

PAPER CODE - 8195

12th CLASS - 1st Annual 2023

MATHEMATICS
GROUP : FIRST

DGK-12-1-23

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 mark in that question.

QUESTION NO. 1

- 1 $\int e^{-x} (\cos x - \sin x) dx = \dots\dots\dots$
(A) $-e^{-x} \sin x + c$ (B) $e^{-x} \sin x + c$ (C) $e^x \cos x$ (D) $-e^x \cos x + c$
- 2 The order of differential equation $x^2 \frac{d^2y}{dx^2} + \frac{dy}{dx} + 2x = 0$ is
(A) 1 (B) 2 (C) 3 (D) 4
- 3 Vertical line passes through (5,4) is
(A) $y = 4$ (B) $x = 5$ (C) $y = 5$ (D) $y = -4$
- 4 Slope of line perpendicular to $3x - 4y + 5 = 0$ is
(A) $-4/3$ (B) $-3/4$ (C) $3/4$ (D) $4/3$
- 5 Coordinate of mid-point of A (-1, 4) and B(6, 2) is $\dots\dots\dots$
(A) (-7, 2) (B) (7, -2) (C) $(5/2, 3)$ (D) $(5/2, -5/2)$
- 6 Graph of $4y \geq 5$ will be $\dots\dots\dots$ half plane
(A) lower (B) right (C) upper (D) left
- 7 Directrix of $y^2 = 8x$ is
(A) $x + 2 = 0$ (B) $x - 2 = 0$ (C) $y + 2 = 0$ (D) $y - 2 = 0$
- 8 Vertices of the ellipse $\frac{x^2}{16} + \frac{y^2}{25} = 1$ are $\dots\dots\dots$
(A) (0, ± 4) (B) (± 4 , 0) (C) (± 5 , 0) (D) (0, ± 5)
- 9 The center of circle $x^2 + y^2 - 6x + 4y + 13 = 0$ is
(A) (3, -2) (B) (-3, 2) (C) (-3, -2) (D) (3, 2)
- 10 An angle in the semi-circle is of measure $\dots\dots\dots$
(A) 30° (B) 90° (C) 45° (D) 60°
- 11 $\begin{bmatrix} k & i & j \end{bmatrix} = \dots\dots\dots$
(A) 1 (B) -1 (C) 0 (D) 3
- 12 If $\underline{U} = i + \alpha j - k$ and $\underline{V} = 2i + j + k$ are perpendicular then $\alpha = \dots\dots\dots$
(A) 1 (B) 2 (C) -1 (D) 0
- 13 $f(x) = x \quad \forall x \in \mathbb{R}$ is called $\dots\dots\dots$
(A) Constant function (B) Identity function (C) Non-linear function (D) Trigonometric function
- 14 $\lim_{x \rightarrow 0} (1-x)^{1/x} = \dots\dots\dots$
(A) e^x (B) ∞ (C) $e^{1/x}$ (D) e^{-1}
- 15 $\frac{d}{dx} (\tan x) = \dots\dots\dots$
(A) $\ln \cos x$ (B) $-\ln \cos x$ (C) $\sec^2 x$ (D) $-\sec^2 x$
- 16 If $f(x) = \sin x$ then $f'(\frac{\pi}{2}) = \dots\dots\dots$
(A) 0 (B) 1 (C) 2 (D) -1
- 17 $\frac{d}{dx} (\cosh 2x) = \dots\dots\dots$
(A) $\cosh 2x$ (B) $2 \cosh 2x$ (C) $2 \sinh 2x$ (D) $\sinh 2x$
- 18 For a stationary point of function we have $f'(x) = \dots\dots\dots$
(A) 0 (B) Positive (C) Negative (D) ∞
- 19 If $v = x^3$ then differential of v is
(A) $3x^2$ (B) $3x^2 dv$ (C) $x^3 dx$ (D) $3x^2 dx$
- 20 $\int \frac{\sec^2 x}{\tan x} dx = \dots\dots\dots$
(A) $\tan x + c$ (B) $-\cot x + c$ (C) $\ln(\tan x) + c$ (D) $\sec x + c$

D

DGK-12-1-23

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

16

i	Express the area A of a circle as a function of its circumference C.
ii	For any real valued function of $f(x) = 2x + 1$, find $f \circ f(x)$.
iii	Evaluate $\lim_{\theta \rightarrow 0} \frac{1 - \cos \theta}{\sin \theta}$
iv	Differentiate $(x - 5)(3 - x)$ w.r.t x
v	Find $\frac{dy}{dx}$ if $xy + y^2 = 2$
vi	Find $\frac{dy}{dx}$ if $y = x \cos y$
vii	Find $f'(x)$ if $f(x) = e^x(1 + \ln x)$
viii	Find y_2 if $x^2 + y^2 = a^2$
ix	Apply Maclaurin series expansion to prove that $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$
x	Find the extreme values for the function $f(x) = 5x^2 - 6x + 2$
xi	Define convex region.
xii	Graph the solution set of the inequality $5x - 4y \leq 20$

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

16

i	Evaluate $\int \frac{dx}{\sqrt{x+1}-\sqrt{x}}$
ii	Evaluate $\int \frac{adt}{2\sqrt{at+b}}$
iii	Find $\int x \ln x \, dx$
iv	Evaluate the definite integral $\int_{-6}^2 \sqrt{3-x} \, dx$
v	Evaluate $\int \frac{2x}{x^2-a^2} \, dx$, $x > a$
vi	Evaluate $\int (x+1)(x-3) \, dx$
vii	Evaluate $\int \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right) \, dx$, $x > 0$
viii	Define equal Vectors.
ix	Find the unit vector in the direction of the vector $\underline{v} = 2\underline{i} + 6\underline{j}$
x	Let $\vec{A} = (2,5)$, $B(-1,1)$ Find \overline{AB}
xi	Write two properties of Dot Product.
xii	Define cross product of two vectors and give its geometrical meanings.

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

18

i	The points A (-5,-2) and B(5,-4) are ends of diameter of Circle, Find the Center and radius of Circle.
ii	The coordinates of P are (-6, 9), the axes are translated through point O'(-3,2), Find coordinate of P referred to new axes.
iii	By means of slopes, show that (4,-5), (7,5) and (10, 15) lie on same line.
iv	Find equation of line whose x-intercept is -3, y-intercept is 4.
v	Convert $15y - 8x + 3 = 0$ into normal and slope intercept form.
vi	Check whether the lines $4x - 3y - 8 = 0$, $3x - 4y - 6 = 0$ and $x - y - 2 = 0$ are concurrent.
vii	Find lines represented by $6x^2 - 19xy + 15y^2 = 0$
viii	Find centre and radius of circle $5x^2 + 5y^2 + 24x + 36y + 10 = 0$
ix	Find equation of circle with centre $(\sqrt{2}, -3\sqrt{3})$ and radius $2\sqrt{2}$
x	Write equation of tangent to $3x^2 + 3y^2 + 5x - 13y + 2 = 0$ at $\left(1, \frac{10}{3}\right)$
xi	Find focus and vertex of parabola $y^2 = -8(x - 3)$
xii	Find equation of ellipse having centre (0, 0), focus at (0, -3) and one vertex at (0, 4)
xiii	Find eccentricity and vertices of hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$

(P.T.O)

