









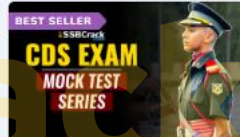



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1. If $z\bar{z} = |z + \bar{z}|$, where $z = x + iy$, $i = \sqrt{-1}$, then the locus of z is a pair of:

- (a) straight lines
- ☒ (b) rectangular hyperbolas
- (c) parabolas
- (d) circles

2. If $1! + 3! + 5! + 7! + \dots + 199!$ is divided by 24, what is the remainder?

- (a) 3
- (b) 6
- ☒ (c) 7
- (d) 9

3. What is the value of $\sqrt{12+5i} + \sqrt{12-5i}$, where $i = \sqrt{-1}$?

- ☒ (a) 24
- (b) 25
- (c) $5\sqrt{2}$
- (d) $5(\sqrt{2} - 1)$

4. If $A = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, then what is the value of $\det(I + AA')$, where I is the 3×3 identity matrix?

- (a) 15
- (b) 6
- ☒ (c) 0
- (d) -1

5. If A , B and C are square matrices of order 3 and $\det(BC) = 2 \det(A)$, then what is the value of $\det(2A^{-1}BC)$?

- (a) 16
- (b) 8
- ☒ (c) 4
- (d) 2

6. If the n^{th} term of a sequence is $\frac{2n+5}{7}$, then what is the sum of its first 140 terms?

- ☒ (a) 2840
- (b) 2780
- (c) 2920
- (d) 5700

7. Let A be a skew-symmetric matrix of order 3. What is the value of $\det(4A^4) - \det(3A^3) + \det(2A^2) - \det(A) + \det(-I)$ where I is the identity matrix of order 3?

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

If $A = \begin{bmatrix} 0 & 3 & 4 \\ -3 & 0 & 5 \\ -4 & -5 & 0 \end{bmatrix}$, then which one of the following statements is correct ?

- (a) A^2 is symmetric matrix with $\det(A^2) = 0$.
- (b) A^2 is symmetric matrix with $\det(A^2) \neq 0$.
- ☒ (c) A^2 is skew-symmetric matrix with $\det(A^2) = 0$.
- (d) A^2 is skew-symmetric matrix with $\det(A^2) \neq 0$.

If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$, then which of the following statements are correct ?

- 1. A^n will always be singular for any positive integer n .
- 2. A^n will always be a diagonal matrix for any positive integer n .
- 3. A^n will always be a symmetric matrix for any positive integer n .

Select the correct answer using the code given below :

- ☒ (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

10. If $(a + b)$, $2b$, $(b + c)$ are in HP, then which one of the following is correct ?

- (a) a , b and c are in AP
- ☒ (b) $a - b$, $b - c$ and $c - a$ are in AP
- (c) a , b and c are in GP
- (d) $a - b$, $b - c$ and $c - a$ are in GP

11. Let $t_1, t_2, t_3 \dots$ be in GP. What is $(t_1 t_3 \dots t_{21})^{\frac{1}{11}}$ equal to ?

- (a) t_{10}
- (b) t_{10}^2
- (c) t_{11}
- (d) t_{11}^2

12. Which one of the following is a square root of $-\sqrt{-1}$?

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

13. What is the maximum number of points of intersection of 10 circles ?

- (a) 45
- ☒ (b) 60
- (c) 90
- (d) 120

14. A set S contains $(2n + 1)$ elements. There are 4096 subsets of S which contain at most n elements. What is n equal to ?

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

If $\begin{vmatrix} x^2 + 3x & x - 1 & x + 3 \\ x + 1 & -2x & x - 4 \\ x - 3 & x + 4 & 3x \end{vmatrix}$

$$= ax^4 + bx^3 + cx^2 + dx + e,$$

then what is the value of e ?

(a) -1

(b) 0

(c) 1

(d) 2

3. If all elements of a third order determinant are equal to 1 or -1 , then the value of the determinant is :

(a) 0 only

(b) an even number but not necessarily 0

(c) an odd number

(d) 0, 1 or -1

7. If $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 3 & 0 \\ 1 & 0 & 1 \end{bmatrix}$, then what is the value of $\det[\text{adj}(\text{adj}A)]$?

