

SOLVED PAPER

National Defence Academy

2012-1

PAPER II : MATHEMATICS

1. What is the sum of the squares of the roots of the equation $x^2 + 2x - 143 = 0$?
 (a) 170 (b) 180
 (c) 190 (d) 290
2. Let $U = \{x \in \mathbb{N} : 1 \leq x \leq 10\}$ be the universal set, \mathbb{N} being the set of natural numbers. If $A = \{1, 2, 3, 4\}$ and $B = \{2, 3, 6, 10\}$ then what is the complement of $(A - B)$?
 (a) $\{6, 10\}$
 (b) $\{1, 4\}$
 (c) $\{2, 3, 5, 6, 7, 8, 9, 10\}$
 (d) $\{5, 6, 7, 8, 9, 10\}$
3. The solution of the simultaneous linear equations $2x + y = 6$ and $3y = 8 + 4x$ will also be satisfied by which one of the following linear equations ?
 (a) $x + y = 5$ (b) $2x + y = 9$
 (c) $2x - 3y = 10$ (d) $2x + 3y = 6$
4. Let $A = \{x : x \text{ is a square of a natural number and } x \text{ is less than } 100\}$ and B is a set of even natural numbers. What is the cardinality of $A \cap B$?
 (a) 4 (b) 5
 (c) 9 (d) None of the above
5. If $A = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 \\ 1 & 0 \end{pmatrix}$ then what is determinant of AB ?
 (a) 0 (b) 1
- (c) 10 (d) 20
6. What is $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix}$ equal to ?
 (a) $4abc$ (b) $4a^2bc$
 (c) $4a^2b^2c^2$ (d) $-4a^2b^2c^2$
7. What is the distance between the lines $3x + 4y = 9$ and $6x + 8y = 18$?
 (a) 0 (b) 3 units
 (c) 9 units (d) 18 units
8. The number 292 in decimal system is expressed in binary system by
 (a) 100001010 (b) 100010001
 (c) 100100100 (d) 101010000
9. What is the arithmetic mean of first 16 natural numbers with weights being the number itself?
 (a) $17/2$ (b) $33/2$
 (c) 11 (d) $187/2$
10. What is the mode for the data 20, 20, 20, 21, 21, 21, 21, 21, 22, 22, 22, 22, 22, 22, 22, 23, 23, 23, 23, 23, 24, 24, 25 ?
 (a) 7 (b) 21
 (c) 22 (d) 25
11. A and B are two matrices such that $AB = A$ and $BA = B$ then what is B^2 equal to ?
 (a) B (b) A
 (c) I (d) $-I$
12. The geometric mean and harmonic mean of two non-negative observations are 10 and 8 respectively. Then what is the arithmetic

