

Question Paper

Class-XII (Session : 2020-21)

Subject-Mathematics (Regular)

Time Allowed : 3 hrs

Maximum Marks : 85

Special Instructions:-

Same as that of Previous Years Annual question paper March 2020.

- (i) Q1 to 10 are multiple choice questions and are of 1 mark each. Q. 11 to 13 are of 3 marks each. Q14 to 22 are of 4 marks each and Q. 23 to 27 are of 6 marks each.
- (ii) All questions are compulsory.
- (iii) 30% more internal choices have been provided from 70% of the syllabus, as 30% syllabus has been deleted due to COVID-19 Pandemic for the session 2020-21 only.

1. $\cos^{-1} \left(\cos \frac{7\pi}{6} \right)$ equals to 1

- (a) $\frac{7\pi}{6}$ (b) $\frac{5\pi}{6}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{6}$

2. Let A be a nonsingular square matrix of order 3×3 . Then $|\text{adj} A|$ is equal to 1

- (a) $|A|$ (b) $|A|^2$ (c) $|A|^3$ (d) $3|A|$

3. $\frac{d}{dx} (e^{-x})$ is equal to 1

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

4. The function $f(x) = \sin x$ is 1

- (a) Increasing in $[0, \pi/2]$
 (b) Decreasing in $[0, \pi/2]$
 (c) Neither increasing nor decreasing in $[0, \pi/2]$
 (d) None of these

5. $\frac{-1}{\sqrt{1-x^2}} dx$ 1

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

6. The degree of the differential equations. 1

$(z'')^3 + (z')^2 + \sin(z') + 1 = 0$

- (a) 3 (b) 2 (c) not defined (d) None of these

7. The direction ratios of the vector $\hat{i} + 2\hat{j} + 3\hat{k}$ is 1

- (a) $\langle 1, 2, 3 \rangle$ (b) $\langle 2, 1, 3 \rangle$

- (c) $\langle \frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}} \rangle$ (d) $\langle 1, -2, 3 \rangle$

8. If θ be the angle between any two vectors $\vec{a}$ and $\vec{b}$ then

$|\vec{a} - \vec{b}| = |\vec{a} \times \vec{b}|$ when θ is equal to 1

- (a) 0 (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) $\frac{1}{\pi}$

9. If a line makes angles $90^\circ, 135^\circ, 45^\circ$ with x, y and z-axis respectively then its direction cosines are 1

- (a) $\langle 0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \rangle$ (b) $\langle 0, \frac{-1}{\sqrt{2}}, 1 \rangle$

- (c) $\langle 0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \rangle$ (d) none of these

10. If A and B are events such that $P(A|B) = P(B|A)$ then 1
 (a) $A \subset B$ But $A \neq B$ (b) $A = B$
 (c) $A \cap B = \phi$ (d) $P(A) = P(B)$
11. Find all points of discontinuity of function given by 3

$$f(x) = \begin{cases} x+1 & \text{if } x \geq 1 \\ x^2+1 & \text{if } x < 1 \end{cases}$$

Or

Find $\frac{dy}{dx}$ if $y = \cos^{-1} \left[\frac{1-x^2}{1+x^2} \right], 0 < x < 1$

12. Show that $z = \log(1+x) - \frac{2x}{2+x}, x > -1$ is an increasing functions of x throughout its domain. 3

Or

Find the equation normal at the point (am^2, am^3) for the curve $ay^2 = x^3$

13. Determine $P(E|F)$ when Mother, Father and Son line up at random for the family picture. 3
 E : Son on one end F : Father in middle.
14. Let L be the set of all lines in a plane and R be the relation in L defined as $R = \{L_1, L_2\} : L_1 \text{ is perpendicular to } L_2\}$. Show that R is symmetric but neither reflexive nor transitive. 4

Or

Find go f and fog. If

$$f(x) = |x|, g(x) = |5x - 2|$$

15. Prove that $\tan^{-1} \sqrt{x} = \frac{1}{2} \cos^{-1} \left(\frac{1-x}{1+x} \right), x \in [0, 1]$ 4

Or

Write in the simplest form.

$$\tan^{-1} \left(\frac{\cos x - \sin x}{\cos x + \sin x} \right), 0 < x < \pi$$

16. Express the matrix as the sum of symmetric and skew symmetric matrix when matrix. 4

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

Or

Using the properties of determinants
Show that

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$$

17. Differentiate $x^{\sin x}$, $x > 0$ w.r.t. x 4

Or

If $e^y (x+1) = 1$ Show that $\frac{d^2 y}{dx^2} = \left(\frac{dy}{dx} \right)^2$

18. Evaluate:- $\int \frac{6x+7}{(x-5)(x-4)} dx$ 4

Or

Evaluate:- $\int x^2 \log x dx$

9

19. By using properties of definite integrals. 4

Evaluate:- $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$

20. Solve the differential equation 4
 $(e^x + e^{-x}) dy - (e^x - e^{-x}) dx = 0$

Or

Find the general solution of the differential equation. 4

$$x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$$

21. Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ & $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find the vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{d} = 15$. 4

Or

Find $|\vec{x}|$ if for a unit vector $\vec{a}$

$$(\vec{x} - \vec{a}) \cdot (\vec{x} + \vec{a}) = 12$$

22. Find the probability of getting 5 exactly twice in 7 throws of a die. 4

Or

Find the probability distribution of no. of heads in 4-tosses of a coin

23. Using matrix method, solve following system of linear equations. 6

$$3x - 2y + 3z = 0; 2x + y - z = 1; 4x - 3y + 2z = 4$$

24. Find the area of the region bounded by the two parabolas $z = x^2$ and $z^2 = x$ 6

Or

Find the area of the region bounded by the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$

25. Find the shortest distance between lines. l_1 and l_2 given by 6

$$\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$$

$$\vec{r} = 3\hat{i} + 3\hat{j} - 5\hat{k} + \mu(2\hat{i} + 3\hat{j} + 6\hat{k})$$

Or

Find the coordinates of the point where the line through $(3, -4, -5)$ and $(2, -3, 1)$ crosses the plane $2x + y + z = 7$

26. Show that of all the rectangles inscribed in a given fixed circle, the square has the maximum area. 6

Or

Find the equations of the normals to the curve $z = x^3 + 2x + 6$ which are parallel to the line $x + 14y + 4 = 0$

27. Minimize $z = 200x + 500y$ 6
subject to the constraints

$$x + 2y \geq 10$$

$$3x + 4y \leq 24$$

$$x \geq 0, y \geq 0$$