}}}}$

$= 4 - \cfrac{5}{1 + \cfrac{1}{3 + \frac{4}{9}}} = 4 - \cfrac{5}{1 + \cfrac{1}{\frac{27+4}{9}}}$

$= 4 - \cfrac{5}{1 + \frac{9}{31}} = 4 - \cfrac{5}{\frac{31+9}{31}}$

$= 4 - \frac{5 \times 31}{40} = \frac{160 - 155}{40}$

$= \frac{5}{40} = \frac{1}{8}$

92. (2) Cost of production of article = Rs. 100 (let)

∴ S.P. = Rs. 133

New cost of production = Rs. 112

∴ S.P. = $\frac{133 \times 110}{100}$

= Rs. 146.30

∴ Profit per cent

$= \left(\frac{146.3 - 112}{112}\right) \times 100$

$= \frac{34.3 \times 100}{112} = \frac{3430}{112}$

$= \frac{245}{8} = 30\frac{5}{8}\%$

93. (3) Ten's digit of original number = x

∴ Unit's digit = $2x$

∴ Number = $10x + 2x = 12x$

According to the question,

$3x - 2 = \frac{1}{6} \times 12x$

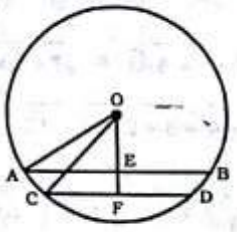
$\Rightarrow 3x - 2 = 2x$

$\Rightarrow 3x - 2x = 2$

$\Rightarrow x = 2$

∴ Number = $12x = 12 \times 2 = 24$

94. (3)



SOLVED PAPER-36

OA = OC = radius
OE ⊥ AB
OF ⊥ CD
∴ AE = EB = 5 cm.
CF = FD = 2 cm.
OE = x cm.
In Δ OAE,
$OA^2 = AE^2 + OE^2$
$\Rightarrow OA^2 = 5^2 + x^2$ .....(i)
In Δ OCF,
$OC^2 = 2^2 + (x+3)^2$ .....(ii)
$\therefore 5^2 + x^2 = 2^2 + (x+3)^2$
$\Rightarrow 25 + x^2 = 4 + x^2 + 6x + 9$
$\Rightarrow 6x = 25 - 13 = 12$

$\Rightarrow x = \frac{12}{6} = 2$ cm.

$\therefore OA^2 = 25 + x^2 = 25 + 4 = 29$

$\therefore OA = \sqrt{29}$ cm.

∴ Diameter of circle $= 2\sqrt{29}$ cm.

95. (2) Lateral surface of cone

$= \pi r\sqrt{h^2 + r^2}$

Its volume $= \frac{1}{3}\pi r^2 h$

According to the question,

$\pi r\sqrt{h^2 + r^2} = \frac{1}{3}\pi r^2 h$

$\Rightarrow \sqrt{h^2 + r^2} = \frac{rh}{3}$

On squaring both sides,

$h^2 + r^2 = \frac{r^2h^2}{9}$

$\Rightarrow \frac{h^2 + r^2}{r^2h^2} = \frac{1}{9}$

$\Rightarrow \frac{h^2}{r^2h^2} + \frac{r^2}{r^2h^2} = \frac{1}{9}$

$\Rightarrow \frac{1}{r^2} + \frac{1}{h^2} = \frac{1}{9}$

96. (1) $\sqrt{7+4\sqrt{3}} = \sqrt{7+2\times2\times\sqrt{3}}$

$= \sqrt{4+3+2\times2\times\sqrt{3}}$

$= \sqrt{\left(2+\sqrt{3}\right)^2} = 2 + \sqrt{3}$

$\sqrt{4+2\times\sqrt{3}\times1} = \sqrt{3+1+2\times\sqrt{3}\times1}$

$= \sqrt{\left(\sqrt{3}+1\right)^2} = \sqrt{3} + 1$

$\therefore \sqrt{7+4\sqrt{3}} - \sqrt{4+2\sqrt{3}}$

$= 2 + \sqrt{3} - \sqrt{3} - 1 = 1$

Again, $1^2 + 2^2 + \ldots\ldots + 10^2$

$= \frac{10\,(10+1)(20+1)}{6}$

$= \frac{10\times11\times21}{6} = 385$

$1^2 + 2^2 + \ldots\ldots + 5^2$

$= \frac{5\,(5+1)(10+1)}{6}$

$= \frac{5\times6\times11}{6} = 55$

$\left[\because 1^2 + 2^2 + 3^2 + \text{---} + n^2 = \frac{n(n+1)(2n+1)}{6}\right]$

$\therefore 6^2 + 7^2 + 8^2 + 9^2 + 10^2$
$= 385 - 55 = 330$

∴ Expression $= \frac{330}{1} = 330$

97. (4) $\tan A = n \tan B$

$\Rightarrow \tan B = \frac{1}{n}\tan A$

$\Rightarrow \cot B = \frac{n}{\tan A}$

and, $\sin A = m \sin B$

$\Rightarrow \sin B = \frac{1}{m}\sin A$

$\Rightarrow \text{cosec } B = \frac{m}{\sin A}$

$\because \text{cosec}^2 B - \cot^2 B = 1$

$\Rightarrow \frac{m^2}{\sin^2 A} - \frac{n^2}{\tan^2 A} = 1$

$\Rightarrow \frac{m^2}{\sin^2 A} - \frac{n^2\cos^2 A}{\sin^2 A} = 1$

$\Rightarrow \frac{m^2 - n^2\cos^2 A}{\sin^2 A} = 1$

$\Rightarrow m^2 - n^2\cos^2 A = \sin^2 A$
$\Rightarrow m^2 - n^2\cos^2 A = 1 - \cos^2 A$
$\Rightarrow m^2 - 1 = n^2\cos^2 A - \cos^2 A$
$\Rightarrow m^2 - 1 = (n^2 - 1)\cos^2 A$

$\Rightarrow \cos^2 A = \frac{m^2 - 1}{n^2 - 1}$

98. (3) In 300 gm of solution,

Sugar $= \frac{300\times40}{100} = 120$ gm.

Let x gm of sugar be mixed.
According to the question,

$\frac{120 + x}{300 + x} = \frac{1}{2}$

$\Rightarrow 240 + 2x = 300 + x$
$\Rightarrow 2x - x = 300 - 240$
$\Rightarrow x = 60$ gm.

99. (3) Let A leave the work after x days.
According to the question,

$\frac{x}{30} + \frac{x+25}{36} = 1$

$\Rightarrow \frac{6x + 5x + 125}{180} = 1$

$\Rightarrow 11x + 125 = 180$
$\Rightarrow 11x = 180 - 125$
$\Rightarrow 11x = 55$

$\Rightarrow x = \frac{55}{11} = 5$ days

100. (2) Rate downstream of boat

$= \left(\frac{1}{\frac{15}{2\times60}}\right)$ kmph

$= \frac{2\times60}{15} = 8$ kmph

Rate upstream of boat
= 5 kmph
∴ Speed of boat in still wate

$= \frac{1}{2}$ (Rate downstream + Rat

upstream)

$= \frac{1}{2}(8 + 5) = \frac{13}{2}$ kmph

$= 6\frac{1}{2}$ kmph