- mean of the observations equal to ?
 (a) 4 (b) 9
 (c) 12.5 (d) 25
13. Consider the following statements :
1. A continuous variable can take all values in an interval.
 2. A random variable which takes a finite number of values is necessarily discrete.
 3. Construction of a frequency distribution is based on data which are discrete.
- Which of the above statements are correct ?
 (a) 1 and 2 only (b) 2 and 3 only
 (c) 1 and 3 only (d) 1, 2 and 3
14. What is the n^{th} term of the sequence 1, 5, 9, 13, 17, ?
 (a) $2n - 1$ (b) $2n + 1$
 (c) $4n - 3$ (d) None of the above
15. What does the series $1 + 3^{-\frac{1}{2}} + 3 + \frac{1}{3\sqrt{3}} + \dots$ represent ?
 (a) AP (b) GP
 (c) HP (d) None of the above
16. If p, q, r are in AP as well as GP, then which one of the following is correct ?
 (a) $p = q \neq r$ (b) $p \neq q \neq r$
 (c) $p \neq q = r$ (d) $p = q = r$
17. What is perimeter of the triangle with vertices A (-4, 2), B (0, -1) and C (3, 3) ?
 (a) $7 + 3\sqrt{2}$ (b) $10 + 5\sqrt{2}$
 (c) $11 + 6\sqrt{2}$ (d) $5 + \sqrt{2}$
18. If the mid point between the points $(a + b, a - b)$ and $(-a, b)$ lies on the line $ax + by = k$, what is k equal to ?
 (a) a/b (b) $a + b$
 (c) ab (d) $a - b$
19. The acute angle which the perpendicular from origin on the line $7x - 3y = 4$ makes with the x-axis is
 (a) zero
 (b) positive but not $\pi/4$
 (c) negative
 (d) $\pi/4$
20. Out of 500 first year students, 260 passed in the first semester and 210 passed in the second semester. If 170 did not pass in either semester, how many passed in both semesters ?
 (a) 80 (b) 40
 (c) 70 (d) 140
21. If a matrix A has inverse B and C, then which one of the following is correct ?
 (a) B may not be equal to C
 (b) B should be equal to C
 (c) B and C should be unit matrices
 (d) None of the above
22. Three dice are thrown. What is the probability that the same number will appear on each of them ?
 (a) $1/6$ (b) $1/18$
 (c) $1/24$ (d) $1/36$
- For the next Two (2) questions that follow :
 The equation formed by multiplying each root of $ax^2 + bx + c = 0$ by 2 is $x^2 + 36x + 24 = 0$.
23. What is $b : c$ equal to ?
 (a) 3 : 1 (b) 1 : 2
 (c) 1 : 3 (d) 3 : 2
24. Which one of the following is correct ?
 (a) $bc = a^2$ (b) $bc = 36 a^2$
 (c) $bc = 72 a^2$
 (d) $bc = 108 a^2$
- For the next THREE (3) questions that follow:
 Let $\sin(A + B) = 1$ and $\sin(A - B) = 1/2$,
 where $A, B \in \left[0, \frac{f}{2}\right]$.
25. What is the value of A?
 (a) $\frac{f}{6}$ (b) $\frac{f}{3}$
 (c) $\frac{f}{4}$ (d) $\frac{f}{8}$

26. What is $\tan(A + 2B)$, $\tan(2A + B)$ equal to ?
 (a) -1 (b) 0
 (c) 1 (d) 2
27. What is $\sin^2 A - \sin^2 B$ equal to ?
 (a) 0 (b) $1/2$
 (c) 1 (d) 2
28. If the latus rectum of an ellipse is equal to half of the minor axis, then what is its eccentricity ?
 (a) $2/\sqrt{3}$ (b) $1/\sqrt{3}$
 (c) $\sqrt{3}/2$ (d) $1/\sqrt{2}$
29. What is the probability that a leap year selected at random contains 53 Mondays ?
 (a) $1/7$ (b) $2/7$
 (c) $7/366$ (d) $26/183$
30. What is the decimal number representation of the binary number $(11101.001)_2$?
 (a) 30.125 (b) 29.025
 (c) 29.125 (d) 28.025
31. What is the equation of line passing through $(0, 1)$ and making an angle with the y -axis equal to the inclination of the line $x - y = 4$ with x -axis ?
 (a) $y = x + 1$ (b) $x = y + 1$
 (c) $2x = y + 2$ (d) None of the above
32. What is $\tan\left(\frac{f}{12}\right)$ equal to ?
 (a) $2 - \sqrt{3}$ (b) $2 + \sqrt{3}$
 (c) $\sqrt{2} - \sqrt{3}$ (d) $\sqrt{3} - \sqrt{2}$
33. If $\theta = 18^\circ$, then what is the value of $4 \sin^2 \theta + 2 \sin \theta$?
 (a) -1 (b) 1
 (c) 0 (d) 2
34. Two poles are 10 m and 20 m high. The line joining their tips makes an angle of 15° with the horizontal. What is the distance between the poles ?
 (a) $10(\sqrt{3} - 1)m$ (b) $5(4 + 2\sqrt{3})m$
 (c) $20(\sqrt{3} + 1)m$ (d) $10(\sqrt{3} + 1)m$
36. In a triangle ABC if the angles A, B, C are in AP, then which one of the following is correct?
 (a) $c = a + b$ (b) $c^2 = a^2 + b^2 - ab$
 (c) $a^2 = b^2 + c^2 - bc$ (d) $b^2 = a^2 + c^2 - ac$
37. If $\sin^{-1} + \sin^{-1} \frac{4}{5} = \sin^{-1} x$, then what is x equal to ?
 (a) $3/5$ (b) $4/5$
 (c) 1 (d) 0
38. If $\operatorname{cosec} \theta - \cot \theta = \frac{1}{\sqrt{3}}$ where $\theta \neq 0$, then what is the value of $\cos \theta$?
 (a) 0 (b) $\frac{\sqrt{3}}{2}$
 (c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{2}}$
39. From the top of a building of height h metre, the angle of depression of an object on the ground is θ . What is the distance (in metre) of the object from the foot of the building ?
 (a) $h \cot \theta$ (b) $h \tan \theta$
 (c) $h \cos \theta$ (d) $h \sin \theta$
40. If $\tan^{-1} 2, \tan^{-1} 3$ are two angles of a triangle, then what is the third angle ?
 (a) $\tan^{-1} 2$ (b) $\tan^{-1} 4$
 (c) $\pi/4$ (d) $\pi/3$
41. What is the maximum value of $\sin 3\theta \cos 2\theta + \cos 3\theta \sin 2\theta$?
 (a) 1 (b) 2
 (c) 4 (d) 10
42. What is $\sin A \cos A \tan A + \cos A \sin A \cot A$ equal to ?
 (a) $\sin A$ (b) $\cos A$
 (c) $\tan A$ (d) 1

