

## NDA I & II Mathematics

1. What is the maximum number of points of intersection of 5 non-overlapping circles?

- A. 10
- B. 15
- C. 20
- D. 25

2. What is the number of ways in which the letters of the word 'ABLE' can be arranged So that the Vowels occupy even places?

- A. 2
- B. 4
- C. 6
- D. 8

3. Let  $A = \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$  and  $B = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ , then what is AB equal to?

- A.  $\begin{bmatrix} ax + hy + gz \\ y \\ z \end{bmatrix}$
- B.  $a + b$
- C.  $\begin{bmatrix} ax + hy + gz \\ hx + by + fz \\ gx + fy + cz \end{bmatrix}$
- D.  $[ax + hy + gz \quad hz + by + fz \quad gx + fy + cz]$

4. What is the value of the determinant  $\begin{vmatrix} i & i^2 & i^3 \\ i^4 & i^6 & i^8 \\ i^9 & i^{12} & i^{15} \end{vmatrix}$  where?

- A. 0
- B. -2
- C. 4i
- D. -4i



5. Let  $S = \{1, \frac{2}{a}, \frac{3}{2}, \dots\}$ . A relation  $R$  on  $S \times S$  is defined by  $xRy$  if  $\log_a x >$

$\log_a y$  when  $\dots$ . Then the relation is

- A. reflexive only
- B. symmetric only
- C. transitive only
- D. both symmetric and transitive

6. If  $1.5 \leq x \leq 4.5$ , then which one of the following is correct?

- A.  $(2x - 3)(2x - 9) > 0$
- B.  $(2x - 3)(2x - 9) < 0$
- C.  $(2x - 3)(2x - 9) \geq 0$
- D.  $(2x - 3)(2x - 9) \leq 0$

7. Let  $A = \begin{bmatrix} x+y & y \\ 2x & x-y \end{bmatrix}$ ,  $B = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$  and  $C = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$ . If  $AB = C$ , then what is the value of the determinant of the matrix  $A$ ?

- A. -10
- B. -14
- C. -24
- D. -34

8. If  $x = \log_c(ab)$ ,  $y = \log_a(bc)$ ,  $z = \log_b(ca)$ , then which of the following is correct?

- A.  $xyz = 1$
- B.  $x + y + z = 1$
- C.  $(1 + x)^{-1} + (1 + y)^{-1} + (1 + z)^{-1} = 1$
- D.  $(1 + x)^{-2} + (1 + y)^{-2} + (1 + z)^{-2} = 1$

9. What is the value of

$$\frac{1}{10} \log_5 1024 - \log_5 10 + \frac{1}{5} \log_5 3125 \quad ?$$

- A. 0
- B. 1
- C. 2
- D. 3



10. The number  $(1101101 + 1011011)_2$  can be written in decimal system as

- A.  $(198)_{10}$
- B.  $(199)_{10}$
- C.  $(200)_{10}$
- D.  $(201)_{10}$

11. For how many values of  $k$ , is the matrix  $\begin{bmatrix} 0 & k & 4 \\ -k & 0 & -5 \\ -k & k & -1 \end{bmatrix}$  singular?

- A. only one
- B. Only two
- C. only four
- D. Infinite

12. If  $C(20, n+2) = C(20, n-2)$ , then what is  $n$  equal to?

- A. 18
- B. 25
- C. 10
- D. 12

13. If  $(1 + 2x - x^2)^6 = a_0 + a_1x + a_2x^2 + \dots + a_{12}x^{12}$ , then what is  $a_0 - a_1 + a_2 - a_3 + a_4 - \dots + a_{12}$  equal to?

- A. 32
- B. 64
- C. 2048
- D. 4096

14. The term independent of  $x$  in the binomial expansion of  $\left(\frac{2}{x^2} - \sqrt{x}\right)^{10}$  is equal to?

- A. 180
- B. 120
- C. 90
- D. 72



15. If matrix  $A = \begin{bmatrix} 1-i & i \\ -i & 1-i \end{bmatrix}$  where  $i = \sqrt{-1}$ , then which one of the following is correct?

- A. A is hermitian
- B. A is skew-hermitian
- C.  $(\bar{A})^T + A$  is hermitian
- D.  $(\bar{A})^T + A$  is skew-hermitian

16. What is the argument of the complex number  $\frac{1-i\sqrt{3}}{1+i\sqrt{3}}$ , where  $i = \sqrt{-1}$ ?

- A.  $240^\circ$
- B.  $210^\circ$
- C.  $120^\circ$
- D.  $60^\circ$

17. The roots  $\alpha$  and  $\beta$  of a quadratic equation, satisfy the relations  $\alpha + \beta = \alpha^2 + \beta^2$  and  $\alpha\beta = \alpha^2\beta^2$ . What is the number of such quadratic equations?

