Paper Code Number: **4195**	2023 (1st-A) INTERMEDIATE PART-II (12th Class)	Roll No: ____________

MATHEMATICS PAPER-II GROUP-I MTN-12-1-23

TIME ALLOWED: 30 Minutes	OBJECTIVE	MAXIMUM MARKS: 20

Q.No.1 **You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question.**

S.#	QUESTIONS	A	B	C	D
1	Slope of line perpendicular to the line $x + 2y + 3 = 0$ is:	$-\frac{1}{2}$	$\frac{1}{2}$	2	$\frac{3}{2}$
2	Distance of the point $(3,\ 2)$ from $x-$axis is:	2	3	5	6
3	The lines ℓ_1, ℓ_2 with slopes m_1 and m_2 are parallel if:	$m_1 + m_2 = 0$	$m_1 m_2 = 1$	$m_1 m_2 = -1$	$m_1 = m_2$
4	$x = 5$ is the solution of inequality:	$2x + 3 < 0$	$2x - 3 > 0$	$x + 1 < 0$	$x < 0$
5	The centre of the circle $(x+1)^2 + (y+2)^2 = 16$ is:	$(1, 2)$	$(-1, 2)$	$(-1, -2)$	$(1, -2)$
6	An angle in semi-circle is of measure:	30^o	45^o	60^o	90^o
7	The parabola $y^2 = 4ax;\ a > 0$ opens towards:	Left	Right	Upward	Downward
8	In an ellipse, the foci lie on:	Major axis	Minor axis	Directrices	Centre
9	Work done by a constant force $\vec{F}$ during displacement $\vec{d}$ is equal to	$\vec{F} \times \vec{d}$	$\vec{F}\vec{d}$	$\vec{F} . \vec{d}$	$\vec{d} \times \vec{F}$
10	If $\vec{a}$ and $\vec{b}$ are two non-zero vectors, then $\vec{a} \times \vec{b} =$	ab	$\vec{a} . \vec{b}$	$\vec{b} \times \vec{a}$	$-\vec{b} \times \vec{a}$
11	$\lim_{x \to +\infty} (e^x) =$	$-\infty$	0	1	$+\infty$
12	$f(x) = x$ [illegible] is a/an:	Odd function	Even function	Neither even nor odd	Constant function
13	If $C \in D_f$ and $f'(C) = 0$ or $f'(C)$ does not exist, then the number C is called:	Increasing value	Decreasing value	Stationary value	Critical value
14	$1 + x + \frac{x^2}{\lfloor 2} + \frac{x^3}{\lfloor 3} + \dots\dots =$	$\sin x$	$\cos x$	e^x	e^{2x}
15	$\frac{d}{dx}(a^x) =$	a^x	$a^x . \ell na$	$\frac{a^x}{\ell na}$	$\frac{\ell na}{a^x}$
16	The notation $f'(x)$ is used by the mathematician:	Lagrange	Newton	Cauchy	Leibniz
17	$\int \tan x\, dx =$	$\ell n\lvert\sin x\rvert + c$	$\ell n\lvert\cos x\rvert + c$	$\ell n\lvert\sec x\rvert + c$	$\ell n\lvert\tan x\rvert + c$
18	$\int \left(\frac{1}{x} + \frac{\sin 2x}{\sin^2 x}\right) dx =$	$\ell n \sin 2x + c$	$\ell n(x \sin^2 x) + c$	$\ell n(x \cos^2 x) + c$	$\ell n(x \sin 2x) + c$
19	$\int e^{2x} dx =$	$2e^{2x} + c$	$e^{2x} + c$	$2xe^{2x} + c$	$\frac{e^{2x}}{2} + c$
20	$\int_0^{\pi/2} \cos x\, dx =$	0	1	2	3

2023 (1^{st}-A) INTERMEDIATE PART-II (12^{th} Class)	Roll No: MIN-12-1-23

MATHEMATICS PAPER-II GROUP-I		
TIME ALLOWED: 2.30 Hours	SUBJECTIVE	MAXIMUM MARKS: 80

NOTE: Write same question number and its parts number on answer book, as given in the question paper.

SECTION-I

2. Attempt any eight parts. $8 \times 2 = 16$

(i)	What is a function?	(ii)	Prove the identity $\cosh^2 x - \sinh^2 x = 1$
(iii)	Given that $f(x) = x^3 - 2x^2 + 4x - 1$ find $f\left(\frac{1}{x}\right)$	(iv)	Differentiate w.r.t. x $\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2$
(v)	Find $\frac{dy}{dx}$ if $\sqrt{x+\sqrt{x}}$	(vi)	Find $\frac{dy}{dx}$ if $y = x\cos y$
(vii)	Differentiate $y = e^{f(x)}$ w.r.t. x	(viii)	Differentiate $\sin x$ w.r.t. $\cot x$
(ix)	Find y_4 if $y = \sin 3x$	(x)	What is a stationary point?
(xi)	Define problem constraint.	(xii)	Define feasible region and feasible solution.

3. Attempt any eight parts. $8 \times 2 = 16$

(i)	Find δy and dy, if $y = x^2 - 1$, when x changes from 3 to 3.02.	(ii)	Evaluate $\int \sin(a+b)x\,dx$
(iii)	Evaluate $\int \frac{-2x}{\sqrt{4-x^2}}dx$	(iv)	Evaluate $\int x.\ln x\,dx$
(v)	Evaluate $\int_1^2 (x^2+1)\,dx$	(vi)	Find the area between the $x-$axis and the curve $y = \sin 2x$ from $x = 0$ to $x = \pi/3$
(vii)	Solve $\frac{dy}{dx} = -y$	(viii)	Find the unit vector of $\underline{v} = 2\underline{i} - \underline{j}$
(ix)	Write direction consines of $\underline{v} = 4\underline{i} - 5\underline{j}$	(x)	Find the cosine of the angle θ between $\underline{u}$ and $\underline{v}$, $\underline{u} = [2, -3, 1]$, $\underline{v} = [2, 4, 1]$
(xi)	Prove that $\underline{a} \times (\underline{b} + \underline{c}) + \underline{b} \times (\underline{c} + \underline{a}) + \underline{c} \times (\underline{a} + \underline{b}) = 0$	(xii)	Find the volume of the parallelepiped for which the given vectors are $\underline{u} = \underline{i} - 4\underline{j} - \underline{k}$; $\underline{v} = \underline{i} - \underline{j} - 2\underline{k}$; $\underline{w} = 2\underline{i} - 3\underline{j} + \underline{k}$

4. Attempt any nine parts. $9 \times 2 = 18$

(i)	Find h such that $A(-1, h)$, $B(3, 2)$ and $C(7, 3)$ are collinear.
(ii)	The $xy-$coordinate axes are rotated about the origin through an angle of 30^o. If the $xy-$coordinates of a point are (5, 7), find its $XY-$coordinates, where OX and OY are the axes obtained after rotation.
(iii)	Find the distance between the parallel lines $2x + y + 2 = 0$ and $6x + 3y - 8 = 0$
(iv)	Check whether the point $(-2, 4)$ lies above or below the line $4x + 5y - 3 = 0$
(v)	Find the area of the region bounded by the triangle with vertices $(a, b+c)$, $(a, b-c)$ and $(-a, c)$
(vi)	By means of slopes, show that the following points lie on the same line $(-4, 6)$, $(3, 8)$, $(10, 10)$
(vii)	Find an equation of the line bisecting the first and third quadrants.
(viii)	Find the centre and radius of the circle with the equation $4x^2 + 4y^2 - 8x + 12y - 25 = 0$
(ix)	Find the length of the tangent from the point $P(-5, 10)$ to the circle $5x^2 + 5y^2 + 14x + 12y - 10 = 0$
(x)	Write an equation of the parabola with given elements focus $(-3, 1)$, directrix $x - 2y - 3 = 0$
(xi)	Find an equation of the ellipse with vertices $(0, \pm 5)$ and eccentricity $\frac{3}{5}$.
(xii)	Find an equation of the hyperbola with the given data. Foci $(2 \pm 5\sqrt{2}, -7)$ and length of transverse axis 10.
(xiii)	Find an equation of the circle with ends of diameter at $(-3, 2)$ and $(5, -6)$

SECTION-II

NOTE: Attempt any three questions. $3 \times 10 = 30$

5.(a)	Evaluate $\lim_{\theta \to 0} \frac{\tan\theta - \sin\theta}{\sin^3\theta}$	(b)	If $x = a\cos^3\theta$, $y = b\sin^3\theta$ then show that $a\frac{dy}{dx} + b\tan\theta = 0$
6.(a)	Evaluate $\int \frac{dx}{\sqrt{7 - 6x - x^2}}$	(b)	Find the equation of perpendicular bisector of the segment joining the points $A(3, 5)$ and $B(9, 8)$
7.(a)	Evaluate $\int_{\pi/6}^{\pi/4} \cos^2\theta \cot^2\theta\, d\theta$	(b)	Maximize $f(x, y) = 2x + 3y$ subject to constraints $2x + y \le 8$, $x + 2y \le 14$, $x \ge 0$, $y \ge 0$

8.(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 length of the chord cut from the line $2x + 3y = 13$ by the circle $x^2 + y^2 = 26$
9.(a)	Show that an equation of the parabola with focus at $(a\cos\alpha, a\sin\alpha)$ and directrix $x\cos\alpha + y\sin\alpha + a = 0$ is $(x\sin\alpha - y\cos\alpha)^2 = 4a(x\cos\alpha + y\sin\alpha)$
(b)	Prove that the line segment joining mid points of two sides of a triangle is parallel to third side and half as long.