(a) 5

(b) 25

(c) 125

(d) 625

18. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then what is

$$23A^3 - 19A^2 - 4A \text{ equal to ?}$$

(a) Null matrix of order 3

(b) Identity matrix of order 3

(c) $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$

(d) $\begin{bmatrix} 7 & 0 & 0 \\ 0 & 7 & 0 \\ 0 & 0 & 7 \end{bmatrix}$

19. The value of the determinant of a matrix A of order 3 is 3. If C is the matrix of cofactors of the matrix A , then what is the value of determinant of C^2 ?

(a) 3

(b) 9

(c) 81

(d) 729

20. If $A_k = \begin{bmatrix} k-1 & k \\ k-2 & k+1 \end{bmatrix}$, then what is $\det(A_1) + \det(A_2) + \det(A_3) + \dots + \det(A_{100})$ equal to?

(a) 100

(b) 1000

(c) 9900

(d) 10000

The Cartesian product $A \times A$ has 16 elements among which are $(0, 2)$ and $(1, 3)$. Which of the following statements is/are correct?

1. It is possible to determine set A .
2. $A \times A$ contains the element $(3, 2)$.

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

Let $A = \{1, 2, 3, \dots, 20\}$. Define a relation R from A to A by $R = \{(x, y) : 4x - 3y = 1\}$, where $x, y \in A$. Which of the following statements is/are correct?

1. The domain of R is $\{1, 4, 7, 10, 13, 16\}$.
2. The range of R is $\{1, 5, 9, 13, 17\}$.
3. The range of R is equal to codomain of R .

Select the correct answer using the code given below :

- (a) 1 only
- (b) 2 only
- (c) 1 and 2
- (d) 2 and 3

23. Consider the following statements :

1. The relation f defined by

$$f(x) = \begin{cases} x^3, & 0 \leq x \leq 2 \\ 4x, & 2 \leq x \leq 8 \end{cases} \text{ is a function.}$$

2. The relation g defined by

$$g(x) = \begin{cases} x^2, & 0 \leq x \leq 4 \\ 3x, & 4 \leq x \leq 8 \end{cases} \text{ is a function.}$$

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

24. Consider the following statements :

1. $A = (A \cup B) \cup (A - B)$
2. $A \cup (B - A) = (A \cup B)$
3. $B = (A \cup B) - (A - B)$

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

5. A function satisfies $f(x-y) = \frac{f(x)}{f(y)}$, where $f(y) \neq 0$. If $f(1) = 0.5$, then what is $f(2) + f(3) + f(4) + f(5) + f(6)$ equal to ?

- (a) $\frac{15}{32}$
- (b) $\frac{17}{32}$
- (c) $\frac{29}{64}$
- (d) $\frac{31}{64}$

6. What is $2 \cot\left(\frac{1}{2} \cos^{-1} \frac{\sqrt{5}}{3}\right)$ equal to ?

- (a) -1
- (b) 1
- (c) $3 + \sqrt{5}$
- (d) $3 - \sqrt{5}$

27. If $\sec^{-1} p - \operatorname{cosec}^{-1} q = 0$, where $p > 0, q > 0$; then what is the value of $p^{-2} + q^{-2}$?

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

28. What is $1 + \sin^2\left(\cos^{-1}\left(\frac{3}{\sqrt{17}}\right)\right)$ equal to ?

- (a) $\frac{25}{17}$
- (b) $\frac{8}{17}$
- (c) $\frac{9}{17}$
- (d) $\frac{47}{17}$

29. If $\tan(\pi \cos \theta) = \cot(\pi \sin \theta)$, $0 < \theta < \frac{\pi}{2}$; then what is the value of $8 \sin^2\left(\theta + \frac{\pi}{4}\right)$?

