Roll No _____ Lahore Board-2024 (To be filled in by the candidate)

(Academic Sessions 2020 – 2022 to 2022 – 2024)

MATHEMATICS 224-1st Annual-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – I Maximum Marks : 20

PAPER CODE = 8195

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If $f(x)=3-\sqrt{x}$ then $f'(1)$ is equal to : (A) $-\frac{1}{2}$ (B) 0 (C) $\frac{1}{2}$ (D) 1
2	$4\int_0^{\pi/4} \sin 2x\,dx =$: (A) $4-2\sqrt{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{1}{2}$ (D) $\sqrt{3}$
3	$\lim_{x\to 0} \frac{\sin ax}{\sin bx} =$: (A) $-\frac{a}{b}$ (B) $-\frac{b}{a}$ (C) $\frac{a}{b}$ (D) $\frac{b}{a}$
4	$\int \ell nx\,dx =$: (A) $\frac{1}{x}+c$ (B) $x\,\ell nx+c$ (C) $\frac{(\ell nx)^2}{2}+c$ (D) $x(\ell nx-1)+c$
5	Let $f(x)=\sqrt{1-x^2}$ in R then domain of f is : (A) Real numbers (B) $\lvert x\rvert\le 1$ (C) Negative real numbers (D) Integers
6	If $\int x\,e^{x^2}\,dx = k\,e^{x^2}$ then k = : (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{x}{3}$ (D) $\frac{x}{2}$
7	If $f(x)$ has second derivative at c such that $f'(c)=0$ and $f''(c)<0$ then c is point of : (A) Maxima (B) Minima (C) Point of inflection (D) Origin
8	If $y=\cot x$, then $\frac{dy}{dx}$ is given by : (A) $\cos ec^2 x$ (B) $-\cos ec^2 x$ (C) $\tan x$ (D) $-\cos ec\,x\cot x$
9	$\int \frac{1}{x^2+a^2}dx =$: (A) $\tan^{-1}\frac{x}{a}+c$ (B) $\frac{1}{a}\tan^{-1}\frac{x}{a}+c$ (C) $\frac{a}{x}\tan^{-1}\frac{x}{a}+c$ (D) $\frac{1}{a}\tan^{-1}\frac{a}{x}+c$

(Turn Over)

1-10	For $y = \log_e 5x$, $\frac{dy}{dx} =$: (A) $\frac{1}{x}$ (B) 5 (C) $\frac{1}{5x}$ (D) 1
11	The straight line $y = mx + c$ is tangent to the parabola $y^2 = 4ax$ if : (A) $c = \frac{a}{m}$ (B) $c = \frac{m}{a}$ (C) $c = \frac{a^2}{m^2}$ (D) $c = am$
12	y-coordinate of any point on x-axis is : (A) 0 (B) x (C) 1 (D) y
13	The volume of parallelepiped determined by $\underline{u} = \underline{i} + 2\underline{j} - \underline{k}$, $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$, $\underline{w} = \underline{i} - 7\underline{j} - 4\underline{k}$ is : (A) 48 (B) 50 (C) 52 (D) 55
14	The distance between the centres of the circles $x^2 + y^2 + 2x + 2y + 1 = 0$ and $x^2 + y^2 - 4x - 6y - 3 = 0$ is : (A) 1 (B) 4 (C) 5 (D) 15
15	If $\underline{a} + \underline{b} + \underline{c} = 0$ then which one is correct : (A) $\underline{a} \times \underline{b} \times \underline{c} = 0$ (B) $\underline{a} \times \underline{b} = \underline{b} \times \underline{c} = \underline{c} \times \underline{a}$ (C) $\underline{a} \cdot \underline{b} = \underline{b} \cdot \underline{c} = \underline{c} \cdot \underline{a}$ (D) $\underline{a} = \underline{b} = \underline{c}$
16	The x-intercept of the line $2x + 3y - 1 = 0$ is : (A) 2 (B) 3 (C) $\frac{1}{3}$ (D) $\frac{1}{2}$
17	The graph of $2x - 3y \le 6$ is : (A) On the origin side (B) Not on the origin side (C) Not decided (D) Through the origin
18	The area of the triangle having $\underline{a}$ and $\underline{b}$ as its two sides is given by : (A) $\lvert\underline{a} \cdot \underline{b}\rvert$ (B) $\frac{1}{2}\lvert\underline{a} \cdot \underline{b}\rvert$ (C) $\lvert\underline{a} \times \underline{b}\rvert$ (D) $\frac{1}{2}\lvert\underline{a} \times \underline{b}\rvert$
19	Homogeneous equation of second degree $ax^2 + 2hxy + by^2 = 0$ where a, b, h are not all zero, represents two imaginary lines if : (A) $h^2 = ab$ (B) $h^2 > ab$ (C) $h^2 < ab$ (D) $h = ab$
20	The eccentricity of the ellipse $\frac{x^2}{64} + \frac{y^2}{28} = 1$ is : (A) $\frac{3}{4}$ (B) $\frac{4}{3}$ (C) $\sqrt{\frac{3}{4}}$ (D) $\sqrt{\frac{4}{3}}$

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MATHEMATICS 224-1st Annual-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Prove that $\cos h^2 x - \sin h^2 x = 1$

(ii) If $f(x) = \sqrt{x+4}$ then find $f(x-1)$

(iii) Evaluate $\lim\limits_{x \to 3} \dfrac{x-3}{\sqrt{x}-\sqrt{3}}$

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

(v) Differentiate $y = (x^2+5)(x^3+7)$ with respect to x.

(vi) Differentiate $\dfrac{x^2+1}{x^2-3}$ with respect to x.

(vii) Find derivative of $(x^3+1)^9$ with respect to x.

(viii) Differentiate $\cos\sqrt{x} + \sqrt{\sin x}$ with respect to the variable involved.

(ix) $\dfrac{dy}{dx} = ?$ If $y = e^{x^2+1}$

(x) Find Maclaurin Series for $\sin x$

(xi) Determine the interval in which $f(x) = 4 - x^2$, $x \in (-2, 2)$ is increasing or decreasing.

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

3. Write short answers to any EIGHT (8) questions : **16**

(i) Using differential to find $\dfrac{dy}{dx}$ if $xy + x = 4$

(ii) Evaluate $\int (a-2x)^{\frac{3}{2}}\, dx$

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

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

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

(vi) Find the area bounded by cos function from $x = -\dfrac{\pi}{2}$ to $x = \dfrac{\pi}{2}$

(vii) Solve the differential equation $\dfrac{dy}{dx} = \dfrac{y}{x^2}$

(viii) Find h such that A (– 1 , h) , B (3 , 2) and C (7 , 3) are collinear.

(ix) The coordinates of a point P are (3 , 2). The axes are translated through the point $O'(1,3)$. Find the coordinates of P referred to new axes.

(x) 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.

(xi) Find the point of intersection of the lines $x - 2y + 1 = 0$ and $2x - y + 2 = 0$

(xii) Find measure of the angle between the lines represented by $9x^2 + 24xy + 16y^2 = 0$

4. Write short answers to any NINE (9) questions : 18

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

(ii) Define feasible region.

(iii) Find the equation of circle whose ends of diameter are $(-3, 2)$ and $(5, -6)$

(iv) Find the position of the point $(5, 6)$ w.r.t the circle $2x^2+2y^2+12x-8y+1=0$

(v) Find the focus and vertex of parabola $y^2=-8(x-3)$

(vi) Find the eccentricity of ellipse $x^2+4y^2=16$

(vii) Find the centre and eccentricity of the conic $\frac{y^2}{4}-x^2=1$

(viii) Identify the conic represented by $4x^2-4xy+y^2-6=0$

(ix) Find the work done by a constant force $\vec{F}=2\hat{i}+4\hat{j}$, if its point of application to a body moves it from A $(1, 1)$ to B $(4, 6)$

(x) Find the value of ' α ' such that $\alpha\underline{i}+\underline{j}$, $\underline{i}+\underline{j}+3\underline{k}$ and $2\underline{i}+\underline{j}-2\underline{k}$ are coplanar.

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

(xii) Find a vector whose magnitude is 4 and is parallel to $2\underline{i}-3\underline{j}+6\underline{k}$

(xiii) If A $(1, -1)$, B $(2, 0)$, C $(-1, 3)$ and D $(-2, 2)$ are given points, find the sum of the vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Find m and n, so that given function f is continuous at $x=3$ 5

$$f(x)=\begin{cases} mx & \text{if } x<3 \\ n & \text{if } x=3 \\ -2x+9 & \text{if } x>3 \end{cases}$$

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

6. (a) If $y=e^{-ax}$, then show that $\frac{d^3y}{dx^3}+a^3y=0$ 5

(b) Evaluate the indefinite integral $\int\sqrt{x^2-a^2}\,dx$ 5

7. (a) Solve the differential equation $2e^x\tan y\,dx+(1-e^x)\sec^2 y\,dy=0$ 5

(b) Maximize $f(x,y)=x+3y$ subject to the constraints
$2x+5y\leq 30$; $5x+4y\leq 20$, $x\geq 0$, $y\geq 0$ 5

8. (a) Find equations of the tangents to the circle $x^2+y^2=2$ perpendicular to the line $3x+2y=6$ 5

(b) Using vectors, prove that $\sin(\alpha+\beta)=\sin\alpha\cos\beta+\cos\alpha\sin\beta$ 5

9. (a) Find centre, foci, eccentricity, vertices and equation of directrices of $\frac{(y+2)^2}{9}-\frac{(x-2)^2}{16}=1$ 5

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

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PAPER CODE = 8192

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If $f(x)=\frac{1}{x^2}$ when which of the following is equal to $fof(x)$:			
	(A) x^4	(B) x^2	(C) 1	(D) $\frac{1}{x^4}$
2	What is the value of $\lim_{x\to 0}(x\sin x)$:			
	(A) α	(B) -1	(C) 1	(D) 0
3	What is the value of $\sqrt{1-x^2}\frac{d}{dx}(\sin^{-1}x+\cos^{-1}x)$:			
	(A) $\sqrt{1-x^2}$	(B) 0	(C) 2	(D) $\frac{1}{x}$
4	$\frac{d}{dx}(\sin h^{-1}x) =$:			
	(A) $\frac{1}{\sqrt{1-x^2}}$	(B) $\frac{-1}{\sqrt{1-x^2}}$	(C) $\frac{1}{\sqrt{1+x^2}}$	(D) $\frac{-1}{\sqrt{1+x^2}}$
5	Derivative of x^3 w.r.t x^3 is :			
	(A) 0	(B) 1	(C) x^3	(D) $3x^2$
6	If $f(x)=a^x$ then $f'(x) =$:			
	(A) $a^x \ell na$	(B) $a^x \ell nx$	(C) $a^x(\ell na)^2$	(D) $(a^x)^2 \ell na$
7	$\int x^{-1}dx$:			
	(A) 0	(B) $-x^{-2}+c$	(C) $\propto$	(D) $\ell nx+c$
8	$\int_0^1 \frac{1}{\sqrt{1-x^2}}dx =$:			
	(A) $\frac{\pi}{6}$	(B) $\frac{\pi}{4}$	(C) $\frac{\pi}{3}$	(D) $\frac{\pi}{2}$
9	$\int \tan x\,dx =$:			
	(A) $\ell n\cot x+c$	(B) $\ell n\sec x+c$	(C) $\ell n\sin x+c$	(D) $\ell n\cos ec\,x+c$

