Model 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. $\text{Cos}^{-1}\left(\text{Cos}\,\frac{7\pi}{6}\right)$ 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. $\frac{d}{dx}(e^{-x})$ in equal to 1

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

4. The function $f(x) = \text{Sin}x$ is 1

(a) Inereasing 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) <1, 2, 3> (b) < 2, 1, 3>
(c) $< \frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}} >$ (d) <1, – 2, 3>

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°, 135°, 45° with x, y and z=axis respectively then its direction cosines are 1

(a) $< 0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} >$ (b) $< 0, \frac{-1}{\sqrt{2}}, 1 >$

(c) $< 0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} >$ (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 $y = \text{Cos}^{-1}\left[\frac{1-x^2}{1+x^2}\right]$, $0<x<1$

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 $R = \{L_1, L_2\} : L_1$ 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 $\tan^{-1}\sqrt{x} = \frac{1}{2}\text{Cos}^{-1}\left(\frac{1-x}{1+x}\right)$, $x \in [0,1]$ 4

Or

Write in the simplest form.

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

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 $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)$

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

Or

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

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 $\vec{a}$

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

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

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

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

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 narmals 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

$x+2y\geq 10$

$3x+4y\leq 24$

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