- (a) 16
- (b) 2
- (c) 1
- (d) $\frac{1}{2}$

30. If $\tan \alpha = \frac{1}{7}$, $\sin \beta = \frac{1}{\sqrt{10}}$; $0 < \alpha, \beta < \frac{\pi}{2}$, then what is the value of $\cos(\alpha + 2\beta)$?

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

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

Consider the equation $(1 - x)^4 + (5 - x)^4 = 82$.

31. What is the number of real roots of the equation ?

- (a) 0
- (b) 2
- (c) 4
- (d) 8

32. What is the sum of all the roots of the equation ?

- (a) 24
- (b) 12
- (c) 10
- (d) 6

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

Consider equation-I : $z^3 + 2z^2 + 2z + 1 = 0$ and equation-II : $z^{1985} + z^{100} + 1 = 0$.

33. What are the roots of equation-I ?

- (a) $1, \omega, \omega^2$
- (b) $-1, \omega, \omega^2$
- (c) $1, -\omega, \omega^2$
- (d) $-1, -\omega, -\omega^2$

34. Which one of the following is a root of equation-II ?

- (a) -1
- (b) $-\omega$
- (c) $-\omega^2$
- (d) ω

35. What is the number of common roots of equation-I and equation-II ?

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

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

A quadratic equation is given by $(a + b)x^2 - (a + b + c)x + k = 0$, where a, b, c are real.

36. If $k = \frac{c}{2}$, ($c \neq 0$), then the roots of the equation are :

- (a) Real and equal
- (b) Real and unequal
- (c) Real iff $a > c$
- (d) Complex but not real

If $k = c$, then the roots of the equation are :

- (a) $\frac{a+c}{a+b}$ and $\frac{b}{a+b}$
 (b) $\frac{a+c}{a+b}$ and $-\frac{b}{a+b}$
 (c) 1 and $\frac{c}{a+b}$
 (d) -1 and $-\frac{c}{a+b}$

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

$$(1+x)^n = 1 + T_1x + T_2x^2 + T_3x^3 + \dots + T_nx^n.$$

What is $T_1 + 2T_2 + 3T_3 + \dots + nT_n$ equal to ?

- (a) 0
 (b) 1
 (c) 2^n
 (d) $n2^{n-1}$

What is $1 - T_1 + 2T_2 - 3T_3 + \dots + (-1)^n nT_n$ equal to ?

- (a) 0
 (b) -2^{n-1}
 (c) $n2^{n-1}$
 (d) 1

What is $T_1 + T_2 + T_3 + \dots + T_n$ equal to ?

- (a) 2^n
 (b) $2^n - 1$
 (c) 2^{n-1}
 (d) $2^n + 1$

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

Let $f(x) = x^2 - 1$ and $\text{gof}(x) = x - \sqrt{x} + 1$.

41. Which one of the following is a possible expression for $g(x)$?

- (a) $\sqrt{x+1} - \sqrt[4]{x+1}$
 (b) $\sqrt{x+1} - \sqrt[4]{x+1} + 1$
 (c) $\sqrt{x+1} + \sqrt[4]{x+1}$
 (d) $x+1 - \sqrt{x+1} + 1$

42. What is $g(15)$ equal to ?

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

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

Let a function f be defined on $\mathbb{R} - \{0\}$ and $2f(x) + f\left(\frac{1}{x}\right) = x + 3$.

43. What is $f(0.5)$ equal to ?

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

If f is differentiable, then what is $f'(0.5)$ equal to?

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

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

A function is defined by

$$f(x) = \begin{vmatrix} x+1 & 2 & 3 \\ 2 & x+4 & 6 \\ 3 & 6 & x+9 \end{vmatrix}$$

The function is decreasing on :

- (a) $\left[-\frac{28}{3}, 0\right]$
- (b) $\left[0, \frac{28}{3}\right]$
- (c) $\left[0, \frac{50}{3}\right]$
- (d) $\left[0, \frac{56}{3}\right]$

3. The function attains local minimum value at :

- (a) $x = -\frac{28}{3}$
- (b) $x = -1$
- (c) $x = 0$
- (d) $x = \frac{28}{3}$

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

Given that $4x^2 + y^2 = 9$.