(Turn Over)

1.10	$\int_0^{\pi} \sin x\,dx =$: (A) 0 (B) 1 (C) 2 (D) π
11	A linear equation in two variables represents : (A) Circle (B) Ellipse (C) Hyperbola (D) Straight line
12	Intercept form of equation of line is : (A) $\frac{x}{a}+\frac{y}{b}=1$ (B) $\frac{x}{a}+\frac{y}{b}=0$ (C) $\frac{x}{a}-\frac{y}{b}=1$ (D) $\frac{x}{a}-\frac{y}{b}=0$
13	Distance of point $(\cos 3x, \sin 3x)$ from origin is : (A) 3 (B) 6 (C) 9 (D) 1
14	(0 , 0) is one of the solution of inequality : (A) $3x+5y>4$ (B) $2x+3y<4$ (C) $x+3y>5$ (D) $2x+3y>5$
15	Equation of circle with centre (3 , 0) and radius $\sqrt{9}$ is : (A) $x^2+y^2-6x=0$ (B) $x^2-6x=9$ (C) $x^2+y^2=9$ (D) $9x^2+y^2=9$
16	Equation of directrix of parabola $y^2=-12x$ is : (A) $x=-3$ (B) $x=3$ (C) $y=3$ (D) $y=-3$
17	Co-vertices of ellipse $\frac{x^2}{b^2}+\frac{y^2}{a^2}=1$; $a>b$ are : (A) $(\pm a,0)$ (B) $(0,\pm a)$ (C) $(0,\pm b)$ (D) $(\pm b,0)$
18	Which of the following vectors is equal to the vector $\underline{i}.\underline{j}\times\underline{k}$: (A) 0 (B) 1 (C) -1 (D) $\underline{i}$
19	For what value of P [2 P 5] is perpendicular to [3 1 P] : (A) $\frac{2}{3}$ (B) -1 (C) 1 (D) $\sqrt{5}$
20	If $\underline{a}$ and $\underline{b}$ are parallel vectors then $\underline{a}\times\underline{b}=$: (A) 0 (B) 1 (C) -1 (D) 2

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SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Given that $f(x)=\cos x$ find $\dfrac{f(a+h)-f(a)}{h}$ and simplify.

(ii) If $f(x)=(-x+9)^3$, find $f^{-1}(x)$

(iii) By rationalizing, find $\underset{x\to 0}{Lim}\dfrac{\sqrt{x+a}-\sqrt{a}}{x}$

(iv) Write down the domain and range of $f(x)=2x-5$

(v) Calculate derivative of $f(x)=x^{2/3}$ at $x=8$

(vi) Find derivative of $\dfrac{1+x}{1-x}$ *w.r.t.* x

(vii) If $y=x^4+2x^2+2$, find $\dfrac{dy}{dx}$

(viii) Find $\dfrac{dy}{dx}$ of implicit function $x^2-4xy-5y=0$

(ix) Apply chain rule to find $\dfrac{dy}{du}$ if $y=x^2+\dfrac{1}{x^2}$ and $u=x-\dfrac{1}{x}$

(x) Differentiate $\sin^2 x$ *w.r.t* $\cos^4 x$

(xi) Find $f'(x)$ if $f(x)=x^3 e^{\frac{1}{x}}$

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

3. Write short answers to any EIGHT (8) questions : **16**

(i) Using differential to find $\dfrac{dx}{dy}$ of $x^4+y^2=xy^2$

(ii) Evaluate $\int (2x+3)^{\frac{1}{2}}\,dx$

(iii) Evaluate $\int x\sqrt{x-a}\,dx$

(iv) Evaluate $\int (\ell nx)^2\,dx$

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

(vi) Find the area bounded by cos function from $x=-\dfrac{\pi}{2}$ to $x=\dfrac{\pi}{2}$

(vii) Solve $\dfrac{dy}{dx}+\dfrac{2xy}{2y+1}=x$

(viii) Find the mid-points of the line joining the two points A (– 8 , 3) , B (2 , – 1).

(ix) Find h such that the points A (– 1 , h) , B (3 , 2) and C (7 , 3) are collinear.

(x) In the triangle A (8 , 6) , B (– 4 , 2) , C (– 2 , – 6), find the slope of altitude of triangle.

(xi) Using slopes, show that the triangle with vertices A (6 , 1) , B (2 , 7) , C (– 6 , – 7) is a right triangle.

(xii) Find the point of intersection of the lines $x+4y-12=0$, $x-3y+3=0$

4. Write short answers to any NINE (9) questions : **18**

(i) Define feasible region.

(ii) Graph the solution set of $5x-4y \leq 20$

(iii) Write the standard and general equation of circle.

(iv) Find centre and radius of $5x^2+5y^2+24x+36y+10=0$

(v) Check the position of the point (5 , 6) with respect to the circle $x^2+y^2=81$

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

(vii) Find foci and eccentricity of ellipse $x^2+4y^2=16$

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

(ix) If $\underline{u}=2\underline{i}-7\underline{j}$, $\underline{v}=\underline{i}-6\underline{j}$ and $\underline{w}=-\underline{i}+\underline{j}$, find $\frac{1}{2}\underline{u}+\frac{1}{2}\underline{v}+\frac{1}{2}\underline{w}$

(x) Find a vector whose magnitude is 4 and is parallel to $2\underline{i}-3\underline{j}+6\underline{k}$

(xi) Find α so that the vector $\underline{u}$ and $\underline{v}$ are perpendicular ; $\underline{u}=\alpha\underline{i}+2\alpha\underline{j}-\underline{k}$ and $\underline{v}=\underline{i}+\alpha\underline{j}+3\underline{k}$

(xii) Find the area of parallelogram whose vertices are A (1 , 2 , – 1) ; B (4 , 2 , – 3) ; C (6 , – 5 , 2) ; D (9 , – 5 , 0)

(xiii) Prove that $\underline{u}.(\underline{v}\times\underline{w})+\underline{v}.(\underline{w}\times\underline{u})+\underline{w}.(\underline{u}\times\underline{v})=3\underline{u}.(\underline{v}\times\underline{w})$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Evaluate $\lim\limits_{x\to 0}\dfrac{\sec x-\cos x}{x}$ 5

(b) Find the derivative w.r.t. x $\sin\sqrt{\dfrac{1+2x}{1+x}}$ 5

6. (a) If $y=(\cos^{-1}x)^2$, prove that $(1-x^2)y_2-xy_1-2=0$ 5

(b) Evaluate $\int\dfrac{2x}{1-\sin x}dx$ 5

7. (a) Find the area between the x-axis and the curve $y=\sqrt{2ax-x^2}$ when $a>0$ 5

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

8. (a) Find equation of the circle passing through the points A (3 , – 1) , B (0 , 1) and having centre at $4x-3y-3=0$ 5

(b) Use vectors to prove that $\sin(\alpha-\beta)=\sin\alpha\cos\beta-\cos\alpha\sin\beta$ 5

9. (a) Mid-points of sides of triangle are (1 , – 1) , (– 4 , – 3) and (– 1 , 1). Find coordinates of vertices of triangle. 5

(b) Show that equation of parabola with focus at $(a\cos\alpha, a\sin\alpha)$ and directrix $x\cos\alpha+y\sin\alpha+a=0$ is $(x\sin\alpha-y\cos\alpha)^2=4a(x\cos\alpha+y\sin\alpha)$ 5

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PAPER CODE = 8191

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1-1	The perimeter P of a square as a function of its area A is given as :			
	(A) $4A$	(B) $4\sqrt{A}$	(C) $2A$	(D) $2\sqrt{A}$
2	Domain of cosine function $y = cosx$ is :			
	(A) Real numbers	(B) $[-1,1]$	(C) $(0,\infty)$	(D) $]-1,1[$
3	If $y = \tanh^{-1} x$, then $\frac{dy}{dx} =$:			
	(A) $\frac{1}{1+x^2}$	(B) $\frac{1}{1-x^2}$	(C) $\frac{-1}{1+x^2}$	(D) $\frac{-1}{1-x^2}$
4	$\frac{d}{dx}(a^{\lambda x}) =$:			
	(A) $a^{\lambda x}$	(B) $a^{\lambda x}\ell na$	(C) $\lambda a^{\lambda x}\ell na$	(D) $\frac{a^{\lambda x}}{\lambda \ell na}$
5	$\frac{d}{dx}(\sin\sqrt{x}) =$:			
	(A) $\cos\sqrt{x}$	(B) $\cos\sqrt{x}\cdot\frac{1}{\sqrt{x}}$	(C) $\sqrt{x}\cos\sqrt{x}$	(D) $\cos\sqrt{x}\cdot\frac{1}{2\sqrt{x}}$
6	If $y = x^2 - 1$, then $dy =$:			
	(A) $xdx + c$	(B) $(x-1)dx$	(C) $2x\,dx + c$	(D) $2x\,dx$
7	$\int_0^3 \frac{dx}{x^2+9} =$:			
	(A) $\frac{\pi}{4}$	(B) $\frac{-\pi}{4}$	(C) 0	(D) $\frac{\pi}{12}$
8	$\int e^x(\sin x + \cos x)\,dx =$:			
	(A) $e^x\cos x + c$	(B) $e^x\sin x$		
	(C) $e^x\sin x + c$	(D) $e^x\cos x$		
9	$\int \frac{2}{x+2}dx =$:			
	(A) $\ell n\lvert x+2\rvert + c$	(B) $\ell n\lvert x+2\rvert^2 + c$	(C) $\frac{1}{\ell n\lvert x+2\rvert} + c$	(D) $2\ell nx + c$
10	$\int \frac{1}{\cos^2 x}dx =$:			
	(A) $\frac{1}{\sin^2 x} + c$	(B) $\tan x + c$	(C) $\sec^2 x + c$	(D) $\cos ec^2 x + c$

11	The lines represented by $ax^2+2hxy+by^2=0$ are imaginary if : (A) $h^2-ab=0$ (B) $h^2-ab<0$ (C) $h^2-ab>0$ (D) $h^2-ab\neq 0$
12	Two lines $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$ are parallel if : (A) $a_1a_2+b_1b_2=0$ (B) $a_1a_2-b_1b_2=0$ (C) $a_1b_2-a_2b_1=0$ (D) $a_1b_2+a_2b_1=0$
13	Inclination of the line joining the points (4 , 6) and (4 , 8) is : (A) 90° (B) 45° (C) 30° (D) Undefined
14	A region is said to feasible region which is restricted to : (A) I quadrant (B) II quadrant (C) III quadrant (D) IV quadrant
15	An angle in a semicircle is of measure : (A) 90° (B) 60° (C) 45° (D) 30°
16	The coordinate of the vertices of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is : (A) $(0,\pm b)$ (B) $(\pm b,0)$ (C) $(0,\pm a)$ (D) $(\pm a,0)$
17	Focus of the parabola $x^2-5y=0$ is : (A) $(\frac{5}{4},0)$ (B) $(0,\frac{5}{4})$ (C) $(0,\frac{-5}{4})$ (D) $(-\frac{5}{4},0)$
18	For parabola, value of eccentricity e is : (A) $e=0$ (B) $e<1$ (C) $e>1$ (D) $e=1$
19	If $\underline{u},\underline{v}$ and $\underline{w}$ are coterminous 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) $\frac{1}{9}[\underline{u}\ \underline{v}\ \underline{w}]$
20	A vector perpendicular to both vectors $\underline{a}$ and $\underline{b}$ is : (A) $\underline{a}\cdot\underline{b}$ (B) $\underline{a}\times\underline{b}$ (C) $\frac{\underline{a}\cdot\underline{b}}{\lvert\underline{a}\rvert}$ (D) $\underline{b}\cdot\underline{a}$

