

1. The sum of the first k terms of a series S is $3k^2 + 5k$. Which one of the following is correct?

- (a) The terms of S form an arithmetic progression with common difference 14.
- (b) The terms of S form an arithmetic progression with common difference 6.
- (c) The terms of S form a geometric progression with common ratio $10/7$.
- (d) The terms of S form a geometric progression with common ratio $11/4$.

2. The sum of the first 8 terms of a GP is five times the sum of its first 4 terms. If $r \neq 1$ is the common ratio, then what is the number of possible real values of r ?

- (a) One
- (b) Two
- (c) Three
- (d) More than three

3. If one root of the equation $x^2 - kx + k = 0$ exceeds the other by $2\sqrt{3}$, then which one of the following is a value of k ?

- (a) 3
- (b) 6
- (c) 9
- (d) 12

4. If $x + \frac{5}{y} = 4$ and $y + \frac{5}{x} = -4$, then what is $(x + y)$ equal to?

- (a) 0
- (b) 1
- (c) 4
- (d) 5

5. If 5th, 7th and 13th terms of an AP are in GP, then what is the ratio of its first term to its common difference?

- (a) -3
- (b) -2
- (c) 2
- (d) 3

6. If $p, 1, q$ are in AP and $p, 2, q$ are in GP, then which of the following statements is/are correct?

I. $p, 4, q$ are in HP.

II. $(1/p), 1/4, (1/q)$ are in AP.

Select the answer using the code given below.

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

7. If $x = (1111)_2$, $y = (1001)_2$ and $z = (110)_2$, then what is $x^3 - y^3 - z^3 - 3xyz$ equal to?

- (a) $(1111001)_2$
- (b) $(1001111)_2$
- (c) $(1)_2$
- (d) $(0)_2$

8. If $\Delta = \begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix}$ and A, B, C, D, G are the cofactors of the elements a, b, c, d, g respectively,

then what is $bB + cC - dD - gG$ equal to?

- (a) 0
- (b) 1
- (c) Δ
- (d) $-\Delta$

9. Consider the following statements in respect of the determinant

$$\Delta = \begin{vmatrix} k(k+2) & 2k+1 & 1 \\ 2k+1 & k+2 & 1 \\ 3 & 3 & 1 \end{vmatrix}$$

(I). Δ is positive if $k > 0$.

(II). Δ is negative if $k < 0$.

(III). Δ is zero if $k = 0$.

How many of the statements given above are correct?

- (a) None
- (b) One
- (c) Two
- (d) All three

10. If $\begin{vmatrix} 2 & 3+i & -1 \\ 3-i & 0 & i-1 \\ -1 & -1-i & 1 \end{vmatrix} = A + iB$

where $i = \sqrt{-1}$, then what is $A + B$ equal to?

- (a) -10
- (b) -6
- (c) 0
- (d) 6

11. If $A^2 + B^2 + C^2 = 0$, then what is the value of the following?

$$\begin{vmatrix} 1 & \cos C & \cos B \\ \cos C & 1 & \cos A \\ \cos B & \cos A & 1 \end{vmatrix}$$

(a) -1 (b) 0
(c) 1 (d) 2

12. If ω is a non-real cube root of unity, then what is a root of the following equation?

$$\begin{vmatrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{vmatrix} = 0$$

(a) $x = 0$ (b) $x = 1$
(c) $x = \omega$ (d) $x = \omega^2$

13. What is $\left(\frac{\sqrt{3}+i}{\sqrt{3}-i}\right)^3$ equal to?

- (a) -1 (b) 0
(c) 1 (d) 3

14. If $x^2 - x + 1 = 0$, then what is

$$\left(x - \frac{1}{x}\right)^2 + \left(x - \frac{1}{x}\right)^4 + \left(x - \frac{1}{x}\right)^8$$

equal to?

- (a) 81 (b) 85
(c) 87 (d) 90

15. How many 7-letter words (with or without meaning) can be constructed using all the letters of the word CAPITAL so that all consonants come together in each word?

- (a) 360 (b) 300
(c) 288 (d) 240

16. If $z \neq 0$ is a complex number, then what is $\text{amp}(z) + \text{amp}(\bar{z})$ equal to?

- (a) 0 (b) $\pi/2$
(c) π (d) 2π

17. How many sides are there in a polygon which has 20 diagonals?

- (a) 6 (b) 7
(c) 8 (d) 10

18. In how many ways can the letters of the word DELHI be arranged keeping the positions of vowels and consonants unchanged?