- A. 0
- B. 2
- C. 3
- D. 4

18. If  $\cot \alpha$  and  $\cot \beta$  are the roots of the equation  $x^2 - 3x + 2 = 0$ , then what is  $\cot(\alpha + \beta)$  equal to?

- A.  $\frac{1}{2}$
- B.  $\frac{1}{3}$
- C. 2
- D. 3

19. If  $p^2$ ,  $q^2$  and  $r^2$  (where  $p, q, r > 0$ ) are in GP, then which of the following is/are correct?

- 1)  $p, q$  and  $r$  are in GP.
- 2)  $\ln p, \ln q$  and  $\ln r$  are in AP.



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

20.If A is a matrix of order  $3 \times 5$  and B is a matrix of order  $5 \times 3$ , then the order of AB and BA will respectively be

- A.  $3 \times 3$  and  $3 \times 3$
- B.  $3 \times 5$  and  $5 \times 3$
- C.  $3 \times 3$  and  $5 \times 5$
- D.  $5 \times 3$  and  $3 \times 5$

21.If  $\sin x + \sin y = \cos y - \cos x$ , where  $0 < y < x < \frac{\pi}{2}$ , then what is  $\tan\left(\frac{x-y}{2}\right)$  equal to?

- A. 0
- B.  $\frac{1}{2}$
- C. 1
- D. 2

###COMMON###22###22###**Direction:** Read the following information and answer the three items that follow :

Let  $\alpha = \beta = 15^\circ$ .

###DONE###

22. What is  $\sin(\alpha + 1^\circ) + \cos(\beta + 1^\circ)$  equal to?

- A.  $\sqrt{3} \cos 1^\circ + \sin 1^\circ$
- B.  $\sqrt{3} \cos 1^\circ - \frac{1}{2} \sin 1^\circ$
- C.  $\frac{1}{\sqrt{2}}(\sqrt{3} \cos 1^\circ - \sin 1^\circ)$
- D.  $\frac{1}{\sqrt{2}}(\sqrt{3} \cos 1^\circ + \sin 1^\circ)$



23. What is the value of  $\sin 7\alpha - \cos 7\beta$ ?

- A.  $\frac{1}{\sqrt{2}}$
- B.  $\frac{1}{2\sqrt{2}}$
- C.  $\frac{\sqrt{3}}{2\sqrt{2}}$
- D.  $\frac{\sqrt{3}}{\sqrt{2}}$

24.

What is the value of  $\sin \alpha + \cos \beta$ ?

- A.  $\frac{1}{\sqrt{2}}$
- B.  $\frac{1}{2\sqrt{2}}$
- C.  $\frac{\sqrt{3}}{2\sqrt{2}}$
- D.  $\frac{\sqrt{3}}{\sqrt{2}}$

###COMMON###25###25### **Direction:** Read the following information and answer the three items that follow :

Let  $t_n = \sin^n \theta + \cos^n \theta$ .

###DONE###

25. What is the value of  $t_{10}$  where  $\theta = 45^\circ$ ?

- A. 1
- B.  $\frac{1}{4}$
- C.  $\frac{1}{16}$
- D.  $\frac{1}{32}$

26. What is  $t_1^2 - t_2$  equal to?



- A.  $\cos 2\theta$
- B.  $\sin 2\theta$
- C.  $2 \cos \theta$
- D.  $2 \sin \theta$

27.

What is  $\frac{t_3 - t_5}{t_5 - t_7}$  equal to?

- A.  $\frac{t_1}{t_3}$
- B.  $\frac{t_3}{t_5}$
- C.  $\frac{t_5}{t_7}$
- D.  $\frac{t_1}{t_7}$

###COMMON###28###28### **Direction:** Read the following information and answer the three items that follow :

Let  $a \sin^2 x + b \cos^2 x = c$ ;  $b \sin^2 y + a \cos^2 y = d$  and  $p \tan x = q \tan y$ .

###DONE###

28. What is  $\frac{p^2}{q^2}$  equal to?

- A.  $\frac{(b - c)(b - d)}{(a - d)(a - c)}$
- B.  $\frac{(a - d)(c - a)}{(b - c)(d - b)}$
- C.  $\frac{(d - a)(c - a)}{(b - c)(d - b)}$
- D.  $\frac{(b - c)(b - d)}{(c - a)(a - d)}$

29. What is  $\frac{d - a}{b - d}$  equal to?

- A.  $\sin^2 y$
- B.  $\cos^2 y$



- C.  $\tan^2 y$
- D.  $\cot^2 y$

30.