Roll No _____ Lahore Board-2023 _____ (To be filled in by the candidate)

(Academic Sessions 2019 – 2021 to 2021 – 2023)

MATHEMATICS 223-1st Annual-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) For $f(x)=\frac{2x+1}{x-1}$, find $f^{-1}(x)$

(ii) Evaluate $\lim_{\theta\to 0}\frac{1-\cos\theta}{\sin\theta}$

(iii) Discuss the continuity of $f(x)$ at $x=c=2$, $f(x)=\begin{cases}2x+5 & \text{if } x\le 2\\ 4x+1 & \text{if } x>2\end{cases}$

(iv) Differentiate w.r.t ' x ' $(x-5)(3-x)$

(v) Find $\frac{dy}{dx}$ if $y^2-xy-x^2+4=0$

(vi) Differentiate w.r.t. ' θ ' $(\sin 2\theta-\cos 3\theta)^2$

(vii) Find $\frac{dy}{dx}$ if $y=x^2\ell n\frac{1}{x}$

(viii) Find y_4 if $y=(2x+5)^{3/2}$

(ix) Apply Maclaurin series expansion to prove that $\cos x=1-\frac{x^2}{2!}+\frac{x^4}{4!}-\frac{x^6}{6!}+-----$

(x) Find extreme values for $f(x)=x^2-x-2$

(xi) Define feasible region.

(xii) Graph the inequality $x+2y\le 6$

3. Write short answers to any EIGHT (8) questions : **16**

(i) Find δy and dy in the case $y=x^2+2x$ when x changes from 2 to 1.8

(ii) Evaluate $\int\frac{1}{\sqrt{x}(\sqrt{x}+1)}dx$, $x>0$

(iii) Evaluate $\int a^{x^2}x\,dx$ $(a>0, a\neq 1)$

(iv) Evaluate $\int\sqrt{4-5x^2}\,dx$

(v) Evaluate $\int_0^{\frac{\pi}{6}} x\cos x\,dx$

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

(vii) Solve the differential equation $x^2(2y+1)\frac{dy}{dx}-1=0$ pakcity.org

(viii) Find the position vector of the point of division of the line segments joining the following pair of points, in the given ratio, point C with position vector $2\underline{i}-3\underline{j}$ and point D with position vector $3\underline{i}+2\underline{j}$ in the ratio 4 : 3

(ix) If $\underline{u}=2\underline{i}+3\underline{j}+4\underline{k}$, $\underline{v}=-\underline{i}+3\underline{j}-\underline{k}$ and $\underline{w}=\underline{i}+6\underline{j}+z\underline{k}$ represent the sides of a triangle, find the value of z.

(Turn Over)

3. (x) Find the angle between the vectors $\underline{u}=2\underline{i}-\underline{j}+\underline{k}$ and $\underline{v}=-\underline{i}+\underline{j}$

(xi) If $\underline{a}=4\underline{i}+3\underline{j}+\underline{k}$ and $\underline{b}=2\underline{i}-\underline{j}+2\underline{k}$, find a unit vector perpendicular to both $\underline{a}$ and $\underline{b}$. Also find the sine of angle between the vectors $\underline{a}$ and $\underline{b}$.

(xii) Find the area of the triangle with vertices A (1 , – 1 , 1) , B (2 , 1, – 1) and C (– 1, 1, 2)

4. Write short answers to any NINE (9) questions : **18**

(i) Show that the points A (0, 2) , B ($\sqrt{3}$, –1) and C (0, – 2) are vertices of a right triangle.

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

(iii) Find an equation of line if its slope is 2 and y-intercept is 5.

(iv) Transform the equation $5x - 12y + 39 = 0$ into two-intercept form.

(v) Find the distance from the points P (6 , – 1) to the line $6x - 4y + 9 = 0$

(vi) Find the point of intersection of lines $3x + y + 12 = 0$ and $x + 2y - 1 = 0$

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

(viii) Find an equation of circle with centre at $(\sqrt{2}, -3\sqrt{3})$ and radius $2\sqrt{2}$

(ix) Find centre and radius of circle $x^2 + y^2 + 12x - 10y = 0$

(x) Find vertex and directrix of parabola $x^2 = 16y$

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

(xii) Find centre and foci of $4x^2 + 9y^2 = 36$

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

SECTION – II

Note : Attempt any THREE questions.

5. (a) Evaluate $\lim\limits_{\theta \to 0} \frac{1-\cos p\theta}{1-\cos q\theta}$ 5

(b) If $\frac{y}{x} = \tan^{-1}\frac{x}{y}$ then prove that $\frac{dy}{dx} = \frac{y}{x}$ 5

6. (a) Evaluate $\int \frac{x}{x^4 + 2x^2 + 5}\, dx$ 5

(b) Find equations of two parallel lines perpendicular to $2x - y + 3 = 0$ such that the product of the x-intercept and y-intercept of each is 3. 5

7. (a) Evaluate $\int_0^{\frac{\pi}{4}} (1+\cos^2\theta)\tan^2\theta\, d\theta$ 5

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

8. (a) If $y = (\cos^{-1} x)^2$, prove that $(1-x^2)y_2 - xy_1 - 2 = 0$ 5

(b) Find equations of the tangents to the circle $x^2 + y^2 = 2$ and parallel to the line $x - 2y + 1 = 0$ 5

9. (a) Find volume of the tetrahedron with the vertices (0, 1, 2) , (3, 2, 1) (1, 2, 1) and (5, 5, 6) 5

(b) Find the centre, foci, eccentricity and directrices of ellipse $\frac{(2x-1)^2}{4} + \frac{(y+2)^2}{16} = 1$ 5

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MATHEMATICS 223-1st Annual-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – II Maximum Marks : 20

PAPER CODE = 8194

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	The mid point of the line segment joining the foci of an ellipse is called : (A) Vertex (B) Directrix (C) Centre (D) Minor axis
2	If (3 , 5) is mid point of (5 , a) and (b, 7) then : (A) $a=4\,,\,b=2$ (B) $a=3\,,\,b=3$ (C) $a=7\,,\,b=-2$ (D) $a=3\,,\,b=1$
3	If 2 and 2 are x and y components of a vector, then its angle with x-axis is : (A) 30° (B) 60° (C) 45° (D) 90°
4	(3 , 2) is not a solution of the inequality : (A) $x-y>1$ (B) $x+y>2$ (C) $3x+5y>8$ (D) $3x-7y<3$
5	$\underline{i}\times\underline{j}=$: (A) $\underline{k}$ (B) $\underline{i}$ (C) $-\underline{k}$ (D) $\underline{j}$
6	Slope of line $3x-2y+5=0$ is : (A) $\frac{-2}{3}$ (B) $\frac{2}{3}$ (C) $\frac{3}{2}$ (D) $\frac{-3}{2}$
7	Length of the diameter of the circle $(x+5)^2+(y-8)^2=12$: (A) $2\sqrt{3}$ (B) 12 (C) 24 (D) $4\sqrt{3}$
8	Transverse axis of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is : (A) $x=\frac{a}{e}$ (B) $y=0$ (C) $x=0$ (D) $y=\frac{a}{e}$
9	Equation of line in slope intercept form is : (A) $y=mx+c$ (B) $\frac{x}{a}+\frac{y}{b}=1$ (C) $y-y_1=m(x-x_1)$ (D) $x\cos\alpha+y\sin\alpha=p$
10	The condition for a line $y=mx+c$ to be tangent to the circle $x^2+y^2=a^2$ is that : (A) $c=\pm m\sqrt{1+a^2}$ (B) $c=\pm a\sqrt{1+m^2}$ (C) $c=\pm a\sqrt{1-m^2}$ (D) $c=\pm\sqrt{1-m^2}$ pakcity.org

(Turn Over)

11	$f(x)=f(o)+xf'(o)+\frac{x^2}{2!}f''(o)+\frac{x^3}{3!}f'''(o)+----$ is called : (A) Taylor's series (B) Binomial series (C) Maclaurin's series (D) Laurent series
12	$\lim_{x\to 0}\frac{\sin 7x}{x}=:$ (A) 7 (B) -7 (C) $\frac{-1}{7}$ (D) $\frac{1}{7}$
13	$\int\frac{e^x}{e^x+1}dx=:$ (A) $\ell n(e^x+1)+c$ (B) $\ell n e^x+c$ (C) $e^{-x}+c$ (D) e^x+c
14	$\frac{d}{dx}(x^2+1)^2=:$ (A) $2x(x^2+1)$ (B) $\frac{(x^2+1)^3}{3}$ (C) $2(x^2+1)$ (D) $4x(x^2+1)$
15	$\int\sin^2 x\,dx=:$ (A) $\frac{x}{2}-\frac{\sin 2x}{4}+c$ (B) $\frac{x}{2}+\frac{\sin 2x}{4}+c$ (C) $\frac{x}{2}-\frac{\sin 2x}{2}+c$ (D) $\frac{x}{2}+\frac{\sin 2x}{2}+c$
16	$\frac{d}{dx}(\tan x^2)=:$ (A) $\sec^2 x^2$ (B) $2x\sec^2 x^2$ (C) $-\sec^2 x^2$ (D) $-2x\sec x^2$
17	$\int e^x(\cos x-\sin x)dx=:$ (A) $e^x\sin x+c$ (B) $e^x\cos x+c$ (C) $e^x\tan x+c$ (D) $e^x\cot x+c$
18	If $f(x)=\sin x+\cos x$ then $f(x)$ is : (A) Even function (B) Odd function (C) Neither even nor odd (D) Constant function
19	$\int_0^3\frac{1}{9+x^2}dx=:$ (A) $\frac{\pi}{4}$ (B) $\frac{-\pi}{12}$ (C) $\frac{-\pi}{4}$ (D) $\frac{\pi}{12}$
20	$\frac{d}{dx}(f(x)\sin x)=:$ (A) $f(x)\cos x+f'(x)\sin x$ (B) $f'(x)\sin x-f(x)\cos x$ (C) $f'(x)\cos x$ (D) $f'(x)\cos x+f(x)\sin x$

Roll No _____ Lahore Board-2023 _____ (To be filled in by the candidate)

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MATHEMATICS 223-1st Annual-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Find the domain and range of $f(x)=\sqrt{x^2-4}$

(ii) Show that $x=a\sec\theta$, $y=b\tan\theta$ represents the equation of hyperbola.

(iii) If $f(x)=-2x+8$, find $f^{-1}(x)$ and $f^{-1}(-1)$

(iv) Differentiate $(3-x)(x-5)$ w.r.t 'x'

(v) Find derivative of $\sqrt{\frac{1+x}{1-x}}$

(vi) If $y=x^4+2x^2+2$, prove $\frac{dy}{dx}=4x\sqrt{y-1}$

(vii) Find the derivative of $(x^3+1)^9$ w.r.t. 'x'

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

(ix) Differentiate w.r.t. variable involved of $\tan^3\theta\sec^2\theta$

(x) Find $\frac{dy}{dx}$ if $y=a^x$

(xi) Define feasible region.