- (a) 6 (b) 9
(c) 12 (d) 24

19. What is the number of positive integer solutions of $x + y + z = 5$?

- (a) 3 (b) 5
(c) 6 (d) 9

20. What is the number of rational terms in the expansion of $\left(3^{\frac{1}{2}} + 5^{\frac{1}{4}}\right)^{12}$?

- (a) 2 (b) 3
(c) 4 (d) 6

21. If the sum of binomial coefficients in the expansion of $(x + y)^n$ is 256, then the greatest binomial coefficient occurs in which one of the following terms?

- (a) Third (b) Fourth
(c) Fifth (d) Ninth

22. If $k < (\sqrt{2} + 1)^3 < k + 2$, where k is a natural number, then what is the value of k ?

- (a) 11 (b) 13
(c) 15 (d) 17

23. If $[x \ 1 \ 1] \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ x \end{bmatrix} = [45]$

then which one of the following is a value of x ?

- (a) -2 (b) -1
(c) 0 (d) 1

24. If $A = \begin{bmatrix} y & z & x \\ z & x & y \\ x & y & z \end{bmatrix}$ where x, y, z are integers, is an orthogonal matrix, then what is the value

of $x^2 + y^2 + z^2$?

- (a) 0 (b) 1
(c) 4 (d) 14

25. Consider the following in respect of a non-singular matrix M :

(I). $|M^2| = |M|^2$

(II). $|M| = |M^{-1}|$

(III). $|M| = |M^T|$

How many of the above are correct?

- (a) None (b) One
(c) Two (d) All three

26. If $f(\theta) = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$ then what is $\{f(\pi)\}^2$ equal to?

- (a) $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$
(c) $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

27. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ then what is $A^2 - 4A$ equal to?

- (a) $-5I_3$ (b) $-I_3$
(c) I_3 (d) $5I_3$

where I_3 is the identity matrix of order 3 .

28. If the number of selections of r as well as $(n + r)$ things from $5n$ different things are equal, then what is the value of r ?

- (a) n (b) $2n$
(c) $3n$ (d) $4n$

29. What is the number of selections of at most 3 things from 6 different things?

- (a) 20 (b) 22
(c) 41 (d) 42

30. If $A = \begin{bmatrix} x & y & z \\ y & z & x \\ z & x & y \end{bmatrix}$ where x, y, z are integers, is an orthogonal matrix, then what is A^2 equal

to?

- (a) Null matrix (b) Identity matrix
(c) A (d) $-A$

Consider the following for the three (03) items that follow :

Let $p = \sin 35^\circ$, $q = \sin 25^\circ$ and $r = \sin(-95^\circ)$.

31. What is $(p + q + r)$ equal to?

- (a) -1 (b) 0
(c) $2\sin 5^\circ$ (d) $2\cos 5^\circ$

32. Let $p = \sin 35^\circ$, $q = \sin 25^\circ$ and $r = \sin(-95^\circ)$.

What is $(pq + qr + rp)$ equal to?

- (a) $-3/4$ (b) 0
(c) $1/4$ (d) $3/4$

33. Let $p = \sin 35^\circ$, $q = \sin 25^\circ$ and $r = \sin(-95^\circ)$.

What is $(p^2 + q^2 + r^2)$ equal to?

- (a) $1/2$ (b) 1
(c) $3/2$ (d)

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

Let $p = |\sin \alpha - \sin(\alpha - 90^\circ)|$.

34. What is the minimum value of p ?

- (a) 0 (b) $1/2$
(c) $1/\sqrt{2}$ (d) 1

35. Let $p = |\sin \alpha - \sin(\alpha - 90^\circ)|$.

What is the maximum value of p ?

- (a) 1 (b) $\sqrt{2}$
(c) $\sqrt{3}$ (d) 2

36. The sides of a triangle ABC are $AB = 3$ cm, $BC = 5$ cm and $CA = 7$ cm.

Consider the following statements:

- (I). The triangle is obtuse-angled triangle.
(II). The sum of acute angles of the triangle is also acute.

Which of the statements given above is/are correct?

- (a) I only (b) II only
(c) Both I and II (d) Neither I nor II

37. The sides of a triangle ABC are $AB = 3$ cm, $BC = 5$ cm and $CA = 7$ cm.

What is $\angle B$ equal to?

- (a) 60° (b) 105°
(c) 120° (d) 150°

38. The sides of a triangle ABC are $AB = 3$ cm, $BC = 5$ cm and $CA = 7$ cm.

What is the area of the triangle?