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

- A.  $\frac{c-b}{a-c}$
- B.  $\frac{a-c}{c-b}$
- C.  $\frac{c-a}{c-b}$
- D.  $\frac{c-b}{c-a}$

31. What is the equation of the plane which cuts an intercept 5 units on the z-axis and is parallel to xy-plane?

- A.  $x + y = 5$
- B.  $z = 5$
- C.  $z = 0$
- D.  $x + y + z = 5$

32. Into how many compartments do the coordinate planes divide the space?

- A. 2
- B. 4
- C. 8
- D. 16

33. If a line has direction ratios  $\langle a + b, b + c, c + a \rangle$ , then what is the sum of the square of its direction cosines?

- A.  $(a + b + c)^2$
- B.  $2(a + b + c)$
- C. 3
- D. 1





34. What is the perpendicular distance from the point (2, 3, 4) to the line  $\frac{x-1}{1} = \frac{y-0}{0} = \frac{z-0}{0}$  ?

- A. 6 units
- B. 5 units
- C. 3 units
- D. 2 units

35. What is the length of the diameter of the sphere whose centre is at (1, -2, 3) and which touches the plane  $6x - 3y + 2z - 4 = 0$ ?

- A. 1 unit
- B. 2 units
- C. 3 units
- D. 4 units

36. A data set of  $n$  observations has mean  $2M$ , while another data set of  $2n$  observations has mean  $M$ . What is the mean of the combined data sets?

- A.  $M$
- B.  $\frac{3M}{2}$
- C.  $\frac{2M}{3}$
- D.  $\frac{4M}{3}$

37. The sum of deviations of  $n$  number of observations measured from 2.5 is 50. The sum of deviations of the same set of observations measured from 3.5 is -50. What is the value of  $n$ ?

- A. 50
- B. 60
- C. 80
- D. 100

38. If  $P(A \cup B) = \frac{5}{6}$ ,  $P(A \cap B) = \frac{1}{3}$  and  $P(\text{not } A) = \frac{1}{2}$ , then which one of the following is not correct?



- A.  $P(B) = \frac{2}{3}$
- B.  $P(A \cap B) = P(A) P(B)$
- C.  $P(A \cup B) > P(A) + P(B)$
- D.  $P(\text{not } A \text{ and not } B) = P(\text{not } A) P(\text{not } B)$

39.If three dice are rolled under the condition that no two dice show the same face, then what is the probability that one of the faces is having the number 6?

- A.  $\frac{5}{6}$
- B.  $\frac{5}{9}$
- C.  $\frac{1}{2}$
- D.  $\frac{5}{12}$

40.The numbers 4 and 9 have frequencies  $x$  and  $(x - 1)$  respectively. If their arithmetic mean is 6, then what is the value of  $x$ ?

- A. 2
- B. 3
- C. 4
- D. 5

41.Let  $l$  be the length and  $b$  be the breadth of a rectangle such that  $l + b = k$ . What is the maximum area of the rectangle?

- A.  $2k^2$
- B.  $k^2$
- C.  $\frac{k^2}{2}$
- D.  $\frac{k^2}{4}$

42.What is the solution of the differential equation  $\ln\left(\frac{dy}{dx}\right) = x$  ?

- A.  $y = e^x + c$
- B.  $y = e^{-x} + c$
- C.  $y = \ln x + c$



D.  $y = 2 \ln x + c$

43. Which one of the following is correct in respect of the graph

of  $y = \frac{1}{x-1}$  ?

- A. The domain is  $\{x \in \mathbb{R} \mid x \neq 1\}$  and the range is the set of reals.
- B. The domain is  $\{x \in \mathbb{R} \mid x \neq 1\}$ , the range is  $\{y \in \mathbb{R} \mid y \neq 0\}$  and the graph intersects y-axis at  $(0, -1)$ .
- C. The domain is the set of reals and the range is the singleton set  $\{0\}$ .
- D. The domain is  $\{x \in \mathbb{R} \mid x \neq 1\}$  and the range is the set of points on the y-axis.

44. Consider the following statements :

1) The function  $f(x) = \ln x$  increases in the interval  $(0, \infty)$ .

2) The function  $f(x) = \tan x$  increases in the interval  $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

Which of the above statements is/are correct?