D

DGR-12-1-23

SECTION-II

Note: Attempt any Three questions from this section

10 x 3 = 30

Q.5-(A)	Find the values m and n , so that the given function is continuous at $x = 3$ $f(x) = \begin{cases} mx & \text{if } x < 3 \\ n & \text{if } x = 3 \\ -2x + 9 & \text{if } x > 3 \end{cases}$
(B)	If $y = \sqrt{x} - \frac{1}{\sqrt{x}}$ show that $2x \frac{dy}{dx} + y = 2\sqrt{x}$
Q.6-(A)	Evaluate the indefinite integral $\int \sqrt{x^2 - a^2} dx$
(B)	Find the equation of the medians of triangle whose vertices are $A(-3,2)$, $B(5,4)$ and $C(3,-8)$
Q.7-(A)	Evaluate $\int_0^{\pi/4} (1 + \cos^2 \theta) \tan^2 \theta d\theta$
(B)	Maximize $f(x, y) = x + 3y$; subject to the constraints $2x + 5y \leq 30$ $5x + 4y \leq 20$ $x \geq 0, y \geq 0$
Q.8-(A)	Find $f'(x)$ if $f(x) = \sqrt{\ln(e^{2x} + e^{-2x})}$
(B)	Write an equation of the circle that passes through the points $A(4,5)$, $B(-4, -3)$, $C(8, -3)$
Q.9-(A)	Find the focus, vertex and directrix of the parabola $x + 8 - y^2 + 2y = 0$
(B)	Prove that angle in a semi circles is a right angle.

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 mark in that question.

QUESTION NO. 1

- 1 $\frac{d}{dx} \left[\frac{f(x)}{g(x)} \right] =$
 (A) $\frac{f(x)g'(x) - f'(x)g(x)}{[g(x)]^2}$ (B) $\frac{f'(x)g(x) - g'(x)f(x)}{[f(x)]^2}$ (C) $\frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$ (D) $\frac{g'(x)f'(x) - f(x)g(x)}{[g(x)]^2}$
- 2 $\frac{1}{1+x^2}$ is derivation of
 (A) $\sin^{-1} x$ (B) $\sec^{-1} x$ (C) $\tan^{-1} x$ (D) $\cot^{-1} x$
- 3 $\int \ln x \, dx$ is equal to
 (A) $x - x \ln x + c$ (B) $x \ln x + x + c$ (C) $\frac{1}{x} \ln x + c$ (D) $x \ln -x + c$
- 4 $\int_1^2 (x^2 + 1) \, dx =$
 (A) $\frac{3}{10}$ (B) 2 (C) $\frac{10}{3}$ (D) 0
- 5 $\int a^x \, dx =$
 (A) $\frac{a^x}{\ln a} + c$ (B) $\frac{\ln a}{a^x} + c$ (C) $\frac{1}{a^x \ln a} + c$ (D) $a^x \ln a + c$
- 6 The solution of differential equation $\frac{dy}{dx} = -y$ is
 (A) $y = x e^{-x}$ (B) $y = c e^{-x}$ (C) $y = e^x$ (D) $y = c e^x$
- 7 The distance between the points (0, 0) and (1, 2) is
 (A) 0 (B) 1 (C) 2 (D) $\sqrt{5}$
- 8 A linear equation in two variables represents
 (A) circle (B) ellipse (C) hyperbola (D) straight line
- 9 The slope- intercept form of equation of line is
 (A) $y = \frac{1}{m} x - c$ (B) $y = mx + c$ (C) $y = cx + m$ (D) $y = cx - m$
- 10 Bisectors of angles of a triangle are
 (A) Parallel (B) Perpendicular (C) Concurrent (D) Non-concurrent
- 11 The feasible solution which maximizes or minimizes the objective function is called
 (A) Exact solution (B) Final solution (C) Optimal solution (D) Objective solution
- 12 Equation of circle with centre at origin and radius $\sqrt{5}$ is
 (A) $x^2 + y^2 = \sqrt{5}$ (B) $x^2 + y^2 = 5$ (C) $x^2 + y^2 = 25$ (D) $(x - 3)^2 + y^2 = 5$
- 13 The parabola $y^2 = 4ax$, $a > 0$ opens
 (A) Right (B) Left (C) Upward (D) Downward
- 14 In an ellipse, the foci lie on
 (A) Major axis (B) Minor axis (C) Directrix (D) Z-axis
- 15 If $\vec{F} = 4\vec{i} + 3\vec{j} + 5\vec{k}$ and $\vec{d} = -\vec{i} + 3\vec{j} + 8\vec{k}$, then work done is
 (A) 30 unit (B) 45 unit (C) 53 unit (D) 47 unit
- 16 If \underline{U} , \underline{V} and \underline{W} are coterminal edges of a tetrahedron, then its volume is
 (A) $[\underline{U} \underline{V} \underline{W}]$ (B) $\frac{1}{3} [\underline{U} \underline{V} \underline{W}]$ (C) $\frac{1}{6} [\underline{U} \underline{V} \underline{W}]$ (D) $\frac{1}{9} [\underline{U} \underline{V} \underline{W}]$
- 17 If $f(x) = x^2$, then range of f is
 (A) All non-negative real numbers (B) Rational numbers (C) Integers (D) Irrational numbers
- 18 $\lim_{\theta \rightarrow 0} \frac{\sin 7\theta}{\theta} =$
 (A) 7 (B) $\frac{1}{7}$ (C) 1 (D) $\frac{2}{7}$
- 19 $\frac{d}{dx} (x^{an}) = 0$
 (A) $-anx^{an-1}$ (B) anx^{an-1} (C) $(an-1)x^{an-1}$ (D) $\frac{x^{an+1}}{an+1}$
- 20 If $y = \frac{1}{x^2}$, then $\frac{dy}{dx}$ at $x = -1$ is
 (A) 2 (B) 3 (C) $\frac{1}{3}$ (D) 4

D

DGR-12-2-23

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

16

i	Prove the identity $\operatorname{sech}^2 x = 1 - \tanh^2 x$
ii	Evaluate $\lim_{x \rightarrow \infty} \left(\frac{x}{1+x} \right)^x$
iii	If $f(x) = \begin{cases} x+2, & x \leq -1 \\ c+2, & x > -1 \end{cases}$, Find C so that $\lim_{x \rightarrow -1} f(x)$ exists
iv	Differentiate w.r.t 'x' $(\sqrt{x} - \frac{1}{\sqrt{x}})^2$
v	Find $\frac{dy}{dx}$, if $x = \theta + \frac{1}{\theta}$ and $y = \theta + 1$
vi	Differentiate w.r.t 'x' $\cos \sqrt{x} + \sqrt{\sin x}$
vii	Find $f'(x)$ if $f(x) = \frac{e^x}{e^{-x} + 1}$
viii	Find y_2 if $x = at^2$, $y = bt^4$
ix	Apply Maclaurin series expansion to prove $e^{2x} = 1 + 2x + \frac{4x^2}{2!} + \frac{8x^3}{3!} + \dots$
x	Find two positive integers whose sum is 30 and their product will be maximum.
xi	Graph the solution region of linear inequality $3x - 2y \geq 6$
xii	Graph the linear inequality $2x \geq -3$ in xy - plane.

