

MATHEMATICS — OBJECTIVE
12th Class · 1st Annual 2024 — Group: Second

Time: 30 Minutes	OBJECTIVE	Marks: 20
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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

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) $(\frac{9}{2}, 6)$ (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) $x > 9$
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 b along vector a is (A) $\frac{\mathbf{a} \cdot \mathbf{b}}{ \mathbf{b} }$ (B) $\frac{\mathbf{a} \cdot \mathbf{b}}{ \mathbf{b} }$ (C) $\frac{\mathbf{a} \cdot \mathbf{b}}{ \mathbf{a} }$ (D) $\frac{\mathbf{a} \cdot \mathbf{b}}{ \mathbf{a} }$
11	The value of $[\hat{i} \hat{j} \hat{k}] = ?$ (A) -1 (B) 0 (C) 1 (D) 2
12	If three vectors a , b and 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	$\lim_{x \rightarrow a} \frac{x^{n-1} - a^{n-1}}{x - a} = ?$ (A) $nan-1$ (B) $(n-1)a^{n-2}$ (C) $nan-1$ (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) $[-1, +\infty)$ (B) $[0, +\infty)$ (C) $[1, +\infty)$ (D) $[2, +\infty)$
15	$\frac{d}{dx} (x - \frac{\sin 2x}{2}) = ?$ (A) $2\sin 2x$ (B) $2\cos 2x$ (C) $2\sin x$ (D) $2\cos x$
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) $(-1, +\infty)$ (B) $(-\infty, -1)$ (C) $(-\infty, 1)$ (D) $(1, 3)$
19	$\int \frac{\sin x - \cos x}{\sqrt{1 - \sin 2x}} dx = ?$ (A) $x + c$ (B) $\sin x + c$ (C) $\cos x + c$ (D) $\cos 2x + c$
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) $x + \ln(x+2)^2 + c$

MATHEMATICS — SUBJECTIVE

12th Class · 1st Annual 2024 — Group: Second

Time: 2 Hrs 30 Minutes	SUBJECTIVE	Marks: 80
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SECTION-I

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

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i	Express the perimeter P of a square as a function of its area A
ii	Find the values of $(f \circ g)$ and $(g \circ f)$ when $f(x) = 2x + 1$, $g(x) = \frac{3}{x-1}$
iii	Evaluate $\lim_{x \rightarrow -1} \frac{x^3 - x}{x + 1}$
iv	Find c such that $\lim_{x \rightarrow -1} f(x)$ exist where $f(x) = \{ x + 2, x \leq -1; c + 2, x > -1 \}$
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 $y = x \sin x$, 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 l_1 : Joining (2, 7) and (7, 10) 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

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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, ± 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 $\underline{u} = \alpha\hat{i} + 2\alpha\hat{j} - \hat{k}$ and $\underline{v} = \hat{i} + \alpha\hat{j} + 3\hat{k}$ are perpendicular. Find the value of α
xi	Define unit vector. Also give an example
xii	Find the value of α 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 $\underline{v}$

SECTION-II

Note: Attempt any Three questions from this section

10 x 3 = 30

Q.5. (A)	Prove that $\lim_{x \rightarrow 0} \frac{a^x - 1}{x} = \log_e a$
(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 $2x + 5y \leq 30$; $5x + 4y \leq 20$; $x, y \geq 0$
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 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?

Notes on this transcription: The subjective paper's heading strip is cut off at the top edge of the source scan; 2 hrs 30 minutes / 80 marks shown, the marks total being the sum of the printed part marks (16+16+18+30). • Objective Q13 options (A) and (C) print identically on the source paper; both are reproduced as printed. • Objective Q6 as printed admits more than one true statement; kept verbatim. • Typeset by Tayarri from the original board paper; no answer key included.