Consider the following for the next ten (10) items that follow :

Mark option (a) if the question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.

Mark option (b) if the question can be answered by using either statement alone.

Mark option (c) if the question can be answered by using both the statements together, but cannot be answered using either statement alone.

Mark option (d) if the question cannot be answered even by using both the statements together.

1. Question : Is $m > n$ if m, n are real numbers ?

Statement-I :

$m = (1 - p)(p^2 + p + 1)$ and

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

Statement-II :

$m = pn$

2. Question : What is the other root of the quadratic equation with real coefficients if one of the roots is $\dfrac{-4 - \sqrt{10}}{2}$?

Statement-I :

The product of the roots is $-\dfrac{3}{2}(3 + \sqrt{10})$.

Statement-II :

The sum of roots of quadratic equation is -1.

3. Question : What is the 3-digit number which is divisible by 10 ?

Statement-I :

If the digits in hundred's place and ten's place of the number are interchanged, the resulting number is diminished by 180.

Statement-II :

If the digit in hundred's place is halved and digit in ten's place and unit place of the number are interchanged, the resulting number is diminished by 336.

4. Question : Are x, y, z equal, where x, y, z are real numbers ?

Statement-I :

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

Statement-II :

$x^3 + y^3 + z^3 - 3xyz = 0$

5. Question : What is the ratio $x : y : z$ equal to if $x, y, z \neq 0$?

Statement-I :

$\dfrac{x + z}{y} = \dfrac{z}{x}$

Statement-II :

$\dfrac{z - y}{x} = \dfrac{x}{z}$

6. Question : What is the sum of two natural numbers ?

Statement-I :

LCM of the two numbers is 144.

Statement-II :

One of the numbers is 72.

JNUP-T-EMT

(3 – C)

7. Question : Is average of the largest and the smallest of 4 given numbers greater than the average of the 4 numbers ?

Statement-I :

The difference between the largest and the second largest numbers is less than the difference between the second smallest and the smallest of the numbers.

Statement-II :

The difference between the largest and the smallest numbers is greater than the difference between the second largest and the second smallest of the numbers.

8. Question : Is $(a - b + c) > (a + b - c)$, where a, b and c are real numbers ?

Statement-I :

b is negative.

Statement-II :

c is negative.

9. Question : What is the cost of 15 pens, 21 pencils and 18 note books ?

Statement-I :

The cost of 7 pens, 6 pencils and 5 note books is ₹ 200.

Statement-II :

The cost of 3 pens, 8 pencils and 7 note books is ₹ 210.

10. Question : What is the area of the triangle inscribed in a semi-circle with the diameter as the base ?

Statement-I :

The diameter of semi-circle is 20 cm.

Statement-II :

Two shorter sides of the triangle are 12 cm and 16 cm.

11. A sphere of radius 5 cm is dropped in a right circular cylindrical vessel partly filled with water. The radius of the cylindrical vessel is 10 cm. If the sphere is completely submerged in water, by how much will the level of water rise in the cylindrical vessel ?

(a) $\frac{5}{3}$ cm

(b) $\frac{5}{2}$ cm

(c) 1 cm

(d) $\frac{5}{6}$ cm

12. Consider the following statements :

1. The angle in a sector greater than a semi-circle is less than a right angle.

2. If two sides of a pair of opposite sides of a cyclic quadrilateral are equal, then its diagonals are also equal.

Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

13. If a, b, c, x, y, z are real numbers such that $(a + b + c)^2 - 3 (ab + bc + ca) + 3 (x^2 + y^2 + z^2) = 0$, then which one of the following is correct ?
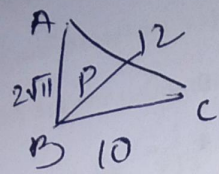
(a) $a = b = c, \ x = y = z \neq 0$

(b) $a = b = c = 0, \ x = y = z = 1$

(c) $a = b = c, \ x = y = z = 0$

(d) $a \neq b \neq c, \ x = y = z = 0$

JNUP-T-EMT

(5 – C)

14. In a triangle ABC, angle B = 90° and p is the length of the perpendicular from B to AC. If BC = 10 cm and AC = 12 cm, then what is the value of p ?