- (a) $15\sqrt{3}/4$ square cm
(b) $15\sqrt{3}/2$ square cm
(c) $15\sqrt{3}$ square cm
(d) $30\sqrt{3}$ square cm

39. The top (M) of a tower is observed from three points P, Q and R lying in a horizontal straight line which passes directly along the foot (N) of the tower. The angles of elevations of M from P, Q and R are $30^\circ, 45^\circ$ and 60° respectively. Let $PQ = a$ and $QR = b$.

What is PN equal to?

- (a) $\left(\frac{3-\sqrt{3}}{2}\right)a$ (b) $\left(\frac{3+\sqrt{3}}{2}\right)a$
(c) $\left(\frac{3-\sqrt{3}}{4}\right)a$ (d) $\left(\frac{3+\sqrt{3}}{4}\right)a$

40. The top (M) of a tower is observed from three points P, Q and R lying in a horizontal straight line which passes directly along the foot (N) of the tower. The angles of elevations of M from P, Q and R are $30^\circ, 45^\circ$ and 60° respectively. Let $PQ = a$ and $QR = b$.

What is MN equal to?

- (a) $\left(\frac{3+\sqrt{3}}{2}\right)b$ (b) $\left(\frac{3-\sqrt{3}}{2}\right)b$
(c) $\left(\frac{3-\sqrt{3}}{4}\right)b$ (d) $\left(\frac{3+\sqrt{3}}{4}\right)b$

41. Let $p = \tan 2\alpha - \tan \alpha$ and $q = \cot \alpha - \cot 2\alpha$.

What is (p/q) equal to?

- (a) $-\tan \alpha \cdot \tan 2\alpha$ (b) $-\cot \alpha \cdot \cot 2\alpha$
(c) $\tan \alpha \cdot \tan 2\alpha$ (d) $\cot \alpha \cdot \cot 2\alpha$

42. Let $p = \tan 2\alpha - \tan \alpha$ and $q = \cot \alpha - \cot 2\alpha$.

What is $(p+q)$ equal to?

- (a) $\sec 4\alpha$ (b) $\operatorname{cosec} 4\alpha$
(c) $2\sec 4\alpha$ (d) $2\operatorname{cosec} 4\alpha$

43. Let $p = \tan 2\alpha - \tan \alpha$ and $q = \cot \alpha - \cot 2\alpha$.

What is $\tan^2 \alpha$ equal to?

- (a) $(pq)/(p+q)$ (b) $(p+2q)/p$
(c) $p/(p+2q)$ (d) $p/(2p+q)$

44. Let $2\sin \alpha + \cos \alpha = 2$, where $0 < \alpha < 90^\circ$.

What is $\tan \alpha$ equal to?

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

45. Let $2\sin \alpha + \cos \alpha = 2$, where $0 < \alpha < 90^\circ$.

What is $2\sin 2\alpha + \cos 2\alpha$ equal to?

- (a) $\frac{11}{10}$ (b) $\frac{11}{5}$
(c) $\frac{12}{5}$ (d) $\frac{13}{5}$

46. In a triangle ABC , two sides BC and CA are in the ratio 2: 1 and their opposite corresponding angles are in the ratio 3: 1.

One of the angles of the triangle is

- (a) 15° (b) 30°
(c) 45° (d) 75°

47. In a triangle ABC , two sides BC and CA are in the ratio 2: 1 and their opposite corresponding angles are in the ratio 3: 1.

Consider the following statements :

- (I). The triangle is right-angled.
(II). One of the sides of the triangle is 3 times the other.
(III). The angles A , C and B of the triangle are in AP.

Which of the statements given above is/are correct?

- (a) I only (b) II and III only
(c) I and III only (d) I, II and III

48. A man at M , standing 100 m away from the base (P) of a chimney of height 50 m, observes the angle of elevation of the highest point (Q) of the smoke to be 45° . The highest point of the chimney is at R . Further P , R and Q are in a straight line and the straight line is perpendicular to PM . What is the angle RMQ equal to?

