



Dinesh Centum Maths Academy, Trichy

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Half Yearly Model Question Paper 2022

11th - MATHS.

PART - I

All Questions are Compulsory.

1. If two sets A and B have 17 elements in common, then the number of elements common to the set $A \times B$ and $B \times A$ is $20 \times 1 = 20$
- 1). 2^{17} 2). 17^2 3). 34 4). insufficient data.
2. $|x+2| \leq 8$, then x belongs to
- 1). (6, 10) 2). (-10, 6) 3). (6, 10) 4). (-10, 6)
3. $\frac{\cos 6x + 6 \cos 4x + 15 \cos 2x + 10}{\cos 5x + 5 \cos 3x + 10 \cos x}$ is equal to
- 1). $\cos 2x$ 2). $\cos x$ 3). $\cos 3x$ 4). $2 \cos x$
4. In ${}^nC_3 : {}^nC_2 = 11 : 1$ then n is
- 1). 5 2). 6 3). 11 4). 7
5. $\cos 1^\circ + \cos 2^\circ + \cos 3^\circ + \dots + \cos 179^\circ =$
- 1). 0 2). 1 3). -1 4). 89

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6. Number of sides of a Polygon having 44 diagonals is
 1) 4 2) 4! 3) 11 4) 22
7. The HM of two Positive numbers whose AM and GM are 16, 8 respectively is
 1) 10 2) 6 3) 5 4) 4
8. $\lim_{x \rightarrow \infty} \left(\frac{x^2 + 5x + 3}{x^2 + x + 3} \right)^x$ is
 1) e^3 2) e^4 3) 1 4) e^2
9. The equation of the line with slope 2 and the length of the Perpendicular from the Origin equal to $\sqrt{5}$ is
 1) $x + 2y = \sqrt{5}$ 2) $2x + y = \sqrt{5}$ 3) $2x + y = 5$ 4) $x + 2y - 5 = 0$
10. The Slope of the line which makes an angle 45° with the line $3x - y = -5$ are
 1) 1, -1 2) $\frac{1}{2}, -2$ 3) $1, \frac{1}{2}$ 4) $2, \frac{1}{2}$
11. If $a_{ij} = \frac{1}{2} (3i - 2j)$ and $A = [a_{ij}]_{2 \times 2}$ is
 1) $\begin{bmatrix} \frac{1}{2} & 2 \\ -\frac{1}{2} & 1 \end{bmatrix}$ 2) $\begin{bmatrix} \frac{1}{2} & -\frac{1}{2} \\ 2 & 1 \end{bmatrix}$ 3) $\begin{bmatrix} 2 & 2 \\ \frac{1}{2} & -\frac{1}{2} \end{bmatrix}$ 4) $\begin{bmatrix} -\frac{1}{2} & \frac{1}{2} \\ 1 & 2 \end{bmatrix}$

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12. The value of the determinant of $A = \begin{bmatrix} 0 & a & -b \\ -a & 0 & c \\ b & -c & 0 \end{bmatrix}$ is
- 1) $-2abc$ 2) abc 3) 0 4) $a^2+b^2+c^2$
13. Two vertices of a triangle have position vectors $3\hat{i}+4\hat{j}-4\hat{k}$ and $2\hat{i}+3\hat{j}+4\hat{k}$. If the position vector of the centroid is $\hat{i}+2\hat{j}+3\hat{k}$, then the position vector of the third vertex is
- 1) $-2\hat{i}-\hat{j}+9\hat{k}$ 2) $-2\hat{i}-\hat{j}-6\hat{k}$ 3) $2\hat{i}-\hat{j}+6\hat{k}$ 4) $-2\hat{i}+\hat{j}+6\hat{k}$
14. One of the diagonals of parallelogram ABCD with $\vec{a}$ and $\vec{b}$ as adjacent sides is $\vec{a}+\vec{b}$. The other diagonal $\vec{BD}$ is
- 1) $\vec{a}-\vec{b}$ 2) $\vec{b}-\vec{a}$ 3) $\vec{a}+\vec{b}$ 4) $\frac{\vec{a}+\vec{b}}{2}$
15. $\lim_{\theta \rightarrow 0} \frac{\sin \sqrt{\theta}}{\sqrt{\sin \theta}}$
- 1) 1 2) -1 3) 0 4) 2
16. If $y = \frac{1}{a-z}$, then $\frac{dz}{dy}$ is
- 1) $(a-z)^2$ 2) $-(z-a)^2$ 3) $(z+a)^2$ 4) $-(z+a)^2$
17. The derivative of $f(x) = x|x|$ at $x = -3$ is
- 1) 6 2) -6 3) does not exist 4) 0

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18. $\int \frac{\sec x}{\sqrt{\cos 2x}} dx$ is

- 1) $\tan^{-1}(\sin x) + C$ 2) $2 \sin^{-1}(\tan x) + C$ 3) $\tan^{-1}(\cos x) + C$ 4) $\sin^{-1}(\tan x) + C$

19. If X and Y be two events such that $P(X/Y) = \frac{1}{2}$, $P(Y/X) = \frac{1}{3}$ and $P(X \cap Y) = \frac{1}{6}$, then $P(X \cup Y)$ is

- 1) $\frac{1}{3}$ 2) $\frac{2}{5}$ 3) $\frac{1}{6}$ 4) $\frac{2}{3}$

20. If A and B are any two events, then the probability that exactly one of them occur is

- 1) $P(A \cup B) + P(\bar{A} \cup \bar{B})$ 2) $P(A \cap \bar{B}) + P(\bar{A} \cap B)$
3) $P(A) + P(B) - P(A \cap B)$ 4) $P(A) + P(B) + 2P(A \cap B)$

PART - II

Answer any seven questions.