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

16

i	Find $\int x \cos x \, dx$
ii	Evaluate $\int x^2 \tan^{-1} x \, dx$
iii	Evaluate $\int_0^{\frac{\pi}{3}} \cos^2 \theta \sin \theta \, d\theta$
iv	Evaluate $\int_1^e x \ln x \, dx$
v	Find area between the x-axis and the curve $y = 4x - x^2$
vi	Solve $\frac{dy}{dx} = \frac{y^2 + 1}{e^{-x}}$
vii	Solve the differential equation $\sec x + \tan y \frac{dy}{dx} = 0$
viii	If $\vec{AB} = \vec{CD}$. Find coordinates of the point A when points B, C, D are (1, 2), (-2, 5), (4, 11) respectively.
ix	Prove $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$
x	Find a vector whose magnitude is 4 and is parallel to $2\hat{i} - 3\hat{j} + 6\hat{k}$
xi	Show that the components of a vector are projections of that vectors along \hat{i} , \hat{j} and \hat{k} respectively.
xii	Show that the vectors $3\hat{i} - 2\hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} + 5\hat{k}$ and $2\hat{i} - \hat{j} - 4\hat{k}$ form a right angle triangle.

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

18

i	Show that for the points A (3, 1), B (-2, -3) and C (2, 2), $ \vec{AB} = \vec{BC} $
ii	Find the point that divide the join of A (-6, 3) and B (5, -2) in the ratio 2 : 3 internally.
iii	Find the slope and inclination of line joining the points (4, 6); (4, 8)
iv	Find an equation of line with x-intercept : -9 and slope : -4
v	Find the area of triangle whose vertices are A (2, 3), B (-1, 1) and C (4, -5)
vi	Find the lines represented by the equation $2x^2 + 3xy - 5y^2 = 0$
vii	Find an equation of the line through (11, -5) and parallel to a line with slope -24
viii	Find an equation of circle with centre (-3, 5) and radius 7
ix	Find centre and radius of circle $x^2 + y^2 - 6x + 4y + 13 = 0$
x	Check the position of the point (5, 6) w.r.t circle $x^2 + y^2 = 81$
xi	Find an equation of parabola with focus (-3, 1) and directrix $x = 3$
xii	Find centre and foci of the ellipse $x^2 + 4y^2 = 16$
xiii	Find foci and vertices of hyperbola $\frac{y^2}{4} - x^2 = 1$

D

SECTION-II

DGK-12-2-23

Note: Attempt any Three questions from this section

10 x 3 = 30

Q.5-(A)	Find the values m and n so that the given function $f(x)$ is continuous at $x = 3$ $f(x) = \begin{cases} mx & \text{if } x < 3 \\ n & \text{if } x = 3 \\ -2x + 9 & \text{if } x > 3 \end{cases}$
(B)	If $y = \sqrt{x} - \frac{1}{\sqrt{x}}$ show that $2x \frac{dy}{dx} + y = 2\sqrt{x}$
Q.6-(A)	Evaluate $\int e^{2x} \cos 3x \, dx$
(B)	Find an equation of the line through $(5, -8)$ and perpendicular to the join of $A(-15, -8)$, $B(10, 7)$
Q.7-(A)	Find the area between the x-axis and the curve $y = \sqrt{2ax - x^2}$, where $a > 0$
(B)	Maximize $f(x, y) = x + 3y$ subject to the constraints $2x + 5y \leq 30$; $5x + 4y \leq 20$; $x \geq 0$; $y \geq 0$
Q.8-(A)	Find y_4 if $y = \cos^3 x$
(B)	Find equation of circle passing through $A(3, -1)$, $B(0, 1)$ and having centre at $4x - 3y - 3 = 0$
Q.9-(A)	Find the centre, foci eccentricity, vertices and equation of directrices of $\frac{(x-1)^2}{2} - \frac{(y-1)^2}{9} = 1$
(B)	Prove that $C = a \cos B + b \cos A$.

DAK 91-22

OBJECTIVE

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 mark in that question.

QUESTION NO. 1

- 1 $\lim_{x \rightarrow +\infty} \frac{2-3x}{\sqrt{3+4x^2}} = \dots\dots\dots$
(A) $3/2$ (B) $-3/2$ (C) $+\infty$ (D) $-\infty$
- 2 If $f(x) = \begin{cases} x+2 & x \leq -1 \\ c+2 & x > -1 \end{cases}$ and $\lim_{x \rightarrow -1} f(x)$ exists then $c = \dots\dots\dots$
(A) -2 (B) 2 (C) 1 (D) -1
- 3 $\frac{d}{dx} \sin^{-1} x = \dots\dots\dots$
(A) $\frac{1}{\sqrt{1+x^2}}$ (B) $\frac{-1}{\sqrt{1+x^2}}$ (C) $\frac{1}{\sqrt{1-x^2}}$ (D) $\frac{-1}{\sqrt{1-x^2}}$
- 4 Any point where function f is neither increasing nor decreasing provided $f'(x) = 0$ is called
(A) Critical point (B) Point of inflection (C) Stationary point (D) Feasible point
- 5 $\frac{d}{dx} \cos(ax+b) = \dots\dots\dots$
(A) $\sin(ax+b)$ (B) $-a \sin(ax+b)$ (C) $a \sin(ax+b)$ (D) $-\sin(ax+b)$
- 6 $\frac{d}{dx} e^{3x} = \dots\dots\dots$
(A) $\frac{1}{3} e^{3x}$ (B) e^{3x} (C) $3 e^{3x}$ (D) $3 e^{3x} \ln 3$
- 7 $\int_{-\pi}^{\pi} \sin x \, dx = \dots\dots\dots$
(A) -1 (B) 0 (C) 1 (D) $\cos x$
- 8 $\int \frac{e^x}{e^x+3} \, dx = \dots\dots\dots$
(A) $e^x + 3 + c$ (B) $e^x + c$ (C) $e^x \ln(e^x + 3) + c$ (D) $\ln(e^x + 3) + c$
- 9 $\int \frac{x}{\sqrt{4+x^2}} \, dx = \dots\dots\dots$
(A) $\sqrt{4+x^2} + c$ (B) $\frac{1}{2} \sqrt{4+x^2}$ (C) $\frac{1}{(x+4)^{3/2}} + c$ (D) $\ln|\sqrt{4+x^2}| + c$
- 10 Solution of differential equation $\frac{dy}{dx} = -y$ is
(A) $y = -ce^x$ (B) $y = ce^x$ (C) $y = ce^{-x}$ (D) $y = e^x$
- 11 The distance between the points A (3, 1), B (-2, -4)
(A) $2\sqrt{5}$ (B) $5\sqrt{2}$ (C) $\sqrt{5}$ (D) $\sqrt{2}$
- 12 The point of intersection of the lines $3x + y + 12 = 0$ and $x + 2y - 1 = 0$ is
(A) (5, 3) (B) (-5, -3) (C) (5, -3) (D) (-5, 3)
- 13 Slope of the line $2x + 5y - 8 = 0$ is
(A) $-2/5$ (B) $2/5$ (C) $5/2$ (D) $-5/2$
- 14 The y-intercept of the equation of line $5x - 12y + 39 = 0$
(A) $\frac{5}{12}$ (B) $\frac{-39}{12}$ (C) $\frac{39}{12}$ (D) $\frac{-5}{12}$
- 15 Graph of the inequality $x + 2y < 6$ lies $\dots\dots\dots$
(A) Opposite to origin (B) Toward origin (C) in 1st quadrant (D) in 2nd quadrant
- 16 Radius of the circle with equation $x^2 + y^2 + 2gx + 2fy + c = 0$ is
(A) $\sqrt{g^2 + f^2 + c}$ (B) $\sqrt{g^2 - f^2 - c}$ (C) $\sqrt{g^2 + f^2 - c^2}$ (D) $\sqrt{g^2 + f^2 - c}$
- 17 The line through the focus and perpendicular to the directrix of parabola is called
(A) tangent to parabola (B) axis of parabola (C) latusrectum of parabola (D) vertex of parabola
- 18 $x = a \cos \theta$, $y = b \sin \theta$ are parametric equations of $\dots\dots\dots$
(A) Circle (B) Parabola (C) Ellipse (D) Hyperbola
- 19 If \underline{u} and \underline{v} be two vectors making an angle θ with each other then projection of \underline{u} along \underline{v} is
(A) $\frac{\underline{u} \cdot \underline{v}}{|\underline{v}|}$ (B) $\frac{\underline{u} \cdot \underline{v}}{|\underline{u}|}$ (C) $\frac{\underline{u} \times \underline{v}}{|\underline{v}|}$ (D) $\frac{\underline{u} \times \underline{v}}{|\underline{u}|}$
- 20 $3\hat{j} \cdot \hat{k} \times \hat{i} = \dots\dots\dots$
(A) 0 (B) -3 (C) \hat{j} (D) 3