47. What is the maximum value of y ?

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

48. What is the maximum value of xy ?

- (a) $\frac{9}{4}$
- (b) $\frac{3}{2}$
- (c) $\frac{4}{9}$
- (d) $\frac{2}{3}$

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

A function is defined by $f(x) = \pi + \sin^2 x$.

49. What is the range of the function?

- (a) $[0, 1]$
- (b) $[\pi, \pi + 1]$
- (c) $[\pi - 1, \pi + 1]$
- (d) $[\pi - 1, \pi - 1]$

50. What is the period of the function?

- (a) 2π
- (b) π
- (c) $\frac{\pi}{2}$
- (d) The function is non-periodic

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

A parabola passes through (1, 2) and satisfies the differential equation $\frac{dy}{dx} = \frac{2y}{x}$, $x > 0$, $y > 0$.

51. What is the directrix of the parabola ?

(a) $y = -\frac{1}{8}$

(b) $y = \frac{1}{8}$

(c) $x = -\frac{1}{8}$

(d) $x = \frac{1}{8}$

52. What is the length of latus rectum of the parabola ?

(a) 1

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

(c) $\frac{1}{4}$

(d) $\frac{1}{8}$

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

Let $f(x) = \frac{a^{x-1} + b^{x-1}}{2}$ and $g(x) = x - 1$.

53. What is $\lim_{x \rightarrow 1} \frac{f(x) - 1}{g(x)}$ equal to ?

(a) $\frac{\ln(ab)}{4}$

(b) $\frac{\ln(ab)}{2}$

(c) $\ln(ab)$

(d) $2 \ln(ab)$

54. What is $\lim_{x \rightarrow 1} f(x)^{\frac{1}{g(x)}}$ equal to ?

(a) \sqrt{ab}

(b) ab

(c) $2ab$

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

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

Let $f(x) = \sqrt{2-x} + \sqrt{2+x}$.

55. What is the domain of the function ?

(a) $(-2, 2)$

(b) $[-2, 2]$

(c) $\mathbb{R} - (-2, 2)$

(d) $\mathbb{R} - [-2, 2]$

56. What is the greatest value of the function ?

(a) $\sqrt{3}$

(b) $\sqrt{6}$

(c) $\sqrt{8}$

(d) 4

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

Let $f(x) = |x|$ and $g(x) = [x] - 1$, where $[.]$ is the greatest integer function.

Let $h(x) = \frac{f(g(x))}{g(f(x))}$.

57. What is $\lim_{x \rightarrow 0^+} h(x)$ equal to ?

(a) -2

(b) -1

(c) 0

(d) 1

58. What is $\lim_{x \rightarrow 0^-} h(x)$ equal to ?

- (a) -2
- (b) -1
- ☒ (c) 0
- (d) 2

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

Let $f(x) = \begin{cases} \frac{x-3}{|x-3|} + a; & x < 3 \\ a - b; & x = 3 \text{ and} \\ \frac{x-3}{|x-3|} + b; & x > 3 \end{cases}$

$f(x)$ be continuous at $x = 3$.

59. What is the value of a ?

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

60. What is the value of b ?

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

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

Let $I = \int_{-2\pi}^{2\pi} \frac{\sin^4 x + \cos^4 x}{1 + 3^x} dx$

61. What is $\int_0^{\pi} (\sin^4 x + \cos^4 x) dx$ equal to ?

- (a) $\frac{3\pi}{8}$
- (b) $\frac{3\pi}{4}$
- (c) $\frac{3\pi}{2}$
- (d) 3π

62. What is I equal to ?

- (a) 0
- ☒ (b) $\frac{3\pi}{4}$
- (c) $\frac{3\pi}{2}$
- (d) 3π

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

Let $f(x) = \begin{cases} ax(x+1) + b, & x < 1 \\ x - 1, & 1 \leq x \leq 2 \end{cases}$