(xii) Graph the feasible region $2x-3y\le 6 \quad x\ge 0\ ,\ y\ge 0$

3. Write short answers to any EIGHT (8) questions : **16**

(i) Using differentials to find $\frac{dy}{dx}$ if $xy-\ell nx=c$

(ii) Evaluate $\int\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)dx$

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

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

(v) Evaluate $\int_{-6}^{2}\sqrt{3-x}\,dx$

(vi) Find the area bounded by cos function from $x=-\frac{\pi}{2}$ to $x=\frac{\pi}{2}$

(vii) Solve the differential equation $\sec^2 x\tan y\,dx+\sec^2 y\tan x\,dy=0$

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

(ix) Find direction cosines of $\vec{v}=3\hat{i}-\hat{j}+2\hat{k}$

(x) Calculate the projection of $\vec{b}$ along $\vec{a}$ if $\vec{a}=\hat{i}-\hat{k}\ ;\ \vec{b}=\hat{j}+\hat{k}$

(xi) If $\vec{a}=2\hat{i}+\hat{j}-\hat{k}\ ;\ \vec{b}=\hat{i}-\hat{j}+\hat{k}$, find $\vec{b}\times\vec{a}$

(xii) Prove that the vectors $\hat{i}-2\hat{j}+3\hat{k}$, $-2\hat{i}+3\hat{j}-4\hat{k}$ and $\hat{i}-3\hat{j}+5\hat{k}$ are coplanar.

(Turn Over)

4. Write short answers to any NINE (9) questions : **18**

(i) Find the equation of the straight line whose slope is 2 and y-intercept is 5.

(ii) Using slopes, show that the triangle with its vertices A (6, 1) , B (2, 7) and C (– 6, – 7) is a right triangle.

(iii) Find an equation of the line through (– 4 , 7) and parallel to the line $2x-7y+4=0$

(iv) Find h such that A (– 1 , h), B (3 , 2) and C (7 , 3) are collinear.

(v) Write intercepts form of equation of straight line.

(vi) Check whether the following lines are concurrent or not

$3x-4y-3=0$

$5x+12y+1=0$

$32x+4y-17=0$

(vii) Find the slope and inclination of the line joining points (– 2 , 4) and (5, 11)

(viii) Find an equation of circle with centre at $(\sqrt{2}\ , -3\sqrt{3})$ and radius $2\sqrt{2}$

(ix) Define focus and directrix of the parabola.

(x) Find the centre and foci of the ellipse $x^2+4y^2=16$

(xi) Find equation of tangent to $y^2=4ax$ at (x_1, y_1)

(xii) Show that the equation $5x^2+5y^2+24x+36y+10=0$ represents a circle. Find its centre.

(xiii) Find an equation of the ellipse with given data : Foci (0 , – 1) and (0 , – 5) and major axis of length 6.

SECTION – II

Note : Attempt any THREE questions.

5. (a) If θ is measured in radians then prove that $\lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1$ 5

(b) Find $\frac{dy}{dx}$ if $y=(1+2\sqrt{x})^3 . x^{\frac{3}{2}}$ 5

6. (a) Evaluate $\int \ell n(x+\sqrt{x^2+1})\,dx$ 5

(b) Find equations of two parallel lines perpendicular to $2x-y+3=0$ such that the product of the x-intercept and y-intercept of each is 3. 5

7. (a) Solve the differential equation $2e^x \tan y\,dx+(1-e^x)\sec^2 y\,dy=0$ 5

(b) Maximize $f(x,y)=x+3y$ subject to constraints

$2x+5y\le 30$, $5x+4y\le 20$, $x \ge 0$, $y \ge 0$ 5

8. (a) If $y=e^x \sin x$, show that $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=0$ 5

(b) Find equations of tangents to the circle $x^2+y^2=2$ perpendicular to the line $3x+2y=6$ 5

9. (a) Show that the equation $9x^2-18x+4y^2+8y-23=0$ represents an ellipse. Find its elements and sketch its graph. 5

(b) Prove that in any triangle ABC $c=a\cos B+b\cos A$ 5

Roll No _____ Lahore Board-2022 _____ (To be filled in by the candidate)

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MATHEMATICS 222-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – I Maximum Marks : 20

PAPER CODE = 8193

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	(0 , 0) is the solution of inequality : (A) $3x-7y<3$ (B) $x+y>2$ (C) $x-y>1$ (D) $3x+5y>7$
2	The slope of a line with inclination 90° is : (A) 0 (B) -1 (C) Undefined (D) 1
3	If $\underline{a}$ and $\underline{b}$ are parallel vectors then $\underline{a} \times \underline{b}$ = : (A) $\underline{0}$ (B) -1 (C) 1 (D) 2
4	Two lines $a_1x+b_1y+c_1=0$, $a_2x+b_2y+c_2=0$ are parallel if : (A) $\frac{a_1}{a_2}=\frac{b_1}{b_2}$ (B) $\frac{a_1}{a_2}=-\frac{b_1}{b_2}$ (C) $\frac{b_1}{c_1}=\frac{b_2}{c_2}$ (D) $\frac{a_1}{c_1}=\frac{a_2}{c_2}$
5	The value of $3\,\underline{j}.\underline{k}\times\underline{i}$ is : (A) -1 (B) -3 (C) 3 (D) 0
6	If a straight line is parallel to x-axis, then its slope is : (A) Undefined (B) -1 (C) 1 (D) 0
7	The centre of the circle $5x^2+5y^2+24x+36y+10=0$ is : (A) $\left(\frac{12}{5},\frac{18}{5}\right)$ (B) $\left(-\frac{12}{5},-\frac{18}{5}\right)$ (C) $\left(\frac{12}{5},-\frac{18}{5}\right)$ (D) $\left(-\frac{12}{5},\frac{18}{5}\right)$
8	The length of the latus rectum of the parabola $y^2=8x$ is : (A) 2 (B) 8 (C) 4 (D) $2\sqrt{8}$
9	The point of intersection of angle bisectors of a triangle is called : (A) Orthocentre (B) Centroid (C) In-centre (D) Circumcentre

(Turn Over)

10	The coordinates of the vertices of hyperbola $\frac{y^2}{16}-\frac{x^2}{49}=1$ are : (A) $(0,\pm 7)$ (B) $(\pm 4,0)$ (C) $(0,\pm 4)$ (D) $(\pm 7,0)$
11	$\frac{d}{dx}(\sin 2x+\cos 2x)=:$ (A) $(\cos 2x-\sin 2x)$ (B) $(\cos 2x+\sin 2x)$ (C) $(2\cos 2x+2\sin 2x)$ (D) $2(\cos 2x-\sin 2x)$
12	$\lim_{h\to 0}(1+2h)^{\frac{1}{h}}=:$ (A) e^2 (B) e (C) $\frac{1}{e}$ (D) $\frac{1}{e^2}$
13	$\int e^{\sin x}\cos x\,dx=:$ (A) $e^{\cos x}+c$ (B) $\ell n\lvert\sin x\rvert+c$ (C) $\ell n\lvert\cos x\rvert+c$ (D) $e^{\sin x}+c$
14	$\frac{d}{dx}(\cot^{-1}x)=:$ (A) $\frac{1}{1+x^2}$ (B) $\frac{1}{1-x^2}$ (C) $-\frac{1}{1+x^2}$ (D) $-\frac{1}{1-x^2}$
15	$\int e^x(\cos x+\sin x)\,dx=:$ (A) $e^{-x}\sin x+c$ (B) $e^x\sin x+c$ (C) $-e^x\sin x+c$ (D) $e^{-x}\cos x+c$
16	If $y=e^{-ax}$ then $\frac{dy}{dx}=:$ (A) ae^{-ax} (B) e^{-ax} (C) a^2e^{-ax} (D) $-ae^{-ax}$
17	$\int\frac{1}{1+x^2}dx=:$ (A) $\tan^{-1}x+c$ (B) $-\tan^{-1}x+c$ (C) $\sin^{-1}x+c$ (D) $\cos^{-1}x+c$
18	The range of $f(x)=\sqrt{x^2-9}$ is : (A) $(-\infty,0]$ (B) $[0,+\infty)$ (C) $(0,+\infty)$ (D) $(-\infty,\infty)$
19	$\int\sin x\cos x\,dx=:$ (A) $\ell n\lvert\sin x\rvert+c$ (B) $\frac{\cos^2 x}{2}+c$ (C) $\frac{\sin^2 x}{2}+c$ (D) $\frac{\sin^2 x\cos^2 x}{2}+c$
20	$\frac{d}{dx}\left(\frac{1}{\operatorname{cosec} x}\right)=:$ (A) $\frac{1}{\sec x}$ (B) $\operatorname{cosec}^2 x$ (C) $\cot x$ (D) $\frac{1}{\operatorname{cosec}^2 x}$

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PAPER – II (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(i) Find domain and range of $f(x)=\sqrt{x+1}$

(ii) Find $fof(x)$ if $f(x)=\sqrt{x+1}$

(iii) Obtain $f^{-1}(x)$ from $f(x)=3x^3+7$

(iv) Evaluate $\lim\limits_{\theta\to 0}\dfrac{1-\cos\theta}{\theta}$

(v) Express $\lim\limits_{x\to+\infty}\left(\dfrac{x}{1+x}\right)^x$ in terms of "e"

(vi) If $y=\dfrac{x^2+1}{x^2-3}$, then find $\dfrac{dy}{dx}$

(vii) Prove that derivative of $\tan^{-1}x$ w.r.t. "x" is $\dfrac{1}{1+x^2}$

(viii) Differentiate $\dfrac{1}{a}\sin^{-1}(\dfrac{a}{x})$ w.r.t. "x"

(ix) Find $\dfrac{dy}{dx}$ if $y=x^2\ell n\sqrt{x}$

(x) If $y=e^{-x}(x^3+2x^2+1)$, then find $\dfrac{dy}{dx}$

(xi) Apply the Maclaurin's series expansion to prove that $e^x=1+\dfrac{x}{1!}+\dfrac{x^2}{2!}+\dfrac{x^3}{3!}+----$

(xii) Determine the interval in which $f(x)=\sin x$, $x\in(-\pi,\pi)$ is decreasing.

3. Write short answers to any EIGHT (8) questions : 16

(i) If $x^2+2y^2=16$, find $\dfrac{dy}{dx}$ by using differentials.

(ii) Evaluate $\int\dfrac{x}{x+2}dx$

(iii) Evaluate indefinite integral $\int\dfrac{\sec^2 x}{\sqrt{\tan x}}dx$

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

(v) Evaluate the definite integral $\int_{-1}^{1}(x^{1/3}+1)dx$

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

(vii) Evaluate $\int e^{-x}(\cos x-\sin x)dx$

(viii) Solve $x\,dy+y(x-1)dx=0$

(ix) Show that the points A (3 , 1) , B (– 2 , – 3) and C (2 , 2) are vertices of an isosceles triangle

(Turn Over)

3. (x) Find an equation of line having x-intercept : -9 and slope : -4

(xi) Show that the lines $4x-3y-8=0$, $3x-4y-6=0$ and $x-y-2=0$ are concurrent.

(xii) What is homogeneous equation?