QUESTION NO. 2 Write short answers any Eight (8) of the following **D4K-G1-22** 16

i	Prove the identity $\sec^2 x = 1 + \tan^2 x$
ii	If $f(x) = 2x + 1$ and $g(x) = x^2 - 1$. Then obtain the expression $fg(x)$
iii	Obtain $f^{-1}(x)$ from $f(x) = -2x + 8$
iv	Evaluate $\lim_{x \rightarrow 0} \frac{\sin x^\circ}{x}$
v	If $f(x) = \begin{cases} x + 2, & x \leq -1 \\ c + 2, & x > -1 \end{cases}$, find "c" so that $\lim_{x \rightarrow -1} f(x)$ exists
vi	If $y = \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2$, then find $\frac{dy}{dx}$
vii	Differentiate $x^2 - \frac{1}{x^2}$ w.r.t. " x^4 "
viii	If $y = x^2 \sec 4x$, then find $\frac{dy}{dx}$
ix	Obtain $\hat{f}(x)$ from $f(x) = x^3 \cdot e^{1/x}$
x	Find $\frac{dy}{dx}$ if $y = x e^{\sin x}$
xi	Determine the interval in which $f(x) = 4 - x^2$, $x \in (-2, 2)$ is increasing
xii	Examine the function $f(x) = x^2 - x - 2$ for critical values

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

i	Use differentials to find $\frac{dy}{dx}$ if $xy + x = 4$
ii	Find $\int \frac{dx}{\sqrt{x+1} - \sqrt{x}}$
iii	Find $\int x \cdot \sqrt{x^2 - 1} dx$
iv	Find $\int \frac{x^2}{x^2+4} dx$
v	Find $\int \tan^{-1} x dx$
vi	Find $\int e^{-x} (\cos x - \sin x) dx$
vii	$\int_{-6}^2 \sqrt{3-x} dx$
viii	Solve the differential equation $\frac{dy}{dx} = \frac{y}{x^2}$
ix	Find the equation of a vertical line through $(-5, 3)$
x	Convert the equation $2x - 4y + 11 = 0$ (i) Two intercepts form (ii) Normal form
xi	Check whether the point $(5, 8)$ lies below or above the line $2x - 3y + 6 = 0$
xii	Find the lines represented by $3x^2 + 7xy + 2y^2 = 0$

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

i	Graph the solution set of $3x - 2y \geq 6$
ii	Graph the solution set of the following linear inequality $3x + 7y \geq 21$, $y \leq 4$
iii	If $\underline{v} = \frac{-\sqrt{3}}{2} \underline{i} - \frac{1}{2} \underline{j}$, then find a unit vector in the direction of \underline{v}
iv	If $\underline{u} = 2\underline{i} + 3\underline{j} + \underline{k}$, $\underline{v} = 4\underline{i} + 6\underline{j} + 2\underline{k}$ and $\underline{w} = -6\underline{i} - 9\underline{j} - 3\underline{k}$ then find $\underline{u} + 2\underline{v}$
v	If $\underline{a} = 2\underline{i} - 2\underline{j} + 4\underline{k}$, $\underline{b} = -\underline{i} + \underline{j} - 2\underline{k}$ then find a unit vector perpendicular to plane containing \underline{a} and \underline{b}
vi	If $\underline{u} = \underline{i} + 2\underline{j} - \underline{k}$, $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$ and $\underline{w} = \underline{i} - 7\underline{j} - 4\underline{k}$. Then find volume of parallelepiped by these vectors
vii	Find work done, if the point at which the constant force $\underline{F} = 4\underline{i} + 3\underline{j} + 5\underline{k}$ is applied to an object moves from $P_1(3, 1, -2)$ to $P_2(2, 4, 6)$
viii	Write equation of normal to the circle $x^2 + y^2 = 25$ at $(5 \cos \theta, 5 \sin \theta)$
ix	Find focus of the parabola $x^2 - 4x - 8y + 4 = 0$
x	Find eccentricity and vertices of the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$
xi	Define circle and write equation of circle in standard form
xii	Find equation of the parabola with focus $(2, 5)$ and directrix $y = 1$
xiii	Find centre and foci of the hyperbola $\frac{y^2}{4} - x^2 = 1$

SECTION-II

10 x 3 = 30

Note: Attempt any Three questions from this section.

DRK-41-22

Q.5- (A)	If $x = \frac{1-t^2}{1+t^2}$, $y = \frac{2t}{1+t^2}$, then show $y \frac{dy}{dx} + x = 0$
(B)	Find m and n so that the given function is continuous at $x = 3$ if $f(x) = \begin{cases} mx & \text{if } x < 3 \\ n & \text{if } x = 3 \\ -2x + 9 & \text{if } x > 3 \end{cases}$
Q.6- (A)	Find $\int \sin^4 x \, dx$
(B)	Find the equation of the line through $(5, -8)$ and perpendicular to join of $A(-15, -8)$, $B(10, 7)$
Q.7-(A)	Evaluate $\int_{-1}^2 (x + x) \, dx$
(B)	Maximize $f(x,y) = x + 3y$; subject to the constraints $2x + 5y \leq 30$, $5x + 4y \leq 20$, $x \geq 0$, $y \geq 0$
Q.8-(A)	Find the area of the region bounded by the triangle whose sides are $7x - y - 10 = 0$; $10x + y - 41 = 0$; $3x + 2y + 3 = 0$
(B)	Determine the equations of tangents to the circle $x^2 + y^2 = 2$ perpendicular to the line $3x + 2y = 6$
Q.9-(A)	By transforming the equation $x^4 + 4y^2 - 2x + 8y + 4 = 0$ referred to a new origin and axes remaining parallel to the original axes, the first terms are removed. Find the coordinates of the new origin and the transformed equation
(B)	Prove that: $\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$

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 mark in that question.