63. If the function $f(x)$ is differentiable at $x = 1$, then what is the value of $(a + b)$?

- (a) $-\frac{1}{3}$
- (b) -1
- ☒ (c) 0
- (d) 1

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

(a) $-\frac{1}{3}$

(b) $-\frac{2}{3}$

(c) 0

(d) 1

5. If $f(x) = |\ln |x||$ where $0 < x < 1$, then what is $f'(0.5)$ equal to?

(a) -2

(b) -1

(c) 0

(d) 2

6. If $f'(x) = \cos(\ln x)$ and $y = f\left(\frac{2x-3}{x}\right)$, then what is $\frac{dy}{dx}$ equal to?

(a) $\cos\left(\ln\left(\frac{2x-3}{x}\right)\right)$

(b) $-\frac{3}{x^2} \sin\left(\ln\left(\frac{2x-3}{x}\right)\right)$

(c) $\frac{3}{x^2} \cos\left(\ln\left(\frac{2x-3}{x}\right)\right)$

(d) $-\frac{3}{x^2} \cos\left(\ln\left(\frac{2x-3}{x}\right)\right)$

67. What is $\int_0^{8\pi} |\sin x| dx$ equal to?

(a) 2

(b) 4

(c) 8

(d) 16

68. What is the area between the curve $f(x) = x|x|$ and x-axis for $x \in [-1, 1]$?

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

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

(c) $\frac{1}{4}$

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

69. What are the order and the degree respectively of the differential equation $x^2 \left(\frac{d^3y}{dx^3}\right)^2 + \left(\frac{dy}{dx}\right)^4 + \sin x = 0$?

(a) 3, 4

(b) 1, 4

(c) 2, 2

(d) 3, 2

70. What is the differential equation of all parabolas of the type $y^2 = 4a(x - b)$?

(a) $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$

(b) $\frac{d^2y}{dx^2} + x^2 \left(\frac{dy}{dx}\right)^2 = 0$

(c) $y^2 \frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$

(d) $y \frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$

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

Let $a_1, a_2, a_3 \dots$ be in AP such that

$$a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{25} + a_{30} + a_{34} = 300.$$

1. What is

$$a_1 + a_5 - a_{10} - a_{15} - a_{20} - a_{25} + a_{30} + a_{34}$$
 equal to ?

- (a) 0
- (b) 25
- ☒ (c) 125
- (d) 250

72. What is $\sum_{n=1}^{34} a_n$ equal to ?

- (a) 900
- (b) 1025
- (c) 1200
- (d) 1275

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

$$\text{Let } p = \cos\left(\frac{\pi}{5}\right)\cos\left(\frac{2\pi}{5}\right) \text{ and } q = \cos\left(\frac{4\pi}{5}\right)\cos\left(\frac{8\pi}{5}\right).$$

73. What is the value of $p + q$?

- (a) $-\frac{1}{2}$
- (b) $-\frac{1}{4}$
- (c) 0
- (d) $\frac{1}{2}$

74. What is the value of pq ?

- (a) $-\frac{1}{16}$
- (b) $-\frac{1}{4}$
- (c) $\frac{1}{4}$
- (d) $\frac{1}{16}$

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

$$\text{Let } p = \frac{1}{3} - \frac{\tan 3x}{\tan x} \text{ and}$$

$$q = 1 - 3 \tan^2 x, 0 < x < \pi, x \neq \frac{\pi}{2}.$$

75. What is pq equal to ?

- (a) 1
- (b) 2
- (c) $\frac{8}{3}$
- (d) $-\frac{8}{3}$

76. For how many values of x does $\frac{1}{p}$ become zero ?

- (a) No value
- ☒ (b) Only one value
- (c) Only two values
- (d) Only three values

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

Let $\sin x + \sin y = \sqrt{3} (\cos y - \cos x)$; $x + y = \frac{\pi}{2}$,
 $0 < x, y < \frac{\pi}{2}$.