Paper Code Number: 4196	2023 (1^{st}-A) INTERMEDIATE PART-II (12^{th} Class)	Roll No: ____________

MATHEMATICS PAPER-II GROUP-II MTN-12-2-23

TIME ALLOWED: 30 Minutes **OBJECTIVE** **MAXIMUM MARKS: 20**

Q.No.1 **You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question.**

S.#	QUESTIONS	A	B	C	D
1	Slope of line which is perpendicular to $y-$axis is:	0	1	2	Undefined
2	$y-$intercept of the line $2x+3y-5=0$ is:	$2/5$	$5/2$	$3/5$	$5/3$
3	The point of intersection of medians of a triangle is called:	Incentre	Centroid	Circumcentre	Orthocenter
4	(0, 1) is the solution of inequality:	$x-3y>0$	$x-5y>0$	$x+y>0$	$x<0$
5	The end points of minor axis of the ellipse are called its:	Vertices	Co-vertices	Foci	Eccentricity
6	The length of latus rectum of parabola $y^2=-8x$ is:	-8	-4	4	8
7	The vertex of the parabola $(x+1)^2=8(y-2)$ is:	$(-1, 2)$	$(1, -2)$	$(-1, -2)$	$(1, 2)$
8	The length of diameter of the circle $x^2+y^2=16$ is:	4	6	8	16
9	$\bar{u}\times(\bar{v}.\bar{w})$ is:	Scalar product	Vector product	Inner product	Meaningless
10	The value of $[\hat{i}\ \ \hat{j}\ \ \hat{k}]$	-1	0	1	2
11	$\lim_{x\to-\infty}(e^x)=$	$-\infty$	0	1	$+\infty$
12	$f(x)=\sin x$ is:	Odd function	Even function	Constant function	Linear function
13	If $y=x+\frac{1}{x}$, then $\frac{dy}{dx}=$	$1-\frac{1}{x}$	$\frac{1}{x}-1$	$1-\frac{1}{x^2}$	$\frac{1}{x^2}-1$
14	If $y=\sinh^{-1}x$, then $\frac{dy}{dx}=$	$\frac{1}{\sqrt{x^2+1}}$	$\frac{1}{\sqrt{x^2-1}}$	$\frac{-1}{\sqrt{x^2+1}}$	$\frac{-1}{\sqrt{x^2-1}}$
15	Derivative of $\cos x$ w.r.t. $\cos x$ is:	$-\sin x$	$\sin x$	0	1
16	The function $f(x)=3x^2$ has minimum value at $x=$	-1	0	1	2
17	$\int_{\pi}^{\pi}\sin x\,dx=$	0	1	2	3
18	If $y=x^3$, then $dy=$	$3x^2$	x^2dx	$3x^2dx$	$3xdx$
19	$\int_a^b f(x)\,dx=$	$\int_b^a f(x)\,dx$	$-\int_b^a f(x)\,dx$	$\int_{-a}^{-b} f(x)\,dx$	$-\int_{-a}^{-b} f(x)\,dx$
20	$\int\frac{f'(x)}{f(x)}dx=$	$\ell n\,f(x)+c$	$\ell n\,f'(x)+c$	$\ell n\,f(x)f'(x)+c$	$\ell nx+c$

INTERMEDIATE PART-II (12th Class)	2023 (1st-A)	Roll No: ________

MATHEMATICS PAPER-II GROUP-II

TIME ALLOWED: 2.30 Hours	SUBJECTIVE	MAXIMUM MARKS: 80

NOTE: Write same question number and its parts number on answer book, as given in the question paper.

SECTION-I

MTN-12-2-23

8 × 2 = 16

2. Attempt any eight parts.

(i)	Define a polynomial function of degree n.	(ii)	Determine whether given function f is even or odd $f(x) = x^{2/3} + 6$
(iii)	Evaluate $\lim_{n\to\infty}\left(1+\frac{3}{n}\right)^{2n}$	(iv)	Find the derivative of $x^{\frac{2}{3}}$ and also calculate the value of derivative at $x = 8$.
(v)	Differentiate w.r.t. x $x^{-3} + 2x^{-\frac{3}{2}} + 3$	(vi)	Find $\frac{dy}{dx}$ if $xy + y^2 = 2$
(vii)	Find $\frac{dy}{dx}$ if $x = y\sin y$	(viii)	Differentiate w.r.t. x $x^2 \sec 4x$
(ix)	Find $\frac{dy}{dx}$ if $y = e^{x^2+1}$	(x)	State Maclaurin's series expansion.
(xi)	Define optimal solution.	(xii)	Define the associated emotion of an inequality.

8 × 2 = 16

3. Attempt any eight parts.

(i)	Find δy and dy for $y = x^2 - 1$, when x changes from 3 to 3.02.	(ii)	Evaluate $\int\left(\sqrt{x}-\frac{1}{\sqrt{x}}\right)^2 dx$
(iii)	Evaluate $\int \frac{x^2}{4+x^2}dx$	(iv)	Evaluate $\int x^2 \ln x\, dx$
(v)	Evaluate $\int_{-1}^{1}(x^{\frac{1}{3}}+1)dx$	(vi)	Find the area between the x – axis and the curve $y=4x-x^2$
(vii)	Solve the differential equation $\frac{dy}{dx}=\frac{y}{x^2}$	(viii)	Find unit vector in the direction of $\underline{v} = 2\underline{i} - \underline{j}$
(ix)	Find vector whose magnitude is 4 and is parallel to $2\underline{i} - 3\underline{j} + 6\underline{k}$	(x)	Calculate the projection of $\underline{a} = \underline{i} - \underline{k}$ along $\underline{b} = \underline{j} + \underline{k}$
(xi)	Find a unit vector perpendicular to the plane containing $\underline{a}$ and $\underline{b}$, $\underline{a} = \underline{i}+\underline{j}$, $\underline{b} = \underline{i}-\underline{j}$	(xii)	Prove that $\underline{i} - 2\underline{j} + 3\underline{k}$, $-2\underline{i} + 3\underline{j} - 4\underline{k}$ and $\underline{i} - 3\underline{j} + 5\underline{k}$ are coplanar.

9 × 2 = 18

4. Attempt any nine parts.

(i)	Show that the points $A(3, 1)$, $B(-2, -3)$ and $C(2, 2)$ are vertices of an isosceles triangle.
(ii)	Show that the points $A(-3, 6)$, $B(3, 2)$ and $C(6, 0)$ are collinear.
(iii)	Find an equation of the straight line if it is perpendicular to a line with slope -6 and its y – intercept is $\frac{4}{3}$.
(iv)	Write down an equation of the line which cuts the x – axis at $(2, 0)$ and y – axis at $(0, -4)$.
(v)	Transform the equation $5x - 12y + 39 = 0$ into two-intercept form.
(vi)	Check whether the lines $3x-4y-3 = 0$, $5x+12y+1 = 0$, $32x+4y-17= 0$ are concurrent or not.
(vii)	Find the distance between the parallel lines $l_1: 2x - 5y + 13 = 0$ and $l_2: 2x - 5y + 6 = 0$
(viii)	Find the centre and radius of the circle with the equation $5x^2 + 5y^2 + 14x + 12y - 10 = 0$
(ix)	Find the co- ordinates of the points of intersection of the line $2x+y=5$ and the circle $x^2 + y^2 + 2x - 9 = 0$
(x)	Write equations of the tangents to the circle $x^2 + y^2 - 4x + 6y + 9 = 0$ at the points on the circle whose ordinate is -2.
(xi)	Find an equation of the parabola whose focus is $F(-3, 4)$ and directrix is $3x-4y+5 = 0$
(xii)	Find an equation of the ellipse having centre at $(0, 0)$, focus at $(0, -3)$ and one vertex at $(0, 4)$.
(xiii)	Find an equation of hyperbola whose foci are $(\pm 4, 0)$ and vertices $(\pm 2, 0)$.

SECTION-II

3 × 10 = 30

NOTE: Attempt any three questions.

5.(a)	Prove that $\lim_{x\to 0}\frac{a^x-1}{x} = \log_e a$	(b)	Find by definition the derivative of $\cos\sqrt{x}$.
6.(a)	Evaluate $\int\frac{x\,dx}{x^4+2x^2+5}$	(b)	Find equations of two parallel lines perpendicular to $2x-y+3=0$ such that product of x – and y – intercepts of each is 3.

7.(a)	Find the area bounded by the curve $y = x^3 - 4x$ and the x – axis.
(b)	Maximize $f(x, y)=x+3y$ subject to constraints $2x+5y\le 30$, $5x+4y\le 20$, $x\ge 0$, $y\ge 0$
8.(a)	Show that $y = x^x$ has minimum value at $x = \frac{1}{e}$
(b)	Find the equation of the circle passing through the points $A(4, 5)$, $B(-4, -3)$, $C(8, -3)$
9.(a)	Find the focus, vertex and directrix of parabola $x^2 - 4x - 8y + 4 = 0$
(b)	Prove that by using vectors method $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

2022 (A) Roll No: ____________

INTERMEDIATE PART-II (12^{th} CLASS)

MATHEMATICS PAPER-II

GROUP-I

TIME ALLOWED: 2.30 Hours

MAXIMUM MARKS: 80

SUBJECTIVE

NOTE: Write same question number and its part number on answer book, as given in the question paper.

SECTION-I

2. Attempt any eight parts. **$8 \times 2 = 16$**

(i) A stone falls from a height of 60m on the ground, the height h after x second is approximately given by $h(x) = 40 - 10x^2$.
(a) What is the height of the stone for $x = 1\text{sec}$ (b) When does the stone strike the ground?

(ii) For the real-valued function, f defined below, find $f^{-1}(x)$ of $f(x) = \frac{2x+1}{x-1}, x > 1$

(iii) Evaluate limit by using algebraic techniques; $\lim_{x\to 2}\frac{\sqrt{x}-\sqrt{2}}{x-2}$

(iv) Express limit in terms of e: $\lim_{x\to\infty}\left(\frac{x}{1+x}\right)^x$

(v) Differentiate between $\log x$ and ℓnx by sketching the graph.

(vi) If $y = \frac{\sqrt{x^2+1}}{\sqrt{x^2-1}}$, find $\frac{dy}{dx}$

(vii) Prove that $y\frac{dy}{dx} + x = 0$ if $x = \frac{1-t^2}{1+t^2}$ and $y = \frac{2t}{1+t^2}$

(viii) Find the derivative w.r.t variable involved. $Cot^{-1}\left(\frac{2x}{1-x^2}\right)$

(ix) Find $f'(x)$ if $f(x) = \sqrt{\ell n(e^{2x} + e^{-2x}}$

(x) Produce y_2 from $x^3 - y^3 = a^3$

(xi) Determine the interval in which f is increasing $f(x) = \sin x$; $x \in (-\pi, \pi)$

(xii) Find the dimensions of a rectangle of largest area having perimeter 120 centimeters.

