**MATHEMATICS**
**GROUP : SECOND**

**PAPER CODE - 8196**
**12th CLASS – 1st Annual 2024**
**OBJECTIVE**

**TIME: 30 MINUTES**
**MARKS: 20**

**NOTE:** You have four choices for each objective type question as A , B , C and D . The choice which you think is correct , fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero marks in that question.

**QUESTION NO. 1** DGK-2-24

1 $\int e^x (\sin x - \cos x)\, dx = ?$
(A) $e^x \cos x + c$ (B) $e^x \sin x + c$ (C) $-e^x \cos x + c$ (D) $-e^x \sin x + c$

2 $\int_0^{1/2} \frac{1}{\sqrt{1-x^2}}\, dx = ?$
(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

3 The distance of a point P(2 , - 3) from the x – axis is equal to
(A) - 3 (B) - 2 (C) 2 (D) 3

4 If (2 , 4) , (4 , 6) and (3 , 2) are the vertices of a triangle , then coordinates of the centroid are
(A) (3 , 4) (B) (4 , 6) (C) $\left(\frac{9}{2}, 6\right)$ (D) (24 , 48)

5 The lines represented by $3x^2 - 5xy - 3y^2 = 0$ will be
(A) Parallel (B) Perpendicular (C) Neither parallel nor perpendicular (D) Tangent lines

6 $x = 2$ is the solution of
(A) $x > 1$ (B) $x < 5$ (C) $x > 7$ (D) $x \geq 9$

7 A chord which contains the centre of the circle is called
(A) Radius (B) Focal chord (C) Diameter (D) Tangent line

8 The perpendicular at the outer end of a radial segment is ..... to the circle
(A) Secant (B) Normal (C) Perpendicular (D) Tangent

9 Asymptotes of the curve $\frac{x^2}{16} - \frac{y^2}{25} = 1$ are
(A) $y = \pm \frac{5}{4} x$ (B) $y = \pm \frac{4}{5} x$ (C) $y = \frac{5}{4}\sqrt{x^2 - 16}$ (D) $y = -\frac{5}{4}\sqrt{x^2 - 16}$

10 Projection of a vector $\vec{b}$ along vector $\vec{a}$ is
(A) $\frac{\vec{a}.\vec{b}}{|\vec{b}|}$ (B) $\frac{\vec{a}.\vec{b}}{\vec{b}}$ (C) $\frac{\vec{a}.\vec{b}}{\vec{a}}$ (D) $\frac{\vec{a}.\vec{b}}{|\vec{a}|}$

11 The value of $[\hat{k}\ \hat{\imath}\ \hat{\jmath}] = ?$
(A) - 1 (B) 0 (C) 1 (D) 2

12 If three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are coplanar , then scalar triple product of these vectors is
(A) a negative number (B) a positive number (C) a non-negative number (D) zero

13 $\lim_{x \to a} \frac{x^{n-1} - a^{n-1}}{x - a} = ?$
(A) $na^{n-1}$ (B) $(n-1)a^{n-2}$ (C) $na^{n-1}$ (D) $(n-1)a^{n-1}$

14 If $f(x) = 2 + \sqrt{x-1}$ $\forall x \in \mathbb{R}$ , then domain of $f^{-1}(x)$ is
(A) [-1 , + ∞) (B) [0 , + ∞) (C) [1 , + ∞) (D) [2 , + ∞)

15 $\frac{d}{dx}\left(x - \frac{\sin 2x}{2}\right) = ?$
(A) $2\sin^2 x$ (B) $2\cos^2 x$ (C) 2sinx (D) 2cosx

16 If $f(x) = \frac{1}{12} x^4$ , then $f^{(4)}(x) = ?$
(A) 0 (B) 1 (C) 2 (D) 3

17 If $xy + y^2 = 2$ , then $\frac{dy}{dx} = ?$
(A) $\frac{x}{x+2y}$ (B) $\frac{-y}{x+2y}$ (C) $\frac{xy-y}{x+2y}$ (D) $\frac{x-2y}{x-y}$

18 If $f(x) = x^2 + 2x - 3$ , then $f(x)$ is decreasing in the interval
(A) (-1 , + ∞) (B) (- ∞ , - 1) (C) (- ∞ , 1) (D) (1 , 3)

19 $\int \frac{\sin x - \cos x}{\sqrt{1 - \sin 2x}}\, dx = ?$
(A) x + c (B) sinx + c (C) cosx + c (D) $\cos^2 x + c$

20 $\int \frac{x}{x+2}\, dx = ?$
(A) $x + ln(x+2) + c$ (B) $x - ln(x+2)^2 + c$ (C) $x - ln(x+2) + c$ (D) $x + ln(x+2)^2 + c$