- A. 1 only
- B. 2 only
- C. Both 1 and 2
- D. Neither 1 nor 2

45. What is the minimum value of  $3 \cos\left(A + \frac{\pi}{3}\right)$  where  $A \in \mathbb{R}$ ?

- A. -3
- B. -1
- C. 0
- D. 3

46. The function  $u(x, y) = c$  which satisfies the differential equation  $x(dx - dy) + y(dy - dx) = 0$ , is

- A.  $x^2 + y^2 = xy + c$
- B.  $x^2 + y^2 = 2xy + c$
- C.  $x^2 - y^2 = xy + c$
- D.  $x^2 - y^2 = 2xy + c$



47. What is the derivative of  $\tan^{-1} x$  with respect to  $\cot^{-1} x$ ?

- A. -1
- B. 1
- C.  $\frac{1}{x^2 + 1}$
- D.  $\frac{x}{x^2 + 1}$

48. What is  $\lim_{x \rightarrow 0} \frac{3^x + 3^{-x} - 2}{x}$  equal to?

- A. 0
- B. -1
- C. 1
- D. Limit does not exist

49. What is the maximum value of  $\sin x \cdot \cos x$ ?

- A. 2
- B. 1
- C.  $\frac{1}{2}$
- D.  $2\sqrt{2}$

50. Consider the following statements:

$$f(x) = e^{-|x|} :$$

- 1) The function is continuous at  $x = 0$ .
- 2) The function is differentiable at  $x = 0$ .

Which of the above statements is/are correct?

- A. 1 only
- B. 2 only
- C. Both 1 and 2
- D. Neither 1 nor 2

51. Consider the following statements :



1) If in a triangle ABC,  $A = 2B$  and  $b = c$ , then it must be an obtuse-angled triangle.

2) There exists no triangle ABC with  $A = 40^\circ$ ,  $B = 65^\circ$  and  $\frac{a}{c} = \sin 40^\circ \operatorname{cosec} 15^\circ$ .

Which of the above statements is/are correct?

- A. 1 only
- B. 2 only
- C. Both 1 and 2
- D. Neither 1 nor 2

52. Consider the following statements :

1) If ABC is a right-angled triangle, right-angled at A and if  $\sin B = \frac{1}{3}$ , then  $\operatorname{cosec} C = 3$

2) If  $b \cos B = c \cos C$  and if the triangle ABC is not right-angled, then ABC must be isosceles.

Which of the above statements is/are correct?

- A. 1 only
- B. 2 only
- C. Both 1 and 2
- D. Neither 1 nor 2

53. What is the value of  $\cos 48^\circ - \cos 12^\circ$ ?

- A.  $\frac{\sqrt{5} - 1}{4}$
- B.  $\frac{1 - \sqrt{5}}{4}$
- C.  $\frac{\sqrt{5} + 1}{2}$
- D.  $\frac{1 - \sqrt{5}}{8}$

54. What is the value of  $8 \cos 10^\circ \cdot \cos 20^\circ \cdot \cos 40^\circ$ ?

- A.  $\tan 10^\circ$
- B.  $\cot 10^\circ$



- C. cosec  $10^\circ$
- D. sec  $10^\circ$

55. The value of ordinate of the graph of  $y = 2 + \cos x$  lies in the interval

- A.  $[0, 1]$
- B.  $[0, 3]$
- C.  $[-1, 1]$
- D.  $[1, 3]$

56. What is  $\sin 3x + \cos 3x + 4 \sin^3 x - 3 \sin x + 3 \cos x - 4 \cos^3 x$  equal to?

- A. 0
- B. 1
- C.  $2 \sin 2x$
- D.  $4 \cos 4x$

57. A and B are positive acute angles such that  $\cos 2B = 3 \sin^2 A$  and  $3 \sin 2A = 2 \sin 2B$ . What is the value of  $(A + 2B)$ ?

- A.  $\frac{\pi}{6}$
- B.  $\frac{\pi}{4}$
- C.  $\frac{\pi}{3}$
- D.  $\frac{\pi}{2}$

###COMMON###58###58### **Direction:** Read the following information and answer the three items that follow :

ABC is a trapezium such that AB and CD are parallel and BC is perpendicular to them. Let  $\angle ADB = \theta$ ,  $\angle ABD = \alpha$ ,  $BC = p$  and  $CD = q$ .

###DONE###

58. If  $\tan \theta = \frac{\cos 17^\circ - \sin 17^\circ}{\cos 17^\circ + \sin 17^\circ}$ , then what is the value of  $\theta$ ?

- A.  $0^\circ$
- B.  $28^\circ$



- C.  $38^\circ$
- D.  $52^\circ$

59. What is AB equal to?

- A.  $\frac{(p^2 + q^2) \sin \theta}{p \cos \theta + q \sin \theta}$
- B.  $\frac{(p^2 - q^2) \cos \theta}{p \cos \theta + q \sin \theta}$
- C.  $\frac{(p^2 + q^2) \sin \theta}{q \cos \theta + p \sin \theta}$
- D.  $\frac{(p^2 - q^2) \cos \theta}{q \cos \theta + p \sin \theta}$

60.

Consider the following :

- 1)  $AD \sin \theta = AB \sin \alpha$
- 2)  $BD \sin \theta = AB \sin (\theta + \alpha)$

Which of the above is/are correct?