3. Attempt any eight parts. **$8 \times 2 = 16$**

(i) Find the approximate increase in the volume of a cube if the length of its each edge changes from 5 to 5.02.

(ii) Evaluate $\int\frac{(1+e^x)^3}{e^x}dx$

(iii) Evaluate by using suitable substitution the integral $\int\frac{1}{\sqrt{a^2-x^2}}dx$

(iv) Evaluate the integral $\int e^x\left(\frac{1}{x} + \ell nx\right)dx$

(v) Evaluate the definite integral $\int_0^2 (e^{\frac{x}{2}} - e^{\frac{-x}{2}})\,dx$

(vi) Find the area below the curve $y = 3\sqrt{x}$ and above the x – axis between $x = 1$ and $x = 4$

(vii) Check whether $y = cx - 1$ is the solution of the differential equation $x\frac{dy}{dx} = 1 + y$

(viii) Solve the differential equation $\frac{dy}{dx} = \frac{3}{4}x^2 + x - 3$

(ix) Find the equation of the straight line if it is perpendicular to a line with slope – 6 and its y – intercept is $\frac{4}{3}$

(x) Check whether the origin and the point P (5, –8) lies on the same side or on opposite side of line $3x + 7y + 15 = 0$

(xi) Find k so that the line joining $A(7, 3)$, $B(k, -6)$ and the line joining $C(-4, 5)$, $D(-6, 4)$ are parallel.

(xii) Find an equation of the line through $(-5, -3)$ and $(9, -1)$.

4. Attempt any nine parts. **$9 \times 2 = 18$**

(i) Shade the feasible region of $5x + 7y \leq 35$

(ii) State the theorem of linear programming.

(iii) Write the equation of the circle with centre at $(\sqrt{2}, -3\sqrt{3})$ and radius is $2\sqrt{2}$.

(iv) Find the centre and radius of circle $5x^2 + 5y^2 + 14x + 12y - 10 = 0$

(v) Write the equation of tangent to the circle $x^2 + y^2 = 25$ at $(4, 3)$.

(vi) Define parabola and write its General equation.

(vii) Find the focus and vertex of $x^2 = -16y$.

(viii) Find the equation of ellipse with data foci $(\pm 3, 0)$ and minor axis of length 10.

(ix) Write any two properties of cross product.

(x) If $\underline{u} = 2\hat{i} - \hat{j} + \hat{k}$ and $\underline{v} = 4\hat{i} + 2\hat{j} - \hat{k}$ find $\underline{u} \times \underline{v}$

(xi) Prove that $\underline{a} \times (\underline{b} + \underline{c}) + \underline{b} \times (\underline{c} + \underline{a}) + \underline{c} \times (\underline{a} + \underline{b}) = 0$

(xii) Find the value of $\left[\hat{i} \quad \hat{i} \quad \hat{k}\right]$

(xiii) Find α so that the vectors $\vec{u} = \alpha\hat{i} + 2\alpha\hat{j} - \hat{k}$, $\vec{v} = \hat{i} + \alpha\hat{j} + 3\hat{k}$ are perpendicular.

SECTION-II

NOTE: Attempt any three questions. **$3 \times 10 = 30$**

5.(a) If $f(x) = \dfrac{2x+1}{x-1}$, $x > 1$ then find $f^{-1}(x)$ and show that $f(f^{-1}(x)) = x$

(b) If $x = a\cos^3\theta$ and $y = b\sin^3\theta$ then show $a\dfrac{dy}{dx} + b\tan\theta = 0$

6.(a) Evaluate $\displaystyle\int \frac{x\,dx}{4 + 2x + x^2}$

(b) The points $A(4, -2)$, $B(-2, 4)$, $C(5, 5)$ are the vertices of a triangle. Find the in-centre of the triangle.

7. (a) Find the area between the x-axis and the curve $y = \sqrt{2ax - x^2}$ when $a > 0$

(b) Maximize $f(x, y) = 2x + 5y$ subject to constraints $2y - x \leq 8$, $x - y \leq 4$, $x \geq 0$, $y \geq 0$

8. (a) Find an equation of line through the point $(2, -9)$ and the intersection of the lines $2x + 5y - 8 = 0$ and $3x - 4y - 6 = 0$

(b) Find the length of the tangent from the point $P(-5, 10)$ to the circle $5x^2 + 5y^2 + 14x + 12y - 10 = 0$

9.(a) Find an equation of hyperbola with foci $(0, \pm 9)$, directrices $y = \pm 4$

(b) Use vectors, prove that $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

Paper Code Number: 4191 | 2022 (A) | Roll No: (251)

INTERMEDIATE PART-II (12th CLASS)

MATHEMATICS PAPER-II | TIME ALLOWED: 30 Minutes

GROUP-I | **OBJECTIVE** | MAXIMUM 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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

(1) The term function was recognized by a German Mathematician ________.
(A) Leibniz (B) Newton (C) Cauchy (D) Langrage

(2) Which one is Identity function?
(A) $f(x)=\sin x$ (B) $f(x)=\sqrt{x}$ (C) $f(x)=x^2$ (D) $f(x)=x$

(3) $\frac{d}{dx}(2^x) =$ _____ (A) $x2^{x-1}$ (B) $2^x \ln 2$ (C) 0 (D) $2\ln 2$

(4) Newton used _______ notation for derivative.
(A) $f'(x)$ (B) $\frac{dy}{dx}$ (C) $\dot{f}(x)$ (D) $Df(x)$

(5) $\frac{d}{dx}(\tan 7x) =$ ______
(A) $7\sec^2 7x$ (B) $7\sec^2 x$ (C) $7\sec 7x$ (D) $\cot 7x$

(6) Which one is increasing function?
(A) $-5x$ (B) $-2x+4$ (C) $-4-2x$ (D) $5x-7$

(7) Find dy, for $y = x^2 + 2x$ when x changes from 2 to 1.8.
(A) -1.02 (B) -0.012 (C) -0.2 (D) -1.2

(8) $\int \tan x dx =$ ______
(A) $\ln|\cos x| + c$ (B) $\ln|\sec x| + c$ (C) $\ln|\sin x| + c$ (D) $\ln|\cot x| + c$

(9) $\int_a^c f(x)dx + \int_c^b f(x)dx =$ ______ where $a < c < b$
(A) $\int_a^b f(x)dx$ (B) $\int_b^a f(x)dx$ (C) $\int_{-a}^b f(x)dx$ (D) $\int_c^a f(x)dx$

(10) The order of differential equation $y\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2x = 0$ is: (A) 1 (B) 2 (C) 3 (D) 4

(11) Mid point of $A(-8, 3)$ and $B(2, -1)$ is ______.
(A) $(-3, 1)$ (B) $(3, -1)$ (C) $(-3, -1)$ (D) $(3, 1)$

(12) Slope of Horizontal line is ______. (A) ∞ (B) $-\infty$ (C) 0 (D) 1

(13) Slope of $3x + 2y - 8 = 0$ is _______.
(A) $\frac{2}{3}$ (B) $\frac{-2}{3}$ (C) 1 (D) $\frac{-3}{2}$

(14) The angle between the lines with slope $\frac{-7}{3}$ to the line slope $\frac{5}{2}$ is ______.
(A) 90^o (B) 145^o (C) 135^o (D) 60^o

(15) If $P(x, y) = 40x + 50y$ then $P(16, 10) =$ _____
(A) 1000 (B) 1140 (C) 0 (D) 1

(16) Centre of $5x^2 + 5y^2 + 14x + 12y - 10 = 0$
(A) $\left(\frac{7}{5}, \frac{6}{5}\right)$ (B) $(-7, -6)$ (C) $\left(\frac{-7}{5}, \frac{-6}{5}\right)$ (D) $(7, 6)$

(17) Latusrectum of $y^2 = -4ax$ is ______.
(A) $x = -a$ (B) $y = -a$ (C) $y = a$ (D) $x = a$

(18) Eccentricity of $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$ is ______.
(A) $e = \frac{c}{a}$ (B) $e = \frac{-c}{a}$ (C) $e = \frac{c}{b}$ (D) $e = \frac{a}{b}$

(19) $3\underline{j}.\underline{k} \times \underline{i} =$ ______ (A) 1 (B) -1 (C) -3 (D) 3

(20) Which one is not a vector quantity?
(A) Magnetic field (B) Weight (C) Force (D) Work

...ber: 4193

2022 (A) Roll No: 252

INTERMEDIATE PART-II (12th CLASS)

MATHEMATICS PAPER-II
GROUP-I

TIME ALLOWED: 30 Minutes

OBJECTIVE

MAXIMUM 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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

(1) Centre of $5x^2+5y^2+14x+12y-10=0$
(A) $\left(\frac{7}{5},\frac{6}{5}\right)$ (B) $(-7,-6)$ (C) $\left(\frac{-7}{5},\frac{-6}{5}\right)$ (D) $(7,6)$

(2) Latusrectum of $y^2=-4ax$ is ______.
(A) $x=-a$ (B) $y=-a$ (C) $y=a$ (D) $x=a$

(3) Eccentricity of $\frac{y^2}{a^2}-\frac{x^2}{b^2}=1$ is ______.
(A) $e=\frac{c}{a}$ (B) $e=\frac{-c}{a}$ (C) $e=\frac{c}{b}$ (D) $e=\frac{a}{b}$

(4) $3\underline{j}.\underline{k}\times\underline{i}=$ ______ (A) 1 (B) -1 (C) -3 (D) 3

(5) Which one is not a vector quantity?
(A) Magnetic field (B) Weight (C) Force (D) Work

(6) The term function was recognized by a German Mathematician ______.
(A) Leibniz (B) Newton (C) Cauchy (D) Langrage

(7) Which one is Identity function?
(A) $f(x)=\sin x$ (B) $f(x)=\sqrt{x}$ (C) $f(x)=x^2$ (D) $f(x)=x$

(8) $\frac{d}{dx}(2^x)=$ ______ (A) $x2^{x-1}$ (B) $2^x\ln 2$ (C) 0 (D) $2\ln 2$

(9) Newton used ______ notation for derivative.
(A) $f'(x)$ (B) $\frac{dy}{dx}$ (C) $\dot{f}(x)$ (D) $Df(x)$