(a) $\dfrac{5\sqrt{11}}{3}$

(b) $\dfrac{10\sqrt{11}}{3}$

(c) $\dfrac{40}{\sqrt{61}}$

(d) $\dfrac{12}{25}$

[handwritten working: triangle diagram labeled A, B, C with sides 12, 10, $2\sqrt{11}$, P; $x^2 = 144$; $\dfrac{100}{044}$; $2\sqrt{11}\times10 = p\times12$; $2\sqrt{11}\times10\dfrac{5}{3} = p$; $2\sqrt{11}$]

15. The mean of p, q, r, s and t is 280. If the mean of p, r and t is 240, what is the mean of q and s ?

(a) 310

(b) 320

(c) 330

(d) 340

[handwritten working: $p+q+r+s+t$; $\dfrac{240}{720}$; $280_5 = \dfrac{sum}{p+q+r+s+t}$; $\dfrac{620}{2}$; $sum = 1400$; $\dfrac{1400}{720}$; $\dfrac{9+s}{620}$; 310; 620]

Consider the following for the next (05) items that follow :

A, B, C, D, E, F and G are cousins. D is thrice as old as A. Further, C is as many years younger to B, as G to E and E to D. The average age of D and G is 16 years; the average age of A and E is 11 years; the average age of B and C is also 11 years. B and C have equal weight. A's weight is 10 kg less than that of B; D is 4 kg heavier than E; E is 4 kg heavier than F; F is 4 kg heavier than G. Further, D has age-weight ratio of 9 : 20, where age is in years and weight in kg; A has age-weight ratio of 2 : 5. Moreover, none of them is more than 40 kg.

16. What is D's age (in years) ?

(a) 15

(b) 16

(c) 17

(d) 18

17. What is the average age (in years) of B, C, D, E and G ?

(a) 12

(b) 13

(c) 14

(d) 15

18. What is the difference between the weights (in kg) of G and C ?

(a) 4

(b) 3

(c) 2

(d) 1

19. What is the average weight (in kg) of A, B, C, D, E, F and G ?

(a) $\dfrac{201}{7}$

(b) $\dfrac{197}{7}$

(c) 30

(d) 32

20. Consider the following statements :

1. The age of F cannot be determined due to insufficient data.

2. The average weight of D and F is equal to weight of E.

3. The weight difference is maximum for D and A.

Which of the statements given above are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

21. Which of the following is/are identity/identities ?

1. $\dfrac{\sin^3\theta + \cos^3\theta}{\sin\theta + \cos\theta} + \sin\theta\cos\theta = 1;\ 0 < \theta < \dfrac{\pi}{2}$

2. $1 - \sin^6\theta = \cos^2\theta\,(\cos^4\theta + 3\sin^2\theta)$

Select the correct answer using the code given below :

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

22. If $7\sin^4\theta + 9\cos^4\theta + 42\sin^2\theta = 16,\ 0 < \theta < \dfrac{\pi}{2}$, then what is $\tan\theta$ equal to ?

(a) 1

(b) $\sqrt{2}$

(c) $\sqrt{3}$

(d) $\dfrac{1}{\sqrt{3}}$

23. An isosceles triangle has its base length 2a and its height is h. On each side of the triangle a square is drawn external to the triangle. What is the area of the figure thus formed ?

(a) $6a^2 + 2h^2 + 2ah$

(b) $6a^2 + 2h^2 + ah$

(c) $4a^2 + 2h^2 + ah$

(d) $6a^2 + h^2 + ah$
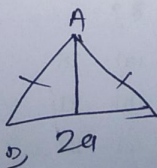
24. If $p = \dfrac{a^2}{(b-a)(c-a)},\ q = \dfrac{b^2}{(c-b)(a-b)},$ $r = \dfrac{c^2}{(a-c)(b-c)}$, then what is $(p+q+r)^2$ equal to ?

(a) 9

(b) 4

(c) 1

(d) 0

25. Which one of the following is a factor of $a^2 - b^2 - c^2 + 2bc + a + b - c$?

(a) $a + b + c + 1$

(b) $a - b - c + 1$

(c) $a + b + c - 1$

(d) $a - b + c + 1$

26. Let α and β be the roots of the equation $\dfrac{1}{x+a+b} = \dfrac{1}{x} + \dfrac{1}{a} + \dfrac{1}{b};\ a \neq 0,\ b \neq 0,\ x \neq 0.$

Which one of the following is a quadratic equation whose roots are α^2 and β^2 ?

(a) $x^2 + (a^2 + b^2)x + a^2b^2 = 0$

(b) $x^2 - (a^2 + b^2)x + a^2b^2 = 0$

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

(d) $x^2 + (a^2 + b^2)x - a^2b^2 = 0$

(9 – C)

27. If $x = \cfrac{6}{7 - \cfrac{6}{7 - \cfrac{6}{7 - \cdots}}}$; $x > 1$, then what is the value of $x^2 - 3x + 2$ equal to ?

(a) 0

(b) 1

(c) 18

(d) 20

28. A train completely overtakes two persons, walking in the same direction with speeds 3 km/hr and 4 km/hr in 9 seconds and $\frac{75}{8}$ seconds respectively. What is the length of the train ?

(a) 60 m

(b) 62·5 m

(c) 55 m

(d) 67·5 m

29. A person bought an article and sold it at a profit of 20%. Had he bought it at 20% less, what would have been the profit percentage if the selling price had been the same ?