Question No. 30 is compulsory.

$7 \times 2 = 14$

21. From the graph $y = \cos x$, draw $|y| = \cos x$

22. Resolve the following rational expressions into partial fractions.

$$\frac{3x+1}{(x-2)(x+1)}$$

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23. Find the Value of $\sin 150^\circ$.
24. Prove that ${}^{2n}C_n = \frac{2^n \times 1 \times 3 \times \dots (2n-1)}{n!}$
25. Write the first 6 terms of the sequences whose n^{th} term a_n is given below.
- $$a_n = \begin{cases} 1 & \text{if } n=1 \\ 2 & \text{if } n=2 \\ a_{n-1} + a_{n-2} & \text{if } n > 2 \end{cases}$$
26. The length of the perpendicular drawn from the origin to a line is 12 and makes an angle 150° with positive direction of x-axis. Find the equation of the line.
27. Compute $|A|$ using Sarrus rule if $A = \begin{bmatrix} 3 & 4 & 1 \\ 0 & -1 & 2 \\ 5 & -2 & 6 \end{bmatrix}$
28. Find λ , when the projection of $\vec{a} = \lambda\hat{i} + \hat{j} + 4\hat{k}$ on $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$ is 4 units
29. Define a continuous function on the closed interval $[a, b]$
30. If two coins are tossed simultaneously, then find the probability of getting - i) atmost two tails.

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PART - III

7x3=21

Answer any SEVEN questions.

Question number 40 is compulsory.

31. Check the relation $R = \{(1,1), (2,2), (3,3), \dots, (n,n)\}$ defined on the set $S = \{1, 2, 3, \dots, n\}$ for the three basic relations.
32. If one root of $k(x-1)^2 = 5x-7$ is double the other root, show that $k=2$ or -25 .
33. Prove that
$$\frac{\cot(180^\circ + \theta) \sin(90^\circ - \theta) \cos(-\theta)}{\sin(270^\circ + \theta) \tan(-\theta) \operatorname{cosec}(360^\circ + \theta)} = \cos^2 \theta \cot \theta.$$
34. If $(n+2)C_8 : (n-2)P_4 = 57:16$, find n .
35. Expand $(1+x)^{\frac{2}{3}}$ upto four terms for $|x| < 1$.
36. Prove: Any square matrix can be expressed as the sum of a symmetric matrix and a skew-symmetric matrix.
37. Find the angle between the vectors $5\hat{i} + 3\hat{j} + 4\hat{k}$ and $6\hat{i} - 8\hat{j} + \hat{k}$.
38. Differentiate the following: $y = \sin^{-1}\left(\frac{1-x^2}{1+x^2}\right)$
39. Integrate the following functions with respect to x : $(2x-5)(36+4x)$
40. Area of the triangle formed by a line with coordinate axes is 36 sq. units. Find the equation of the line if the perpendicular drawn from origin to the line makes an angle of 45° with positive the x -axis.

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PART - IV

7x5 = 35

Answer all the questions.

41. a). Let $f, g: \mathbb{R} \rightarrow \mathbb{R}$ be defined as $f(x) = 2x - |x|$ and $g(x) = 2x + |x|$.
Find $f \circ g$.

Or

b). Show that
$$\begin{vmatrix} b+c & a & a^2 \\ c+a & b & b^2 \\ a+b & c & c^2 \end{vmatrix} = (a+b+c)(a-b)(b-c)(c-a)$$

42. a). State and Prove : Napier's Formula.

Or

- b). A factory has two machines I and II. Machine - I produces 40% of items of the output and Machine - II produces 60% of the items. Further 4% of items produced by Machine - I are defective and 5% produced by Machine - II are defective. If an item is drawn at random, find the probability that it is a defective item.

43. a). Prove that the sum of the first n non-zero even numbers is $n^2 + n$.

Or

- b). Evaluate $\int \sqrt{4-x^2} dx$

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44. a). Find the Value of $\sqrt[3]{126}$ Correct to two decimal places.

Or

b). If $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$ then prove that at $\theta = \frac{\pi}{2}$, $y'' = \frac{1}{a}$

45. a). Rewrite $\sqrt{3}x + y + 4 = 0$ into normal form.

Or

b). Evaluate the following limits:

$$\lim_{x \rightarrow 0} \frac{\tan 2x}{\sin 5x}$$

46. a). Find all values of x that satisfies the inequality $\frac{2x-3}{(x-2)(x-4)} < 0$

Or

b). Prove that the points whose position vectors $2\hat{i} + 4\hat{j} + 3\hat{k}$, $4\hat{i} + \hat{j} + 9\hat{k}$ and $10\hat{i} - \hat{j} + 6\hat{k}$ form a right angled triangle.

47. a). Show that the equation $9x^2 - 24xy + 16y^2 - 12x + 16y - 12 = 0$ represents a pair of parallel lines. Find the distance between them

Or

b). Find $\frac{dy}{dx}$ if $x = a(t - \sin t)$, $y = a(1 - \cos t)$.

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