4. Write short answers to any NINE (9) questions : **18**

(i) Graph the solution set of $2x+1\geq 0$

(ii) Define problem constraint.

(iii) Find an equation of circle with centre $(\sqrt{2}, -3\sqrt{3})$ and radius $2\sqrt{2}$

(iv) Find slope of tangent to $x^2+y^2=5$ at $(4, 3)$

(v) Check the position of the point $(5, 6)$ with respect to the circle $x^2+y^2=81$

(vi) Find focus and vertex of $y^2=8x$

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

(viii) Find equation of hyperbola with centre $(0, 0)$, focus $(6, 0)$, vertex $(4, 0)$

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

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

(xi) Find the cosine of the angle θ between $\underline{u}$ and $\underline{v}$; $\underline{u}=\underline{i}-3\underline{j}+4\underline{k}$; $\underline{v}=4\underline{i}-\underline{j}+3\underline{k}$

(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) A force $\overrightarrow{F}=7\underline{i}+4\underline{j}-3\underline{k}$ is applied at P $(1, -2, 3)$. Find its moment about the point Q $(2, 1, 1)$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Discuss the continuity of $f(x)$ at $x=1$ $f(x)=\begin{cases} 3x-1 & \text{if } x<1 \\ 4 & \text{if } x=1 \\ 4x & \text{if } x>1 \end{cases}$ 5

(b) Show that $2^{x+h}=2^x\{1+(\ell n\,2)h+\frac{(\ell n\,2)^2h^2}{2!}+\frac{(\ell n\,2)^3h^3}{3!}+.....\}$ 5

6. (a) Evaluate $\int\sqrt{4-5x^2}\,dx$ 5

(b) Find the equation of perpendicular bisector of segment joining the points A $(3, 5)$ and B $(9, 8)$ 5

7. (a) Evaluate the integral $\int_0^{\pi/4}\frac{\cos\theta+\sin\theta}{2\cos^2\theta}\,d\theta$ 5

(b) Maximize $f(x,y)=x+3y$ subject to the constraints
$2x+5y\leq 30$; $5x+4y\leq 20$, $x\geq 0$, $y\geq 0$ 5

8. (a) Find the interior angles whose vertices are A $(-2, 11)$, B $(-6, -3)$, C $(4, -9)$ 5

(b) Find an equation of the circle passing through the points A $(4, 5)$, B $(-4, -3)$, C $(8, -3)$ 5

9. (a) Prove angle in a semi circle is right angle. 5

(b) Find an equation of the tangent to the parabola $y^2=-6x$ which is parallel to the line $2x+y+1=0$. Also find point of tangency. 5

Roll No _____ Lahore Board-2022 _____ (To be filled in by the candidate)

(Academic Sessions 2018 – 2020 to 2020 – 2022)

MATHEMATICS 222-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – II Maximum Marks : 20

PAPER CODE = 8192

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If the degree of a polynomial function is 1, then it is called : (A) Identity function (B) Linear function (C) Constant function (D) Trigonometric function
2	$\lim_{x\to 1}\frac{x^2-1}{x^2-x} =:$ (A) 2 (B) $\frac{1}{2}$ (C) 4 (D) 5
3	If $y=\frac{1}{x^2}$, then $\frac{dy}{dx}$ at $x=-1$ is : (A) 2 (B) 3 (C) $\frac{1}{3}$ (D) 4
4	$\frac{d}{dx}(\cot^{-1}x) =:$ (A) $\frac{1}{1+x^2}$ (B) $\frac{-1}{1+x^2}$ (C) $-\operatorname{cosec}^2 x$ (D) $\sec^2 x$
5	Two positive integer whose sum is 30 and their product will be maximum are : (A) 14 , 16 (B) 15 , 15 (C) 10 , 20 (D) 12 , 18
6	$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] =:$ (A) $\frac{f(x)g'(x)-f'(x)g(x)}{[g(x)]^2}$ (B) $\frac{f'(x)g(x)-f(x)g'(x)}{[f(x)]^2}$ (C) $\frac{g(x)f'(x)-f(x)g'(x)}{[g(x)]^2}$ (D) $\frac{g'(x)f(x)-g(x)f(x)}{[g(x)]^2}$
7	$\int \sec x\,dx =:$ (A) $\ell n(\sec x+\tan x)+c$ (B) $\ell n(\operatorname{cosec} x+\cot x)+c$ (C) $\ell n(\sin x+\cos x)+c$ (D) $\sec x+\tan x+c$
8	The solution of differential equation $\frac{dy}{dx}=-y$ is : (A) $y=xe^{-x}$ (B) $y=ce^{-x}$ (C) $y=e^x$ (D) $y=ce^x$
9	$\int_{-1}^{3} x^3dx =:$ (A) 20 (B) 40 (C) 30 (D) 60

(Turn Over)

10	$\int \sin 3x\,dx =$: (A) $-\frac{\cos 3x}{3}+c$ (B) $\frac{\cos 3x}{3}+c$ (C) $3\cos 3x+c$ (D) $-3\cos 3x+c$
11	An equation of the horizontal line through the point P (7 , −9) is : (A) $y=-9$ (B) $y=9$ (C) $x=7$ (D) $x=-7$
12	The perpendicular distance of line $3x+4y+10=0$ from the origin is : (A) 0 (B) 1 (C) 2 (D) 3
13	Slope of line perpendicular to line $3x-4y+5=0$ is : (A) $\frac{-3}{4}$ (B) $\frac{-4}{3}$ (C) $\frac{3}{4}$ (D) $\frac{4}{3}$
14	Point of intersection of lines $x-2y+1=0$ and $2x-y+2=0$ equals : (A) (1 , 0) (B) (0 , 1) (C) (−1 , 0) (D) (0 , −1)
15	(0 , 0) is the solution of inequality : (A) $7x+2y>3$ (B) $x-3y>0$ (C) $x+2y<6$ (D) $x-3y<0$
16	The condition for a line $y=mx+c$ to be the tangent to the circle $x^2+y^2=a^2$ is : (A) $c=\pm m\sqrt{(1+a^2)}$ (B) $c=\pm a\sqrt{1+m^2}$ (C) $c=\pm a\sqrt{1-m^2}$ (D) $c=\pm m\sqrt{1-a^2}$
17	In an ellipse, the foci lie on : (A) Major axis (B) Minor axis (C) Directrix (D) Z-axis
18	The radius of the circle $x^2+y^2+2gx+2fy+c=0$ is : (A) $\sqrt{g^2+f^2+c}$ (B) $\sqrt{g^2-f^2+c}$ (C) $g+f-c$ (D) $\sqrt{g^2+f^2-c}$
19	Length of the vector $2\hat{i}-\hat{j}+2\hat{k}$ is : (A) 6 (B) 4 (C) 3 (D) 5
20	Cosine of the angle between two non-zero vectors $\underline{a}$ and $\underline{b}$ is : (A) $\underline{a}\,.\,\underline{b}$ (B) $\frac{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}{\underline{a}\,.\,\underline{b}}$ (C) $\frac{\underline{a}\,.\,\underline{b}}{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}$ (D) $\frac{\underline{a}\times\underline{b}}{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}$

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2018 – 2020 to 2020 – 2022)

MATHEMATICS 222-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

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

(ii) Find $f^{-1}(x)$ for $f(x)=-2x+8$

(iii) Evaluate $\lim\limits_{x\to 0}\dfrac{\sin x^\circ}{x}$

(iv) Define rational function with example.

(v) Evaluate $\lim\limits_{x\to\infty}\left(\dfrac{x}{1+x}\right)^x$

(vi) Find $\dfrac{dy}{dx}$ from first principle if $y=\sqrt{x+2}$

(vii) Differentiate w.r.t. " x "; $y=\dfrac{x^2+1}{x^2-3}$

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

(ix) Find derivative w.r.t. x if $y=\cot^{-1}\left(\dfrac{x}{a}\right)$

(x) Find $\dfrac{dy}{dx}$ if $y=\log_{10}(ax^2+bx+c)$

(xi) Apply the Maclaurin Series to prove that $e^{2x}=1+2x+\dfrac{4x^2}{\lfloor 2}+\dfrac{8x^3}{\lfloor 3}+----$

(xii) Define increasing function with example.

3. Write short answers to any EIGHT (8) questions : **16**

(i) Find δy and dy in $y=\sqrt{x}$, when x changes from 4 to 4.41

(ii) Evaluate the integral $\int\dfrac{(\sqrt{\theta}-1)^2}{\sqrt{\theta}}d\theta$, $\theta>0$

(iii) Find $\int\dfrac{1}{x(\ell nx)}dx$

(iv) Evaluate the integral $\int\dfrac{x+2}{\sqrt{x+3}}dx$

(v) Using by part method to evaluate $\int x^2\,\ell nx\,dx$

(vi) Evaluate the definite integral $\int_0^{\frac{\pi}{3}}\cos^2\theta\sin\theta\,d\theta$

(vii) Find the area between the x-axis and the curve $y=\cos\dfrac{1}{2}x$ from $x=-\pi$ to π

(viii) Solve the differential equation $\sin y\cos ec\,x\dfrac{dy}{dx}=1$

(ix) Find h such that A $(-1, h)$, B $(3, 2)$, C $(7, 3)$ are collinear.

3. (x) Two points $P(-5,-3)$ and $O'(-2,-6)$ are given in XY-coordinate, find the coordinate of P in xy-coordinate system.

(xi) Find equation of the line having x-intercept -3 and y-intercept 4.

(xii) Find the distance from the point P $(6,-1)$ to the line $6x-4y+9=0$

4. Write short answers to any NINE (9) questions : **18**

(i) Define problem constraint.

(ii) Graph the solution set of the linear inequality $3y-4\leq 0$

(iii) Find slope of tangent to $x^2+y^2=5$ at $(4,3)$

(iv) Find α if $\underline{u}=\alpha\underline{i}+2\alpha\underline{j}-\underline{k}$ and $\underline{v}=\underline{i}+\alpha\underline{j}+3\underline{k}$ are perpendicular to each other.

(v) Find the direction cosine of the vector $\overrightarrow{PQ}$, where P (2, 1, 5) and Q (1, 3, 1)

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

(vii) Find cosine of the angle between $\underline{u}=[-3,5]$ and $\underline{v}=[6,-2]$

(viii) Write standard equation of the hyperbola.

(ix) Find the centre of the ellipse $9x^2+y^2=18$

(x) Find the equation of the circle with centre $(5,-2)$ and radius is 4.