- A. 1 only
- B. 2 only
- C. Both 1 and 2
- D. Neither 1 nor 2

61. Read the following information and answer the two items that follow :

Let  $\frac{\tan 3A}{\tan A} = K$ , where  $\tan A \neq 0$  and  $K \neq \frac{1}{3}$ .

For real values of  $\tan A$ , K cannot lie between

- A.  $\frac{1}{3}$  and 3
- B.  $\frac{1}{2}$  and 2
- C.  $\frac{1}{5}$  and 5



D.  $\frac{1}{7}$  and 7

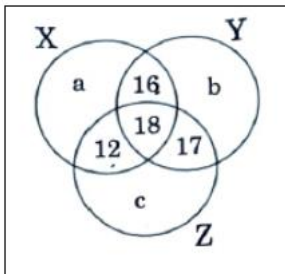
62. Read the following information and answer the two items that follow :

Let  $\frac{\tan 3A}{\tan A} = K$ , where  $\tan A \neq 0$  and  $K \neq \frac{1}{3}$ .

**What is  $\tan^2 A$  equal to?**

- A.  $\frac{K+3}{3K+1}$
- B.  $\frac{K-3}{3K-1}$
- C.  $\frac{3K-3}{K-1}$
- D.  $\frac{K+3}{3K-1}$

###COMMON###63###63### Consider the following Venn diagram, where X, Y and Z are three sets. Let the number of elements in z be denoted by  $n(Z)$  which is equal to 90



###DONE###

63. If the number of elements belonging to neither X, nor Y, nor Z is equal to p, then what is the number of elements in the complement of X?

- A.  $p + b + 60$
- B.  $p + b + 40$
- C.  $p + a + 60$
- D.  $p + a + 40$

64. What is the value of  $n(X) + n(Y) + n(Z) - n(X \cap Y) - n(Y \cap Z) - n(X \cap Z) + n(X \cap Y \cap Z)$ ?





- A.  $a + b + 43$
- B.  $a + b + 63$
- C.  $a + b + 96$
- D.  $a + b + 106$

65.

If the number of elements in Y and Z are in the ratio 4 : 5, then what is the value of b?

- A. 18
- B. 19
- C. 21
- D. 23

66.If  $3x - 4y - 5 = 0$  and  $3x - 4y + 15 = 0$  are the equations of a pair of opposite sides of a square, then what is the area of the square?

- A. 4 square units
- B. 9 square units
- C. 16 square units
- D. 25 square units

67.What is the obtuse angle between the lines whose slopes are  $2 - \sqrt{3}$  and  $2 + \sqrt{3}$ ?

- A.  $105^\circ$
- B.  $120^\circ$
- C.  $135^\circ$
- D.  $150^\circ$

68.If the foot of the perpendicular drawn from the point  $(0, k)$  to the line  $3x - 4y - 5 = 0$  is  $(3, 1)$ , then what is the value of k?

- A. 3
- B. 4
- C. 5
- D. 6

69.Let ABC be a triangle. If  $D(2, 5)$  and  $E(5, 9)$  are the mid-points of the AB and AC respectively, then what is the length of the side BC?



- A. 8
- B. 10
- C. 12
- D. 14

70. Under which condition, are the points  $(a, b)$ ,  $(c, d)$  and  $(a - c, b - d)$  collinear?

- A.  $ab = cd$
- B.  $ac = bd$
- C.  $ad = bc$
- D.  $abc = d$

71. In the parabola,  $y^2 = x$ , what is the length of the chord passing through the vertex and inclined to the x-axis at an angle  $\theta$ ?

- A.  $\sin \theta \cdot \sec^2 \theta$
- B.  $\cos \theta \cdot \operatorname{cosec}^2 \theta$
- C.  $\cot \theta \cdot \sec^2 \theta$
- D.  $2 \tan \theta \cdot \operatorname{cosec}^2 \theta$

72. If the circumcentre of the triangle formed by the lines  $x + 2 = 0$ ,  $y + 2 = 0$  and  $kx + y + 2 = 0$  is  $(-1, -1)$ , then what is the value of  $k$ ?

- A. -1
- B. -2
- C. 1
- D. 2

73. Let  $P(x, y)$  be any point on the ellipse  $25x^2 + 16y^2 = 400$ . If  $Q(0, 3)$  and  $R(0, -3)$  are two points, then what is  $(PQ + PR)$  equal to?

- A. 12
- B. 10
- C. 8
- D. 6

74. The point  $(1, -1)$  is one of the vertices of a square. If  $3x + 2y = 5$  is the equation of one diagonal of the square, then what is the equation of the other diagonal?