(10) $\frac{d}{dx}(\tan 7x)=$ ______
(A) $7\sec^2 7x$ (B) $7\sec^2 x$ (C) $7\sec 7x$ (D) $\cot 7x$

(11) Which one is increasing function?
(A) $-5x$ (B) $-2x+4$ (C) $-4-2x$ (D) $5x-7$

(12) Find dy, for $y=x^2+2x$ when x changes from 2 to 1.8.
(A) -1.02 (B) -0.012 (C) -0.2 (D) -1.2

(13) $\int \tan x\,dx=$ ______
(A) $\ln|\cos x|+c$ (B) $\ln|\sec x|+c$ (C) $\ln|\sin x|+c$ (D) $\ln|\cot x|+c$

(14) $\int_a^c f(x)dx+\int_c^b f(x)dx=$ ______ where $a<c<b$
(A) $\int_a^b f(x)dx$ (B) $\int_b^a f(x)dx$ (C) $\int_{-a}^b f(x)dx$ (D) $\int_c^a f(x)dx$

(15) The order of differential equation $y\frac{d^2y}{dx^2}+\frac{dy}{dx}-2x=0$ is: (A) 1 (B) 2 (C) 3 (D) 4

(16) Mid point of $A(-8,3)$ and $B(2,-1)$ is ______.
(A) $(-3,1)$ (B) $(3,-1)$ (C) $(-3,-1)$ (D) $(3,1)$

(17) Slope of Horizontal line is ______. (A) ∞ (B) $-\infty$ (C) 0 (D) 1

(18) Slope of $3x+2y-8=0$ is ______.
(A) $\frac{2}{3}$ (B) $\frac{-2}{3}$ (C) 1 (D) $\frac{-3}{2}$

(19) The angle between the lines with slope $\frac{-7}{3}$ to the line slope $\frac{5}{2}$ is ______.
(A) 90° (B) 145° (C) 135° (D) 60°

(20) If $P(x,y)=40x+50y$ then $P(16,10)=$ ______
(A) 1000 (B) 1140 (C) 0 (D) 1

...ber: 4195

2022 (A)

Roll No: 353

INTERMEDIATE PART-II (12th CLASS)

MATHEMATICS PAPER-II

GROUP-I

TIME ALLOWED: 30 Minutes

OBJECTIVE

MAXIMUM 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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

(1) Mid point of $A(-8,3)$ and $B(2,-1)$ is ______.
(A) $(-3,1)$ (B) $(3,-1)$ (C) $(-3,-1)$ (D) $(3,1)$

(2) Slope of Horizontal line is ______. (A) ∞ (B) $-\infty$ (C) 0 (D) 1

(3) Slope of $3x+2y-8=0$ is ______.
(A) $\frac{2}{3}$ (B) $\frac{-2}{3}$ (C) 1 (D) $\frac{-3}{2}$

(4) The angle between the lines with slope $\frac{-7}{3}$ to the line slope $\frac{5}{2}$ is ______.
(A) 90^o (B) 145^o (C) 135^o (D) 60^o

(5) If $P(x,y)=40x+50y$ then $P(16,10)=$ ______
(A) 1000 (B) 1140 (C) 0 (D) 1

(6) Centre of $5x^2+5y^2+14x+12y-10=0$
(A) $\left(\frac{7}{5},\frac{6}{5}\right)$ (B) $(-7,-6)$ (C) $\left(\frac{-7}{5},\frac{-6}{5}\right)$ (D) $(7,6)$

(7) Latusrectum of $y^2=-4ax$ is ______.
(A) $x=-a$ (B) $y=-a$ (C) $y=a$ (D) $x=a$

(8) Eccentricity of $\frac{y^2}{a^2}-\frac{x^2}{b^2}=1$ is ______.
(A) $e=\frac{c}{a}$ (B) $e=\frac{-c}{a}$ (C) $e=\frac{c}{b}$ (D) $e=\frac{a}{b}$

(9) $3\underline{j}.\underline{k}\times\underline{i}=$ ______ (A) 1 (B) -1 (C) -3 (D) 3

(10) Which one is not a vector quantity?
(A) Magnetic field (B) Weight (C) Force (D) Work

(11) The term function was recognized by a German Mathematician ______.
(A) Leibniz (B) Newton (C) Cauchy (D) Langrage

(12) Which one is Identity function?
(A) $f(x)=\sin x$ (B) $f(x)=\sqrt{x}$ (C) $f(x)=x^2$ (D) $f(x)=x$

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(14) Newton used ______ notation for derivative.
(A) $f'(x)$ (B) $\frac{dy}{dx}$ (C) $\dot{f}(x)$ (D) $Df(x)$

(15) $\frac{d}{dx}(\tan 7x)=$ ______
(A) $7\sec^2 7x$ (B) $7\sec^2 x$ (C) $7\sec 7x$ (D) $\cot 7x$

(16) Which one is increasing function?
(A) $-5x$ (B) $-2x+4$ (C) $-4-2x$ (D) $5x-7$

(17) Find dy, for $y=x^2+2x$ when x changes from 2 to 1.8.
(A) -1.02 (B) -0.012 (C) -0.2 (D) -1.2

(18) $\int \tan x dx=$ ______
(A) $\ln|\cos x|+c$ (B) $\ln|\sec x|+c$ (C) $\ln|\sin x|+c$ (D) $\ln|\cot x|+c$

(19) $\int_a^c f(x)dx+\int_c^b f(x)dx=$ ______ where $a<c<b$
(A) $\int_a^b f(x)dx$ (B) $\int_b^a f(x)dx$ (C) $\int_{-a}^b f(x)dx$ (D) $\int_c^a f(x)dx$

(20) The order of differential equation $y\frac{d^2y}{dx^2}+\frac{dy}{dx}-2x=0$ is: (A) 1 (B) 2 (C) 3 (D) 4

Paper Code Number: 4197

2022 (A) Roll No: 254

INTERMEDIATE PART-II (12^{th} CLASS)

MATHEMATICS PAPER-II
GROUP-I

TIME ALLOWED: 30 Minutes
MAXIMUM MARKS: 20

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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

(1) Which one is increasing function?
(A) $-5x$ (B) $-2x+4$ (C) $-4-2x$ (D) $5x-7$

(2) Find dy, for $y = x^2 + 2x$ when x changes from 2 to 1.8.
(A) -1.02 (B) -0.012 (C) -0.2 (D) -1.2

(3) $\int \tan x dx =$ ______
(A) $\ln|\cos x| + c$ (B) $\ln|\sec x| + c$ (C) $\ln|\sin x| + c$ (D) $\ln|\cot x| + c$

(4) $\int_a^c f(x)dx + \int_c^b f(x)dx =$ ______ where $a < c < b$
(A) $\int_a^b f(x)dx$ (B) $\int_b^a f(x)dx$ (C) $\int_{-a}^b f(x)dx$ (D) $\int_c^a f(x)dx$

(5) The order of differential equation $y\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2x = 0$ is: (A) 1 (B) 2 (C) 3 (D) 4

(6) Mid point of $A(-8, 3)$ and $B(2, -1)$ is ______.
(A) $(-3, 1)$ (B) $(3, -1)$ (C) $(-3, -1)$ (D) $(3, 1)$

(7) Slope of Horizontal line is ______. (A) ∞ (B) $-\infty$ (C) 0 (D) 1

(8) Slope of $3x + 2y - 8 = 0$ is ______.
(A) $\frac{2}{3}$ (B) $\frac{-2}{3}$ (C) 1 (D) $\frac{-3}{2}$

(9) The angle between the lines with slope $\frac{-7}{3}$ to the line slope $\frac{5}{2}$ is ______.
(A) 90^o (B) 145^o (C) 135^o (D) 60^o

(10) If $P(x, y) = 40x + 50y$ then $P(16, 10) =$ ______
(A) 1000 (B) 1140 (C) 0 (D) 1

(11) Centre of $5x^2 + 5y^2 + 14x + 12y - 10 = 0$
(A) $\left(\frac{7}{5}, \frac{6}{5}\right)$ (B) $(-7, -6)$ (C) $\left(\frac{-7}{5}, \frac{-6}{5}\right)$ (D) $(7, 6)$

(12) Latusrectum of $y^2 = -4ax$ is ______.
(A) $x = -a$ (B) $y = -a$ (C) $y = a$ (D) $x = a$

(13) Eccentricity of $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$ is ______.
(A) $e = \frac{c}{a}$ (B) $e = \frac{-c}{a}$ (C) $e = \frac{c}{b}$ (D) $e = \frac{a}{b}$

(14) $3\underline{j}.\underline{k} \times \underline{i} =$ ______ (A) 1 (B) -1 (C) -3 (D) 3

(15) Which one is not a vector quantity?
(A) Magnetic field (B) Weight (C) Force (D) Work

(16) The term function was recognized by a German Mathematician ______.
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(17) Which one is Identity function?
(A) $f(x) = \sin x$ (B) $f(x) = \sqrt{x}$ (C) $f(x) = x^2$ (D) $f(x) = x$

(18) $\frac{d}{dx}(2^x) =$ ______ (A) $x2^{x-1}$ (B) $2^x \ln 2$ (C) 0 (D) $2\ln 2$

(19) Newton used ______ notation for derivative.
(A) $f'(x)$ (B) $\frac{dy}{dx}$ (C) $\dot{f}(x)$ (D) $Df(x)$

(20) $\frac{d}{dx}(\tan 7x) =$ ______
(A) $7\sec^2 7x$ (B) $7\sec^2 x$ (C) $7\sec 7x$ (D) $\cot 7x$

2022 (A) Roll No: 255

INTERMEDIATE PART-II (12th CLASS)

MATHEMATICS PAPER-II TIME ALLOWED: 2.30 Hours

GROUP-II **SUBJECTIVE** MAXIMUM MARKS: 80

NOTE: Write same question number and its part number on answer book, as given in the question paper.

SECTION-I

2. Attempt any eight parts. **8 × 2 = 16**

(i) Define a polynomial function of degree n.

