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**MATHEMATICS — Paper II**Time 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

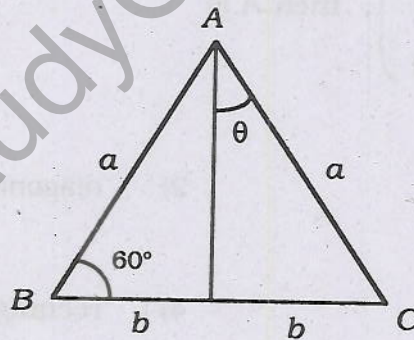
3) 3                                  4) 5

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,  $\theta$  is



1)  $60^\circ$                               2)  $45^\circ$

3)  $30^\circ$                               4)  $15^\circ$

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.



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  $30^\circ$ . 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 × 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  $\Delta PQR$  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.  $\Delta ABC$  and  $\Delta DEF$  are similar, the area of  $\Delta ABC$  is 9 sq.cm and that of  $\Delta DEF$  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  $60^\circ$  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  $\Delta PQR$ . 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  $\Delta ABC$ .  $DP$  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 × 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 × 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  $30^\circ$  and  $60^\circ$ . 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  $\Delta ABC$  such that  $AB = 5.6$  cm,  $m\angle C = 60^\circ$  and median through the vertex  $C$  is 4 cm.
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