ROUP : SECOND

SUBJECTIVE

## SECTION-I

DGK-2-24

**QUESTION NO. 2 Write short answers any Eight (8) of the following** 16

| | |
|---|---|
| i | Express the perimeter P of a square as a function of its area A |
| ii | Find the values of ( $fog$ ) and ( $gof$ ) when $f(x) = 2x + 1$ , $g(x) = \frac{3}{x-1}$ |
| iii | Evaluate $\lim\limits_{x \to -1} \frac{x^3 - x}{x+1}$ |
| iv | Find c such that $\lim\limits_{x \to -1} f(x)$ exist where $f(x) = \begin{cases} x+2 , & x \leq -1 \\ c+2 , & x > -1 \end{cases}$ |
| v | Find $\frac{dy}{dx}$ by definition when $y = 2x^2 + 1$ |
| vi | Find $\frac{dy}{dx}$ when $y = \frac{2x-3}{2x+1}$ |
| vii | If $x = \theta + \frac{1}{\theta}$ and $y = \theta + 1$ , find $\frac{dy}{dx}$ |
| viii | Differentiate $\sin x$ w.r.t. $\cot x$ |
| ix | If $y = x\, e^{\sin x}$ , find $\frac{dy}{dx}$ |
| x | Find $y_2$ when $x = at^2$ , $y = bt^4$ |
| xi | Find the extreme values of $f(x) = 3x^2$ |
| xii | Find $y_2$ when $y = 2x^5 - 3x^4 + 4x^3 + x - 2$ |

**QUESTION NO. 3 Write short answers any Eight (8) of the following** 16

| | |
|---|---|
| i | Use differentials to find $\frac{dy}{dx}$ and $\frac{dx}{dy}$ of $x^4 + y^2 = xy^2$ |
| ii | Evaluate $\int \frac{(1-\sqrt{x})^2}{\sqrt{x}}\, dx$ |
| iii | Evaluate $\int \frac{dx}{x^2 + 4x + 13}$ |
| iv | Evaluate $\int x^2 \tan^{-1} x\, dx$ |
| v | Evaluate $\int \frac{(a-b)x}{(x-a)(x-b)}\, dx$ |
| vi | Evaluate $\int_1^2 \frac{x^2+1}{x+1}\, dx$ |
| vii | Solve the differential equation $\frac{dy}{dx} = \frac{1-x}{y}$ |
| viii | Show that points A(-1 , 2) , B(7 , 5) and C(2 , - 6) are vertices of right triangle |
| ix | In a triangle A(8 , 6) , B( - 4 , 2) , C( - 2 , - 6) find slope of any one median of triangle |
| x | Find the slopes of lines $l_1$ and $l_2$ where<br>$l_1$ : Joining (2 , 7) and (7 , 10)<br>$l_2$ : Joining (1 , 1) and (-5 , 3) |
| xi | Find the lines represented by $3x^2 + 7xy + 2y^2 = 0$ |
| xii | Find the distance between parallel lines $2x + y + 2 = 0$ , $6x + 3y - 8 = 0$ |

**QUESTION NO. 4 Write short answers any Nine (9) of the following** 18

| | |
|---|---|
| i | Indicate the solution set of the system of linear inequalities $3x + 7y \geq 21$ , $x - y \leq 2$ |
| ii | Define feasible region |
| iii | Find centre and radius of the circle $4x^2 + 4y^2 - 8x + 12y - 25 = 0$ |
| iv | Find vertex and directrix of parabola $(x - 1)^2 = 8(y + 2)$ |
| v | Define axis of parabola |
| vi | Find an equation of hyperbola with foci $(0 , \pm 6)$ and $e = 2$ |
| vii | Find centre and vertices of ellipse $25x^2 + 9y^2 = 225$ |
| viii | Find equation of tangent to the conic $y^2 = 4ax$ at point $(x_1 , y_1)$ |
| ix | Find direction cosines of the vector $6\hat{i} - 2\hat{j} + \hat{k}$ |
| x | If the vectors $\underline{u} = \alpha\underline{i} + 2\alpha\underline{j} - \underline{k}$ and $\underline{v} = \underline{i} + \alpha\underline{j} + 3\underline{k}$ are perpendicular. Find the value of $\alpha$ |
| xi | Define unit vector. Also give an example |
| xii | Find the value of $\alpha$ for which $\alpha\hat{i} + \hat{j}$ , $\hat{i} + \hat{j} + 3\hat{k}$ and $2\hat{i} + \hat{j} - 2\hat{k}$ are coplanar |
| xiii | Define cross product of two vectors $\underline{u}$ and $\underline{v}$ |

(P.T.O)

## SECTION-II

**Note: Attempt any Three questions from this section** DGK-2-24 **10 x 3 = 30**

| | |
|---|---|
| Q.5- (A) | Prove that $\lim_{x \to 0} \frac{a^x - 1}{x} = \log_e a$ |
| (B) | If $x = a \cos^3 \theta$ , $y = b \sin^3 \theta$ , show that $a \frac{dy}{dx} + b \tan \theta = 0$ |
| Q.6- (A) | If $y = e^x \sin x$ , show that $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$ |
| (B) | Evaluate : $\int \sqrt{a^2 + x^2}\ dx$ |
| Q.7-(A) | Evaluate $\int_0^1 \frac{3x}{\sqrt{4-3x}}\ dx$ |
| (B) | Maximize $f(x, y) = x + 3y$ subject to constraints<br>$2x + 5y \leq 30$<br>$5x + 4y \leq 20$ ; $x, y \geq 0$ |
| Q.8-(A) | Show that the circles $x^2 + y^2 + 2x - 2y - 7 = 0$ and $x^2 + y^2 - 6x + 4y + 9 = 0$ touches externally |
| (B) | Use vector method to prove that $\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$ |
| Q.9-(A) | Find an equation of the ellipse with given data<br>centre (0 , 0) , focus (0 , - 3) , vertex (0 , 4) |
| (B) | If two vertices of an equilateral triangle are A( - 3 , 0) and B(3 , 0). Find the third vertex. How many of these triangles are possible ? |