- (a) $\tan^{-1}\left(\frac{1}{2}\right)$ (b) $\tan^{-1}\left(\frac{1}{3}\right)$
(c) $\tan^{-1}\left(\frac{2}{3}\right)$ (d) $\tan^{-1}\left(\frac{3}{4}\right)$

49. If k is a root of $x^2 - 4x + 1 = 0$, then what is $\tan^{-1} k + \tan^{-1} \frac{1}{k}$ equal to?

- (a) $-\pi/2$ (b) 0
(c) $\pi/4$ (d) $\pi/2$

50. If $\tan^{-1} k + \tan^{-1} \frac{1}{2} = \frac{\pi}{4}$, then what is the value of k ?

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

51. Under what condition will the lines $m^2x + ny - 1 = 0$ and $n^2x - my + 2 = 0$ be perpendicular?

- (a) $mn - 1 = 0$ (b) $mn + 1 = 0$
(c) $m + n = 0$ (d) $m - n = 0$

52. If p and q are real numbers between 0 and 1 such that the points $(p, 1)$, $(1, q)$ and $(0, 0)$ form an equilateral triangle, then what is $(p + q)$ equal to?

- (a) $\sqrt{2}$ (b) $\sqrt{2} - 1$
(c) $2 - \sqrt{3}$ (d) $4 - 2\sqrt{3}$

53. The vertices of a triangle are $A(1, 1)$, $B(0, 0)$ and $C(2, 0)$. The angular bisectors of the triangle meet at P . What are the coordinates of P ?

- (a) $(1, \sqrt{2} - 1)$ (b) $(1, \sqrt{3} - 1)$
(c) $(1, 1/2)$ (d) $(1/2, \sqrt{2} - 1)$

54. Let $A(3, -1)$ and $B(1, 1)$ be the end points of line segment AB . Let P be the middle point of the line segment AB . Let Q be the point situated at a distance $\sqrt{2}$ units from P on the perpendicular bisector line of AB . What are the possible coordinates of Q ?

- (a) $(2, 1)$ (b) $(3, 1)$
(c) $(2, 2)$ (d) $(1, 3)$

55. ABC is an equilateral triangle and AD is the altitude on BC . If the coordinates of A are

(1, 2) and that of D are $(-2, 6)$, then what is the equation of BC ?

- (a) $3x + 4y - 18 = 0$ (b) $4x + 3y - 1 = 0$
(c) $4x - 3y + 26 = 0$ (d) $3x - 4y + 30 = 0$

56. What is the equation of the circle whose diameter is 10 cm and the equations of two of its diameters are $x + y = 0$ and $x - y = 0$?

- (a) $x^2 + y^2 = 1$
(b) $x^2 + y^2 = 25$
(c) $x^2 + y^2 = 100$
(d) $x^2 + y^2 - 2x - 2y - 23 = 0$

57. A square is inscribed in a circle $x^2 + y^2 + 2x + 2y + 1 = 0$ and its sides are parallel to coordinate axes. Which one of the following is a vertex of the square?

- (a) $(-2, 2)$ (b) $(-2, -2)$
(c) $(-1 + \frac{1}{\sqrt{2}}, -1 - \frac{1}{\sqrt{2}})$ (d) None of the above

58. A tangent to the parabola $y^2 = 4x$ is inclined at an angle 45° with the positive direction of x -axis. What is the point of contact of the tangent and the parabola?

- (a) $(1, 1)$ (b) $(2, 2\sqrt{2})$
(c) $(\frac{1}{2}, \frac{1}{\sqrt{2}})$ (d) $(1, 2)$

59. What is the distance between the two foci of the hyperbola $25x^2 - 75y^2 = 225$?

- (a) $2\sqrt{3}$ units (b) $4\sqrt{3}$ units
(c) $\sqrt{6}$ units (d) $2\sqrt{6}$ units

60. If any point on an ellipse is $(3\sin \alpha, 5\cos \alpha)$, then what is the eccentricity of the ellipse?

- (a) $4/3$ (b) $4/5$
(c) $3/4$ (d) $1/2$

61. If a line in 3 dimensions makes angles α, β and γ with the positive directions of the coordinate axes, then what is $\cos(\alpha + \beta)\cos(\alpha - \beta)$ equal to?

- (a) $\cos^2 \gamma$ (b) $-\cos^2 \gamma$
(c) $\sin^2 \gamma$ (d) $-\sin^2 \gamma$

62. $A(1, 2, -1), B(2, 5, -2)$ and $C(4, 4, -3)$ are three vertices of a rectangle. What is the area of the rectangle?

- (a) 8 square units (b) 9 square units
(c) $\sqrt{66}$ square units (d) $\sqrt{68}$ square units

63. ABC is a triangle right-angled at B . If $A(k, 1, -1), B(2k, 0, 2)$ and $C(2 + 2k, k, 1)$ are the vertices of the triangle, then what is the value of k ?