77. What is a value of $\sin 3x + \sin 3y$?

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

78. What is a value of $\cos^3 x + \cos^3 y$?

- (a) $\frac{3\sqrt{3}}{8}$
- (b) $\frac{3\sqrt{6}}{8}$
- (c) $\frac{3\sqrt{6}}{4}$
- (d) 1

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

The angles A, B and C of a triangle ABC are in the ratio 3 : 5 : 4.

79. What is the value of $a + b + \sqrt{2} c$ equal to ?

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

80. What is the ratio of $a^2 : b^2 : c^2$?

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

81. What is the equation of directrix of parabola $y^2 = 4bx$, where $b < 0$ and $b^2 + b - 2 = 0$?

- (a) $x + 1 = 0$
- (b) $x - 2 = 0$
- (c) $x - 1 = 0$
- (d) $x + 2 = 0$

82. The points $(-a, -b)$, $(0, 0)$, (a, b) and (a^2, ab) are :

- (a) lying on the same circle
- (b) vertices of a square
- (c) vertices of a parallelogram that is not a square
- (d) collinear

83. Given that $16p^2 + 49q^2 - 4r^2 - 56pq = 0$. Which one of the following is a point on a pair of straight lines $(px + qy + r)(px + qy - r) = 0$?

- (a) $\left(2, \frac{7}{2}\right)$
- (b) $\left(2, -\frac{7}{2}\right)$
- (c) $(4, -7)$
- (d) $(4, 7)$

84. If $3x + y - 5 = 0$ is the equation of a chord of the circle $x^2 + y^2 - 25 = 0$, then what are the coordinates of the mid-point of the chord ?

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

85. Consider the following in respect of the equation $\frac{x^2}{24-k} + \frac{y^2}{k-16} = 2$.

1. The equation represents an ellipse if $k = 19$.
2. The equation represents a hyperbola if $k = 12$.
3. The equation represents a circle if $k = 20$.

How many of the statements given above are correct?

- (a) Only one
 (b) Only two
 (c) All three
 (d) None

86. Consider the following statements in respect of hyperbola $\frac{x^2}{\cos^2 \theta} - \frac{y^2}{\sin^2 \theta} = 1$:

1. The two foci are independent of θ .
2. The eccentricity is $\sec \theta$.
3. The distance between the two foci is 2 units.

How many of the statements given above are correct?

- (a) Only one
 (b) Only two
 (c) All three
 (d) None

87. Consider the following in respect of the circle $4x^2 + 4y^2 - 4ax - 4ay + a^2 = 0$:

1. The circle touches both the axes.
2. The diameter of the circle is $2a$.
3. The centre of the circle lies on the line $x + y = a$.

How many of the statements given above are correct?

- (a) Only one
 (b) Only two
 (c) All three
 (d) None

88. For what values of k is the line $(k-3)x - (5-k^2)y + k^2 - 7k + 6 = 0$ parallel to the line $x + y = 1$?

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

89. The line $x + y = 4$ cuts the line joining $P(-1, 1)$ and $Q(5, 7)$ at R . What is $PR : RQ$ equal to?

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

90. What is the sum of the intercepts of the line whose perpendicular distance from origin is 4 units and the angle which the normal makes with positive direction of x -axis is 15° ?

- (a) 8
 (b) $4\sqrt{6}$
 (c) $8\sqrt{6}$
 (d) 16

91. What is the length of projection of the vector $\hat{i} + 2\hat{j} + 3\hat{k}$ on the vector $2\hat{i} + 3\hat{j} - 2\hat{k}$?

- (a) $\frac{1}{\sqrt{17}}$
- (b) $\frac{2}{\sqrt{17}}$
- (c) $\frac{3}{\sqrt{17}}$
- (d) $\frac{2}{\sqrt{14}}$

92. If $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = 144$ and $|\vec{b}| = 4$, then what is the value of $|\vec{a}|$?