(a) 25%

(b) 40%

(c) 50%

(d) 60%

30. If $2s = a + b + c$, then what is $s^2 + (s-a)(s-b) + (s-b)(s-c) + (s-c)(s-a)$ equal to ?

(a) $(a + b + c)^2$

(b) $ab + bc + ca$

(c) $2(ab + bc + ca)$

(d) $3(ab + bc + ca)$

JNUP-T-EMT

31. A pendulum swings through an angle of 9° and its end describes an arc of length 14·3 cm. What is the length of the pendulum ? (Take $\pi = \frac{22}{7}$)

(a) 88 cm

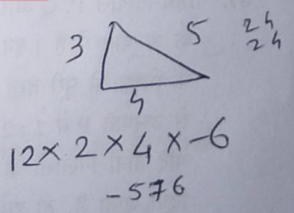(b) 91 cm

(c) 95 cm

(d) 98 cm
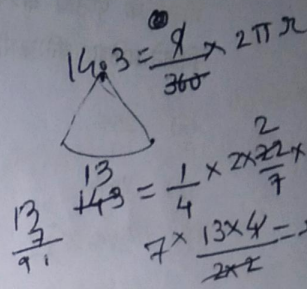
32. The arch of a bridge is in the form of an arc of a circle. If the span of the bridge is 40 m and height in the middle is 8 m, then what is the radius of curvature of the bridge ?

(a) 25 m

(b) 27 m

(c) 29 m

(d) 31 m

33. If a, b and c are the sides of a right-angled triangle, where $a > b > c$, then what is the value of the expression $(a + b + c)(a + b - c)(a - b + c)(a - b - c)$?

(a) $4b^2c^2$

(b) $-4b^2c^2$

(c) $-2a^2b^2$

(d) $-4a^2b^2$

34. The cube root of x varies inversely as the square root of y. $x = 8$ when $y = 3$. What is the value of x when $y = \sqrt[3]{3}$?

(a) 18

(b) 21

(c) 24

(d) 27

35. Three solid lead spheres of diameters 6 cm, 8 cm and 10 cm are melted together and recast as a solid sphere. What is the percentage diminution of the surface area as compared to the sum of the surface areas of the three spheres ?

(a) 25%

(b) 26%

(c) 27%

(d) 28%

36. A solid sphere of radius 3 cm is melted to form a hollow cylinder of height 4 cm and external diameter 10 cm. What is the thickness of the cylinder ?

(a) 0·42 cm

(b) 0·46 cm

(c) 0·50 cm

(d) 1·00 cm

37. Three glasses P, Q and R have capacities in the ratio 1 : 2 : 3. All these glasses are completely filled with mixtures of milk and water. The ratio of milk to water in P is 1 : 2, in Q it is 2 : 3 and in R it is 3 : 1. If the content of all three glasses are put into a bigger container, what will be the ratio of milk to water in the container ?

(a) 203 : 117

(b) 203 : 157

(c) 172 : 91

(d) 165 : 88

38. What is the LCM of $x^4 + x^2y^2 + y^4$, $x^3 + y^3$, $x^3 - y^3$?

(a) $(x^2 - y^2)(x^4 + x^2y^2 + y^4)^2$

(b) $(x^2 - y^2)(x^4 + 2x^2y^2 + y^4)$

(c) $(x^6 - y^6)$

(d) $(x^6 + y^6)$

39. What is

$$\frac{x^2 - y^2 - z^2 - 2yz}{x^2 + y^2 - z^2 + 2xy} + \frac{x^2 - y^2 - z^2 - 2yz}{x^2 - y^2 + z^2 - 2xz}$$

equal to ?

(a) $\dfrac{x}{x + y - z}$

(b) $\dfrac{y + z}{x + y - z}$

(c) $\dfrac{2x}{x + y - z}$

(d) $\dfrac{2y + 2z}{x + y - z}$

40. If $\tan A + \cot A = 2$, where $0 < A < 90°$, then what is the value of

$$\tan^2 A + \tan^3 A + \tan^4 A + ... + \tan^n A ?$$

(a) 1

(b) $n - 2$

(c) $n - 1$

(d) n

JNUP-T-EMT

(13 – C)

41. What is the radius of the sphere passing through the corners of the cuboid with edges 8 cm, 12 cm and 24 cm ?

(a) 10·5 cm

(b) 14 cm

(c) 21 cm

(d) 28 cm

42. A lamp shade is in the shape of a part of a cone and its top and bottom ends are circles whose circumferences are respectively 30 cm and 40 cm. The perpendicular distance between the ends is 6 cm. If the cone were to be completed, then how far would its vertex be from the top end ?

(a) 20 cm

(b) 18 cm

(c) 12 cm

(d) 9 cm

43. A sum of money at 20% rate of compound interest per annum becomes more than 100 times in n years. What is the least value of n ? (Use $\log_{10} 2 = 0.301$, $\log_{10} 3 = 0.477$)

(a) 23

(b) 24

(c) 25

(d) 26

44. The corners of an equilateral triangular plate were cut in such a manner that it forms a regular hexagonal plate. What is the ratio of the area of the triangular plate to the area of the hexagonal plate ?