(xi) Find the equation of the hyperbola with foci $(\pm 5,0)$ and vertex $(3,0)$

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

(xiii) Find focus and vertex of the parabola $x^2=5y$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Prove that $\lim\limits_{x\to 0}\dfrac{a^x-1}{x}=\log_e a$ 5

(b) If $x=\dfrac{1-t^2}{1+t^2}, y=\dfrac{2t}{1+t^2}$ prove that $y\dfrac{dy}{dx}+x=0$ 5

6. (a) Evaluate $\int \ell n(x+\sqrt{x^2+1})\,dx$ 5

(b) Prove that the linear equation $ax+by+c=0$ in two variables x and y represents a straight line. 5

7. (a) Find the area between the x-axis and the curve $y=\sqrt{2ax-x^2}$ when $a>0$ 5

(b) Graph the solution region of the system of linear inequalities and find the corner points of $2x-3y\leq 6$, $2x+3y\leq 12$, $x\geq 0$ 5

8. (a) Find a joint equation of the lines through the origin and perpendicular to the lines represented by $x^2-2xy\tan\alpha-y^2=0$ 5

(b) Find equations of the tangent lines to the circle $x^2+y^2+4x+2y=0$ drawn from P $(-1,2)$ 5

9. (a) Find the centre, foci, eccentricity, vertices and equations of directrices of $\dfrac{y^2}{16}-\dfrac{x^2}{9}=1$ 5

(b) Prove that $\sin(\alpha-\beta)=\sin\alpha\cos\beta-\cos\alpha\sin\beta$ 5

Roll No _____ Lahore Board-2021 _____ (To be filled in by the candidate)

(Academic Sessions 2017 – 2019 to 2019 – 2021)

MATHEMATICS 221-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – I Maximum Marks : 20

PAPER CODE = 8195

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	$\int (2x+3)^{\frac{1}{2}}\,dx =:$ (A) $\frac{(2x+3)^{\frac{3}{2}}}{2}+c$ (B) $\frac{1}{3}(2x+3)^{\frac{3}{2}}+c$ (C) $\frac{1}{2}(2x+3)^{\frac{1}{3}}+c$ (D) $\frac{1}{3}(2x+3)^{\frac{-1}{2}}+c$
2	Distance between A (3 , 1) and B (-2 , -4) is : (A) $\sqrt{17}$ (B) $5\sqrt{2}$ (C) $\sqrt{26}$ (D) $2\sqrt{5}$
3	If $f(x)=\frac{x}{x^2-4}$ then range of $f(x)$ is : (A) All real number (B) Rational number (C) All negative real number (D) Integer
4	Slope 'm' through $A(x_1,y_1)$ $B(x_2,y_2)$ is : (A) $\frac{x_2-x_1}{y_2-y_1}$ (B) $\frac{x_2+x_1}{y_2-y_1}$ (C) $\frac{y_2-y_1}{x_2-x_1}$ (D) $\frac{y_1-y_2}{x_1+x_2}$
5	$\lim_{x\to 0}\frac{\sin ax}{\sin bx} =:$ (A) $\frac{b}{a}$ (B) a (C) $\frac{a}{b}$ (D) $\frac{1}{b}$
6	$\int (a-2x)^{\frac{3}{2}}\,dx =:$ (A) $\frac{1}{5}(a-2x)^{\frac{3}{2}}+c$ (B) $\frac{1}{5}(a-2x)^{\frac{5}{2}}+c$ (C) $-\frac{1}{5}(a-2x)^{\frac{5}{2}}+c$ (D) $-\frac{3}{5}(a-2x)^{\frac{5}{2}}+c$
7	$\int \sec x\,dx =:$ (A) $\sec x+\tan x$ (B) $\sec^2 x$ (C) $\ln\lvert\sec x-\tan x\rvert$ (D) $\ln\lvert\sec x+\tan x\rvert+c$
8	If $f(x)=\frac{1}{x^m}$ then $f'(x) =:$ (A) $-xm^{-1}$ (B) $-mx^{-m-1}$ (C) $-mx^{-m+1}$ (D) $-m^{-1}x$

(Turn Over)

1-9	Midpoint of the line segment joining A (3, 1) and B (– 2 , – 4) is : (A) $\left(\frac{1}{2},-\frac{3}{2}\right)$ (B) $\left(\frac{5}{2},\frac{5}{2}\right)$ (C) $\left(\frac{1}{2},\frac{3}{2}\right)$ (D) $\left(\frac{1}{2},\frac{5}{2}\right)$
10	The derivative of $\frac{1}{1+x}$ is : (A) x (B) $1+x$ (C) $(1+x)^{-2}$ (D) $-1(1+x)^{-2}$
11	In circle $x^2+y^2+2gx+2fy+c=0$, the radius is : (A) $\sqrt{g^2+f^2+c}$ (B) g^2+f^2-c (C) $\sqrt{g^2+f^2-c}$ (D) g^2+f^2+c
12	$x = 5$ is the solution of inequality : (A) $2x-3>0$ (B) $2x+3<0$ (C) $x+4<0$ (D) $x+3<0$
13	In vectors $\vec{a}\times\vec{b}=$: (A) $\vec{b}\times\vec{a}$ (B) $-\vec{b}\times\vec{a}$ (C) $+\vec{b}$ (D) $-\vec{a}\times\vec{b}$
14	In equation of circle $x^2+y^2=r^2$ the centre of circle is : (A) (x , y) (B) (0 , 0) (C) (1 , 0) (D) (0 , r)
15	Magnitude of vector $\vec{u}=2i-7j$ is : (A) $\sqrt{53}$ (B) $\sqrt{55}$ (C) $\sqrt{48}$ (D) $\sqrt{52}$
16	$\frac{d}{dx}(\cos^{-1}x)=$: (A) $\frac{1}{\sqrt{1-x^2}}$ (B) $\frac{-1}{\sqrt{1-x^2}}$ (C) $\frac{1}{\sqrt{1+x^2}}$ (D) $\frac{1}{1+x^2}$
17	$1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+----$ is Maclaurin series for : (A) e^x (B) $\sqrt{1+x}$ (C) $\cos x$ (D) $\sin x$
18	The vector $\overrightarrow{PQ}$ through P (0 , 5) and Q (– 1 , – 6) is : (A) [– 1 , 11] (B) [– 1 , – 11] (C) [0 , 11] (D) [1 , 1]
19	$\frac{d}{dx}\tan^{-1}x=$: (A) $\frac{1}{1-x^2}$ (B) $\frac{1}{\sqrt{1-x^2}}$ (C) $\frac{1}{\sqrt{1+x^2}}$ (D) $\frac{1}{1+x^2}$
20	The focus of parabola $y^2=4ax$ is : (A) (0 , a) (B) (– a , 0) (C) (a , 0) (D) (0 , – a)

Roll No _____ Lahore Board-2021 _____ (To be filled in by the candidate)

(Academic Sessions 2017 – 2019 to 2019 – 2021)

MATHEMATICS 221-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Find the domain and range of the function g defined by : $g(x)=\sqrt{x^2-4}$

(ii) The real valued functions f and g are given. Find fog (x), if

$f(x)=3x^4-2x^2$ and $g(x)=\frac{2}{\sqrt{x}}$, $x\neq 0$

(iii) Evaluate $\lim\limits_{\theta\to 0}\frac{1-\cos\theta}{\theta}$

(iv) Evaluate $\lim\limits_{x\to 1}\frac{x^3-3x^2+2x-1}{x^3-x}$

(v) Find $\frac{dy}{dx}$ if $x^2-4xy-5y=0$

(vi) Differentiate w.r.t. 'x' $\cot^{-1}(\frac{x}{a})$

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

(viii) Find y_2 if $x^3-y^3=a^3$

(ix) Prove that $\frac{d}{dx}(\operatorname{cosec}^{-1}x)=\frac{-1}{|x|\sqrt{x^2-1}}$

(x) Differentiate $\frac{2x-1}{\sqrt{x^2+1}}$

(xi) Find the interval in which function is increasing or decreasing :

$f(x)=\cos x \qquad x\in\left(\frac{-\pi}{2},\frac{\pi}{2}\right)$

(xii) Find y_4 if $y=\sin 3x$

3. Write short answers to any EIGHT (8) questions : **16**

(i) Use differentials to approximate the value of $\sqrt[4]{17}$

(ii) Solve $\int\frac{dx}{\sqrt{x+1}-\sqrt{x}}$

(iii) Evaluate $\int\frac{\cot\sqrt{x}}{\sqrt{x}}dx$

(iv) Solve $\int\frac{\sec^2 x}{\sqrt{\tan x}}dx$

(v) Solve $\int e^{2x}[-\sin x+2\cos x]dx$

(vi) Evaluate $\int_0^{\frac{\pi}{4}}\sec x(\sec x+\tan x)\,dx$

(vii) Solve the differential equation $\frac{1}{x}\frac{dy}{dx}=\frac{1}{2}(1+y^2)$

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

(ix) The points A (– 5 , – 2) , B (5 , – 4) are ends of a diameter of a circle. Find centre and radius of it.

(Turn Over)

3. (x) Transform the equation $5x-12y+39=0$ into normal form.

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

(xii) Find the lines represented by $2x^2+3xy-5y^2=0$

4. Write short answers to any NINE (9) questions : **18**

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

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

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

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

(v) Find the coordinates of the points of intersection of the line $x+2y=6$ with the circle $x^2+y^2-2x-2y-39=0$

(vi) Find the vertex of the parabola $x^2=4(y-1)$

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

(viii) Find a unit vector in the direction of $\underline{v}=-\frac{\sqrt{3}}{2}\underline{i}-\frac{1}{2}\underline{j}$

(ix) Find a vector whose magnitude is 4 and is parallel to $2\underline{i}-3\underline{j}+6\underline{k}$

(x) If $\underline{v}$ is a vector for which $\underline{v}.\underline{i}=0$, $\underline{v}.\underline{j}=0$ and $\underline{v}.\underline{k}=0$, find $\underline{v}$

(xi) If $\underline{a}+\underline{b}+\underline{c}=0$, then prove that $\underline{a}\times\underline{b}=\underline{b}\times\underline{c}=\underline{c}\times\underline{a}$

(xii) Find the volume of parallelepiped for which the vectors $\underline{u}=\underline{i}-4\underline{j}-\underline{k}$, $\underline{v}=\underline{i}-\underline{j}-2\underline{k}$ and $\underline{w}=2\underline{i}-3\underline{j}+\underline{k}$ are three edges.

(xiii) Give a force $\underline{F}=2\underline{i}+\underline{j}-3\underline{k}$ acting at a point A (1 , – 2 , 1). Find the moment of $\underline{F}$ about the point B (2 , 0 , – 2)

SECTION – II

Note : Attempt any THREE questions.

