CLASS XII (2019-20)
MATHEMATICS (041)
SAMPLE PAPER-1

Time : 3 Hours **Maximum Marks : 80**

General Instructions :

(i) All questions are compulsory.
(ii) The questions paper consists of 36 questions divided into 4 sections A, B, C and D.
(iii) Section A comprises of 20 questions of 1 mark each. Section B comprises of 6 questions of 2 marks each. Section C comprises of 6 questions of 4 marks each. Section D comprises of 4 questions of 6 marks each.
(iv) There is no overall choice. However, an internal choice has been provided in three questions of 1 mark each, two questions of 6 marks each. You have to attempt only one of the alternatives in all such questions.
(v) Use of calculators is not permitted.

SECTION-A

DIRECTION : (Q 1-Q 10) are multiple choice type questions. Select the correct option.

Q1. The operation $*$ is defined as $a * b = 2a + b$, then $(2 * 3) * 4$ is. [1]

(a) 18 (b) 17
(c) 19 (d) 21

Q2. $\cos^{-1}\dfrac{1-x^2}{1-x^2} =$ [1]

(a) $2\cos^{-1}x$ (b) $2\sin^{-1}x$
(c) $2\tan^{-1}x$ (d) $\cos^{-1}2x$

Q3. $A = \begin{bmatrix} 3 & 6 \\ 5 & -4 \end{bmatrix}$, $B = \begin{bmatrix} 7 & 8 \\ 5 & 6 \end{bmatrix}$, $2A + 3B = ?$ [1]

(a) $\begin{bmatrix} 27 & 24 \\ 22 & 10 \end{bmatrix}$ (b) $\begin{bmatrix} 27 & 36 \\ 25 & 10 \end{bmatrix}$
(c) $\begin{bmatrix} 27 & 36 \\ 25 & 15 \end{bmatrix}$ (d) $\begin{bmatrix} 27 & 36 \\ 35 & 10 \end{bmatrix}$

Q4. If 7 and 2 are two roots of the equation $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$ then the third root is [1]

(a) -9 (b) 14
(c) $\dfrac{1}{2}$ (d) None of these

Q5. $\dfrac{d(2^x)}{d(3^x)} =$ [1]

(a) $\left(\dfrac{2}{3}\right)^x$ (b) $\dfrac{2^{x-1}}{3^{x-1}}$

(c) $\left(\frac{2}{3}\right)^x \log_3 2$ (d) $\left(\frac{2}{3}\right)^x \log_2 3$

Q6. If $y = x^2 + 3x - 4$, then the slope (gradient) of the normal to the curve at (1, 1) is [1]

(a) 5 (b) $-\frac{1}{5}$

(c) 8 (d) $-\frac{1}{8}$

Q7. Integrating factor of the differential equation $\frac{dy}{dx} + y\sec x = \tan x$ is- [1]

(a) $\sec x + \tan x$ (b) $\sec x - \tan x$

(c) $\sec x$ (d) $\tan x \sec x$

Q8. $x\hat{i} - 3\hat{j} + 5\hat{k}$, $-x\hat{i} + x\hat{j} + 2\hat{k}$ are perpendicular to each other then $x =$ [1]

(a) -2, 5 (b) 2, 5

(c) -2, -5 (d) 2, -5

Q9. The coordinates of the midpoint of the line segment joining the points (2, 3, 4) and $(8, -3, 8)$ are [1]

(a) (10, 0, 12) (b) (5, 6, 0)

(c) (6, 5, 0) (d) (5, 0, 6)

Q10. If A and B are two events such that $P(A) \neq 0$ and $P\left(\frac{B}{A}\right) = 1$ [1]

(a) $B \subset A$ (b) $A \subset B$

(c) $B = \phi$ (d) $A \cap B = \phi$

Q. 11-15 (Fill in the blanks)

Q11. If the binary operation $*$ defined on Q, is defined as $a * b = 2a + b - ab$, $\forall\, a, b \in Q$, then the value of $3 * 4$ is ..... [1]

Q12. If the vectors: $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{c} = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$ are coplanar, then the value of λ is ..... . [1]

Q13. $\sin\left(2\sin^{-1}\frac{3}{5}\right)$ is equal to ..... [1]

Q14. $\cos^{-1}(2x - 1) =$ ..... [1]

(a) $2\cos^{-1} x$ (b) $\cos^{-1}\sqrt{x}$

(c) $2\cos^{-1}\sqrt{x}$ (d) None of these

OR

The principal value of $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$ is .....

(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{6}$

(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{3}$

Q15. If $y = x^2 + 3x - 4$, then the slope (gradient) of the normal to the curve at (1, 1) is ..... [1]

(a) 5 (b) $-\frac{1}{5}$

(c) 8 (d) $-\frac{1}{8}$

OR

The angle which the tangent to curve $y = x^2$ at $(0, 0)$ makes with the positive direction of x-axis is ..... [1]

(a) 90° (b) 0°

(c) 45° (d) 30°

Q16. Find matrix X, if $X + \begin{bmatrix} 4 & 6 \\ -3 & 7 \end{bmatrix} = \begin{bmatrix} 3 & -6 \\ 5 & -8 \end{bmatrix}$ [1]

OR

$A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, then find the value of $\theta\left(\text{where}, \theta\, \varepsilon\left(0, \frac{\pi}{2}\right)\right)$ satisfying the equation $A^T + A = I_2$.