- (a) -3 (b) -1
(c) 1 (d) 3

64. If a line $\frac{x+1}{p} = \frac{y-1}{q} = \frac{z-2}{r}$, where $p = 2q = 3r$, makes an angle θ with the positive direction of y -axis, then what is $\cos 2\theta$ equal to?

- (a) $-31/49$ (b) $-37/49$
(c) $31/49$ (d) $37/49$

65. What is the equation of the plane passing through the point $(1, 1, 1)$ and perpendicular to the line whose direction ratios are $\langle 3, 2, 1 \rangle$?

- (a) $x + 2y + 3z = 6$ (b) $3x + 2y + z = 6$
(c) $x + y + z = 3$ (d) $3x + 2y + z = 0$

66. A line makes angles α, β and γ with the positive directions of the coordinate axes. If $\vec{a} = (\sin^2 \alpha)\hat{i} + (\sin^2 \beta)\hat{j} + (\sin^2 \gamma)\hat{k}$ and $\vec{b} = \hat{i} + \hat{j} + \hat{k}$, then what is $\vec{a} \cdot \vec{b}$ equal to?

- (a) -2 (b) -1
(c) 1 (d) 2

67. Consider the following statements in respect of a vector $\vec{d} = (\vec{a} \times \vec{b}) \times \vec{c}$:

- (I). $\vec{d}$ is coplanar with $\vec{a}$ and $\vec{b}$.
(II). $\vec{d}$ is perpendicular to $\vec{c}$.

Which of the statements given above is/are correct?

- (a) I only (b) II only
(c) Both I and II (d) Neither I nor II

68. The position vectors of three points A, B and C are $\vec{a}, \vec{b}$ and $\vec{c}$ respectively such that $3\vec{a} - 4\vec{b} + \vec{c} = \vec{0}$. What is $AB:BC$ equal to?

- (a) 3:1 (b) 1:3
(c) 3:4 (d) 1:4

69. The position vectors of three points A, B and C are $\vec{a}, \vec{b}$ and $\vec{c}$ respectively, where $\vec{c} = (\cos^2 \theta)\vec{a} + (\sin^2 \theta)\vec{b}$. What is $(\vec{a} \times \vec{b}) + (\vec{b} \times \vec{c}) + (\vec{c} \times \vec{a})$ equal to?

- (a) $\vec{0}$ (b) $2\vec{c}$
(c) $3\vec{c}$ (d) Unit vector

70. Let $\vec{a}, \vec{b}, (\vec{a} \times \vec{b})$ be unit vectors. What is $(\vec{a} \cdot \vec{b})$ equal to?

- (a) 0 (b) $1/2$
(c) 1 (d) 3

71. Let $x = \sec \theta - \cos \theta$ and $y = \sec^4 \theta - \cos^4 \theta$.

What is $\left(\frac{dy}{dx}\right)^2$ equal to?

- (a) $\frac{4(y^2+4)}{(x^2+4)}$ (b) $\frac{4(y^2-4)}{(x^2-4)}$
(c) $\frac{16(y^2+4)}{(x^2+4)}$ (d) $\frac{16(y^2-4)}{(x^2-4)}$

72. Let $x = \sec \theta - \cos \theta$ and $y = \sec^4 \theta - \cos^4 \theta$.

What is $\left(\frac{x^2+4}{y^2+4}\right) \frac{dy}{dx} \left[(x^2+4) \frac{d^2y}{dx^2} - 16y\right]$ equal to?

- (a) $16x$ (b) $16y$
(c) $-16x$ (d) $-16y$

73. Let ABC be a triangle right-angled at B and $AB + AC = 3$ units.

What is $\angle A$ equal to if the area of the triangle is maximum?

- (a) $\pi/6$ (b) $\pi/4$
(c) $\pi/3$ (d) $5\pi/12$

74. Let ABC be a triangle right-angled at B and $AB + AC = 3$ units.

What is the maximum area of the triangle?

- (a) $\sqrt{3}/2$ square unit (b) $\sqrt{3}$ square units
(c) $\sqrt{6}/2$ square units (d) $\sqrt{6}$ square units

75. Let $(x+y)^{p+q} = x^p y^q$, where p, q are positive integers.

The derivative of y with respect to x

- (a) depends on p only
(b) depends on q only
(c) depends on both p and q
(d) is independent of both p and q

76. Let $(x+y)^{p+q} = x^p y^q$, where p, q are positive integers.

If $p + q = 10$, then what is $\frac{dy}{dx}$ equal to?