- A.  $3x - 2y = 5$
- B.  $2x - 3y = 1$
- C.  $2x - 3y = 5$
- D.  $2x + 3y = -1$

75. The center of the circle  $(x - 2a)(x - 2b) + (y - 2c)(y - 2d) = 0$  is

- A.  $(2a, 2c)$
- B.  $(2b, 2d)$
- C.  $(a + b, c + d)$
- D.  $(a - b, c - d)$

76. Consider the following in respect of a non-singular matrix of order 3:

- 1)  $A(\text{adj } A) = (\text{adj } A)A$
- 2)  $|\text{adj } A| = |A|$

Which of the above statements is/are correct?

- A. 1 only
- B. 2 only
- C. Both 1 and 2
- D. Neither 1 nor 2

77. What is the sum of the last five coefficients in the expansion of  $(1 + x)^9$  when it is expanded in ascending powers of  $x$ ?

- A. 256
- B. 512
- C. 1024
- D. 2048

78. Let  $p, q$  and  $r$  be three distinct positive real numbers.

If  $D = \begin{vmatrix} p & q & r \\ q & r & p \\ r & p & q \end{vmatrix}$ , then which one of the following is correct?

- A.  $D < 0$
- B.  $D \leq 0$
- C.  $D > 0$
- D.  $D \geq 0$



79. Consider the proper subsets of  $\{1, 2, 3, 4\}$ . How many of these subsets are superset of the set  $\{3\}$ ?

- A. 5
- B. 6
- C. 7
- D. 8

80. What is the modulus of the complex number  $\frac{\cos \theta + i \sin \theta}{\cos \theta - i \sin \theta}$ , where  $i = \sqrt{-1}$ ?

- A.  $\frac{1}{2}$
- B. 1
- C.  $\frac{3}{2}$
- D. 2

81. What is the value of  $k$  such that integration of  $\frac{3x^2 + 8 - 4k}{x}$  with respect to  $x$ , may be a rational function?

- A. 0
- B. 1
- C. 2
- D. -2

82. What is the minimum value of  $|x - 1|$ , where  $x \in \mathbb{R}$ ?

- A. 0
- B. 1
- C. 2
- D. -1

83. What is  $\int \frac{dx}{x(x^n + 1)}$  equal to?

- A.  $\frac{1}{n} \ln \left( \frac{x^n}{x^n + 1} \right) + c$
- B.  $\ln \left( \frac{x^n + 1}{x^n} \right) + c$



- C.  $\ln\left(\frac{x^n}{x^n+1}\right) + c$   
D.  $\frac{1}{n}\ln\left(\frac{x^n+1}{x^n}\right) + c$

84. If  $x^m y^n = a^{m+n}$ , then what is  $\frac{dy}{dx}$  equal to?

- A.  $\frac{my}{nx}$   
B.  $-\frac{my}{nx}$   
C.  $\frac{mx}{ny}$   
D.  $-\frac{ny}{mx}$

85. If  $f(x) = 2x - x^2$ , then what is the value of  $f(x + 2) + f(x - 2)$  when  $x = 0$ ?

- A. -8  
B. -4  
C. 8  
D. 4

86. What is the area of the region enclosed between the curve  $y^2 = 2x$  and the straight line  $y = x$ ?

- A.  $\frac{1}{2}$   
B. 1  
C.  $\frac{2}{3}$   
D. 2

87. What is the domain of the function  $f(x) = \cos^{-1}(x - 2)$ ?

- A. [-1, 1]  
B. [1, 3]  
C. [0, 5]  
D. [-2, 1]



88. What is  $\int (e^{\log x} + \sin x) \cos x dx$  equal to?

- A.  $\sin x + x \cos x + \frac{\sin^2 x}{2} + c$
- B.  $\sin x - x \cos x + \frac{\sin^2 x}{2} + c$
- C.  $x \sin x + \cos x + \frac{\sin^2 x}{2} + c$
- D.  $x \sin x - \cos x + \frac{\sin^2 x}{2} + c$

89. The solution of the differential equation  $dy = (1 + y^2) dx$  is

- A.  $y = \tan x + c$
- B.  $y = \tan(x + c)$
- C.  $\tan^{-1}(y + c) = x$
- D.  $\tan^{-1}(y + x) = 2x$

90. If  $f(x) = \frac{\sin x}{x}$ , where  $x \in \mathbb{R}$ , is to be continuous at  $x = 0$ , then the value of the function at  $x = 0$

- A. should be 0
- B. should be 1
- C. should be 2
- D. cannot be determined

91. Let  $y = 3x^2 + 2$ . If  $x$  changes from 10 to 10.1, then what is the total change in  $y$ ?

- A. 4.71
- B. 5.23
- C. 6.03
- D. 8.01

92. What is the value of  $\int_0^{\pi/4} (\tan^3 x + \tan x) dx$  ?

- A.  $\frac{1}{4}$
- B.  $\frac{1}{2}$



- C. 1
- D. 2

93.If  $p(x) = (4e)^{2x}$ , then what is  $\int p(x)dx$  equal to?