(a) 2 : 1

(b) 3 : 2

(c) 4 : 3

(d) 5 : 3
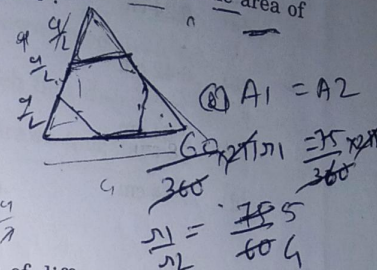
**45.** Two equal arcs of different circles C_1 and C_2 subtend angles of 60° and 75° respectively, at the centres. What is the ratio of the radius of C_1 to the radius of C_2 ?

(a) 4 : 5

(b) 5 : 4

(c) 1 : 1

(d) 3 : 2

46. ABC is a triangle with sides AB = 41 cm, BC = 28 cm and CA = 15 cm. If D, E and F are the mid-points of AB, BC and CA respectively, then what is the area of the triangle DEF ?

(a) 63 square cm

(b) 45 square cm

(c) 31·5 square cm

(d) 22·5 square cm
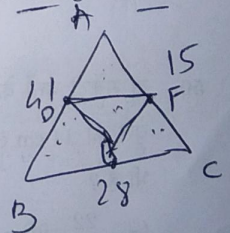
47. A triangle has sides 13 cm, 14 cm and 15 cm long. What is the length of the smallest altitude of the triangle ?

(a) 11 cm

(b) 11·2 cm

(c) 12 cm

(d) 12·2 cm

JNUP-T-EMT

48. The circumference of a circle exceeds the diameter by 16·8 cm. What is the diameter of the circle ? (Take $\pi = \dfrac{22}{7}$)
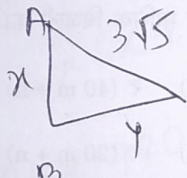
(a) 6·24 cm

(b) 6·42 cm

(c) 7·64 cm

(d) 7·84 cm

Handwritten work:
$$16.8 \quad 5$$
$$15\overline{)117\cdot6}$$
$$2\pi r = d + 16\cdot8$$
$$d\pi = d + 16\cdot8$$
$$d \times \frac{22}{7} = d + 16\cdot8$$
$$\frac{22d}{7} = d + 16\cdot8$$
$$22d = 7d + 11\cdot7\cdot6$$
$$15d = 117\cdot6$$
$$d = 7$$

49. The hypotenuse AC of a right-angled ABC is $3\sqrt{5}$ cm. If AB is doubled and BC is tripled such that ABC remains a right-angled triangle, the hypotenuse becomes 15 cm. What is AB + BC equal to ?

(a) 10 cm

(b) 9 cm

(c) $2\sqrt{5}$ cm

(d) 8 cm

Handwritten work:
$$x^2 + y^2 = 45$$
$$x^2 + y^2 = (3\sqrt{5})^2$$
$$4x^2 + 9y^2 = 225$$

50. What is the area of the region between two concentric circles if the chord of the outer circle of length 14 cm is a tangent of the inner circle ? (Take $\pi = \dfrac{22}{7}$)

(a) 125 square cm

(b) 132 square cm

(c) 144 square cm

(d) 154 square cm

JNUP-T-EMT

Handwritten work:
$$y^2 + 2xy = 49$$
$$(x+y)^2 = x^2 + 49$$
$$x^2 + y^2 + 2xy = x^2 + 49$$

Consider the following for the next two (02) items that follow :

A line segment AB is bisected at C and semi-circles S_1, S_2 and S_3 are drawn respectively on AB, AC and CB as diameters such that they all lie on same side of AB. A circle S is drawn touching internally S_1 and externally S_2 and S_3.

51. If r is the radius of S and R is the radius of S_2, then which one of the following is correct ?

(a) R = 3r

(b) R = 2r

(c) 3R = 4r

(d) 2R = 3r
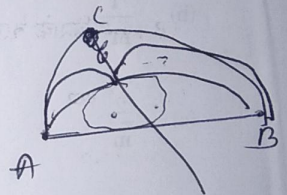
52. If m is the area of the circle S and n is the area of semi-circle S_1, then which one of the following is correct ?