Q17. Evaluate $\int_0^{\pi/2} x \sin x\, dx$ [1]

Q18. Examine the continuity of the function [1]

$$f(x) = \begin{cases} \frac{|\sin x|}{x}, & x \neq 0 \\ 1, & x = 0 \text{ at } x = 0 \end{cases}$$

Q19. Find the volume of a parallelopiped whose sides are given by [1]
$-3\hat{i} + 7\hat{j} + 5\hat{k}$, $-5\hat{i} + 7\hat{j} - 3\hat{k}$ and $7\hat{i} - 5\hat{j} - 3\hat{k}$.

Q20. Two coins are tossed. What is the probability of coming up two heads if it is known that at least one head comes up. [1]

SECTION B

Q21. Evaluate $\int_0^1 \frac{2x}{5x^2 + 1} dx$. [2]

OR

Evaluate $\int_0^2 [x^2] dx$, where $[\cdot]$ is the greatest integer function. [2]

Q22. Find the value of k, if the area of a triangle is 4 sq units and vertices are $(k, 0)$, $(4, 0)$ and $(0, 2)$. [2]

Q23. Using properties of determinants, prove that $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$ [2]

Q24. Show that, $\tan\left(\frac{1}{2}\sin^{-1}\frac{3}{4}\right) = \frac{4-\sqrt{7}}{3}$. [2]

OR

Prove that, $\cot\left(\frac{\pi}{4} - 2\cot^{-1}3\right) = 7$.

Q25. Rajeev appears for an interview for two posts A and B for which selection is independent. The probability of his selection for post A is 1/5 and for post B is 1/6. He prepare well for two posts by getting all the possible informations. What is the probability that he is selected for atleast one of the post? [2]

Q26. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{c} = \hat{i} - 2\hat{j} + \hat{k}$, then find a vector of magnitude 6 units, which is parallel to the vector $2\vec{a} - \vec{b} + 3\vec{c}$. [2]

SECTION C

Q27. Differentiate the equation $y = e^{\sin x} + (\tan x)^x$ w.r.t. x. [4]

Q28. Evaluate $\int_0^{\pi/2} \frac{\sin^2 x}{\sin x + \cos x}\, dx$. [4]

OR

Evaluate $\int_0^3 f(x)\, dx$, where $f(x) = |x| + |x-1| + |x-2|$.

Q29. For the matrices A and B, prove that $(AB)' = B'A'$, if $A = \begin{bmatrix} 1 \\ -4 \\ 3 \end{bmatrix}$ and $B = [-1\ 2\ 1]$. [4]

Q30. Prove that, [4]

$\cos\left[\tan^{-1}\left\{\sin\left(\cot^{-1} x\right)\right\}\right] = \sqrt{\frac{1+x^2}{2+x^2}}$.

Q31. Evaluate $\int \frac{dx}{5 + 4\cos x}$ [4]

OR

Evaluate $\int \frac{\sin 2x}{(1+\sin x)(2+\sin x)}\, dx$.

Q32. Show that the differential equation:

$\sin x \frac{dy}{dx} + (\cos x) \cdot y = \cos x \cdot \sin^2 x$ is linear and also solve the differential equation. [4]

SECTION D

Q33. Find the area of the region bounded by the paraboles $y^2 = 4ax$ and $x^2 = 4ay$. [6]

OR

Find the area of the region included between the parabola $y^2 = x$ and the line $x + y = 2$ and the X -axis.

Q34. A merchant plant to sell two types of personal computers, a desktop model and a portable model that will cost ₹25000 and ₹40000, respectively. He estimates that the total monthly demand of computers will not exceed 250 units. Find the number of units of each type of computers which the merchant should stock to get maximum profit, if he does not want to invest more than ₹70 lakh and his profit on the desktop model is ₹4500 and on the portable model is ₹5000. Make an LPP and solve it graphically. [6]

Q35. An open box with a square base is to be made out of a given quantity of metal sheet of area c^2. Show that maximum volume of the box is $c^3/6\sqrt{3}$. [6]

OR

Find all the points of local maxima and local minima of $f(x) = -x + 2\sin x$ on $[0, 2\pi]$. Also, find local maximum and minimum values.

Q36. A manufacturer produces three models of toys in the form of bikes say X, Y and Z. Model X takes as

10 man-hour to make per unit, Model Y takes 5 man-hour per unit and model Z takes 4 man-hour per unit. There are a total 212 man-hour available per week. Handling and marketing costs are ₹20, ₹30 and ₹40 per unit for models X, Y and Z respectively. The total funds available for these purposes are ₹920 per week. Profits per unit for models X, Y and Z are ₹40, ₹10 and ₹70 respectively, but at the end of the week, company get a profit of ₹810. Solve the system of equations by matrix method. [6]

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