QUESTION NO. 1

DGK 92-22

- 1 $\lim_{n \rightarrow +\infty} \left(1 + \frac{1}{n}\right)^n = \dots\dots\dots$
(A) e^n (B) e (C) $e^{1/2}$ (D) $e^{-1/2}$
- 2 If $f(x) = 2x + 1$, $g(x) = \frac{3}{x-1}$ $x \neq 1$ then $f \circ g(x) = \dots\dots\dots$
(A) $\frac{5+x}{x-1}$ (B) $\frac{3}{2x}$ (C) $4x + 3$ (D) $\frac{3(x-1)}{4-x}$
- 3 $\frac{d}{dx} \cot h^{-1} x = \dots\dots\dots$
(A) $\frac{1}{1-x^2}$ (B) $\frac{1}{x^2-1}$ (C) $\frac{1}{1+x^2}$ (D) $\frac{-1}{1+x^2}$
- 4 $\frac{d}{dx} (x+4)^{1/3} = \dots\dots\dots$
(A) $(x+4)^{-1/3}$ (B) $\frac{1}{3}(x+4)^{-1/3}$ (C) $\frac{1}{3}(x+4)^{-2/3}$ (D) $\frac{1}{3}(x+4)^{2/3}$
- 5 $\frac{d}{dx} e^{\sin x} = \dots\dots\dots$
(A) $e^{\sin x}$ (B) $\cos x e^{\sin x}$ (C) $\sin x e^{\sin x-1}$ (D) $-\cos x e^{\sin x}$
- 6 If f be a differentiable function on the open interval (a, b) then f is increasing function if
(A) $f'(x) < 0$ (B) $f'(x) > 0$ (C) $f(x) \leq 0$ (D) $f''(x) < 0$
- 7 $\int \frac{1}{ax+b} dx = \dots\dots\dots$
(A) $\ln |ax+b| + c$ (B) $\frac{ax+b}{a} + c$ (C) $\frac{-a}{(ax+b)^2} + c$ (D) $\frac{1}{a} \ln |ax+b| + c$
- 8 $\int (f(x))^{-1} f'(x) dx = \dots\dots\dots$
(A) $\ln |f(x)| + c$ (B) $\frac{[(f(x))^{-1}]^2}{2} + c$ (C) $(f(x))^{-1} + c$ (D) $f(x) + c$
- 9 $\int \tan^2 x dx = \dots\dots\dots$
(A) $\sec^2 x + c$ (B) $\sec^2 x - x + c$ (C) $x - \sec^2 x + c$ (D) $-\operatorname{cosec}^2 x + c$
- 10 Solution of the differential equation $x \frac{dy}{dx} = 1 + y$ is
(A) $c - \frac{1}{x}$ (B) ce^y (C) $y = cx - 1$ (D) $x^2 + y^2 = c$
- 11 Equation of horizontal line through $(7, -9)$ is
(A) $y = -9$ (B) $y = 9$ (C) $x = 7$ (D) $x = -7$
- 12 Slope intercept form of the line $2x + y - 11 = 0$ is
(A) $\frac{x}{(11/2)} + \frac{y}{11} = 1$ (B) $y = -2x + 11$ (C) $y = 2x - 11$ (D) $y = -2x - 11$
- 13 If $\theta = 45^\circ$ be the inclination of the line with x -axis then slope of the line is
(A) $\frac{-1}{\sqrt{2}}$ (B) $\frac{1}{\sqrt{2}}$ (C) -1 (D) 1
- 14 The equation $ax^2 + 2hxy + by^2 = 0$ represents a pair of orthogonal lines if
(A) $h^2 - ab = 0$ (B) $a + b = 0$ (C) $h^2 + ab = 0$ (D) $a - b = 0$
- 15 The non-negative constraints used in a system of linear inequalities are called
(A) Problem constraints (B) Decision variable (C) Feasible solution (D) Optimal solution
- 16 Co-ordinate of the centre of the circle $x^2 + y^2 + 12x - 10y = 0$ is
(A) $(6, -5)$ (B) $(-6, -5)$ (C) $(-6, 5)$ (D) $(6, 5)$
- 17 Focus of the parabola $x^2 = -4ax$ is
(A) $(0, -a)$ (B) $(0, a)$ (C) $(-a, 0)$ (D) $(a, 0)$
- 18 Equation of Directrices of Hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$
(A) $y = 0$ (B) $x = 0$ (C) $y = \pm \frac{c}{e^2}$ (D) $x = \pm \frac{c}{e^2}$
- 19 The value of $[\underline{i} \ \underline{j} \ \underline{k}] = \dots\dots\dots$
(A) 1 (B) 0 (C) -1 (D) \underline{k}
- 20 With usual notations in any triangle ABC $c \cos A + a \cos C = \dots\dots\dots$
(A) a (B) b (C) c (D) 1

QUESTION NO. 2 Write short answers any Eight (8) of the following **D9K-92-22** 16

i	If $f(x) = x^2 - x$, Evaluate $f(x-1)$
ii	Explain Identity function by example
iii	Evaluate $\lim_{x \rightarrow \pi} \frac{\sin x}{\pi - x}$
iv	Show that $x = a \cos t$ and $y = a \sin t$ are the parametric equation of the circle $x^2 + y^2 = a^2$
v	Express $\lim_{n \rightarrow +\infty} \left(1 + \frac{3}{n}\right)^{2n}$ in terms of e
vi	If $x = t^2 + 1$, $y = t^2$ find $\frac{dy}{dx}$
vii	If $3x + 4y + 7 = 0$ then find $\frac{dy}{dx}$
viii	Differentiate $\frac{1}{a} \sin^{-1} \frac{a}{x}$ w.r.t x
ix	Find y_2 if $x^2 + y^2 = a^2$
x	Explain increasing function and give its example
xi	Differentiate $\sin x$ w.r.t $\cot x$
xii	Calculate $\frac{d}{dx} (3x^{4/3})$

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

i	Evaluate $\int \frac{\cos 2x - 1}{1 + \cos 2x} dx$
ii	Evaluate $\int a^{x^2} x dx$
iii	Evaluate $\int \frac{dx}{\frac{1}{2} \sin x + \frac{\sqrt{3}}{2} \cos x}$
iv	Evaluate $\int (e^n x)^2 dx$
v	Find $\int_{-1}^3 (x^3 + 3x^2) dx$
vi	If $\int_{-2}^1 f(x) dx = 5$ and $\int_{-2}^1 g(x) dx = 4$ Then evaluate $\int_{-2}^1 (2f(x) + 3g(x)) dx$
vii	Find area between the x-axis and the curve $y = 4x - x^2$
viii	Check $y = \tan(e^x + c)$ is a solution of the differential equation of $\frac{dy}{dx} = \frac{y^2 + 1}{e^{-x}}$
ix	If the vertices of a triangular region are $A(5, 3)$, $B(-2, 2)$ and $C(4, 2)$. Find its area
x	Convert $5x - 12y + 39 = 0$ into slope intercept and intercept form
xi	Find the point three-fifth of the way along line segment from $A(-5, 8)$ to $B(5, 3)$
xii	By means of slope show that the points $(4, -5)$, $(5, 7)$ and $(10, 15)$ lies on a same line

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

i	Graph the solution set of linear inequality $3y - 4 \leq 0$ in xy - plane
ii	Define feasible region and feasible solution
iii	Find an equation of the circle with centre at $(\sqrt{2}, -3\sqrt{3})$ and radius $2\sqrt{2}$
iv	Find the focus and directrix of the parabola $y^2 = -8(x - 3)$
v	Find an equation of the ellipse with foci $(-3\sqrt{3}, 0)$ and vertices $(\pm 6, 0)$
vi	Find focus of the parabola $x^2 - 4x - 8y + 4 = 0$
vii	Check the position of the point $(5, 6)$ with respect to the circle $x^2 + y^2 = 81$
viii	Find the centre and radius of the circle $4x^2 + 4y^2 - 8x + 12y - 25 = 0$
ix	Write the vector \underline{PQ} in the form $x\underline{i} + y\underline{j}$ if $P(0, 5)$, $Q(-1, -6)$
x	Find the sum of the vectors \underline{AB} and \underline{CD} given that four points $A(1, -1)$, $B(2, 0)$, $C(-1, 3)$, $D(-2, 2)$
xi	Find a unit vector in the direction of $\underline{V} = \underline{i} + 2\underline{j} - \underline{k}$
xii	Find the cosines of angle θ between $\underline{U} = [2, -3, 1]$, $\underline{V} = [2, 4, 1]$
xiii	Prove that $\underline{a} \times (\underline{b} + \underline{c}) + \underline{b} \times (\underline{c} + \underline{a}) + \underline{c} \times (\underline{a} + \underline{b}) = 0$