43. What is the value of $\sec^2 \tan^{-1}\left(\frac{5}{11}\right)$?
- (a) 121/96 (b) 217/921
(c) 146/121 (d) 267/121
44. Which one of the following is positive in the third quadrant?
- (a) $\sin \theta$ (b) $\cos \theta$
(c) $\tan \theta$ (d) $\sec \theta$
45. What is the value of $\sin (1920^\circ)$?
- (a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$
(c) $\frac{\sqrt{3}}{2}$ (d) $\frac{1}{3}$
46. The angle of elevation of the tip of a flag staff from a point 10 m due South of its base in 60° . What is the height of the flag staff correct to the nearest metre?
- (a) 15 m (b) 16 m
(c) 17 m (d) 18 m
47. What is $\frac{\sin_{\theta}}{\operatorname{cosec}_{\theta}} + \frac{\cos_{\theta}}{\sec_{\theta}}$ equal to?
- (a) 1 (b) 1/2
(c) 1/3 (d) 2
48. If $\tan \theta + \sec \theta = 4$, then what is the value of $\sin \theta$?
- (a) 8/17 (b) 8/15
(c) 15/17 (d) 23/32
49. What is the value of $\cos\left\{\cos^{-1}\frac{4}{5} + \cos^{-1}\frac{12}{13}\right\}$?
- (a) 63/65 (b) 33/65
(c) 22/65 (d) 11/65
50. What is the angle subtended by 1 m pole at a distance 1 km on the ground in sexagesimal measure?
- (a) $\frac{9}{50f}$ degree (b) $\frac{9}{5f}$ degree
(c) 3.4 minute
(d) 3.5 minute
51. If $\cot A \cdot \cot B = 2$, then what is the value of $\cos(A+B) \cdot \sec(A-B)$?
- (a) 1/3 (b) 2/3
(c) 1 (d) -1
52. Consider the following statements:
- Every zero matrix is a square matrix.
 - A matrix has a numerical value.
 - A unit matrix is a diagonal matrix.
- Which of the above statements is/are correct?
- (a) 2 only (b) 3 only
(c) 2 and 3
(d) 1 and 3
53. If the sequence $\{S_n\}$ is a geometric progression and $S_2 S_{11} = S_p S_8$, then what is the value of p?
- (a) 1 (b) 3
(c) 5
(d) cannot be determined
54. In the expansion of $(1+x)^n$, what is the sum of even binomial coefficients?
- (a) 2^n (b) 2^{n-1}
(c) 2^{n+1}
(d) None of the above
55. The value of the term independent of x in the expansion of $\left(x^2 - \frac{1}{x}\right)^9$ is
- (a) 9 (b) 18
(c) 48 (d) 84
56. What is the number of ways that 4 boys and 3 girls can be seated so that boys and girls alternate?
- (a) 12 (b) 72
(c) 120 (d) 144
57. If the difference between the roots of $ax^2 + bx + c = 0$ is 1, then which one of the following is correct?
- (a) $b^2 = a(a+4c)$
(b) $a^2 = b(b+4c)$
(c) $a^2 = c(a+4c)$
(d) $b^2 = a(b+4c)$
58. If one of the roots of the equation