- (a) $\frac{y}{x}$ (b) xy
(c) $x^{10}y^{10}$ (d) $\left(\frac{y}{x}\right)^{10}$

77. The slope of the tangent to the curve $y = f(x)$ at $(x, f(x))$ is 4 for every real number x and the curve passes through the origin.

What is the nature of the curve?

- (a) A straight line passing through (1,4)
(b) A straight line passing through (-1,4)
(c) A parabola with vertex at origin and focus at (2,0)
(d) A parabola with vertex at origin and focus at (1,0)

78. The slope of the tangent to the curve $y = f(x)$ at $(x, f(x))$ is 4 for every real number x and

the curve passes through the origin.

What is the area bounded by the curve, the x -axis and the line $x = 4$?

- (a) 8 square units (b) 16 square units
(c) 32 square units (d) 64 square units

79. Let $f(x) = \begin{cases} x^3, & x^2 < 1 \\ x^2, & x^2 \geq 1 \end{cases}$

What is $\lim_{x \rightarrow 0} f'(x)$ equal to?

- (a) 2 (b) 1
(c) 0 (d) Limit does not exist

80. Let $f(x) = \begin{cases} x^3, & x^2 < 1 \\ x^2, & x^2 \geq 1 \end{cases}$

Consider the following statements :

(I). The function is continuous at $x = -1$.

(II). The function is differentiable at $x = 1$.

Which of the statements given above is/are correct?

- (a) I only (b) II only
(c) Both I and II (d) Neither I nor II

81. Let the function $y = (1 - \cos x)^{-1}$, where $x \neq 2n\pi$ and n is an integer.

What is the range of the function?

- (a) $[0, \infty)$ (b) $[0.5, \infty)$
(c) $[1, \infty)$ (d) $(-\infty, 0.5]$

82. Let the function $y = (1 - \cos x)^{-1}$, where $x \neq 2n\pi$ and n is an integer.

What is $\int y dx$ equal to?

- (a) $-\tan(x/2) + c$
(b) $-\cot(x/2) + c$
(c) $\tan(x/2) + c$
(d) $\cot(x/2) + c$

83. Let the function $f(x) = \sin[x]$, where $[\cdot]$ is the greatest integer function and $g(x) = |x|$.

What is $\lim_{x \rightarrow 0} \{f(x)g(x)\}$ equal to?

- (a) -1 (b) 0
(c) 1 (d) Limit does not exist

84. Let the function $f(x) = \sin[x]$, where $[\cdot]$ is the greatest integer function and $g(x) = |x|$.

What is $\lim_{x \rightarrow 0} \frac{f(x)}{g(x)}$ equal to?

- (a) $-\sin 1$ (b) $\sin 1$
(c) 0 (d) Limit does not exist

85. Let the curve $f(x) = |x - 3|$.

What is the domain of the function $f(x)$?

- (a) $(0, \infty)$ (b) $(3, \infty)$
(c) $(-\infty, \infty)$ (d) $(-\infty, \infty) \setminus \{3\}$

86. Let the curve $f(x) = |x - 3|$.

What is the area bounded by the curve $f(x)$ and $y = 3$?

- (a) 3 square units (b) 4.5 square units
(c) 7.5 square units (d) 9 square units

87. Let $f = \{(1, 1), (2, 4), (3, 7), (4, 10)\}$.

If $f(x) = px + q$, then what is the value of $(p + q)$?

- (a) -1 (b) 0
(c) 1 (d) 5

88. Let $f = \{(1, 1), (2, 4), (3, 7), (4, 10)\}$.

Consider the following statements :

(I). f is one-one function.

(II). f is onto function if the codomain is the set of natural numbers.

Which of the statements given above is/are correct?

- (a) I only (b) II only
(c) Both I and II (d) Neither I nor II

89. Let the function $f(x) = x^2 - 1$.

What is $\lim_{x \rightarrow 1} \{f \circ f(x)\}$ equal to?

- (a) -1 (b) 0
(c) 1 (d) 2

90. Let the function $f(x) = x^2 - 1$.

What is the area bounded by the function $f(x)$ and the x -axis?

- (a) $1/3$ square unit (b) $2/3$ square unit
(c) $4/3$ square units (d) 2 square units

91. Let $y = \sin^{-1}\left(x - \frac{4x^3}{27}\right)$.

What is y equal to?