SECTION-II

Note: Attempt any Three questions from this section

10 x 3 = 30

D9K-92-22

Q.5- (A)	Find $\lim_{\theta \rightarrow 0} \frac{\tan\theta - \sin\theta}{\sin^3\theta}$
(B)	Prove that if $\frac{y}{x} = \tan^{-1} \frac{x}{y}$ then $\frac{dy}{dx} = \frac{y}{x}$
Q.6- (A)	Evaluate $\int \frac{x + \sin x}{1 + \cos x} dx$
(B)	Find an equation of line through $(-4, 7)$ and parallel to the line $2x - 7y + 4 = 0$
Q.7-(A)	Evaluate $\int_0^{\pi/4} \frac{\sec\theta}{\sin\theta + \cos\theta} d\theta$
(B)	Graph the feasible region of the system of linear inequalities and find the corner points of $3x + 2y \geq 6$, $x + y \leq 4$, $x \geq 0$, $y \geq 0$
Q.8-(A)	Find a joint equation of the straight lines through the origin perpendicular to the lines represented by $x^2 + xy - 6y^2 = 0$
(B)	Find equation of the tangent drawn from $(0, 5)$ to $x^2 + y^2 = 16$
Q.9-(A)	Find the centre, foci, eccentricity, vertices and equations of directrices of $\frac{y^2}{4} - x^2 = 1$
(B)	Prove that : $\sin(\alpha + \beta) = \sin\alpha \cos\beta + \cos\alpha \sin\beta$

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 mark in that question.

QUESTION NO. 1

- 1 $\frac{d}{dx} (\cos^{-1} \frac{x}{a}) = \dots\dots\dots$
 (A) $\frac{1}{1-x^2}$ (B) $\frac{1}{1+x^2}$ (C) $\frac{-1}{\sqrt{a^2-x^2}}$ (D) $\frac{1}{\sqrt{a^2-x^2}}$
- 2 If $y = \ln(\sin x)$, then $\frac{dy}{dx}$ is
 (A) $\tan x$ (B) $\cot x$ (C) $-\tan x$ (D) $-\cot x$
- 3 The minimum value of the function $f(x) = x^2 + 2x - 3$ is at $x = \dots\dots\dots$
 (A) -3 (B) 1 (C) 0 (D) -1
- 4 $\int x^{-1} dx = \dots\dots\dots$
 (A) $0 + c$ (B) $-x^{-2} + c$ (C) $\frac{x^{-2}}{-2} + c$ (D) $\ln x + c$
- 5 $\int \frac{1}{1+\cos x} dx =$
 (A) $\frac{1}{2} \tan \frac{x}{2}$ (B) $\tan \frac{x}{2}$ (C) $\cot \frac{x}{2}$ (D) $\frac{1}{2} \cot \left(\frac{x}{2}\right)$
- 6 $\int_{\frac{1}{\sqrt{2}}}^{\frac{\sqrt{3}}{2}} \frac{dx}{\sqrt{1-x^2}} =$
 (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{12}$
- 7 The order of the differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 3x = 0$ is
 (A) 1 (B) 2 (C) 0 (D) 3
- 8 The solution set of inequality $2x - 3 \geq 0$ is
 (A) $\left[\frac{3}{2}, \infty\right]$ (B) $\left[\frac{2}{3}, \infty\right]$ (C) $\left[\frac{2}{3}, \infty\right]$ (D) $\left[\frac{3}{2}, 0\right]$
- 9 Perpendicular distance of the point $P(6, -1)$ from the line $3x + 4y + 1 = 0$ is
 (A) 3 (B) 11 (C) 2 (D) 4
- 10 The coordinates of the point that divides the join of $A(-6, 3)$ and $B(5, -3)$ in the ratio $2 : 3$ externally
 (A) $\left(-\frac{8}{3}, 1\right)$ (B) $\left(\frac{8}{5}, -1\right)$ (C) $(-28, 13)$ (D) $(28, -13)$
- 11 If coordinates of the mid points of the sides of a triangle are $(3, 2)$, $(2, 3)$ and $(1, -1)$, then the area of the triangle is
 (A) 10 sq. units (B) 6 sq. units (C) 11 sq. units (D) 5 sq. units
- 12 The latus rectum of a parabola $y^2 = 4ax$ is
 (A) $y = -a$ (B) $x = -a$ (C) $y = a$ (D) $x = a$
- 13 Condition that line $y = mx + c$ is tangent to the circle $x^2 + y^2 = a^2$ is
 (A) $c = \pm m \sqrt{1+a^2}$ (B) $c = \pm m \sqrt{1-a^2}$ (C) $c = \pm a \sqrt{1-m^2}$ (D) $c = \pm a \sqrt{1+m^2}$
- 14 The projection of $\underline{u} = a\underline{i} + b\underline{j} + c\underline{k}$ along \underline{i} is
 (A) 0 (B) b (C) a (D) c
- 15 A constant force \underline{F} acting on a body, displaces it from A to B. The work done by \underline{F} is
 (A) $\underline{F} \cdot \underline{AB}$ (B) $\underline{F} \times \underline{AB}$ (C) $-\underline{F} \times \underline{AB}$ (D) $-\underline{F} \cdot \underline{AB}$
- 16 The angle between the vectors $4\underline{i} + 2\underline{j} - \underline{k}$ and $-\underline{i} + \underline{j} - 2\underline{k}$ is
 (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π
- 17 The coordinates of vertices of hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is
 (A) $(\pm a, 0)$ (B) $(0, \pm b)$ (C) $(0, \pm a)$ (D) $(\pm b, 0)$
- 18 If $f(x) = -2x+6$, then $f^{-1}(x) = \dots\dots\dots$
 (A) $6-2x$ (B) $\frac{6-x}{2}$ (C) $\frac{2}{6-x}$ (D) $2x-6$
- 19 $\lim_{x \rightarrow 0} (1+3x)^{2/x} = \dots\dots\dots$
 (A) e^2 (B) e^8 (C) e^6 (D) e^4
- 20 If $f(x) = \tan x$, then $f\left(\frac{\pi}{4}\right) = \dots\dots\dots$
 (A) 1 (B) $\frac{1}{2}$ (C) 2 (D) $\frac{1}{3}$