- $x^2 + ax - b = 0$ is 1, then what is $(a - b)$ equal to?
 (a) -1 (b) 1
 (c) 2 (d) -2
59. If α and β are the roots of the equation $x^2 - q(1 + x) - r = 0$. then what is $(1 + \alpha)(1 + \beta)$ equal to?
 (a) $1 - r$ (b) $q - r$
 (c) $1 + r$ (d) $q + r$
60. If $1/4, 1/x, 1/10$ are in HP, then what is the value of x ?
 (a) 5 (b) 6
 (c) 7 (d) 8
61. If $f(xy) = f(x)f(y)$, then $f(t)$ may be of the form:
 (a) $t + k$ (b) $ct + k$
 (c) $t^k + c$ (d) t^k
62. If $A + iB = \frac{4+2i}{1-2i}$ where $i = \sqrt{-1}$, then what is the value of A ?
 (a) -8 (b) 0
 (c) 4 (d) 8
63. If $z = \bar{z}$, then which one of the following is correct?
 (a) The real part of z is zero.
 (b) The imaginary part of z is zero.
 (c) the real part of z is equal to imaginary part of z .
 (d) The sum of real and imaginary parts of z is z .
64. If A and B are two non-empty sets having n elements in common, then what is the number of common elements in the sets $A \times B$ and $B \times A$?
 (a) n (b) n^2
 (c) $2n$ (d) zero
65. If A and B are any two sets, then what is $A \cap (A \cup B)$ equal to?
 (a) Complement of A
 (b) Complement of B
 (c) B
 (d) A
66. What is the cosine of angle between the planes $x + y + z + 1 = 0$ and $2x - 2y + 2z + 1 = 0$?
 (a) $1/2$ (b) $1/3$
 (c) $2/3$ (d) None of the above
67. If $A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & -1 \\ 1 & 2 \end{bmatrix}$, then what is $B^{-1}A^{-1}$ equal to?
 (a) $\begin{bmatrix} 1 & -3 \\ -1 & 2 \end{bmatrix}$ (b) $\begin{bmatrix} -1 & 3 \\ 1 & -2 \end{bmatrix}$
 (c) $\begin{bmatrix} -1 & 3 \\ -1 & -2 \end{bmatrix}$ (d) $\begin{bmatrix} -1 & -3 \\ 1 & -2 \end{bmatrix}$
68. Which one of the following functions is differentiable for all real values of x ?
 (a) $\frac{x}{|x|}$ (b) $x|x|$
 (c) $\frac{1}{|x|}$ (d) $\frac{1}{x}$
69. Which of the following differential equations is not linear?
 (a) $\frac{d^2y}{dx^2} + 4y = 0$ (b) $x \frac{dy}{dx} + y = x^3$
 (c) $(x - y)^2 \frac{dy}{dx} = 9$
 (d) $\cos^2 x \frac{dy}{dx} + y = \tan x$
70. What is the sum of the squares of direction cosines of the line joining the points $(1, 2, -3)$ and $(-2, 3, 1)$?
 (a) 0 (b) 1
 (c) 3 (d) $\frac{2}{\sqrt{26}}$
71. What is the diameter of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 8z - 7 = 0$?
 (a) 4 units (b) 5 units
 (c) 6 units (d) 12 units

72. What is the slope of the tangent to the curve $t^2 + 3t - 8, y = 2t^2 - 2t - 5$ at $t = 2$?

- (a) $7/6$ (b) $6/7$
(c) 1 (d) $5/6$

73. Which one of the following statements is correct?

- (a) e^x is an increasing function
(b) e^x is decreasing function
(c) e^x is neither increasing nor decreasing function
(d) e^x is a constant function

74. If $y = \cos t$ and $x = \sin t$, then what is $\frac{dy}{dx}$

equal to?

