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MATHEMATICS — Paper IITime Allowed : $2\frac{1}{2}$ Hours]

[Maximum Marks : 100

PART - I**SECTION - A**(i) Answer *all* the questions.(ii) Choose the correct answer from the given alternatives : $20 \times 1 = 20$

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

1) square matrix

2) diagonal matrix

3) unit matrix

4) rectangular matrix.

2. If $A = \begin{pmatrix} 0 & 2 \\ -1 & 5 \end{pmatrix}$, then $A - I_2$ is

1) $\begin{pmatrix} 0 & 2 \\ -1 & 5 \end{pmatrix}$

2) $\begin{pmatrix} -1 & 2 \\ -1 & 4 \end{pmatrix}$

3) $\begin{pmatrix} -1 & -2 \\ -1 & 4 \end{pmatrix}$

4) $\begin{pmatrix} 0 & -2 \\ 1 & -5 \end{pmatrix}$

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3. If the order of the matrix A is $p \times m$ and order of the matrix $B \times A$ is $n \times m$, then the order of the matrix B is

1) $p \times n$

2) $m \times p$

3) $m \times n$

4) $n \times p$

4. If two circles touch externally, the number of common tangents that can be drawn are

1) 2

2) 4

3) 3

4) 5

5. Two chords AB and CD of a circle intersect internally at P . If $AP = 4$ cm, $PB = 3$ cm, $PC = 1.5$ cm, then CD is

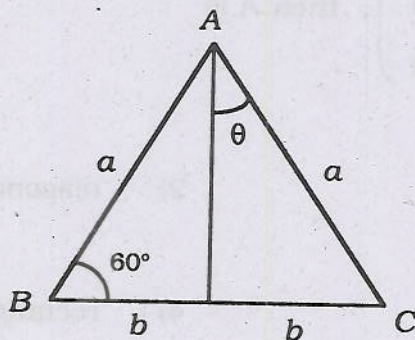
1) 8 cm

2) 10.5 cm

3) 12 cm

4) 9.5 cm.

6. In the figure, θ is



1) 60°

2) 45°

3) 30°

4) 15°

7. A vertical stick 12 m long casts a shadow 8 m long on the ground. At the same time a tower casts the shadow 40 m long on the ground. Then the height of the tower is

1) 50 m

2) 55 m

3) 60 m

4) 65 m.

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14. $\sin^2 1^\circ + \sin^2 2^\circ + \dots + \sin^2 90^\circ =$

1) 90

2) 45

3) 46

4) 45.5.

15. $\frac{\sqrt{1 - \sin^2 \theta}}{\sin \theta} =$

1) $\cot \theta$

2) $\frac{\sin \theta}{2}$

3) $\tan \theta$

4) $\frac{1 + \sin \theta}{\sin^2 \theta}$

16. $2(\sin^2 60^\circ + \cos^2 30^\circ) - (\sin^2 45^\circ + \cos^2 45^\circ)$ is

1) 3

2) 2

3) 1

4) 0.

17. A trekker before climbing a mountain finds the height of the mountain from a point 20 km from it. He finds the angle of elevation to be 30° . The height of the mountain is

1) $\frac{20\sqrt{3}}{3}$ km

2) $20\sqrt{3}$ km

3) 20 km

4) 30 km.

18. If $\tan \theta + \cot \theta = 2$, then the value of $\tan^2 \theta + \cot^2 \theta$ is

1) 0

2) 1

3) 2

4) 4.

19. The standard deviation is the of the variance.

1) cube

2) square

3) square root

4) cube root.

20. The probability of getting 3 heads or 3 tails in tossing 3 coins is

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

2) $\frac{1}{4}$

3) $\frac{3}{8}$

4) $\frac{1}{2}$.

SECTION - B

Answer any ten questions :

 $10 \times 2 = 20$

21. Find Y , given $\begin{pmatrix} -3 & -2 & 4 \\ 5 & -6 & -3 \end{pmatrix} - 2Y = \begin{pmatrix} -5 & 4 & 6 \\ 3 & -4 & 5 \end{pmatrix}$.
22. Solve $\begin{pmatrix} 1 & 2 \\ 2 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$.
23. The sides of ΔPQR are 8 cm, 10 cm and 12 cm. Three circles are drawn with centres P , Q and R such that each one touching the other two externally. Determine the radii of the circles.
24. If the bisector of an angle of a triangle bisects the opposite side, prove that the triangle is isosceles.
25. ΔABC and ΔDEF are similar, the area of ΔABC is 9 sq.cm and that of ΔDEF is 16 sq.cm. If $EF = 4.2$ cm, find BC .
26. A triangle has vertices at $A(3, 4)$, $B(1, 2)$ and $C(-5, -6)$. Find the slope of the median through A .
27. Find the equation of the line having an inclination 60° with the positive direction of X -axis and passing through the point $(4, 2)$.
28. Show that the straight lines $7x - y + 6 = 0$ and $3x + 21y + 11 = 0$ are perpendicular to each other.
29. Find the equation of the line passing through $(3, -4)$ and making equal intercepts on the axes.