(a) 9m = 2n

(b) 9m = 4n

(c) 3m = 2n

(d) 7m = 3n

(17 – C)

Consider the following for the next two (02) items that follow :

Let $\dfrac{(x-a)(x-b)}{(x-ma)(x-mb)} = \dfrac{(x+a)(x+b)}{(x+ma)(x+mb)}$;

$$m, a, b > 0.$$

53. What is $\dfrac{x^2 + ab}{x^2 + m^2 ab}$ equal to ?

(a) $-\dfrac{1}{m^2}$

(b) $\dfrac{1}{m^2}$

(c) $\dfrac{2}{m}$

(d) $\dfrac{1}{m}$

54. What is x equal to ?

(a) $\pm\sqrt{mab}$

(b) $\pm\sqrt{ab}$

(c) $\pm\sqrt{2mab}$

(d) $\pm\sqrt{2ab}$

JNUP-T-EMT

Consider the following for the next two (02) items that follow :

The total monthly electricity bill for a house consists of the sum of two parts, one part is proportional to number of rooms and the other part is proportional to number of units consumed. ₹ 400 is the monthly electricity bill for a house with 8 rooms and consuming 240 units and ₹ 320 is the monthly electricity bill for a house with 6 rooms and consuming 200 units.

55. What is the monthly electricity bill for a house with m rooms and consuming n units ?

(a) ₹ (40 m + n)

(b) ₹ (20 m + n)

(c) ₹ $\dfrac{(40\,m + n)}{2}$

(d) ₹ $\dfrac{(30\,m + n)}{2}$

56. What is the monthly electricity bill for a house with 7 rooms consuming 300 units ?

(a) ₹ 500

(b) ₹ 440

(c) ₹ 340

(d) ₹ 300

(19 – C)

A grouped frequency distribution is given below :

Weekly wages in Rupees (₹)	Numbers of workers
2050 – 2550	5
2550 – 3050	10
3050 – 3550	k
3550 – 4050	8
4050 – 4550	2
4550 – 5050	10

57. If average weekly wages earned by a worker is ₹ 3,520, then what is the value of k ?

    (a) 10

    (b) 12

    (c) 15

    (d) 20

58. What is the median (approximate value) of the distribution ?

    (a) ₹ 3,263

    (b) ₹ 3,383

    (c) ₹ 3,413

    (d) ₹ 3,483

JNUP-T-EMT

A quadratic equation is given by

$(a + b + c) x^2 - (2a + 2b) x + (a + b - c) = 0;$

where a, b and c are real and distinct.

59. What are the roots of the equation ?

    (a) $1, \dfrac{(a + b - c)}{(a + b + c)}$

    (b) $1, \dfrac{(a - b + c)}{(a + b + c)}$

    (c) $-1, \dfrac{(-a - b + c)}{(a + b + c)}$

    (d) $-1, \dfrac{(a + b - c)}{(a + b + c)}$

60. Consider the following statements :

    1. One of the roots of the equation is always less than 1 if a, b and c are all positive.

    2. One of the roots of the equation is always negative if a, b and c are all negative.

    Which of the statements given above is/are correct ?

    (a) 1 only

    (b) 2 only

   (c) Both 1 and 2

    (d) Neither 1 nor 2

A flagstaff stands on the top of a vertical tower. The angle of elevation of the top of the flagstaff from a certain place on the same horizontal level with the base of the tower is found to be α. Advancing a distance d towards the tower in the same horizontal plane, the angle of elevation of the top of the flagstaff is observed to be β and that of the top of the tower is observed to be γ. Let H be the height of the top of the flagstaff from the base of the tower and h be the height of the tower.

61. Which one of the following is correct ?

(a) $H \tan \gamma - h \tan \beta = 0$

(b) $h \tan \gamma - H \tan \beta = 0$

(c) $H \tan \gamma - h \tan \alpha = 0$

(d) $h \tan \gamma - H \tan \alpha = 0$

62. Which one of the following is correct ?

(a) $d = \dfrac{H(\cot \alpha - \cot \beta)}{2}$

(b) $d = \dfrac{H(\tan \alpha - \tan \beta)}{2}$

(c) $d = H(\cot \alpha - \cot \beta)$

(d) $d = H(\tan \alpha - \tan \beta)$
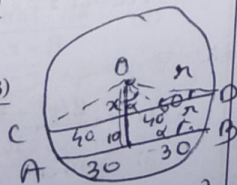
AB is a straight road leading to the foot P of a tower of height h. Q is at distance x from P and R is at a distance y from Q (R is farther from P than Q; R, Q are on the same side). The angle of elevation of the top of the tower at Q is twice of that at R. (Use the formula $\tan 2\theta = \dfrac{2 \tan \theta}{1 - \tan^2 \theta}$)

63. Which one of the following is correct ?

(a) $x = y$

(b) $x < y$

(c) $x > y$

(d) Cannot be concluded due to insufficient data

64. Which one of the following is correct ?

(a) $h^2 = x^2 - y^2$

(b) $h^2 = x^2 + y^2$

(c) $h^2 = 2(y^2 - x^2)$

(d) $h^2 = y^2 - x^2$

Two parallel chords AB and CD of a circle are of lengths 60 cm and 80 cm respectively. They are on the same side of the centre O and 10 cm apart.