- (a) xy (b) x/y
(c) $-y/x$ (d) $-x/y$

75. What is $\int (x^2 + 1)^{\frac{5}{2}} x dx$ equal to?

- (a) $(x^2 + 1)^{\frac{7}{2}} + c$
(b) $\frac{2}{7}(x^2 + 1)^{\frac{7}{2}} + c$
(c) $\frac{1}{7}(x^2 + 1)^{\frac{7}{2}} + c$ (d) None of the above

where c is a constant of integration.

76. If $f(x) = x^2 - 6x + 8$ and there exists a point c in the interval $[2, 4]$ such that $f'(c) = 0$, then what is the value of c ?

- (a) 2.5 (b) 2.8
(c) 3 (d) 3.5

77. If $\begin{vmatrix} 8 & -5 & 1 \\ 5 & x & 1 \\ 6 & 3 & 1 \end{vmatrix} = 2$, then what is the value of

x ?

- (a) 4 (b) 5
(c) 6 (d) 8

78. What is the order of the product

$$\begin{bmatrix} x & y & z \end{bmatrix} \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} ?$$

- (a) 3×1 (b) 1×1
(c) 1×3 (d) 3×3

79. What is $\int_{-\frac{f}{2}}^{\frac{f}{2}} |\sin x| dx$ equal to?

- (a) 2 (b) 1
(c) π (d) 0

80. The area bounded by the curve $x = f(y)$, the y -axis and the two lines $y = a$ and $y = b$ is equal to:

- (a) $\int_a^b y dx$ (b) $\int_a^b y^2 dx$
(c) $\int_a^b x dy$ (d) None of the above

81. If $y = \frac{x+1}{x-1}$, then what is $\frac{dy}{dx}$ equal to?

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

82. Which one of the following statement is correct?

- (a) The derivative of a function $f(x)$ at a point will exist if there is one tangent to the curve $y = f(x)$ at that point and the tangent is parallel to y -axis
(b) The derivative of a function $f(x)$ at a point will exist if there is one tangent to the curve $y = f(x)$ at that point and the tangent must be parallel to x -axis
(c) The derivative of a function $f(x)$ at a point will exist if there is one and only one

- tangent to the curve $y = y(x)$ at the point and the tangent is not parallel to y-axis
- (d) None of the above
83. Consider the following :
- $\int \ln 10 dx = x + c$
 - $\int 10^x dx = 10^x + c$
- where c is the constant integration.
Which of the above is/are correct ?
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2
84. How many tangents are parallel to x-axis
..... $^2 - 4x + 3$?
- 1
 - 2
 - 3
 - No tangent is parallel to x-axis
85. What is $\lim_{x \rightarrow 0} x^2 \sin\left(\frac{1}{x}\right)$ equal to ?
- 0
 - 1
 - 1/2
 - Limit does not exist
86. What is $\lim_{x \rightarrow -2} \left(\frac{x+2}{x^3+8}\right)$ equal to ?
- 1/4
 - 1/4
 - 1/12
 - 1/12
87. What is the solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = 0$?
- $xy = c$
 - $x = cy$
 - $y = cx$
 - None of the above
- where c is a constant.
88. What is the degree of the differential equation $y = x \frac{dy}{dx} + \left(\frac{dy}{dx}\right)^{-1}$?
- 1
 - 2
 - 1
 - Degree does not exist
89. What is $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$ equal to ?
- $\frac{f}{4}$
 - $\frac{f}{8}$
 - $\frac{f^2}{8}$
 - $\frac{f^2}{32}$
90. What is the rate of change of $\sqrt{x^2 + 16}$ with respect to x^2 at $x = 3$?
- 1/5
 - 1/10
 - 1/20
 - None of the above
91. If $\vec{a} = (2, 1, -1)$, $\vec{b} = (1, -1, 0)$, $\vec{c} = (5, -1, 1)$, then what is the unit vector parallel to $\vec{a} + \vec{b} + \vec{c}$ in the opposite direction ?
- $\frac{\hat{i} + \hat{j} - 2\hat{k}}{3}$
 - $\frac{\hat{i} - 2\hat{j} + 2\hat{k}}{3}$
 - $\frac{2\hat{i} - \hat{j} + 2\hat{k}}{3}$
 - None of the above
92. If the magnitudes of two vectors \vec{a} and \vec{b} are equal then which one of the following is correct ?
- $(\vec{a} + \vec{b})$ is parallel to $(\vec{a} - \vec{b})$
 - $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b}) = 1$
 - $(\vec{a} + \vec{b})$ is perpendicular to $(\vec{a} - \vec{b})$
 - None of the above
93. Consider the following in respect of the function $f(x) = |x - 3|$.
- $f(x)$ is continuous at $x = 3$
 - $f(x)$ is differentiable at $x = 0$
- Which of the above statements is/are correct?
- 1 only
 - 2 only