(ii) Determine whether the given function is odd or even $f(x)=\dfrac{3x}{x^2+1}$

(iii) Evaluate $\lim\limits_{x\to\infty}\left(1+\dfrac{3}{n}\right)^{2n}$

(iv) Find the limit of $\lim\limits_{x\to 2}\dfrac{x^3-8}{x^2-x-6}$

(v) Prove the identity $\cosh^2 x+\sinh^2 x=\cosh 2x$

(vi) Find the derivative of $x^{\frac{2}{3}}$ and also calculate the value of derivative at $x=8$

(vii) Find $\dfrac{dy}{dx}$ if $x=1-t^2$ and $y=3t^2-2t^3$

(viii) Find $\dfrac{dy}{dx}$ if $y^3-2xy^2+x^2y+3x=0$

(ix) Differentiate $x^2-\dfrac{1}{x^2}$ w.r.t. x^4

(x) Find $\dfrac{dy}{dx}$ if $x=y\sin y$

(xi) Find $\dfrac{dy}{dx}$ if $y=e^{x^2+1}$

(xii) What do you mean by power series?

3. Attempt any eight parts. **8 × 2 = 16**

(i) Find Δy and dy for $y=x^2-1$ when x changes from 3 to 3.02.

(ii) Evaluate $\int\left(\sqrt{x}-\dfrac{1}{\sqrt{x}}\right)^2 dx$

(iii) Evaluate $\int\dfrac{x^2}{4+x^2}dx$

(iv) Evaluate $\int x\sin x\,dx$

(v) Evaluate $\int_1^2\dfrac{x^2+1}{x+1}dx$

(vi) Evaluate $\int_0^3\dfrac{dx}{x^2+9}$

(vii) Find the area between the x-axis and the curve $y=x^2+1$ from $x=1$ to $x=2$

(viii) Solve the differential equation $\dfrac{dy}{dx}=\dfrac{1-x}{y}$

(ix) Find the coordinates of the point that divides the join of $A(-6,3)$ and $B(5,-2)$ in the ratio 2 : 3 internally.

(x) Find the points trisecting the join of $A(-1,4)$ and $B(6,2)$.

(xi) Find k so that the line joining $A(7,3)$; $B(k,-6)$ and the line joining $C(-4,5)$; $D(-6,4)$ are parallel.

(xii) Find measure of the angle between the lines represented by $x^2-xy-6y^2=0$

4. Attempt any nine parts. **$9 \times 2 = 18$**

(i) Graph the solution region of inequality $5x - 4y \le 20$

(ii) Describe the corner point of the solution region.

(iii) Calculate the centre and radius of circle. $5x^2 + 5y^2 + 24x + 36y + 10 = 0$

(iv) Write down equation of the normal line to the circle $x^2 + y^2 = 25$ at $(5\cos\theta, 5\sin\theta)$

(v) Determine the focus and directrix of $x^2 = -16y$

(vi) Find the eccentricity of the ellipse $9x^2 + y^2 = 18$

(vii) Form an equation of the hyperbola whose foci are $(\pm 4, 0)$ and vertices $(\pm 2, 0)$.

(viii) Find the points of intersection of $x^2 + y^2 = 8$ and $x^2 - y^2 = 1$

(ix) Determine the vector from the point A to origin where $\overrightarrow{AB} = 4\underline{i} - 2\underline{j}$ and $B(-2, 5)$

(x) What are the direction cosines of $\underline{v} = 6\underline{i} - 2\underline{j} + \underline{k}$?

(xi) If $\underline{a} = \underline{i} - \underline{k}$, $\underline{b} = \underline{j} + \underline{k}$ calculate the projection of $\underline{a}$ along $\underline{b}$.

(xii) Prove that $\underline{a} \times (\underline{b} + \underline{c}) + \underline{b} \times (\underline{c} + \underline{a}) + \underline{c} \times (\underline{a} + \underline{b}) = 0$

(xiii) Find α, so that the vectors $\underline{i} - \underline{j} + \underline{k}$, $\underline{i} - 2\underline{j} - 3\underline{k}$ and $3\underline{i} - \alpha\underline{j} + 5\underline{k}$ are coplanar.

SECTION-II

NOTE: Attempt any three questions. **$3 \times 10 = 30$**

5.(a) Evaluate $\lim\limits_{\theta \to 0} \dfrac{\tan\theta - \sin\theta}{\sin^3\theta}$

(b) If $y = e^x \sin x$, show that $\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} + 2y = 0$

6.(a) Evaluate $\int \sqrt{x^2 - a^2}\, dx$

(b) Find equations of the altitudes of the triangle whose vertices are $A(-3, 2)$, $B(5, 4)$, $C(3, -8)$

7. (a) Evaluate $\displaystyle\int_0^{\frac{\pi}{4}} \frac{dx}{1 + \sin x}$

(b) Indicate the solution region of the following system of linear inequality by shading
$5x + 7y \le 35$, $x - 2y \le 2$, $x \ge 0$

8. (a) Find a joint equation of the straight line through the origin perpendicular to the lines represented by $x^2 + xy - 6y^2 = 0$

(b) Find the length of the chord cut off from the line $2x + 3y = 13$ by the circle $x^2 + y^2 = 26$

9.(a) Find the centre, foci eccentricity, vertices and directrices of the ellipse $9x^2 + y^2 = 18$

(b) Find the volume of the tetrahedron with vertices $(0, 1, 2)$, $(3, 2, 1)$, $(1, 2, 1)$ and $(5, 5, 6)$

Paper Code Number: 4192

2022 (A)

Roll No: 256

INTERMEDIATE PART-II (12th CLASS)

MATHEMATICS PAPER-II TIME ALLOWED: 30 Minutes

GROUP-II **OBJECTIVE** MAXIMUM 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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

(1) If $f(x) = -2x + 8$, then $f^{-1}(x) = ?$ (A) $\frac{2-x}{8}$ (B) $2x - 8$ (C) $\frac{8-x}{2}$ (D) $\frac{8+x}{2}$

(2) The domain of $f(x) = \sqrt{x}$ is: (A) IR (B) $[0, +\infty]$ (C) $[1, +\infty]$ (D) $[2, +\infty]$

(3) If $x^2 + y^2 = 4$, then $\frac{dy}{dx} = ?$ (A) $-\frac{x}{y}$ (B) $\frac{x}{y}$ (C) $\frac{y}{x}$ (D) $-\frac{y}{x}$

(4) If $f(x) = \sin x$, then $f'\left(\frac{\pi}{2}\right) = ?$ (A) 1 (B) -1 (C) $\frac{1}{2}$ (D) 0

(5) $\frac{d}{dx}(\ell n(\sec x)) = ?$ (A) $\sec x$ (B) $\sec x \tan x$ (C) $\tan x$ (D) $\cot x$

(6) $\frac{d}{dx}(\coth^{-1} x) = ?$ (A) $\frac{1}{1-x^2}$ (B) $\frac{1}{1+x^2}$ (C) $\frac{-1}{1+x^2}$ (D) $\frac{1}{x^2-1}$

(7) $\int \frac{1}{x} . \ell nx \, dx = ?$ (A) $\ell nx + c$ (B) $\frac{(\ell nx)^2}{2} + c$ (C) $\frac{1}{x} + c$ (D) $\frac{1}{x^2} + c$

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

(9) $\int_{-1}^{1} x dx = ?$ (A) 2 (B) 0 (C) 1 (D) $\frac{1}{2}$

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

(11) The line $ax + by + c = 0$ is parallel to y-axis if: (A) $c = 0$ (B) $a = 0$ (C) $a = b$ (D) $b = 0$

(12) Slope of a line perpendicular to $x = 3$ is: (A) 1 (B) -1 (C) 0 (D) Undefined

(13) The distance of $(3, 7)$ from $x = 0$ is: (A) 3 (B) -3 (C) 7 (D) -7

(14) x-intercept of $2x + 3y - 1 = 0$ is: (A) $\frac{1}{2}$ (B) 2 (C) 3 (D) $\frac{1}{3}$

(15) $x = 5$ is a solution of: (A) $x < 0$ (B) $x + 4 < 0$ (C) $2x - 3 < 0$ (D) $2x + 3 > 0$

(16) $2x^2 + 3y^2 = 16$ is an equation of: (A) Circle (B) Hyperbola (C) Parabola (D) Ellipse

(17) Length of a latus rectum of $y^2 = 4x$ is: (A) 4 (B) 1 (C) 2 (D) $\frac{1}{4}$

(18) Conic is circle of eccentricity e is: (A) $e > 1$ (B) $e = 0$ (C) $e < 1$ (D) $e = 1$

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

(20) The direction cosines of a vector $\hat{j}$ are: (A) 1, 0, 0 (B) 0, 1, 0 (C) 0, 0, 1 (D) 1, 1, 1

Paper Code Number: 4194

2022 (A) Roll No: ______

INTERMEDIATE PART-II (12th CLASS)

MATHEMATICS PAPER-II TIME ALLOWED: 30 Minutes

GROUP-II **OBJECTIVE** MAXIMUM 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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

(1) $2x^2 + 3y^2 = 16$ is an equation of: (A) Circle (B) Hyperbola (C) Parabola (D) Ellipse

(2) Length of a latus rectum of $y^2 = 4x$ is: (A) 4 (B) 1 (C) 2 (D) $\frac{1}{4}$

(3) Conic is circle of eccentricity e is: (A) $e > 1$ (B) $e = 0$ (C) $e < 1$ (D) $e = 1$

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

(5) The direction cosines of a vector $\hat{j}$ are: (A) 1, 0, 0 (B) 0, 1, 0 (C) 0, 0, 1 (D) 1, 1, 1

(6) If $f(x) = -2x + 8$, then $f^{-1}(x) = ?$ (A) $\frac{2-x}{8}$ (B) $2x - 8$ (C) $\frac{8-x}{2}$ (D) $\frac{8+x}{2}$

(7) The domain of $f(x) = \sqrt{x}$ is: (A) IR (B) $[0, +\infty]$ (C) $[1, +\infty]$ (D) $[2, +\infty]$

(8) If $x^2 + y^2 = 4$, then $\frac{dy}{dx} = ?$ (A) $-\frac{x}{y}$ (B) $\frac{x}{y}$ (C) $\frac{y}{x}$ (D) $-\frac{y}{x}$