- (a) $\sin^{-1} x$ (b) $\sin^{-1}\left(\frac{x}{3}\right)$
(c) $3\sin^{-1} x$ (d) $3\sin^{-1}\left(\frac{x}{3}\right)$

92. Let $y = \sin^{-1}\left(x - \frac{4x^3}{27}\right)$.

What is $\frac{dy}{dx}$ equal to?

- (a) $\frac{1}{\sqrt{9-x^2}}$ (b) $\frac{1}{\sqrt{3-x^2}}$
(c) $\frac{3}{\sqrt{9-x^2}}$ (d) $\frac{9}{\sqrt{9-x^2}}$

93. Let the function $f(x) = x^2 + 9$.

What is $\lim_{x \rightarrow 0} \frac{\sqrt{f(x)} - 3}{\sqrt{f(x)} + 7 - 4}$ equal to?

- (a) $2/3$ (b) 1
(c) $4/3$ (d) 2

94. Let the function $f(x) = x^2 + 9$

Consider the following statements :

- (I). $f(x)$ is an increasing function.
(II). $f(x)$ has local maximum at $x = 0$.

Which of the statements given above is/are correct?

- (a) I only (b) II only
(c) Both I and II (d) Neither I nor II

95. The function $f(x)$ satisfies $f\left(\frac{x}{y}\right) = \frac{f(x)}{f(y)}$ for all positive real values of x and y , and $f(2) = 3$.

What is $f(16)$ equal to?

- (a) 18 (b) 27
(c) 54 (d) 81

96. The function $f(x)$ satisfies $f\left(\frac{x}{y}\right) = \frac{f(x)}{f(y)}$ for all positive real values of x and y , and $f(2) = 3$.

What is $f(1)f(4)$ equal to?

- (a) 4 (b) 8
(c) 9 (d) 18

97. A function f is such that $f(xy) = f(x + y)$ for all real values of x and y , and $f(5) = 10$.

What is $f(0)$ equal to?

- (a) 0 (b) 1
(c) 5 (d) 10

98. A function f is such that $f(xy) = f(x + y)$ for all real values of x and y , and $f(5) = 10$.

What is $f(20) + f(-20)$ equal to?

- (a) 0 (b) 10
(c) 20 (d) 40

99. Let $f(x) = [x^2]$, where $[\cdot]$ is the greatest integer function.

What is $\int_{\sqrt{2}}^{\sqrt{3}} f(x) dx$ equal to?

- (a) $\sqrt{3} - \sqrt{2}$ (b) $2(\sqrt{3} - \sqrt{2})$
(c) $3 - \sqrt{2}$ (d) 1

100. Let $f(x) = [x^2]$, where $[\cdot]$ is the greatest integer function.

What is $\int_{\sqrt{2}}^2 f(x) dx$ equal to?

- (a) $6 - \sqrt{3} - 2\sqrt{2}$ (b) $6 - \sqrt{3} - \sqrt{2}$
(c) $6 - \sqrt{3} + 2\sqrt{2}$ (d) $6 + \sqrt{3} - 2\sqrt{2}$

101. The frequency distribution of height of students of a class is given below:

Height (in cm)	Number of Students
160 – 162	12
162 – 164	15
164 – 166	24
166 – 168	13

What is the total number of students whose height is less than or equal to 165 cm?

- (a) 15 (b) 39
(c) 51 (d) None of the above

102. The frequency distribution of height of students of a class is given below:

Height (in cm)	Number of Students
160 – 162	12
162 – 164	15
164 – 166	24
166 – 168	13

What is the median height of the class?

- (a) 162.41 cm (b) 163.41 cm
(c) 164.41 cm (d) 165.41 cm

103. The frequency distribution of height of students of a class is given below:

Height (in cm)	Number of Students
160 – 162	12
162 – 164	15
164 – 166	24
166 – 168	13

The height which occurs most frequently in the class is

- (a) 163.5 cm (b) 163.9 cm
(c) 164.5 cm (d) 164.9 cm

104. The frequency distribution of height of students of a class is given below:

Height (in cm)	Number of Students
160 – 162	12
162 – 164	15

$164 - 166$	24
$166 - 168$	13

The most appropriate graphical representation of the given frequency distribution is

- (a) bar chart (b) percentage bar chart
(c) histogram (d) pie chart

105. The sum and the sum of squares of the observations corresponding to length X (in cm) and weight Y (in gm) of 50 tropical tubers are given as $\Sigma X = 200$, $\Sigma Y = 250$, $\Sigma X^2 = 900$ and $\Sigma Y^2 = 1400$.

Which one of the following is correct?