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

16

1	Find the Domain and Range of $f(x) = x$
2	Determine whether the function $f(x) = \frac{3x}{x^2+1}$ is even or odd
3	For the functions $f(x) = 3x^4 - 2x^2$, $g(x) = \frac{2}{\sqrt{x}}$ find $f \circ g(x)$ and $g \circ f(x)$
4	Evaluate $\lim_{x \rightarrow \infty} \frac{5x^4 - 10x^2 + 1}{3x^3 + 10x^2 + 50}$
5	Find by definition the derivative of $\frac{1}{x^3}$
6	Differentiate $\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2$ w.r.t x
7	Find $\frac{dy}{dx}$ if $x^2 - 4xy - 5y = 0$
8	Differentiate $\sin x$ w.r.t $\cot x$
9	For $f(x) = \ln \sqrt{e^{2x} + e^{-2x}}$; find $f'(x)$
10	Find y_1 if $x^3 - y^3 = a^3$
11	Find extreme values of $f(x) = 2x^3 - 2x^2 - 36x + 3$
12	Find $\frac{dy}{dx}$ if $y = \ln(\tan h x)$

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

16

1	Find dy if $y = x^2 + 2x$, when x changes from 2 to 1.8
2	Evaluate $\int \frac{(1-\sqrt{x})^2}{\sqrt{x}} dx$ ($x > 0$)
3	Evaluate $\int \frac{\cot \sqrt{x}}{\sqrt{x}} dx$
4	Evaluate $\int e^x (\cos x + \sin x) dx$
5	Evaluate $\int_1^2 \frac{x}{x^2+2} dx$
6	Evaluate $\int_0^{\pi/3} \cos^2 x \cdot \sin x dx$
7	Find the area between the x-axis and the curve $y = x^2 + 1$ from $x = 1$ to $x = 2$
8	Solve the differential equation $\frac{dy}{dx} = -y$
9	Show that the points $A(0,2)$, $B(\sqrt{3}, -1)$ and $C(0,-2)$ are vertices of a right triangle
10	Find an equation of the line through $(-4, -6)$ and perpendicular to a line having slope $-3/2$
11	Find whether the point $(5,8)$ lies above or below the line $2x - 3y + 6 = 0$
12	Find the lines represented by $20x^2 + 17xy - 24y^2 = 0$

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

18

1	Graph the solution set of $2x + y \leq 6$
2	Find equation of circle with ends of a diameter at $(-3, 2)$ and $(5, -6)$
3	Find centre and radius of circle $5x^2 + 5y^2 + 14x + 12y - 10 = 0$
4	Find vertex and directrix of parabola $x^2 = -16y$
5	Find an equation of parabola whose focus is $F(-3,4)$ and directrix $3x - 4y + 5 = 0$
6	Find foci and vertices of Hyperbola $\frac{y^2}{16} - \frac{x^2}{49} = 1$
7	Find centre and eccentricity of $\frac{x^2}{4} - \frac{y^2}{9} = 1$
8	Find magnitude of vector $\underline{u} = \underline{i} + \underline{j}$
9	Find a unit vector in the direction of $\underline{v} = [-2, 4]$
10	Find a vector of length 5 in the direction opposite that of $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$
11	If \underline{v} is a vector for which $\underline{v} \cdot \underline{i} = 0$, $\underline{v} \cdot \underline{j} = 0$, $\underline{v} \cdot \underline{k} = 0$ Find \underline{v}
12	Compute $\underline{a} \times \underline{b}$ if $\underline{a} = -4\underline{i} + \underline{j} - 2\underline{k}$, $\underline{b} = 2\underline{i} + \underline{j} + \underline{k}$
13	Find the value of $3\underline{j} \cdot \underline{k} \times \underline{i}$

Note: Attempt any Three questions from this section

10 x 3 = 30

Q.5-(A)	If $f(x) = \begin{cases} \frac{\sqrt{2x+5}-\sqrt{x+7}}{x-2}, & x \neq 2 \\ k, & x = 2 \end{cases}$ Find k so that f(x) is continuous at x = 2 (B) Prove that $y \frac{dy}{dx} + x = 0$ if $x = \frac{1-t^2}{1+t^2}$, $y = \frac{2t}{1+t^2}$
Q.6-(A)	Evaluate $\int \frac{x \sin^{-1}x}{\sqrt{1-x^2}} dx$ (B) One vertex of a parallelogram is (1, 4), the diagonals intersect at (2, 1) and the sides have slopes 1 and $-\frac{1}{7}$. Find the other three vertices
Q.7-(A)	Solve the differential equation $\sec^2x \tan y dx + \sec^2y \tan x dy = 0$ (B) Maximize $f(x,y) = x + 3y$ subject to constraints $2x + 5y \leq 30$, $5x + 4y \leq 20$, $x \geq 0$, $y \geq 0$
Q.8-(A)	Find equation of circle passing through A(-7, 7), B(5, -1), C(10, 0) (B) Show that mid-point of hypotenuse of a right angle triangle is equidistance from its vertices
Q.9-(A)	If $y = a \cos(\ln x) + b \sin(\ln x)$, Prove that $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0$ (B) Find the centre, foci, eccentricity and vertices of $9x^2 - 12x - y^2 - 2y + 2 = 0$

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 mark in that question.

QUESTION NO. 1

- | | |
|----|--|
| 1 | $\int \tan x \, dx = \dots\dots\dots$
(A) $\ln \sec x + c$ (B) $\ln \csc x + c$ (C) $\ln \cos x + c$ (D) $\ln \sin x + c$ |
| 2 | $\int \ln x^{-1} dx = \dots\dots\dots$
(A) $x \ln x + x + c$ (B) $-x \ln x + x + c$ (C) $-x - x \ln x + c$ (D) $x + \ln x + c$ |
| 3 | $\int_0^{\pi/2} \sin x \, dx = \dots\dots\dots$
(A) 1 (B) 2 (C) 4 (D) 6 |
| 4 | $\int \left(\frac{1}{x} + \ln x\right) e^x \, dx = \dots\dots\dots$
(A) $\frac{1}{x} e^x + c$ (B) $e^x \ln x + c$ (C) $e^x \frac{\ln x}{x} + c$ (D) $\frac{\ln x}{x} + c$ |
| 5 | If m_1 and m_2 are slopes of two lines, then lines are perpendicular if
(A) $m_1 m_2 = 1$ (B) $m_1 = m_2$ (C) $m_1 m_2 = -1$ (D) $m_1 = -m_2$ |
| 6 | An equation of horizontal line through point P(7, -9) is
(A) $y = -9$ (B) $y = 9$ (C) $x = 7$ (D) $x = -7$ |
| 7 | The perpendicular distance of the line $3x + 4y + 10 = 0$ from (0, 0) is
(A) 0 (B) 1 (C) 2 (D) 10 |
| 8 | $x = 5$ is the solution of inequality
(A) $2x - 3 > 0$ (B) $2x + 3 < 0$ (C) $x + 4 < 0$ (D) $x < 0$ |
| 9 | The radius of circle $(x - 5)^2 + (y - 3)^2 = 8$ is
(A) 2 (B) $2\sqrt{2}$ (C) 4 (D) 64 |
| 10 | The vertex of parabola $(x - 1)^2 = 8(y + 2)$ is
(A) (1, 2) (B) (0, 1) (C) (-1, -2) (D) (1, -2) |
| 11 | $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is the standard equation of
(A) Circle (B) Parabola (C) Ellipse (D) Hyperbola |
| 12 | If $\underline{u} = 2\underline{i} + 4\underline{j} + 7\underline{k}$ and $\underline{v} = 2\underline{i} + 6\underline{j} + \alpha \underline{k}$ are perpendicular, then $\alpha = ?$
(A) -4 (B) 4 (C) 28 (D) 0 |
| 13 | $2 \underline{k} \cdot \underline{j} \times \underline{i}$ is equal to
(A) 1 (B) -1 (C) -2 (D) 2 |
| 14 | If $\underline{u} = 2\underline{i} - \underline{j} - 2\underline{k}$, then $ \underline{u} = ?$
(A) 2 (B) 3 (C) 4 (D) 5 |
| 15 | $f(x) = \cos x + \sin x$ is function
(A) Even (B) Odd (C) Both even and odd (D) Neither even nor odd |
| 16 | $\lim_{x \rightarrow \infty} \left(1 + \frac{3}{n}\right)^{2n} = \dots\dots\dots$
(A) e^2 (B) e^4 (C) e^6 (D) e^9 |
| 17 | $\frac{d}{dx} \left(\frac{1}{\sqrt{x}}\right) = \dots\dots\dots$
(A) $\frac{1}{2x\sqrt{x}}$ (B) $-\frac{1}{2x\sqrt{x}}$ (C) $\frac{\sqrt{x}}{2}$ (D) $-\frac{\sqrt{x}}{2}$ |
| 18 | $\frac{d}{dx} (\cos x^2) = \dots\dots\dots$
(A) $-\sin x^2$ (B) $2x \sin x^2$ (C) $-2x \sin x^2$ (D) $\sin x \cdot 2x$ |
| 19 | If $y = 5 e^{3x-4}$, then $\frac{dy}{dx} = \dots\dots\dots$
(A) $15 e^{3x-4}$ (B) $-15 e^{3x-4}$ (C) $20 e^{3x-4}$ (D) $-20 e^{3x-4}$ |
| 20 | If $y = \sin 3x$, then $y_2 = \dots\dots\dots$
(A) $3 \cos 3x$ (B) $9 \sin 3x$ (C) $9 \cos 3x$ (D) $-9 \sin 3x$ |