(9) If $f(x) = \sin x$, then $f'\left(\frac{\pi}{2}\right) = ?$ (A) 1 (B) -1 (C) $\frac{1}{2}$ (D) 0

(10) $\frac{d}{dx}(\ell n(\sec x)) = ?$ (A) $\sec x$ (B) $\sec x \tan x$ (C) $\tan x$ (D) $\cot x$

(11) $\frac{d}{dx}(\coth^{-1} x) = ?$ (A) $\frac{1}{1-x^2}$ (B) $\frac{1}{1+x^2}$ (C) $\frac{-1}{1+x^2}$ (D) $\frac{1}{x^2-1}$

(12) $\int \frac{1}{x}.\ell nx\, dx = ?$ (A) $\ell nx + c$ (B) $\frac{(\ell nx)^2}{2} + c$ (C) $\frac{1}{x} + c$ (D) $\frac{1}{x^2} + c$

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

(14) $\int_{-1}^{1} x dx = ?$ (A) 2 (B) 0 (C) 1 (D) $\frac{1}{2}$

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

(16) The line $ax + by + c = 0$ is parallel to y-axis if: (A) $c = 0$ (B) $a = 0$ (C) $a = b$ (D) $b = 0$

(17) Slope of a line perpendicular to $x = 3$ is: (A) 1 (B) -1 (C) 0 (D) Undefined

(18) The distance of $(3, 7)$ from $x = 0$ is: (A) 3 (B) -3 (C) 7 (D) -7

(19) x-intercept of $2x + 3y - 1 = 0$ is: (A) $\frac{1}{2}$ (B) 2 (C) 3 (D) $\frac{1}{3}$

(20) $x = 5$ is a solution of: (A) $x < 0$ (B) $x + 4 < 0$ (C) $2x - 3 < 0$ (D) $2x + 3 > 0$

Code Number: 4196

2022 (A)

Roll No: ______ (288)

INTERMEDIATE PART-II (12th CLASS)

MATHEMATICS PAPER-II

GROUP-II

TIME ALLOWED: 30 Minutes

OBJECTIVE

MAXIMUM 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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

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

(2) $\int_{-1}^{1} x dx = ?$ (A) 2 (B) 0 (C) 1 (D) $\frac{1}{2}$

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

(4) The line $ax + by + c = 0$ is parallel to $y-$axis if: (A) $c = 0$ (B) $a = 0$ (C) $a = b$ (D) $b = 0$

(5) Slope of a line perpendicular to $x = 3$ is: (A) 1 (B) -1 (C) 0 (D) Undefined

(6) The distance of $(3, 7)$ from $x = 0$ is: (A) 3 (B) -3 (C) 7 (D) -7

(7) $x-$intercept of $2x + 3y - 1 = 0$ is: (A) $\frac{1}{2}$ (B) 2 (C) 3 (D) $\frac{1}{3}$

(8) $x = 5$ is a solution of: (A) $x < 0$ (B) $x + 4 < 0$ (C) $2x - 3 < 0$ (D) $2x + 3 > 0$

(9) $2x^2 + 3y^2 = 16$ is an equation of: (A) Circle (B) Hyperbola (C) Parabola (D) Ellipse

(10) Length of a latus rectum of $y^2 = 4x$ is: (A) 4 (B) 1 (C) 2 (D) $\frac{1}{4}$

(11) Conic is circle of eccentricity e is: (A) $e > 1$ (B) $e = 0$ (C) $e < 1$ (D) $e = 1$

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

(13) The direction cosines of a vector $\hat{j}$ are: (A) 1, 0, 0 (B) 0, 1, 0 (C) 0, 0, 1 (D) 1, 1, 1

(14) If $f(x) = -2x + 8$, then $f^{-1}(x) = ?$ (A) $\frac{2-x}{8}$ (B) $2x - 8$ (C) $\frac{8-x}{2}$ (D) $\frac{8+x}{2}$

(15) The domain of $f(x) = \sqrt{x}$ is: (A) IR (B) $[0, +\infty]$ (C) $[1, +\infty]$ (D) $[2, +\infty]$

(16) If $x^2 + y^2 = 4$, then $\frac{dy}{dx} = ?$ (A) $-\frac{x}{y}$ (B) $\frac{x}{y}$ (C) $\frac{y}{x}$ (D) $-\frac{y}{x}$

(17) If $f(x) = \sin x$, then $f'\left(\frac{\pi}{2}\right) = ?$ (A) 1 (B) -1 (C) $\frac{1}{2}$ (D) 0

(18) $\frac{d}{dx}(\ell n(\sec x)) = ?$ (A) $\sec x$ (B) $\sec x \tan x$ (C) $\tan x$ (D) $\cot x$

(19) $\frac{d}{dx}(\coth^{-1} x) = ?$ (A) $\frac{1}{1-x^2}$ (B) $\frac{1}{1+x^2}$ (C) $\frac{-1}{1+x^2}$ (D) $\frac{1}{x^2-1}$

(20) $\int \frac{1}{x}.\ell nx\, dx = ?$ (A) $\ell nx + c$ (B) $\frac{(\ell nx)^2}{2} + c$ (C) $\frac{1}{x} + c$ (D) $\frac{1}{x^2} + c$

Paper Code Number: 4198

2022 (A)

Roll No: ___(259)___

INTERMEDIATE PART-II (12th CLASS)

MATHEMATICS PAPER-II

TIME ALLOWED: 30 Minutes

GROUP-II

OBJECTIVE

MAXIMUM 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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.**

Q.No.1

(1) If $f(x)=\sin x$, then $f'\left(\frac{\pi}{2}\right)=?$ (A) 1 (B) -1 (C) $\frac{1}{2}$ (D) 0

(2) $\frac{d}{dx}(\ell n(\sec x))=?$ (A) $\sec x$ (B) $\sec x\tan x$ (C) $\tan x$ (D) $\cot x$

(3) $\frac{d}{dx}(\coth^{-1}x)=?$ (A) $\frac{1}{1-x^2}$ (B) $\frac{1}{1+x^2}$ (C) $\frac{-1}{1+x^2}$ (D) $\frac{1}{x^2-1}$

(4) $\int\frac{1}{x}.\ell nx\,dx=?$ (A) $\ell nx+c$ (B) $\frac{(\ell nx)^2}{2}+c$ (C) $\frac{1}{x}+c$ (D) $\frac{1}{x^2}+c$

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

(6) $\int_{-1}^{1}xdx=?$ (A) 2 (B) 0 (C) 1 (D) $\frac{1}{2}$

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

(8) The line $ax+by+c=0$ is parallel to $y-$axis if: (A) $c=0$ (B) $a=0$ (C) $a=b$ (D) $b=0$

(9) Slope of a line perpendicular to $x=3$ is: (A) 1 (B) -1 (C) 0 (D) Undefined

(10) The distance of $(3,7)$ from $x=0$ is: (A) 3 (B) -3 (C) 7 (D) -7

(11) $x-$intercept of $2x+3y-1=0$ is: (A) $\frac{1}{2}$ (B) 2 (C) 3 (D) $\frac{1}{3}$

(12) $x=5$ is a solution of: (A) $x<0$ (B) $x+4<0$ (C) $2x-3<0$ (D) $2x+3>0$

(13) $2x^2+3y^2=16$ is an equation of: (A) Circle (B) Hyperbola (C) Parabola (D) Ellipse

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

(17) The direction cosines of a vector $\hat{j}$ are: (A) 1, 0, 0 (B) 0, 1, 0 (C) 0, 0, 1 (D) 1, 1, 1

(18) If $f(x)=-2x+8$, then $f^{-1}(x)=?$ (A) $\frac{2-x}{8}$ (B) $2x-8$ (C) $\frac{8-x}{2}$ (D) $\frac{8+x}{2}$

(19) The domain of $f(x)=\sqrt{x}$ is: (A) IR (B) $[0,+\infty]$ (C) $[1,+\infty]$ (D) $[2,+\infty]$

F.C

(20) If $x^2+y^2=4$, then $\frac{dy}{dx}=?$ (A) $-\frac{x}{y}$ (B) $\frac{x}{y}$ (C) $\frac{y}{x}$ (D) $-\frac{y}{x}$

MATHEMATICS PAPER-II MTN-G1-21 TIME ALLOWED: 30 Minutes

GROUP-I MTN-G1-21 OBJECTIVE MAXIMUM 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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.** MTN-GI-21

Q.No.1

(1) When the expression $\sqrt{a^2 - x^2}$ involves in integration substitute, is:
(A) $x = a\sin\theta$ (B) $a\sec\theta$ (C) $a\tan\theta$ (D) $a = \sin\theta$

(2) $\int_0^3 \frac{1}{\sqrt{9 - x^2}}dx =$ ______ (A) $\frac{2}{\pi}$ (B) $\frac{-2}{\pi}$ (C) $\frac{-\pi}{2}$ (D) $\frac{\pi}{2}$

(3) Which of the following is not a solution of the system of inequalities
$x + 2y \le 8,\ 2x - 3y \le 6,\ 2x + y \ge 2 \quad x \ge 0,\ y \ge 0$
(A) (1, 0) (B) (8, 0) (C) (0, 4) (D) (3, 0)

(4) When axes are translated, the coordinates of the point $(-6, 9)$ are changed into $(-3, 7)$, find the point through which axes are translated:
(A) $(-3, 2)$ (B) $(3, -2)$ (C) $(7, -3)$ (D) $(-9, 6)$

(5) The equation of horizontal line passing through $(-5, 3)$ is:
(A) $x + 5 = 0$ (B) $-5x + 3y = 0$ (C) $3x - 5y = 0$ (D) $y - 3 = 0$

(6) A line passes through $(1, 5)$ and $(k, 7)$ has a slope k, the values of k is:
(A) -1 and 2 (B) 3 and -2 (C) 2, -3 (D) -1, -2

(7) The focus of the parabola $y^2 = 4ax$ is:
(A) $(a, 0)$ (B) $(0, a)$ (C) $(-a, 0)$ (D) $(0, -a)$