65. What is the diameter of the circle ?

(a) 120 cm

(b) 110 cm

(c) 100 cm

(d) 90 cm
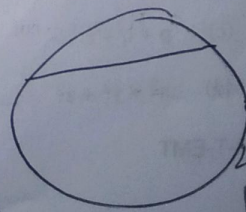
66. If the chord AB subtends an angle α and chord CD subtends an angle β at the centre O, then what is the value of $\tan\left(\dfrac{\beta}{2}\right) - \tan\left(\dfrac{\alpha}{2}\right)$?

(a) $\dfrac{3}{4}$

(b) $\dfrac{5}{12}$

(c) $\dfrac{1}{2}$

(d) $\dfrac{7}{12}$
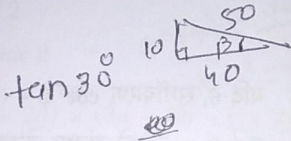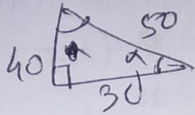
Consider the following for the next two (02) items that follow :

Let $p = x^4 - y^2z^2$, $q = y^4 - z^2x^2$, $r = z^4 - x^2y^2$.

67. What is $px^2 + qy^2 + rz^2$ equal to ?

(a) $(x^2 + y^2 + z^2)(p + q + r)$

(b) $-(x^2 + y^2 + z^2)(p + q + r)$

(c) $(y^2 + z^2 - x^2)(r - q - p)$

(d) $(x^2 + y^2 - z^2)(p - q - r)$

68. What is $x^2(px^2 + qy^2 + rz^2) + qr - p^2$ equal to ?

(a) 0

(b) 1

(c) $p + q + r$

(d) $x^2 + y^2 + z^2$

Consider the following for the next two (02) items that follow :

A right conical cap just covers two spheres placed one above the other on a table such that it touches both the spheres. Let r be the radius of the smaller sphere and R be the radius of the bigger sphere. Let 2θ be the vertical angle of the cone.

69. What is the height of the cone ?

(a) $\dfrac{2r^2}{R - r}$

(b) $\dfrac{2R^2}{R - r}$

(c) $\dfrac{2(r^2 + R^2)}{R - r}$

(d) $\dfrac{r^2 + R^2}{R - r}$

70. What is the radius of the base of the cone ?

(a) $\dfrac{2r^2 \tan\theta}{R - r}$

(b) $\dfrac{2R^2 \tan\theta}{R - r}$

(c) $\dfrac{2(r^2 + R^2)\tan\theta}{R - r}$

(d) $\dfrac{(r^2 + R^2)\tan\theta}{R - r}$

(25 – C)

Consider the following statements :

1. If $(a + b)^2$ is directly proportional to $(a − b)$, then $(a^2 + b^2)$ is directly proportional to ab.

2. If a is directly proportional to b, then $(a^2 − b^2)$ is directly proportional to ab.

Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

(handwritten: $(a+b) = k(a-b)$ $k = \frac{a+b}{a-b}$ $a^2+b^2 = \frac{a+b}{a-b} \times ab$ $a^2+b^2 = \frac{(a+b)^2}{a^2-b^2} \times ab$)

72. If $(3a + 6b + c + 2d) \times (3a − 6b − c + 2d) = (3a − 6b + c − 2d) \times (3a + 6b − c − 2d)$, then which one of the following is correct ?

(a) ab = cd

(b) ac = bd

(c) ad = bc

(d) ad + bc = 0

73. If $3 \sin \theta + 5 \cos \theta = 5$, then what is the value of $5 \sin \theta − 3 \cos \theta$ equal to ?

(a) 5

(b) − 3

(c) − 2

(d) 0

(handwritten: $\sqrt{a^2+b^2} - c^2$ $9+25-25$ $5\times\frac{3}{5} - 3\times1$ $\frac{34}{25}$ $3-0$)

74. The combined age of a man and his wife is 6 times the combined age of their children. Two years ago their combined age was 10 times the combined age of their children; and six years later their combined age will be 3 times the combined age of their children. How many children do they have if each child is at least 2 years old ?

(a) 2

(b) 3

(c) 4

(d) 5

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(handwritten: $a \propto b$ $x = ky$ (120) $\frac{60}{?}$ $(27-C)$)

75. What is

$3 (\sin x − \cos x)^4 + 6 (\sin x + \cos x)^2 + 4 (\sin x)^6 + 4 (\cos x)^6$

equal to ?

(a) 9

(b) 11

(c) 13

(d) 15

(handwritten: $\not{x=0}$ $3(-1)^4 + 6(0+7)^2 + 4(\ldots + 4(1)$ $3 + 6 + 4$ (17))

76. What is the value of $\sin \theta + \cos \theta$, if θ satisfies the equation $\cot^2 \theta − (\sqrt{3} + 1) \cot \theta + \sqrt{3} = 0$; $0 < \theta < \frac{\pi}{4}$?