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

16

1	Find $\text{fof}(x)$ for $f(x) = \sqrt{x+1}$, $g(x) = \frac{1}{x^2}$, $x \neq 0$
2	Find $f^{-1}(x)$ if $f(x) = (-x+9)^3$
3	Find $f(x-1)$ if $f(x) = \sqrt{x+4}$
4	Find $\frac{f(a+h)-f(a)}{h}$, for $f(x) = \sin x$
5	If $y = \sqrt{x} - \frac{1}{\sqrt{x}}$, show that $\frac{2x dy}{dx} + y = 2\sqrt{x}$
6	Differentiate w.r.t x If $y = \frac{2x-1}{\sqrt{x^2+1}}$
7	Differentiate $\frac{x^2+1}{x^2-1}$ w.r.t, x^3
8	Find $\frac{dy}{dx}$ if $y = x \cos y$
9	Find $\frac{dy}{dx}$ if $y = e^{-x} (x^3+2x^2+1)$
10	Find $\frac{dy}{dx}$ if $y = \ln(\tan h x)$
11	Find $\frac{dy}{dx}$ if $y = \sin h^{-1}(x^3)$
12	Find y_2 if $y = x^2 e^{-x}$

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

16

1	Find dy if $y = x^2$ and x changes from 2 to 2.01
2	Evaluate $\int \frac{\sin x + \cos^3 x}{\cos^2 x \sin x} dx$
3	Evaluate the given integral $\int \sin^2 x dx$
4	Evaluate $\int \cos x \left(\frac{\ln \sin x}{\sin x} \right) dx$
5	Find the antiderivative of $\sin^{-1} x$
6	Evaluate the definite integral $\int_0^{\pi/2} \cos^2 \theta \sin \theta d\theta$
7	Solve the differential equation $\frac{dy}{dx} = y^2 + 1/e^{-x}$
8	The length of perpendicular from the origin to a line is 5 units and the inclination of this perpendicular is 120° . Find the slope of the line
9	Find an equation of the line through $(-5, -3)$ and $(9, -1)$
10	Convert the given equation into normal form : $4x + 7y - 2 = 0$
11	Find an equation of each of the lines represented by : $20x^2 + 17xy - 24y^2 = 0$
12	Find the interior angles (any two) of the triangle whose vertices are : $A(6, 1), B(2, 7), C(-6, -7)$

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

18

1	Graph the solution set of $5x - 4y \leq 20$
2	Find the sum of \vec{AB} and \vec{CD} given the four points $A(1, -1), B(2, 0), C(-1, 3)$ and $D(-2, 2)$
3	Find $2\vec{CB} - 2\vec{CA}$ if $A = (2, 5), B = (-1, 1)$ and $C = (2, -6)$
4	Find a vector whose magnitude is 2 and is parallel to $-\underline{i} + \underline{j} + \underline{k}$
5	If \underline{v} is a vector for which $\underline{v} \cdot \underline{i} = 0, \underline{v} \cdot \underline{j} = 0, \underline{v} \cdot \underline{k} = 0$ then find \underline{v}
6	A force $\vec{F} = 7\underline{i} + 4\underline{j} - 3\underline{k}$ is applied at $P(1, -2, 3)$. Find its moment about the point $Q(2, 1, 1)$
7	If $\underline{a} = 2\underline{i} + \underline{j} - \underline{k}$, $\underline{b} = \underline{i} - \underline{j} + \underline{k}$ find $\underline{b} \times \underline{a}$ and show $\underline{b} \times \underline{a}$ is perpendicular to \underline{a}
8	Find centre and radius of circle $4x^2 + 4y^2 - 8x + 12y - 25 = 0$
9	Find the length of the tangent from the point $P(-5, 10)$ to the circle $5x^2 + 5y^2 + 14x + 12y - 10 = 0$
10	Find focus and vertex of the parabola $x^2 = -16y$
11	Find eccentricity and vertices of $9x^2 - 12x - y^2 - 2y + 2 = 0$
12	Find an equation of the tangent to the conic $x^2 - xy + y^2 - 2 = 0$ at the point whose ordinate is $\sqrt{2}$
13	Find the volume of tetrahedron with the vertices $A(2, 1, 8), B(3, 2, 0), C(2, 1, 4)$ and $D(3, 2, 10)$

D4K-II-21
SECTION-II

Note: Attempt any Three questions from this section

10 x 3 = 30

Q.5- (A)	Evaluate $\lim_{\theta \rightarrow 0} \frac{1 - \cos p\theta}{1 - \cos q\theta}$
(B)	Find $\frac{dy}{dx}$ if $x = a(\cos t + \sin t)$, $y = a(\sin t - t \cos t)$
Q.6- (A)	Evaluate $\int \sqrt{x^2 + 4} \, dx$
(B)	One vertex of a parallelogram is (1 , 4) , the diagonals intersect at (2 , 1) and the sides have slope 1 and $-\frac{1}{7}$. Find the other three vertices
Q.7-(A)	Evaluate $\int_0^{\pi/4} \frac{\cos\theta + \sin\theta}{\cos 2\theta + 1} \, d\theta$
(B)	Graph the feasible region of the following system of linear inequalities and find the corner points $3x + 7y \leq 21$, $x - y \leq 3$, $x \geq 0$, $y \geq 0$
Q.8-(A)	Find the coordinates of the points of intersection of the line $x + 2y = 6$ with the circle $x^2 + y^2 - 2x - 2y - 39 = 0$
(B)	Use vectors prove that $\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$
Q.9-(A)	If $y = (\cos^{-1}x)^2$ then prove that $(1 - x^2) y_2 - xy_1 - 2 = 0$
(B)	Find an equation of the parabola whose focus is (- 3 , 4) and directrix is $3x - 4y + 5 = 0$