(8) The eccentricity of $\frac{y^2}{4} - x^2 = 1$ equals: (A) $\frac{-2}{\sqrt{5}}$ (B) $\frac{2}{\sqrt{5}}$ (C) $\frac{-\sqrt{5}}{2}$ (D) $\frac{\sqrt{5}}{2}$

(9) Conic are the curves obtained by cutting a right circular cone by:
(A) Sphere (B) A line (C) A plane (D) A curve

(10) If $\underline{a}$ and $\underline{b}$ are two non-zero vectors, then $\underline{a} \times \underline{b} =$ ______
(A) $-\underline{b} \times \underline{a}$ (B) $\underline{a} \cdot \underline{b}$ (C) $-\underline{a} \times -\underline{b}$ (D) $\underline{b} \times \underline{a}$

(11) Angle between the vectors $\underline{i} + \underline{j},\ \underline{i} - \underline{j}$ is: (A) π (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{4}$ (D) 0

(12) Projection of $\underline{a}$ along $\underline{b}$ is:
(A) $\hat{a} \cdot \hat{b}$ (B) $\underline{a} - \underline{b}$ (C) $\underline{a} \cdot \hat{b}$ (D) $\hat{a} \cdot \underline{b}$

(13) If $f(x) = \sqrt{x + 4}$ then $f(x^2 + 4)$ is equal to:
(A) $\sqrt{x^2 + 8}$ (B) $\sqrt{x^2 - 8}$ (C) $\sqrt{x - 8}$ (D) $x^2 - 8$

(14) The function $f(x) = \frac{2 + 3x}{2x}$ is not continuous at: (A) $x = -3$ (B) $x = -2/3$ (C) $x = 1$ (D) $x = 0$

(15) $\lim_{x \to a} \frac{f(x) - f(a)}{x - a} =$ ______ (A) $f'(x)$ (B) $f'(a)$ (C) $f'(0)$ (D) $f'(x - a)$

(16) $f(x) = x^{2/3}$, then $f'(8) =$ ______ (A) $\frac{1}{2}$ (B) $\frac{2}{3}$ (C) $\frac{1}{3}$ (D) 3

(17) The derivative of $\frac{x^3 + 2x^2}{x^3}$ equals: (A) $\frac{2}{x^2}$ (B) $\frac{-2}{x^2}$ (C) $\frac{1}{2x^2}$ (D) $\frac{-1}{2x^2}$

(18) If $f(x) = \tan^{-1} x$, then $f'(\cot x)$ is equal to:
(A) $\frac{1}{1 + x^2}$ (B) $\sin^2 x$ (C) $\cos^2 x$ (D) $sex^2 x$

(19) $f(x + \delta x) =$ ______
(A) $f'(x)dx$ (B) $f(x) - f'(x)dx$ (C) $f(x) + f'(x)dx$ (D) $f(x)dx$

(20) $\int \frac{a}{x\sqrt{x^2 - 1}}dx =$ ______
(A) $a\tan^{-1} x$ (B) $-a\operatorname{cosec}^{-1} x + c$ (C) $-a\sec^{-1} x + c$ (D) $\frac{1}{a}\sec^{-1} x + c$

MATHEMATICS PAPER-II — TIME ALLOWED: 2.30 Hours

GROUP-I — **SUBJECTIVE** — MAXIMUM MARKS: 80

NOTE: Write same question number and its part number on answer book, as given in the question paper.

MTN-GI-21

SECTION-I

2. Attempt any eight parts. **$8 \times 2 = 16$**

(i) Determine whether the function $f(x) = \sin x + \cos x$ is even or odd.

(ii) With out finding the inverse, state domain and range of f^{-1} where $f(x) = \dfrac{x-1}{x-4}$ $x \neq 4$

(iii) Evaluate the limit $\lim\limits_{x \to 2} \dfrac{x^3 - 8}{x^2 + x - 6}$ by using algebraic techniques.

(iv) Express the Limit $\lim\limits_{x \to 0} (1 + 2x^2)^{\frac{1}{x^2}}$ in terms of e.

(v) Find the derivative of $(x+4)^{\frac{1}{3}}$ by definition.

(vi) Differentiate $x^2 - \dfrac{1}{x^2}$ w.r.t x^4.

(vii) If $y = \ell n\,(x + \sqrt{x^2 + 1})$ then find $\dfrac{dy}{dx}$

(viii) If $y = x^2 \cdot e^{-x}$ then find y_2

(ix) If $x = 1 - t^2$ and $y = 3t^2 - 2t^3$ then find $\dfrac{dx}{dt}$ and $\dfrac{dy}{dt}$

(x) If $f(x) = 4 - x^2$, $x \in (-2, 2)$ then find interval in which $f(x)$ is increasing or decreasing.

(xi) Prove that $\dfrac{d}{dx}(\tan^{-1} x) = \dfrac{1}{1 + x^2}$

(xii) If $y = \sin 3x$ then find y_4

3. Attempt any eight parts. **$8 \times 2 = 16$**

(i) Using differentials find $\dfrac{dy}{dx}$ and $\dfrac{dx}{dy}$ if $x^2 + 2y^2 = 16$

(ii) Evaluate $\int \cos 3x \sin 2x \, dx$

(iii) Evaluate $\int \dfrac{x^2}{4 + x^2}\, dx$

(iv) Evaluate $\int x \,\ell nx \, dx$

(v) Evaluate $\int \dfrac{(a-b)x}{(x-a)(x-b)}\, dx$, $a > b$

(vi) Evaluate $\int_0^3 \dfrac{dx}{x^2 + 9}$

(vii) Solve the differential equation $y\,dx + x\,dy = 0$

(viii) Evaluate $\int \sec x \, dx$

(ix) Find K so that the line joining $A(7, 3)$, $B(K, -6)$ and the line joining $C(-4, 5)$, $D(-6, 4)$ are parallel.

(x) Find whether the given point $P(5, 8)$ lies above or below the line $2x - 3y + 6 = 0$

(xi) Determine value of P such that the lines $2x - 3y - 1 = 0$, $3x - y - 5 = 0$ and $3x + Py + 8 = 0$ meet at a point.

(xii) Find the lines represented by $3x^2 + 7xy + 2y^2 = 0$

4. **Attempt any nine parts.** **$9 \times 2 = 18$**

(i) Graph the solution set of linear inequality in xy-plane $3x - 2y \geq 6$

(ii) Find the equation of a circle with ends of a diameter at $(-3, 2)$ and $(5, -6)$

(iii) Find the centre and radius of a circle $4x^2 + 4y^2 - 8x + 12y - 25 = 0$

(iv) Write down the equation of normal to the circle $x^2 + y^2 = 25$ at $(4, 3)$

(v) Find the vertex and directrix of $x^2 = 4(y-1)$

(vi) Write the equation of parabola with focus $(-3, 1)$ and directrix $x - 2y - 3 = 0$

(vii) Find the equation of hyperbola with Foci $(\pm 5, 0)$ and vertex is $(3, 0)$

(viii) Find the magnitude of vector $\underline{u} = \underline{i} + \underline{j}$

(ix) Find a unit vector in the direction of $\underline{v} = \underline{i} + 2\underline{j} - \underline{k}$

(x) Find the direction cosines of $\underline{v} = 3\underline{i} - \underline{j} + 2\underline{k}$

(xi) If $\underline{u} = [2, -3, 1]$, $\underline{v} = [2, 4, 1]$ find the cosine of angle θ between $\underline{u}$ and $\underline{v}$

(xii) If $\underline{a} \times \underline{b} = 0$ and $\underline{a} \cdot \underline{b} = 0$, what conclusion can be drawn about $\underline{a}$ or $\underline{b}$?

(xiii) Find α so that $\underline{i} - \underline{j} + \underline{k}$, $\underline{i} - 2\underline{j} - 3\underline{k}$ and $3\underline{i} - \alpha\underline{j} + 5\underline{k}$ are coplanar.

SECTION-II

NOTE: Attempt any three questions. **$3 \times 10 = 30$**

5.(a) If $f(x) = \begin{cases} \dfrac{\sqrt{2x+5} - \sqrt{x+7}}{x-2}, & x \neq 2 \\ K, & x = 2 \end{cases}$ Find the value of K so that f is continuous at $x = 2$

(b) If $x = a\cos^3\theta$, $y = b\sin^3\theta$, show that $a\dfrac{dy}{dx} + b\tan\theta = 0$

6.(a) Evaluate the integral $\displaystyle\int \frac{\sqrt{2}}{\sin x + \cos x}\,dx$

(b) Find the condition that the lines $y = m_1x + c_1$, $y = m_2x + c_2$, $y = m_3x + c_3$ are concurrent.

7. (a) Evaluate $\displaystyle\int_0^{\pi/4} \frac{\sin x - 1}{\cos^2 x}\,dx$

(b) Maximize $f(x, y) = 2x + 5y$ subject to constraints $2y - x \leq 8$, $x - y \leq 4$, $x \geq 0$, $y \geq 0$

8. (a) Write equations of two tangents from $(2, 3)$ to the circle $x^2 + y^2 = 9$

(b) By using vectors prove that $\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$

9.(a) If $y = (\cos^{-1}x)^2$, prove that $(1 - x^2)y_2 - xy_1 - 2 = 0$

(b) Show that an equation of parabola with focus at $(a\cos\alpha, a\sin\alpha)$ and directrix $x\cos\alpha + y\sin\alpha + a = 0$ is $(x\sin\alpha - y\cos\alpha)^2 = 4a(x\cos\alpha + y\sin\alpha)$

GROUP-II **OBJECTIVE** MAXIMUM 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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

(1) The perimeter P of a square as a function of its area A is:
(A) $P = \sqrt{A}$ (B) $P = 2\sqrt{A}$ (C) $P = 3\sqrt{A}$ (D) $P = 4\sqrt{A}$

(2) $\lim\limits_{x \to 3} \dfrac{x-3}{\sqrt{x}-\sqrt{3}}$ (A) $\sqrt{3}$ (B) $2\sqrt{3}$ (C) $\dfrac{1}{\sqrt{3}}$ (D) $\dfrac{1}{2\sqrt{3}}$

(3) If $3x + 4y - 5 = 0$, then $\dfrac{dy}{dx} =$ (A) $4/3$ (B) $-4/3$ (C) $3/4$ (D) $-3/4$