- A.  $\frac{p(x)}{1+2\ln 2} + c$
- B.  $\frac{p(x)}{2(1+2\ln 2)} + c$
- C.  $\frac{2p(x)}{1+\ln 4} + c$
- D.  $\frac{p(x)}{1+\ln 2} + c$

94.If  $e^{\theta\phi} = c + 4\theta\phi$ , where  $c$  is an arbitrary constant and  $\phi$  is a function of  $\theta$ , then what is  $\phi d\theta$  equal to?

- A.  $\theta d\phi$
- B.  $-\theta d\phi$
- C.  $4\theta d\phi$
- D.  $-4\theta d\phi$

95.If  $f(x) = 3x^2 - 5x + p$  and  $f(0)$  and  $f(1)$  are opposite in sign, then which of the following is correct?

- A.  $-2 < p < 0$
- B.  $-2 < p < 2$
- C.  $1 < p < 2$
- D.  $3 < p < 5$

96.Three cooks X, Y and Z bake a special kind of cake, and with respective probabilities 0.02, 0.03 and 0.05, it fails to rise. In the restaurant where they work, X bakes 50%, Y bakes 30% and Z bakes 20% of cakes. What is the probability of failures caused by X?

- A.  $\frac{9}{29}$
- B.  $\frac{10}{29}$
- C.  $\frac{19}{29}$



D.  $\frac{28}{29}$

97.If A and B are two events such that  $P(A) = 0.6$ ,  $P(B) = 0.5$  and  $P(A \cap B) = 0.4$ , then consider the following statements :

1.  $P(\bar{A} \cup B) = 0.9$
2.  $P(\bar{B} \cup \bar{A}) = 0.6$

Which of the above statements is/are correct?

- A. 1 only
- B. 2 only
- C. Both 1 and 2
- D. Neither 1 nor 2

98.Consider a random variable X which follows Binomial distribution with parameters  $n = 10$  and  $p = \frac{1}{5}$ . Then  $Y = 10 - X$  follows Binomial distribution with parameters n and p respectively given by

- A.  $5, \frac{1}{5}$
- B.  $5, \frac{2}{5}$
- C.  $10, \frac{3}{5}$
- D.  $10, \frac{4}{5}$

99.Let X and Y represent prices (in Rs.) of a commodity in Kolkata and Mumbai respectively. It is given that  $\bar{X} = 65$ ,  $\bar{Y} = 67$ ,  $\sigma_X = 2.5$ ,  $\sigma_Y = 3.5$  and  $r(X, Y) = 0.8$ . What is the equation of regression of Y on X?

- A.  $Y = 0.175 X - 5$
- B.  $Y = 1.12 X - 5.8$
- C.  $Y = 1.12 X - 5$
- D.  $Y = 0.17 X + 5.8$





100. In a lottery of 10 tickets numbered 1 to 10, two tickets are drawn simultaneously. What is the probability that both the tickets drawn have prime numbers?

- A.  $\frac{1}{15}$
- B.  $\frac{1}{2}$
- C.  $\frac{2}{15}$
- D.  $\frac{1}{5}$

101. A committee of 3 is to be formed from a group of 2 boys and 2 girls. What is the probability that the committee consists of 2 boys and 1 girl?

- A.  $\frac{2}{3}$
- B.  $\frac{1}{4}$
- C.  $\frac{3}{4}$
- D.  $\frac{1}{2}$

102. A dealer has a stock of 15 gold coins out of which 6 are counterfeits. A person randomly picks 4 of the 15 gold coins. What is the probability that all the coins picked will be counterfeits?

- A.  $\frac{1}{91}$
- B.  $\frac{4}{91}$
- C.  $\frac{6}{91}$
- D.  $\frac{15}{91}$

103. A husband and wife appear in an interview for two vacancies for the same post. The Probability of the husband's selection is  $\frac{1}{7}$  and that of the



wife's selection is  $\frac{1}{5}$ . If the events are independent, then the probability of which one of the following is  $\frac{11}{35}$ ?

- A. At least one of them will be selected
- B. Only one of them will be selected
- C. None of them will be selected
- D. Both of them will be selected

104. The arithmetic mean of 100 observations is 40. Later, it was found that an observation '53' was wrongly read as '83'. What is the correct arithmetic mean?

- A. 39.8
- B. 39.7
- C. 39.6
- D. 39.5

105. What is the probability that February of a leap year selected at random, will have five Sundays?

- A.  $\frac{1}{5}$
- B.  $\frac{1}{7}$
- C.  $\frac{2}{7}$
- D. 1

106. If  $\sum x_i = 20$ ,  $\sum x_i^2 = 200$  and  $n = 10$  for an observed variable  $x$ , then what is the coefficient of variation?