- (a) 3
- (b) 4
- (c) 5
- (d) 6

93. If θ is the angle between vectors \vec{a} and \vec{b} such that $\vec{a} \cdot \vec{b} \geq 0$, then which one of the following is correct?

- (a) $0 \leq \theta \leq \pi$
- (b) $\frac{\pi}{2} \leq \theta \leq \pi$
- (c) $0 \leq \theta \leq \frac{\pi}{2}$
- (d) $0 < \theta < \frac{\pi}{2}$

94. The vectors $60\hat{i} + 3\hat{j}$, $40\hat{i} - 8\hat{j}$ and $\beta\hat{i} - 52\hat{j}$ are collinear if:

- (a) $\beta = 20$
- (b) $\beta = 40$
- (c) $\beta = -40$
- (d) $\beta = 26$

95. Consider the following in respect of the vectors $\vec{a} = (0, 1, 1)$ and $\vec{b} = (1, 0, 1)$:

1. The number of unit vectors perpendicular to both \vec{a} and \vec{b} is only one.
2. The angle between the vectors is $\frac{\pi}{3}$.

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

96. If L is the line with direction ratios $\langle 3, -2, 6 \rangle$ and passing through $(1, -1, 1)$, then what are the coordinates of the points on L whose distance from $(1, -1, 1)$ is 2 units?

- (a) $\left(-\frac{11}{7}, \frac{13}{7}, \frac{19}{7}\right)$ and $\left(\frac{1}{7}, \frac{3}{7}, \frac{5}{7}\right)$
- (b) $\left(\frac{19}{7}, -\frac{11}{7}, \frac{13}{7}\right)$ and $\left(-\frac{1}{7}, \frac{3}{7}, -\frac{5}{7}\right)$
- (c) $\left(\frac{13}{7}, \frac{11}{7}, \frac{19}{7}\right)$ and $\left(-\frac{1}{7}, -\frac{3}{7}, \frac{5}{7}\right)$
- (d) $\left(\frac{13}{7}, -\frac{11}{7}, \frac{19}{7}\right)$ and $\left(\frac{1}{7}, -\frac{3}{7}, -\frac{5}{7}\right)$

97. Which one of the planes is parallel to the line $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$?

- (a) $2x + 2y + z - 1 = 0$
- (b) $2x - y - 2z + 5 = 0$
- (c) $2x + 2y - 2z + 1 = 0$
- (d) $x - 2y + z - 1 = 0$

98. What is the angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$?

- (a) 0°
- (b) 30°
- (c) 60°
- (d) 90°

99. What is the equation of the sphere concentric with the sphere $x^2 + y^2 + z^2 - 2x - 6y - 8z - 5 = 0$ and which passes through the origin?

- (a) $x^2 + y^2 + z^2 - 2x - 8z = 0$
- (b) $x^2 + y^2 + z^2 - 2x - 6y = 0$
- (c) $x^2 + y^2 + z^2 - 6y - 8z = 0$
- (d) $x^2 + y^2 + z^2 - 2x - 6y - 8z = 0$

100. A point P lies on the line joining A(1, 2, 3) and B(2, 10, 1). If z-coordinate of P is 7, what is the sum of other two coordinates?

- (a) -15
- (b) -13
- (c) -11
- (d) -9

101. The sum of deviations of n numbers from 10 and 20 are p and q respectively. If $(p - q)^2 = 10000$, then what is the value of n?

- (a) 10
- (b) 20
- (c) 50
- (d) 100

102. If $\bar{X} = 20$ is the mean of 10 observations x_1, x_2, \dots, x_{10} ; then what is the value of $\sum_{i=1}^{10} \left(\frac{3x_i - 4}{5} \right)$?

- (a) 0
- (b) 12
- (c) 112
- (d) 1012

103. If the mean and the sum of squares of 10 observations are 40 and 16160 respectively, then what is the standard deviation?