(4) $\dfrac{d}{dx}(\sqrt{\cot x}) =$ (A) $\dfrac{1}{2\sqrt{\cot x}}$ (B) $\dfrac{\operatorname{cosec}^2 x}{2\sqrt{\cot x}}$ (C) $\dfrac{-\operatorname{cosec}^2 x}{2\sqrt{\cot x}}$ (D) $\dfrac{2\operatorname{cosec}^2 x}{\sqrt{\cot x}}$

(5) If $f(x) = \tan^{-1} x$, then $f'(\cot x) =$ (A) $\sin^2 x$ (B) $\cos^2 x$ (C) $\sec^2 x$ (D) $\dfrac{1}{1+x^2}$

(6) $\dfrac{d}{dx}(-\cot x) =$ (A) $\sec^2 x$ (B) $\operatorname{cosec}^2 x$ (C) $-\operatorname{cosec}^2 x$ (D) $\tan^2 x$

(7) $\int a^x dx =$ (A) $a^x + c$ (B) $a^x + \ell na + c$ (C) $a^x \cdot \ell na + c$ (D) $a^x \cdot \dfrac{1}{\ell na} + c$

(8) The anti-derivative of $\dfrac{1}{(1+x^2)\tan^{-1} x}$ is:
(A) $\ell n(\tan^{-1} x) + c$ (B) $\ell n(1+x^2) + c$ (C) $2(\tan^{-1} x)^2 + c$ (D) $\dfrac{1}{2}(\tan^{-1} x)^2 + c$

(9) Suitable substitution for solving $\int \dfrac{1}{x\sqrt{x^2 - a^2}} dx$ is:
(A) $x = a \sin\theta$ (B) $x = a \tan\theta$ (C) $x = a \sec\theta$ (D) $x = a \cos\theta$

(10) $\int_0^{\pi/4} \sec^2 x \, dx =$ (A) 0 (B) 1 (C) 2 (D) $\dfrac{1}{2}$

(11) If $(3, 5)$ is the mid-point of $(5, a)$ and $(1, 7)$, then $a =$____ (A) 3 (B) 5 (C) 7 (D) 9

(12) The point $(3, -8)$ lies in the ______ quadrant. (A) 1st (B) 2nd (C) 3rd (D) 4th

(13) The lines ℓ_1 and ℓ_2 with slopes m_1 and m_2 respectively, are parallel if:
(A) $m_1 m_2 = 1$ (B) $m_1 = m_2$ (C) $m_1 m_2 = -1$ (D) $m_1 + m_2 = 0$

(14) The point $(2, 1)$ is not in the solution of the inequality:
(A) $2x + y > 3$ (B) $2x + y > 4$ (C) $2x + y < 3$ (D) $2x + y > 1$

(15) Centre of the circle $x^2 + y^2 + 7x - 3y = 0$, is:
(A) $(7, -3)$ (B) $\left(-7/2, 3/2\right)$ (C) $(-7, 3)$ (D) $\left(7/2, -3/2\right)$

(16) The equation of directrix of the parabola $x^2 = 5y$ is:
(A) $x + 5/4 = 0$ (B) $x - 5/4 = 0$ (C) $y + 5/4 = 0$ (D) $y - 5/4 = 0$

(17) The length of latus-rectum of hyperbola $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$, is:
(A) $\dfrac{a^2}{2b}$ (B) $\dfrac{b^2}{2a}$ (C) $\dfrac{b^2}{a}$ (D) $\dfrac{2b^2}{a}$

(18) If $\underline{u} = 2\alpha\underline{i} + \underline{j} - \underline{k}$ and $\underline{v} = \underline{i} + \alpha\underline{j} + 4\underline{k}$, are perpendicular, then $\alpha =$
(A) $-4/3$ (B) $4/3$ (C) $3/4$ (D) 4

(19) The vectors $\underline{u}$, $\underline{v}$ and $\underline{w}$ are coplanar if:
(A) $\underline{u} \cdot \underline{v} \times \underline{w} = 0$ (B) $\underline{u} \cdot \underline{v} \times \underline{w} = 1$ (C) $\underline{u} \cdot \underline{v} \times \underline{w} = 2$ (D) $\underline{u} \cdot \underline{v} \times \underline{w} = 3$

(20) Work done by a constant force $\vec{F}$ during a displacement $\vec{d}$ is equal to:
(A) $\vec{F} \times \vec{d}$ (B) $\vec{d} \times \vec{F}$ (C) $\vec{F} + \vec{d}$ (D) $\vec{F} \cdot \vec{d}$

GROUP-II **SUBJECTIVE** MAXIMUM MARKS: 80

NOTE: Write same question number and its part number on answer book, as given in the question paper.

SECTION-I

2. Attempt any eight parts. **$8 \times 2 = 16$**

(i) Express perimeter P of a square as a function of its area A.

(ii) If $f(x) = \sqrt{x+1}$, $g(x) = \frac{1}{x^2}$ find $fog(x)$, $gof(x)$

(iii) Evaluate $\lim\limits_{x \to -1} \frac{x^3 - x}{x+1}$

(iv) Evaluate $\lim\limits_{x \to 0} \frac{1 - \cos x}{\sin^2 x}$

(v) Differentiate $\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2$ w.r.t. x

(vi) Find $\frac{dy}{dx}$ if $x = 1 - t^2$, $y = 3t^2 - 2t^3$

(vii) Prove that $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$

(viii) Find $\frac{dy}{dx}$ if $y = x \cos y$

(ix) Find $\frac{dy}{dx}$ if $y = \frac{x}{\ell nx}$

(x) Find $f'(x)$ if $f(x) = e^{\sqrt{x}-1}$

(xi) Find y_2 if $y = x^2 e^{-x}$

(xii) Find Maclaurin series for $\sin x$.

3. Attempt any eight parts. **$8 \times 2 = 16$**

(i) Use differentials to find dy and δy if $y = x^2 + 2x$, x changes from 2 to 1.8.

(ii) Find $\int \frac{1 - \sqrt{x}}{\sqrt{x}}\, dx$

(iii) Find $\int \frac{1 - x^2}{1 + x^2}\, dx$

(iv) Find $\int \frac{\cot \sqrt{x}}{\sqrt{x}}\, dx$

(v) Find $\int \frac{\sqrt{2}}{\sin x + \cos x}\, dx$

(vi) Find $\int x \,\ell nx\, dx$

(vii) Solve the differential equation $(e^x + e^{-x})\frac{dy}{dx} = e^x - e^{-x}$

(viii) Find $\int_0^{\pi/3} \cos^2\theta \sin\theta \, d\theta$

(ix) By means of slope, show that $(-1, -3)$, $(1, 5)$, $(2, 9)$ lie on the same line.

(x) Check whether the point $(-7, 6)$ lies above or below the line $4x + 3y - 9 = 0$

(xi) Check whether the lines $12x + 35y - 7 = 0$ and $105x - 36y + 11 = 0$ are parallel or perpendicular.

(xii) Express $15y - 8x + 3 = 0$ in normal form.

(i) Graph the solution set of $3x - 2y \geq 6$

(ii) Find an equation of the circle with ends of a diameter at $(-3, 2)$ and $(5, -6)$

(iii) Find the radius of the circle $5x^2 + 5y^2 + 14x + 12y - 10 = 0$

(iv) Find the length of the tangent drawn from the point $(-5, 4)$ to the circle $5x^2 + 5y^2 - 10x + 15y - 131 = 0$

(v) Find the focus and directrix of the parabola $x^2 = 4(y-1)$

(vi) Find the foci and eccentricity of $\frac{y^2}{16} - \frac{x^2}{9} = 1$

(vii) Write down the equation of tangent to $3x^2 + 3y^2 + 5x - 13y + 2 = 0$ at $\left(1, \frac{10}{3}\right)$

(viii) Find the magnitude of the vector $\vec{u} = \hat{i} + \hat{j}$

(ix) Find a unit vector in the direction of $\underline{v} = 2\underline{i} - \underline{j}$

(x) Let $\underline{v} = 3\underline{i} - 2\underline{j} + 2k$, $\underline{w} = 5\underline{i} - \underline{j} + 3\underline{k}$ find $\underline{v} - 3\underline{w}$

(xi) Find α so that $\left|\alpha\underline{i} + (\alpha+1)\underline{j} + 2\underline{k}\right| = 3$

(xii) Find the direction cosines of $\underline{v} = 3\underline{i} - \underline{j} + 2\underline{k}$

(xiii). Find a vector of lengths 5 in the direction opposite that of $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$

SECTION-II

NOTE: Attempt any three questions. **$3 \times 10 = 30$**

5.(a) Prove that $y\frac{dy}{dx} + x = 0$ if $x = \frac{1-t^2}{1+t^2}$, $y = \frac{2t}{1+t^2}$

(b) If $f(x) = \begin{cases} \frac{\sqrt{2x+5} - \sqrt{x+7}}{x-2}, & x \neq 2 \\ K, & x = 2 \end{cases}$ find value of K so that f is continuous at $x = 2$

6.(a) Determine value of p such that the lines $2x - 3y - 1 = 0$, $3x - y - 5 = 0$ and $3x + py + 8 = 0$ meet at a point.

(b) Evaluate $\int x^3 e^{5x}\, dx$

7. (a) Evaluate $\int_{-1}^{2} \left(x + |x|\right) dx$

(b) Minimize $z = 2x + y$; subject to the constraints $x + y \geq 3$; $7x + 5y \leq 35$; $x \geq 0$, $y \geq 0$

8. (a) Show that the circles $x^2 + y^2 + 2x - 2y - 7 = 0$ and $x^2 + y^2 - 6x + 4y + 9 = 0$ touch externally.

(b) A force of magnitude 6 units acting parallel to $2\underline{i} - 2\underline{j} + \underline{k}$, displaces, the point of application from $(1, 2, 3)$ to $(5, 3, 7)$. Find work done.

9.(a) A box with a square base and open top is to have a volume of 4 cubic dm. Find the dimensions of the box which will require the least material.

(b) Find the centre, foci and vertices of the following $9x^2 - 12x - y^2 - 2y + 2 = 0$