- (a) Variance (X) > Variance (Y)
(b) Variance (X) < Variance (Y)
(c) Variance (X) = Variance (Y)
(d) Cannot be determined from the given data

106. The sum and the sum of squares of the observations corresponding to length X (in cm) and weight Y (in gm) of 50 tropical tubers are given as $\Sigma X = 200$, $\Sigma Y = 250$, $\Sigma X^2 = 900$ and $\Sigma Y^2 = 1400$.

Which one of the following statements is correct?

- (a) Coefficient of variation of X is strictly more than coefficient of variation of Y .
(b) Coefficient of variation of X is strictly less than coefficient of variation of Y .
(c) Coefficient of variation of X is same as coefficient of variation of Y .
(d) Coefficient of variation cannot be determined from the given data.

107. Let X be a random variable following binomial distribution with parameters $n = 6$ and $p = k$. Further, $9P(X = 4) = P(X = 2)$.

What is the value of k ?

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

108. Let X be a random variable following binomial distribution with parameters $n = 6$ and $p = k$. Further, $9P(X = 4) = P(X = 2)$.

What is the value of $P(X = 3)$?

- (a) $135/1024$ (b) $5/128$
(c) $45/1024$ (d) $70/1024$

109. A committee of 6 members is formed from a group of 7 gentlemen and 4 ladies.

What is the probability that the committee includes exactly 3 gentlemen?

- (a) $10/33$ (b) $30/77$
(c) $100/231$ (d) $5/11$

110. A committee of 6 members is formed from a group of 7 gentlemen and 4 ladies.

What is the probability that the committee includes at least 2 ladies?

- (a) $41/66$ (b) $47/66$
(c) $49/66$ (d) $53/66$

111. The probabilities that A , B and C become managers are $3/10$, $1/2$ and $4/5$ respectively. The probabilities that bonus scheme will be introduced if A , B and C become managers are $4/9$, $2/9$ and $1/3$ respectively.

What is the probability that the bonus scheme will be introduced?

- (a) $17/45$ (b) $19/45$
(c) $23/45$ (d) $26/45$

112. The probabilities that A , B and C become managers are $3/10$, $1/2$ and $4/5$ respectively. The probabilities that bonus scheme will be introduced if A , B and C become managers are $4/9$, $2/9$ and $1/3$ respectively.

If the bonus scheme has been introduced, then what is the probability that the manager appointed was B ?

- (a) $5/23$ (b) $6/23$
(c) $7/23$ (d) $8/23$

113. The arithmetic mean of 100 observations is 50. If 5 is subtracted from each observation and then divided by 20, then what is the new arithmetic mean?

- (a) 2.25 (b) 3.5
(c) 4.25 (d) $5 \cdot 5$

114. The standard deviation of 100 observations is 10 . If 5 is added to each observation and then divided by 20, then what will be the new standard deviation?
(a) 0.25 (b) 0.5
(c) 0.75 (d) 1.00
115. If $P(A) = 1/3$, $P(B) = 1/2$ and $P(A \cap B) = 1/4$, then what is the value of $P(B | A^c)$?
(a) $1/8$ (b) $3/8$
(c) $5/8$ (d) $7/8$
116. If $P(A) = 1/3$, $P(B) = 1/2$ and $P(A \cap B) = 1/4$, then what is the value of $P(A^c \cap B^c)$?
(a) $1/4$ (b) $5/12$
(c) $7/12$ (d) $11/12$
117. If two fair dice are tossed, then what is the probability that the sum of the numbers on the faces of the dice is strictly greater than 7 ?
(a) $1/3$ (b) $5/12$
(c) $7/12$ (d) $3/4$
118. The probability of a man hitting a target is $1/5$. If the man fires 7 times, then what is the probability that he hits the target at least twice?
(a) $1 - \left(\frac{3}{5}\right)\left(\frac{4}{5}\right)^6$ (b) $1 - \left(\frac{3}{5}\right)\left(\frac{4}{5}\right)^7$
(c) $1 - \left(\frac{11}{5}\right)\left(\frac{4}{5}\right)^6$ (d) $1 - \left(\frac{11}{5}\right)\left(\frac{4}{5}\right)^7$
119. Let X be a random variable following binomial distribution whose mean and variance are 200 and 160 respectively. What is the value of the number of trials (n)?
(a) 500 (b) 1000
(c) 1500 (d) 2000
120. What is the arithmetic mean of $8^2, 9^2, 10^2, \dots, 15^2$?
(a) 133.5 (b) $135 \cdot 5$
(c) 137.5 (d) 139.5