5. (a) Discuss the continuity of $f(x)$ at $x=c$ $f(x)=\begin{cases}3x-1 & \text{if } x<1\\ 4 & \text{if } x=1\\ 2x & \text{if } x>1\end{cases}$, $c=1$ 5

(b) Show that $\frac{dy}{dx}=\frac{y}{x}$ if $\frac{y}{x}=\tan^{-1}\frac{x}{y}$ 5

6. (a) Evaluate $\int x\sin^{-1}x\,dx$ 5

(b) Find the interior angles of the triangle with vertices A (6, 1) , B (2, 7) , C (– 6, – 7) 5

7. (a) Evaluate $\int_0^{\frac{\pi}{4}}\frac{1}{1+\sin x}dx$ 5

(b) Minimize $z=2x+y$ subject to constraints 5

$x+y \ge 3$, $7x+5y \le 35$; $x \ge 0$, $y \ge 0$

8. (a) Prove that in any triangle ABC $b^2=c^2+a^2-2ca\cos B$. 5

(b) Find the length of the chord cut off from the line $2x+3y=13$ by the circle $x^2+y^2=26$ 5

9. (a) If $y=(\cos^{-1}x)^2$ then prove that $(1-x^2)y_2-xy_1-2=0$ 5

(b) Find the points of intersection of the given conic $\frac{x^2}{18}+\frac{y^2}{8}=1$ *and* $\frac{x^2}{3}-\frac{y^2}{3}=1$ 5

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2017 – 2019 to 2019 – 2021)

MATHEMATICS 221-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – II Maximum Marks : 20

PAPER CODE = 8198

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	The derivative of $\frac{1}{1+x}$ is :			
	(A) x	(B) $1+x$	(C) $(1+x)^{-2}$	(D) $-1(1+x)^{-2}$
2	$\int \cos x\,dx =$:			
	(A) $1-\sin^2 x$	(B) $\sqrt{1-\sin^2 x}$	(C) $\sin x$	(D) $-\sin x$
3	$\int_1^2 (x^2+1)\,dx =$:			
	(A) $\frac{10}{3}$	(B) $\frac{3}{10}$	(C) π	(D) $\frac{\pi}{2}$
4	If $y=\cot^{-1}x$, then $\frac{dy}{dx} =$:			
	(A) $\frac{1}{1-x^2}$	(B) $\frac{-1}{1+x^2}$	(C) $\frac{1}{x^2-1}$	(D) $\frac{1}{x^2+1}$
5	The derivative of $\ell n(\tanh x)$ is :			
	(A) $\frac{1}{\tanh x}$	(B) $\frac{\sec h^2 x}{\tanh x}$	(C) $\sec h^2 x$	(D) $\sec hx$
6	$x=at^2$ and $y=2at$ are parametric equations of :			
	(A) Parabola	(B) Ellipse	(C) Circle	(D) Hyperbola
7	If $y^2+x^2=a^2$, then $\frac{dy}{dx} =$:			
	(A) $-\frac{x}{y}$	(B) $-\frac{y}{x}$	(C) $\frac{x}{y}$	(D) $\frac{y}{x}$
8	The order of $\frac{dy}{dx}=\frac{4}{3}x^3+x-3$ is :			
	(A) 1	(B) $\frac{3}{4}$	(C) $\frac{4}{3}$	(D) -3
9	$\int_a^x 3x^2dx =$:			
	(A) x^3+a^3	(B) x^3-a^3	(C) $3x^3$	(D) x^3

(Turn Over)

1-10	If θ is measured in radian then $\lim_{\theta \to 0} \frac{\sin 7\theta}{\theta} =$: (A) 7 (B) $\frac{1}{7}$ (C) $\frac{7\pi}{22}$ (D) $\frac{7\pi}{12}$
11	The measure of the angle between the lines $ax^2 + 2hxy + by^2 = 0$ is given by $\tan\theta =$: (A) $\frac{\sqrt{h^2 - ab}}{a-b}$ (B) $\frac{2\sqrt{h^2 - ab}}{a+b}$ (C) $\frac{h^2 - ab}{a+b}$ (D) ∞
12	If $\vec{a} = \hat{i} - \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$ then $\vec{a} \cdot \vec{b} =$: (A) 0 (B) 1 (C) -1 (D) $\sqrt{2}$
13	The feasible solution which maximize or minimize the objective function is called : (A) Boundary (B) Half plane (C) Optimal solution (D) Initial values
14	The value of c for $\frac{y^2}{16} - \frac{x^2}{49} = 1$ is : (A) 16 (B) 49 (C) 65 (D) $\sqrt{65}$
15	The equation of a straight line represented by $x\cos\alpha + y\sin\alpha = P$ is called : (A) Normal form (B) Angular form (C) Symmetric form (D) P – form
16	The unit vector in the direction of $\vec{v} = [3, -4]$: (A) $5[3, -4]$ (B) $\frac{1}{5}[3, -4]$ (C) $\hat{i}$ (D) $\hat{j}$
17	The points A $(-5, -2)$, B $(5, -4)$ are ends point of a diameter of the circle. The centre will be : (A) $(0, 3)$ (B) $(0, -3)$ (C) $(5, 2)$ (D) $(-5, 4)$
18	$xy = 0$ represents : (A) A pair of lines (B) Hyperbola (C) Parabola (D) Ellipse
19	The projection of $\vec{v}$ along $\vec{u}$ is : (A) $\frac{\vec{u} \cdot \vec{v}}{\lvert u \rvert}$ (B) $\frac{\vec{u} \cdot \vec{v}}{\lvert v \rvert}$ (C) $\frac{\vec{u} \cdot \vec{v}}{\lvert u \rvert \lvert v \rvert}$ (D) $\frac{\vec{u} \cdot \vec{v}}{\lvert u \rvert + \lvert v \rvert}$
20	An angle inscribed in a semi-circle is : (A) 0 (B) $\frac{\pi}{2}$ (C) π (D) 2π

Roll No _____ Lahore Board-2021 _____ (To be filled in by the candidate)

(Academic Sessions 2017 – 2019 to 2019 – 2021)

MATHEMATICS 221-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Express the area A of a circle as a function of its circumference C.

(ii) For the real-valued function $f(x)=\frac{2x+1}{2x-1}$, $x>1$. Find $f^{-1}(x)$

(iii) Evaluate $\lim_{x\to 3}\frac{x-3}{\sqrt{x}-\sqrt{3}}$

(iv) Find the domain and range of $g(x)=|x-3|$

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

(vi) Find $\frac{dy}{dx}$ if $xy+y^2=2$

(vii) Differentiate $\sin x$ *w.r.t.* $\cot x$

(viii) Find $\frac{dy}{dx}$ if $y=x^2\ell n\frac{1}{x}$

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

(x) If $y=\ell n(\tanh x)$, find $\frac{dy}{dx}$

(xi) Find $\frac{dy}{dx}$ if $y=(x^2+5)(x^3+7)$

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

3. Write short answers to any EIGHT (8) questions : **16**

(i) Use differential to find $\frac{dy}{dx}$ for $xy+x=4$

(ii) Evaluate the integral $\int\frac{3x+2}{\sqrt{x}}dx$

(iii) Evaluate $\int\frac{x+b}{(x^2+2bx+c)^{1/2}}dx$

(iv) Evaluate $\int e^x(\cos x+\sin x)\,dx$

(v) Evaluate $\int\frac{(a-b)x}{(x-a)(x-b)}dx$

(vi) Evaluate $\int_{-1}^{1}(x^{1/3}+1)\,dx$

(vii) Find the area above the x-axis and under the curve $y=5-x^2$ from $x=-1$ to $x=2$

(viii) Solve differential equation $ydx+xdy=0$

(ix) Find mid-point of line segment joining A (– 8 , 3) ; B (2 , – 1)

(x) Two points ' P ' and ' O' ' given in xy-coordinate system. Find XY-coordinates of ' P ' referred to translated axis $O'X$ and $O'Y$ for P (– 2 , 6) ; O' (– 3 , 2)

(xi) Find equation of the line joining (– 5 , – 3) and (9 , – 1)

(xii) Find equation of vertical line through (– 5 , 3)

 (Turn Over)

4. Write short answers to any NINE (9) questions : 18

(i) Graph the solution set of given linear inequality in xy-plane : $2x+y\le 6$

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

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

(iv) Write an equation of parabola with given elements : Focus $(-3, 1)$; directrix $x-2y-3=0$

(v) Find an equation of directrices of given hyperbola $\frac{x^2}{4}-\frac{y^2}{9}=1$

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

(vii) Find the unit vector in the same direction as the vector $\underline{v}=[3,-4]$

(viii) Find the constant a so that the vectors $\underline{v}=\underline{i}-3\underline{j}+4\underline{k}$ and $\underline{w}=a\underline{i}+9\underline{j}-12\underline{k}$ are parallel.

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

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

(xi) Compute $\underline{b}\times\underline{a}$. Check your answer by showing that $\underline{b}$ is perpendicular to $\underline{b}\times\underline{a}$: $a=2\underline{i}+\underline{j}-\underline{k}$; $\underline{b}=\underline{i}-\underline{j}+\underline{k}$.

(xii) If $\underline{a}+\underline{b}+\underline{c}=0$, then prove that $\underline{a}\times\underline{b}=\underline{b}\times\underline{c}=\underline{c}\times\underline{a}$

(xiii) Give a force $\underline{F}=2\underline{i}+\underline{j}-3\underline{k}$ acting at a point A $(1, -2, 1)$. Find the moment of $\underline{F}$ about the point B $(2, 0, -2)$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Find value of k, if the function $f(x)=\begin{cases}\frac{\sqrt{2x+5}-\sqrt{x+7}}{x-2}, & x\neq 2\\ k, & x=2\end{cases}$ is continuous at $x=2$ 5

(b) If $y=\tan(p\tan^{-1}x)$ then show that $(1+x^2)y_1-p(1+y^2)=0$ 5

6. (a) Evaluate $\int\frac{\sqrt{2}}{\sin x+\cos x}\,dx$ 5

(b) Find an equation of the line through the intersection of the lines $x-y-4=0$ and $7x+y+20=0$ and parallel to the line $6x+y-14=0$ 5

7. (a) Find the area bounded by the curve $y=x^3-4x$ and the x-axis. 5

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

8. (a) Write equation of the circle passing through the points A $(-7, 7)$, B $(5, -1)$ and C $(10, 0)$ 5

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

9. (a) Show that $y=\frac{\ell nx}{x}$ has maximum value at $x=e$ 5

(b) Find focus, vertex and directrix of parabola $x^2-4x-8y+4=0$ 5

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2015 – 2017 to 2017 – 2019)

MATHEMATICS 219-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – I Maximum Marks : 20

PAPER CODE = 8195

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If $y = e^{2x}$ then $y_2 =$:			
	(A) e^{2x}	(B) $2e^{2x}$	(C) $4e^{2x}$	(D) $16e^{2x}$
2	$\int a^x dx =$:			
	(A) $\frac{\ell na}{a^x} + c$	(B) $\frac{a^x}{\ell na} + c$	(C) $\frac{1}{a^x \ell na} + c$	(D) $a^x \ell na + c$
3	$f(x) = ax + b, a \neq 0$ is :			
	(A) Trigonometric function	(B) Linear function		
	(C) Cubic function	(D) Quadratic function		
4	$\int_0^{\frac{\pi}{2}} \cos x \, dx =$:			
	(A) $\frac{\pi}{2}$	(B) 0	(C) -1	(D) 1
5	$\lim_{n \to +\infty} \left(1 + \frac{1}{n}\right)^{\frac{n}{2}} =$:			
	(A) e^{-1}	(B) e^2	(C) $e^{\frac{1}{2}}$	(D) e^3
6	Differential of y is denoted by :			
	(A) $\frac{dy}{dx}$	(B) dy	(C) dx	(D) dy
7	If $f(x) = \cos x$ then $f'(\pi) =$:			
	(A) 1	(B) 0	(C) -1	(D) 2
8	The value of $\frac{dy}{dx} = \frac{-2}{x^3}$ at $x = -1$ is :			
	(A) 4	(B) 5	(C) -2	(D) 2
9	Order of the differential equation $\frac{x d^2y}{dx^2} + \frac{dy}{dx} - 2x = 0$ is :			
	(A) 1	(B) 2	(C) 3	(D) 4

(Turn Over)

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2015 – 2017 to 2017 – 2019)

MATHEMATICS 219-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(i) Define explicit function.

(ii) Determine whether the function $f(x)=x\sqrt{x^2+5}$ is even or odd.