- (c) Both 1 and 2
(d) Neither 1 nor 2
94. If four dice are thrown together, then what is the probability that the sum of the numbers appearing on them is 25 ?
(a) 0 (b) $1/2$
(c) 1 (d) $1/1296$
95. Let O be the origin and P, Q, R be the points such that $\overline{PO} + \overline{OQ} = \overline{QO} + \overline{OR}$. Then which one of the following is correct ?
(a) P, Q, R are the vertices of an equilateral triangle
(b) P, Q, R are the vertices of an isosceles triangle
(c) P, Q, R are collinear
(d) None of the above
96. What is the value of $2\log_8 2 - \frac{1}{3}\log_3 9$?
(a) 0 (b) 1
(c) 2
(d) $1/3$
97. What is the value of m if the vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + m\hat{j} + 5\hat{k}$ are coplanar ?
(a) -2 (b) 2
(c) -4 (d) 4
98. If $|\vec{a}| = 10$, $|\vec{b}| = 2$ and $\vec{a} \cdot \vec{b} = 12$, then what is the value of $|\vec{a} \times \vec{b}|$?
(a) 12 (b) 16
(c) 20 (d) 24
99. If the vectors $\hat{i} - x\hat{j} - y\hat{k}$ and $\hat{i} + x\hat{j} - y\hat{k}$ are orthogonal to each other, then what is the locus of the point (x, y) ?
(a) a parabola (b) an ellipse
(c) a circle (d) a straight line
100. If A is square matrix such that $A^2 = I$ where I is the identity matrix, then what is A^{-1} equal to ?
(a) A + I (b) Null matrix
(c) A (d) Transpose of A
101. What is the eccentricity of the conic $4x^2 + 9y^2 = 144$?
(a) $\frac{\sqrt{5}}{3}$ (b) $\frac{\sqrt{5}}{4}$
(c) $\frac{3}{\sqrt{5}}$ (d) $2/3$
102. If two rows of a determinant are identical, then what is the value of the determinant ?
(a) 0 (b) 1
(c) -1
(d) Can be any real value
103. If $A = \{0, 1\}$ and $B = \{1, 0\}$, then what is $A \times B$ equal to ?
(a) $\{(0, 1), (1, 0)\}$
(b) $\{(0, 0), (1, 1)\}$
(c) $\{(0, 1), (1, 0), (1, 1)\}$
(d) $A \times A$
104. What is the perpendicular distance of the point (x, y) from x-axis ?
(a) x (b) y
(c) $|x|$ (d) $|y|$
105. If ABCD is a cyclic quadrilateral then what is $\sin A + \sin B - \sin C - \sin D$ equal to ?
(a) 0 (b) 1
(c) 2 (d) $2(\sin A + \sin B)$
106. What is the value of $\sin 420^\circ \cdot \cos 390^\circ + \cos(-300^\circ) \cdot \sin(-330^\circ)$?
(a) 0 (b) 1
(c) 2 (d) -1
107. Consider the following statements :
1. 1° in radian measure is less than 0.02 radians.
2. 1 radian in degree measure is greater than 45° .
Which of the above statements is/are correct?
(a) 1 only (b) 2 only