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30. Prove that $\frac{1 + \cos \theta - \sin^2 \theta}{\sin \theta (1 + \cos \theta)} = \cot \theta$.
31. If $A = 30^\circ$, verify that $\cos 2A = \frac{1 - \tan^2 A}{1 + \tan^2 A}$.
32. If $x = a \sec \theta$ and $y = b \tan \theta$, find the value of $b^2 x^2 - a^2 y^2$.
33. A tree 12 m high is broken by the wind in such a way that its top touches the ground and makes an angle $\frac{\pi}{4}$ radians with the ground. At what height from the bottom of the tree is broken by the wind?
34. The sum of the squares of the deviations from the mean of 6 variables is 54. Find the variance.
35. A number is selected at random from 1 to 100. Find the probability that it is not a square number.

PART - II

SECTION - C

Answer any two questions :

$2 \times 5 = 10$

36. State and prove SAS similarity on triangles.
37. L be a point on the side QR of $\triangle PQR$. If LM, LN are drawn parallel to PR and QP meeting QP, PR at M, N respectively, MN meets produced QR in T . Prove that $LT^2 = RT \times QT$.
38. D is the mid-point of side BC of $\triangle ABC$. DP bisects $\angle ADB$ meeting AB at P and DQ bisects $\angle ADC$ meeting AC at Q . Prove that $PQ \parallel BC$.

SECTION - D

Answer any three questions :

 $3 \times 5 = 15$

39. If $A = \begin{pmatrix} 3 & 2 & 0 \\ 1 & 4 & 0 \\ 0 & 0 & 5 \end{pmatrix}$, show that $A^2 - 7A + 10I_3 = 0$.

40. Verify that $(AB)^T = B^T A^T$ if $A = \begin{pmatrix} 2 & 3 & -1 \\ 4 & 1 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & -2 \\ 3 & -3 \\ 2 & 6 \end{pmatrix}$.

41. Find the standard deviation and variance for the following data :

$x :$	10	15	18	20	25
$f :$	3	2	5	8	2

42. A number is selected at random from 40 to 80. Find the probability that it is divisible by 6 or 9.

SECTION - E

Answer any two questions :

 $2 \times 5 = 10$

43. Show that $2(\sin^6 \theta + \cos^6 \theta) - 3(\sin^4 \theta + \cos^4 \theta) + 1 = 0$.

44. If $\operatorname{cosec} \phi = \sqrt{2}$, show that

$$\frac{2 \sin^2 \phi + 3 \cot^2 \phi}{4 (\tan^2 \phi - \cos^2 \phi)} = 2.$$

45. From the top of a building 60 m high the angle of depression of the top and the bottom of a tower are observed to be 30° and 60° . Find the height of the tower.

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SECTION - F

Answer any *three* questions :

$3 \times 5 = 15$

46. Find the area of the quadrilateral $ABCD$ whose vertices are $A(3, 4)$, $B(-1, 6)$, $C(-3, -4)$ and $D(6, 1)$.
47. Write down the equation of the line AB through $(3, 2)$, perpendicular to the line $3x - 2y + 5 = 0$. AB meets the X -axis at A and the Y -axis at B . Calculate the area of triangle OAB , where O is the origin.
48. Find the equation of the line passing through the point of intersection of the lines $2x + y - 3 = 0$ and $5x + y - 6 = 0$ and perpendicular to the line joining the points $(1, 2)$ and $(2, 1)$.
49. Find the orthocentre of the triangle ABC whose vertices are $A(-2, 1)$, $B(-1, -4)$ and $C(0, -5)$.

PART - III**SECTION - G**

Answer any *one* question :

$1 \times 10 = 10$

50. Draw a circle of radius 3.6 cm. Take a point P on it. Without using the centre of the circle, draw a tangent to the circle at the point P .
51. Construct a ΔABC such that $AB = 5.6$ cm, $m\angle C = 60^\circ$ and median through the vertex C is 4 cm.
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