(a) $\sqrt{2}$

(b) 2

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

(d) $\frac{\sqrt{3} − 1}{2}$

(handwritten: $x^2 - (\sqrt{3}+1)x + \sqrt{3} = 0$ $\tan A$)

77. Which one of the following is a value of θ, if θ satisfies the equation $\tan 2\theta \tan 4\theta − 1 = 0$; $0 < \theta < \frac{\pi}{2}$?

(a) $\frac{\pi}{12}$

(b) $\frac{\pi}{15}$

(c) $\frac{\pi}{6}$

(d) $\frac{\pi}{5}$

(handwritten: $\tan 2\theta \tan 4\theta = 1$ $\tan 2\times\frac{\pi}{12} \times \tan 4\times\frac{\pi}{12} = 1$ $\frac{1}{\sqrt{3}}$ $\tan\frac{\pi}{3} + \tan\frac{2\pi}{3}$ $\sqrt{3} + \frac{1}{\sqrt{3}}$ $\tan(\frac{\pi}{2}+\frac{\pi}{3})$ $\cot\frac{\pi}{3}$ $\sqrt{3}+1$)

78. If $\tan x = \dfrac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta}$, $\dfrac{\pi}{4} < \theta < \dfrac{\pi}{2}$, then what is $\sqrt{2}\ \sin x$ equal to ?

(a) $\sin\theta + \cos\theta$

(b) $\sin\theta - \cos\theta$

(c) $\dfrac{\sin\theta + \cos\theta}{2}$

(d) $\dfrac{\sin\theta - \cos\theta}{2}$

79. How many values of θ will satisfy the equation $(\sin^2\theta - 4\sin\theta + 3)(4 - \cos^2\theta + 4\sin\theta) = 0$, where $0 < \theta < \dfrac{\pi}{2}$?

(a) None

(b) Only one

(c) Onle two

(d) Only three

80. If $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ and $x\sin\theta - y\cos\theta = 0$, for every $\theta \in \left(0, \dfrac{\pi}{2}\right)$, then what is $x^2 + y^2$ equal to ?

(a) 0

(b) 1

(c) 2

(d) 3

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81. How many real roots does the equation $\sqrt{x+9} = x - 3$ have ?

(a) Onle one

(b) Only two

(c) Only three

(d) None

82. If $x = 97 + 56\sqrt{3}$, then what is the value of $\sqrt[4]{x} + \dfrac{1}{\sqrt[4]{x}}$?

(a) 7

(b) 6

(c) 5

(d) 4

83. Let L be the LCM and H be the HCF of two given numbers. L and H are in the ratio 3 : 2. If the sum of the two numbers is 45, then what is the product of the numbers ?

(a) 243

(b) 486

(c) 504

(d) Cannot be determined due to insufficient data

84. A man walks at an average speed of 3 km/hr from his home and reaches office 40 minutes early. If he walks at an average speed of 2 km/hr, he would reach office 40 minutes late. What is the distance between his home and office ?

(a) 6 km

(b) 8 km

(c) 10 km

(d) 12 km

(29 – C)

85. If $3^{x-1} + 3^{3-x} = 6$, then what is $2^{x-1} + 2^{3-x}$ equal to?

$$3^x \frac{1}{3} + 27\frac{1}{3^x} = 6$$

$$\frac{3^x}{3} + \frac{27}{3^x} = 6 \quad 2^{3-1}$$

$$\frac{P}{3} + \frac{27}{P} = 6 \quad 2^2$$

$$4+1$$

(a) 4

(b) 3

(c) 2

(d) 1

$$3^x = 3^1$$

$$\boxed{x = 1}$$

$$\frac{P^2 + 81}{3P} = 18P \quad P^2 - 18P + 81 = 81$$

$$P^2 = 9 \quad P = 3 \quad -9 \quad -9$$

86. If $x\left(a - b + \dfrac{ab}{a-b}\right) = y\left(a + b - \dfrac{ab}{a+b}\right)$ and $x + y = 2a^3$, then what is $x - y$ equal to?

(a) $-2b^3$

(b) $-2ab^3$

(c) $2b^3$

(d) $2ab^3$

87. Which one of the following is a factor of $3\sqrt{3}x^3 + 2\sqrt{2}y^3 - 18xy + 6\sqrt{6}$?

(a) $\sqrt{3}x + \sqrt{2}y - \sqrt{3}$

(b) $\sqrt{3}x + \sqrt{2}y - \sqrt{6}$

(c) $3x^2 + 2y^2 - \sqrt{18}x - \sqrt{12}y - \sqrt{6}xy + 6$

(d) $3x^2 + 2y^2 + \sqrt{18}x + \sqrt{12}y - \sqrt{6}xy + 6$

88. What is number of digits in the expansion of 125^{100} ? (Given $\log_{10} 2 = 0 \cdot 301$)

(a) 69

(b) 70

(c) 209

(d) 210

$$\log 125^{100}$$

$$100 \, \log 125$$

89. What is the HCF of

$acx^3 + bcx^2 + adx^2 + acdx + bdx + bcd$ and

$adx^3 + acx^2 + bdx^2 + bcx + acdx + bcd$

if HCF $(c, d) = 1, c \neq d$?