- (c) Both 1 and 2 (d) Neither 1 nor 2
108. What is the maximum value of $\sin^2 x$?
 (a) -1 (b) 0
 (c) 1 (d) Infinity
109. The sum and product of matrices A and B exist. Which of the following implications are necessarily true ?
 1. A and B square matrices of same order.
 2. A and B are non-singular matrices.
 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
110. What is the area of the rectangle having vertices A, B C and D with position vectors $-\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}$, $\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}$, $\hat{i} - \frac{1}{2}\hat{j} + 4\hat{k}$ and $-\hat{i} - \frac{1}{2}\hat{j} + 4\hat{k}$?
 (a) $1/2$ square unit
 (b) 1 square unit
 (c) 2 square unit
 (d) 4 square unit
111. The set $A = \{x : x + 4 = 4\}$ can also be represented by :
 (a) 0 (b) ϕ
 (c) $\{\phi\}$ (d) $\{0\}$
112. If a line makes the angles α , β , γ with the axes, then what is the value of $1 + \cos 2\alpha + \cos 2\beta + \cos 2\gamma$ equal to ?
 (a) -1 (b) 0
 (c) 1 (d) 2
113. What is the sum of the series $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \dots$ equal to ?
 (a) $1/2$ (b) $3/2$
 (c) 2 (d) $2/3$
114. Consider the following statements :
 1. Two independent variables are always uncorrelated.
2. The coefficient of correlation between two variables X and Y is positive when X decreases then Y decreases.
 Which of the above statements is/are correct?
 (a) 1 only (b) 2 only
 (c) Both 1 and 2 (d) Neither 1 nor 2
115. A variate X takes values 2, 9, 3, 7, 5, 4, 3, 2, 10. What is the median ?
 (a) 2 (b) 4
 (c) 7 (d) 9
116. What are the direction ratios of normal to the plane $2x - y + 2z + 1 = 0$?
 (a) $\langle 2, 1, 2 \rangle$ (b) $\langle 1, -\frac{1}{2}, 1 \rangle$
 (c) $\langle 1, -2, 1 \rangle$ (d) None of the above
- For the next Four (4) questions that follow :**
- In a city, three daily newspapers A, B, C are published, 42% read A; 51% read B; 68% read C; 30% read A and B; 28% read B and C; 36% read A and C; 8% do not read any of the three newspapers.
117. What is the percentage of persons who read all the three papers?
 (a) 20% (b) 25%
 (c) 30% (d) 40%
118. What is the percentage of persons who read only two papers ?
 (a) 19% (b) 31%
 (c) 44% (d) None of the above
119. What is the percentage of persons who read only one paper ?
 (a) 38% (b) 48%
 (c) 51% (d) None of the above
120. What is the percentage of persons who read only A but neither B nor C ?
 (a) 4% (b) 3%
 (c) 1% (d) None of the above

Paper II : Mathematics

1. (d)	2. (c)	3. (a)	4. (a)	5. (a)	6. (c)	7. (a)	8. (c)	9. (a)	10. (c)
11. (b)	12. (c)	13. (b)	14. (c)	15. (d)	16. (d)	17. (b)	18. (c)	19. (b)	20. (d)
21. (b)	22. (d)	23. (a)	24. (d)	25. (b)	26. (c)	27. (b)	28. (c)	29. (b)	30. (c)
31. (a)	32. (a)	33. (b)	34. (b)	35. (b)	36. (d)	37. (a)	38. (b)	39. (a)	40. (c)
41. (a)	42. (d)	43. (c)	44. (c)	45. (c)	46. (c)	47. (a)	48. (c)	49. (b)	50. (a)
51. (a)	52. (b)	53. (c)	54. (b)	55. (d)	56. (d)	57. (a)	58. (a)	59. (a)	60. (c)
61. (d)	62. (b)	63. (a)	64. (b)	65. (d)	66. (b)	67. (b)	68. (b)	69. (a)	70. (b)
71. (c)	72. (b)	73. (a)	74. (d)	75. (c)	76. (c)	77. (d)	78. (b)	79. (a)	80. (c)
81. (b)	82. (c)	83. (a)	84. (a)	85. (a)	86. (c)	87. (a)	88. (b)	89. (d)	90. (b)
91. (c)	92. (c)	93. (b)	94. (a)	95. (a)	96. (a)	97. (c)	98. (b)	99. (b)	100. (c)
101. (a)	102. (a)	103. (d)	104. (d)	105. (a)	106. (b)	107. (c)	108. (c)	109. (a)	110. (b)
111. (d)	112. (b)	113. (d)	114. (a)	115. (b)	116. (b)	117. (b)	118. (a)	119. (b)	120. (c)