- A. 80
- B. 100
- C. 150
- D. 200

107. What is the standard deviation of the observations

$-\sqrt{6}, -\sqrt{5}, -\sqrt{4}, -1, 1, \sqrt{4}, \sqrt{5}, \sqrt{6}$  ?



- A.  $\sqrt{2}$
- B. 2
- C.  $2\sqrt{2}$
- D. 4

###COMMON###108###108###Directions for the following three (03) items :

Read the following information and answer the three items that follow :

Marks	Number of students	
	Physics	Mathematics
10 – 20	8	10
20 – 30	11	21
30 – 40	30	38
40 – 50	26	15
50 – 60	15	10
60 – 70	10	6

###DONE###

108. What is the mean of marks in Physics?

- A. 38.4
- B. 39.4
- C. 40.9
- D. 41.6

109. Consider the following statements:

1. Modal value of the marks in Physics lies in the interval 30 - 40.
2. Median of the marks in Physics is less than that of marks in Mathematics.

Which of the above statements is/are correct?



- A. 1 only
- B. 2 only
- C. Both 1 and 2
- D. Neither 1 nor 2

110.

The difference between number of students under Physics and Mathematics is largest for the interval

- A. 20 – 30
- B. 30 – 40
- C. 40 – 50
- D. 50 – 60

111. What is  $\lim_{x \rightarrow 0} \frac{\sin x \log(1-x)}{x^2}$  equal to?

- A. -1
- B. Zero
- C. -e
- D.  $-\frac{1}{e}$

112. The order and degree of the differential equation

are  $k \frac{dy}{dx} = \int \left[ 1 + \left( \frac{dy}{dx} \right)^2 \right]^{\frac{2}{3}} dx$  respectively

- A. 1 and 1
- B. 2 and 3
- C. 2 and 4
- D. 1 and 4

113. If  $\lim_{x \rightarrow 1} \frac{x^4 - 1}{x - 1} = \lim_{x \rightarrow k} \frac{x^3 - k^3}{x^2 - k^2}$ , where  $k \neq 0$ , then what is the value of k?

- A.  $\frac{2}{3}$
- B.  $\frac{4}{3}$
- C.  $\frac{8}{3}$



D. 4

114. The radius of a circle is increasing at the rate of 0.7 cm/sec. What is the rate of increase of its circumference?

- A. 4.4 cm/sec
- B. 8.4 cm/sec
- C. 8.8 cm/sec
- D. 15.4 cm/sec

115. What is  $\lim_{x \rightarrow 1} \frac{x + x^2 + x^3 - 3}{x - 1}$  equal to?

- A. 1
- B. 2
- C. 3
- D. 6

116. If the vectors  $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$ ,  $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$  and  $\vec{c} = \hat{j} + p\hat{k}$  are coplanar, then what is the value of p?

- A. 1
- B. -1
- C. 5
- D. -5

117. If  $|\vec{a} \times \vec{b}|^2 + |\vec{a} \cdot \vec{b}|^2 = 144$  and  $|\vec{a}| = 4$ , then what is  $|\vec{b}|$  equal to?

- A. 3
- B. 4
- C. 6
- D. 8

118. Two adjacent sides of a parallelogram are  $2\hat{i} - 4\hat{j} + 5\hat{k}$  and  $\hat{i} - 2\hat{j} - 3\hat{k}$ . What is the magnitude of dot product of vectors which represent its diagonals?

- A. 21
- B. 25
- C. 31



D. 36

119. Let A be a point in space such that  $|\overline{OA}| = 12$ , where O is the origin. If  $\overline{OA}$  is inclined at angles  $45^\circ$  and  $60^\circ$  with x-axis and y-axis respectively, then what is  $\overline{OA}$  equal to?

- A.  $6\hat{i} + 6\hat{j} + \sqrt{2}\hat{k}$
- B.  $6\hat{i} + 6\sqrt{2}\hat{j} + 6\hat{k}$
- C.  $6\sqrt{2}\hat{j} + 6\hat{i} + 6\hat{k}$
- D.  $3\sqrt{2}\hat{j} + 3\hat{i} + 6\hat{k}$

120. If  $\hat{a}$  is a unit vector in the xy-plane making an angle  $30^\circ$  with the positive x-axis, then what  $\hat{a}$  is equal to?

- A.  $\frac{\sqrt{3}\hat{i} + \hat{j}}{2}$
- B.  $\frac{\sqrt{3}\hat{i} - \hat{j}}{2}$
- C.  $\frac{\hat{i} + \sqrt{3}\hat{j}}{2}$
- D.  $\frac{\hat{i} - \sqrt{3}\hat{j}}{2}$