- (a) 16
- (b) 6
- (c) 5
- (d) 4

104. Three dice are thrown. What is the probability of getting a sum which is a perfect square?

- (a) $\frac{17}{108}$
- (b) $\frac{5}{108}$
- (c) $\frac{19}{108}$
- (d) $\frac{23}{108}$

105. A, B, C and D are mutually exclusive and exhaustive events.

If $2P(A) = 3P(B) = 4P(C) = 5P(D)$, then what is $77P(A)$ equal to ?

- (a) 12
- (b) 15
- (c) 20
- (d) 30

106. Two distinct natural numbers from 1 to 9 are picked at random. What is the probability that their product has 1 in its unit place ?

- (a) $\frac{1}{81}$
- (b) $\frac{1}{72}$
- (c) $\frac{1}{18}$
- (d) $\frac{1}{36}$

107. Two dice are thrown. What is the probability that difference of numbers on them is 2 or 3 ?

- (a) $\frac{7}{36}$
- (b) $\frac{7}{18}$
- (c) $\frac{5}{18}$
- (d) $\frac{11}{36}$

DFTK-S-MTH

108. What is the mean of the numbers 1, 2, 3, ..., 10 with frequencies ${}^9C_0, {}^9C_1, {}^9C_2, \dots, {}^9C_9$, respectively ?

- (a) 1.1×2^8
- (b) 1.2×7^4
- (c) 5.5
- (d) 0.55

109. The probability that a person recovers from a disease is 0.8. What is the probability that exactly 2 persons out of 5 will recover from the disease ?

- (a) 0.00512
- (b) 0.02048
- (c) 0.2048
- (d) 0.0512

110. Suppose that there is a chance for a newly constructed building to collapse, whether the design is faulty or not. The chance that the design is faulty is 10%. The chance that the building collapses is 95% if the design is faulty, otherwise it is 45%. If it is seen that the building has collapsed, then what is the probability that it is due to faulty design ?

- (a) 0.10
- (b) 0.19
- (c) 0.45
- (d) 0.95

111. If r is the coefficient of correlation between x and y , then what is the correlation coefficient between $(3x + 4)$ and $(-3y + 3)$?

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

112. A fair coin is tossed 6 times. What is the probability of getting a result in the 6th toss which is different from those obtained in the first five tosses?

- (a) $\frac{7}{16}$
- (b) $\frac{1}{16}$
- (c) $\frac{1}{32}$
- (d) $\frac{1}{64}$

113. If H is the Harmonic Mean of three numbers $^{10}C_4$, $^{10}C_5$, and $^{10}C_6$, then what is the value of $\frac{270}{H}$?

- (a) 1
- (b) $\frac{14}{17}$
- (c) $\frac{17}{14}$
- (d) $\frac{1}{31}$

114. In a class, there are n students including the students P and Q . What is the probability that P and Q sit together if seats are assigned randomly?

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

115. In a Binomial distribution $B(n, p)$, $n = 6$ and $9P(X = 4) = P(X = 2)$. What is p equal to?

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

Consider the following for the next five (05) questions that follow :

Three boys P, Q, R and three girls S, T, U are to be arranged in a row for a group photograph.

6. What is the probability that all three boys sit together ?

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

(b) $\frac{1}{4}$

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

☒ (d) $\frac{1}{12}$

17. What is the probability that boys and girls sit alternatively ?

(a) $\frac{4}{5}$

(b) $\frac{1}{10}$

☒ (c) $\frac{5}{6}$

(d) $\frac{1}{7}$

118. What is the probability that no two girls sit together ?

☒ (a) $\frac{2}{5}$

(b) $\frac{3}{5}$

(c) $\frac{1}{18}$

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

119. What is the probability that P and Q take the two end positions ?

☒ (a) $\frac{1}{15}$

(b) $\frac{7}{15}$

(c) $\frac{14}{15}$

(d) $\frac{11}{45}$

120. What is the probability that Q and U sit together ?

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











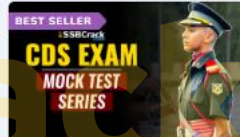

☒ (b) $\frac{1}{4}$

(c) $\frac{5}{6}$

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

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