(a) $bx + c$

(b) $cx + d$

(c) $ax + d$

(d) $ax + b$

90. If $x^n - py^n + qz^n$ is divisible by $x^2 + abyz - bzx - axy$, then what is $\dfrac{p}{a^n} - \dfrac{q}{b^n}$ equal to?

(a) -1

(b) 0

(c) 1

(d) 2

Handwritten: a b c = 1 2 3

91. If $a^2 - bc = \alpha$, $b^2 - ac = \beta$, $c^2 - ab = \gamma$, then what is $\dfrac{a\alpha + b\beta + c\gamma}{(a+b+c)(\alpha+\beta+\gamma)}$ equal to ?

(a) $a + b - c$

(b) $a - b + c$

(c) $-a + b + c$

(d) 1

Handwritten: $\frac{-5+2+21}{18}$, $\alpha = -5$, $\beta = 1$, $\gamma = 7$, $\frac{18}{18} = 2$

92. If $(x-1)^3$ is a factor of $x^4 + \alpha x^3 + \beta x^2 + \gamma x - 1$, then the other factor will be :

(a) $x + 1$

(b) $x - 3$

(c) $x + 2$

(d) x

Handwritten: $x = 1$; $1 + \alpha + \beta + \gamma - 1 = 0$; $\alpha + \beta + \gamma = 0$; $1 - \alpha + \beta - \gamma - 1$

93. A 2-digit number is such that the sum of the number and the number obtained by reversing the order of the digits of the number is 55. Further, the difference of the given number and the number obtained by reversing the order of the digits of the number is 45. What is the product of the digits ?

(a) 5

(b) 2

(c) 1

(d) 0

Handwritten: $11x + 11y = 55$; $x + y = 5$; $9x - 9y = 45$; $x - y = 5$; $2x = 10$; $x = 5$

94. If A and B can finish a work in 10 days, B and C can finish the same work in 12 days, C and A can finish the same work in 15 days; then in how many days can A, B and C together finish half of the work ?

(a) 8 days

(b) 5 days

(c) 4 days

(d) 3 days

Handwritten: 6 A+B — 10; 5 B+C — 12; 4 A+C — 15; } 60; A+B+C = $\frac{15}{2}$

95. A person borrowed ₹ 10,000 at 12% rate of interest per annum compounded quarterly for a period of 9 months. What is the interest paid by him to settle his account after 9 months ?

(a) ₹ 927·27

(b) ₹ 947·47

(c) ₹ 967·67

(d) ₹ 987·87

Handwritten: $\frac{1 \times 5 + 2 \times 1 + 3 \times 7}{6 \times 3}$; $\frac{3}{100}$; $\frac{12}{4} = 3\%$; $SI = \frac{10000 \times 3 \times 3}{100}$; $SI = 900$

96. For what relation between a and b is the equation $\sin\theta = \dfrac{a+b}{2\sqrt{ab}}$ possible ?

(a) $a = b$

(b) $a \le b$

(c) $a \ge b$

(d) $a > b$

Handwritten: $\frac{A+C}{n} = \frac{B}{1}$; $\frac{2a}{2\sqrt{a^2}}$; $\frac{2a}{2a} = A$; $(B+C) = 1$; $(A+B) : \frac{C}{1}$

97. Three persons A, B and C together can do a piece of work in 36 days. A and B together can do five times as much work as C alone; B and C together can do as much work as A alone. If A and C together can do n times as much work as B alone, then what is the value of n ?

(a) 1·5

(b) 2

(c) 2·5

(d) 3

Handwritten: A+B+C — 36; A+B

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(33 – C)

Handwritten: $\frac{36 \times 2}{15}$; $-16 + 8\alpha + 4\beta - 2\gamma - 1$

98. If $\dfrac{2a}{3} = \dfrac{4b}{5} = \dfrac{3c}{4}$, then what is the value of

$\dfrac{18}{a}\sqrt{a^2 + c^2 - b^2}$?

(a) $3\sqrt{5}$

(b) $\sqrt{355}$

(c) $\sqrt{375}$

(d) $3\sqrt{15}$

99. The sum of deviations of n numbers from 10 and 20 are a, b respectively. If $\dfrac{b}{a} = -4$, then what is the mean of these n numbers ?

(a) 12

(b) 14

(c) 16

(d) 18

100. If the median of observations

12, 1, 8, 54, 61, 28, 45, 35, 21, 17

is M, then what is the value of 2M + 5 ?

(a) 12

(b) 28

(c) 52

(d) 54

(35 – C)