(iii) Prove that $\lim_{x\to 0}\frac{\sqrt{x+a}-\sqrt{a}}{x}=\frac{1}{2\sqrt{a}}$

(iv) If $y=\sqrt{x}-\frac{1}{\sqrt{x}}$, find $\frac{dy}{dx}$

(v) Find $\frac{dy}{dx}$ if $x^2+y^2=4$

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

(vii) Differentiate $\sin^{-1}\sqrt{1-x^2}$ *w.r.t.* 'x'

(viii) Differentiate $y=a^{\sqrt{x}}$

(ix) Prove that $\frac{d}{dx}(\cosh x)=\sinh x$

(x) Find $\frac{dy}{dx}$ *if* $y=(x+1)^x$

(xi) Define decreasing function. Give an example.

(xii) Determine $f(x)=\cos x$ is increasing or decreasing in the interval $(\frac{\pi}{2},\pi)$

3. Write short answers to any EIGHT (8) questions : 16

(i) What is differential coefficient?

(ii) Evaluate $\int\frac{e^{2x}+e^x}{e^x}dx$

(iii) Integrate by substitution $\int\frac{-2x}{\sqrt{4-x^2}}dx$

(iv) Find the integral $\int\frac{\cos x}{\sin x\,\ell n(\sin x)}dx$

(v) Evaluate integral by parts $\int x.\sin x dx$

(vi) Find indefinite integral $\int a^{ax}\left[a\sec^{-1}x+\frac{1}{x\sqrt{x^2-1}}\right]dx$

(vii) Evaluate $\int\frac{5x+8}{(x+3)(2x-1)}dx$ using partial fraction.

(viii) Define definite integral.

(ix) Calculate the integral $\int_0^{\frac{\pi}{4}}\sec x(\sec x+\tan x)dx$

(x) If $\int_{-2}^{1}f(x)dx=5$, $\int_{-2}^{1}g(x)dx=4$, then evaluate $\int_{-2}^{1}[3f(x)-2g(x)]dx$

(Turn Over)

3. (xi) If a non-vertical line divides a plane into two, then write the name that two planes?

(xii) Graph the inequality $x+3y>6$

4. Write short answers to any NINE (9) questions : **18**

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

(ii) Show that the triangle with vertices A $(1, 1)$, B $(4, 5)$ and C $(12, -5)$ is right triangle.

(iii) Find an equation of the line through $(-4, -6)$ and perpendicular to the line having slope $\frac{-3}{2}$.

(iv) Define trapezium.

(v) Define parabola.

(vi) Check the position of the point (5, 6) with respect to the circle $2x^2+2y^2+12x-8y+1=0$

(vii) Find eccentricity of the ellipse $x^2+4y^2=16$

(viii) Find an equation of hyperbola if its foci $(0, \pm 9)$ and directrices $y=\pm 4$

(ix) If $\overrightarrow{AB}=\overrightarrow{CD}$, find coordinates of point A. If B, C, D are $(1, 2), (-2, 5), (4, 11)$

(x) Write direction cosine of $\overrightarrow{PQ}$, if P $(2, 1, 5)$ Q $(1, 3, 1)$.

(xi) Show that vectors $3\underline{i}-2\underline{j}+\underline{k}$, $\underline{i}-3\underline{j}+5\underline{k}$ and $2\underline{i}+\underline{j}-4\underline{k}$ form a right triangle.

(xii) Find unit vector perpendicular to the plane of $\underline{a}$ and $\underline{b}$ if $\underline{a}=-\underline{i}-\underline{j}-\underline{k}$, $\underline{b}=2\underline{i}-3\underline{j}+4\underline{k}$.

(xiii) A force $\underline{F}=7\underline{i}+4\underline{j}-3\underline{k}$ is applied at P $(1, -2, 3)$. Find its moment about the point Q $(2, 1, 1)$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Find the values of 'm' and 'n' so that $f(x)=\begin{cases} mx & \text{if } x<3 \\ n & \text{if } x=3 \\ -2x+9 & \text{if } x>3 \end{cases}$ is continuous at $x=3$ 5

(b) If $y=e^x.\sin x$, then prove that $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=0$ 5

6. (a) Evaluate $\int \frac{\sqrt{2}}{\sin x+\cos x}dx$ 5

(b) Find an equation of the perpendicular bisector of the segment joining the points A $(3, 5)$ and B $(9, 8)$ 5

7. (a) Solve the differential equation $\left(x^2-yx^2\right)\frac{dy}{dx}+y^2+xy^2=0$ 5

(b) Graph the solution region of the following system of linear inequalities and find the corner points : $x+y\le 5$, $-2x+y\le 2$, $y\ge 0$ 5

8. (a) Find the lines represented by each of the following and also find measure of the angle between them $x^2+2xy\sec\alpha+y^2=0$ 5

(b) Find the coordinates of the points of intersection of the line $2x+y+5=0$ and the circle $x^2+y^2+2x-9=0$. Also find the length of intercepted chord. 5

9. (a) Find equation of parabola with elements directrix : $x=-2$, focus $(2,2)$ 5

(b) Prove that $\sin(\alpha-\beta)=\sin\alpha.\cos\beta-\cos\alpha\sin\beta$ by method of vectors. 5

Roll No _____ Lahore Board-2019 _____ (To be filled in by the candidate)

(Academic Sessions 2015 – 2017 to 2017 – 2019)

MATHEMATICS 219-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – II Maximum Marks : 20

PAPER CODE = 8198

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	$\frac{d}{dx}(\sqrt{x}) =:$ (A) $\sqrt{x}$ (B) $\frac{1}{\sqrt{x}}$ (C) $\frac{1}{2x}$ (D) $\frac{1}{2\sqrt{x}}$
2	$\int \tan x dx =:$ (A) $\ell n\lvert\sec x\rvert + c$ (B) $\ell n\lvert\cos ecx\rvert + c$ (C) $\ell n\lvert\sin x\rvert + c$ (D) $\ell n\lvert\cot x\rvert + c$
3	$\int \frac{e^x}{e^x+3} dx =:$ (A) $\ell n(e^x+3)+c$ (B) $e^{2x}+c$ (C) e^0+c (D) $e^{2x}+3+c$
4	$\frac{d}{dx}(\cos x^2) =:$ (A) $2x\sin x^2$ (B) $-2x\sin x^2$ (C) $2\cos x$ (D) $-2\sin x$
5	If $y = \sin^{-1}\frac{x}{a}$, then $\sin y =:$ (A) $\cos y$ (B) $\cos x$ (C) $\frac{x}{a}$ (D) $\frac{y}{a}$
6	The function $y = 27 + x^2$ is a / an : (A) Constant function (B) Even function (C) Implicit function (D) Explicit function
7	A function $f(x)$ has relative maximum at $x = c$, if $f'(c) = 0$ and : (A) $f''(c) > 0$ (B) $f''(c) < 0$ (C) $f''(c) = 0$ (D) $f'(c) \neq 0$
8	$\int \sec^2 x dx =:$ (A) $\cot x + c$ (B) $\tan x + c$ (C) $2\sec x + c$ (D) $\frac{1}{\cos^2 x} + c$
9	$\int_{-\pi}^{\pi} \sin x\, dx =:$ (A) 2π (B) 0 (C) 1 (D) $\cos\pi$

(Turn Over)

1-10	If $f(x)=2x+1$, then $f^{-1}(x)=?$: (A) $2x-1$ (B) $1-2x$ (C) $x-\frac{1}{2}$ (D) $\frac{x-1}{2}$
11	y-intercept of the line $2x-y-4=0$ is : (A) 2 (B) -2 (C) 4 (D) -4
12	An angle in the semi circle is of measure : (A) 30° (B) 60° (C) 90° (D) 180°
13	The perpendicular distance of a line $5x+12y=7$ from origin is : (A) $\frac{1}{13}$ (B) $\frac{13}{7}$ (C) $\frac{7}{13}$ (D) -7
14	Equation of latus-rectum of parabola $y^2=4ax$ is : (A) $x=-a$ (B) $y=-a$ (C) $x=a$ (D) $y=a$
15	The mid point of line segment joining $A(-8,3), B(2,-1)$ is : (A) $(-6,2)$ (B) $(10,4)$ (C) $(-3,1)$ (D) $(-16,-3)$
16	The triple scalar product of vectors, calculates the volume of : (A) Triangle (B) Parallelogram (C) Tetrahedron (D) Parallelepiped
17	The equation of line $\frac{x}{b}+\frac{y}{a}=1$ is in : (A) Normal form (B) Intercept form (C) Point-slope form (D) Two-points form
18	The radius of circle $x^2+y^2=5$ is : (A) 25 (B) $\sqrt{5}$ (C) 5 (D) $(0,0)$
19	Non-zero vector $\underline{a}$ and $\underline{b}$ are parallel if $\underline{a}\times\underline{b}=$: (A) 0 (B) 1 (C) -1 (D) (a,b)
20	The solution of the inequality $x+2y<6$ is : (A) $(1,1)$ (B) $(1,3)$ (C) $(1,4)$ (D) $(1,5)$

4. **Write short answers to any NINE (9) questions :** 18

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

(ii) Find the slope and inclination of the line joining the points A $(-2, 4)$ and B $(5, 11)$

(iii) By means of slopes show that points A $(-1, -3)$, B $(1, 5)$ and C $(2, 9)$ are collinear.

(iv) Find equation of the line through $(-4, 7)$ and parallel to the line $2x - 7y + 4 = 0$

(v) Find equation of circle with centre at $(5, -2)$ and radius 4.

(vi) Find focus and vertex of the parabola $y^2 = -8(x-3)$

(vii) Find equation of tangent to the parabola $x^2 = 16y$ at the point whose abscissa is 8.

(viii) Find foci and vertices of the ellipse $25x^2 + 9y^2 = 225$

(ix) Find the angle between the vectors $\underline{u} = 2\underline{i} - \underline{j} + \underline{k}$ and $\underline{v} = -\underline{i} + \underline{j}$

(x) Find scalar α so that the vectors $2\underline{i} + \alpha\underline{j} + 5\underline{k}$ and $3\underline{i} + \underline{j} + \alpha\underline{k}$ are perpendicular.

(xi) If $\underline{v}$ is a vector for which $\underline{v}.\underline{i} = 0$, $\underline{v}.\underline{j} = 0$, $\underline{v}.\underline{k} = 0$ find $\underline{v}$

(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 the value of α so that $\alpha\underline{i} + \underline{j}$, $\underline{i} + \underline{j} + 3\underline{k}$ *and* $2\underline{i} + \underline{j} - 2\underline{k}$ are coplanar.

SECTION – II

Note : Attempt any THREE questions.

5. (a) If $f(x) = \begin{cases} 3x & \text{if } x \le -2 \\ x^2 - 1 & \text{if } -2 < x < 2 \\ 3 & \text{if } x \ge 2 \end{cases}$

discuss continuity at $x = 2$ and $x = -2$ 5

(b) If $y = e^x \sin x$, show that $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$ 5

6. (a) Integrate $\int \frac{12}{x^3 + 8}\,dx$ 5

(b) Find equations of two parallel lines, perpendicular to $2x - y + 3 = 0$ such that the product of the x- and y-intercepts of each is 3. 5

7. (a) Evaluate the definite integral $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \frac{\cos x}{\sin x(2 + \sin x)}\,dx$ 5

(b) Minimize $z = 2x + y$ subject to the constraints

$x + y \ge 3$, $7x + 5y \le 35$, $x \ge 0$, $y \ge 0$ 5

8. (a) Find equation of the line through the point $(2, -9)$ and intersection of the lines

$2x + 5y - 8 = 0$

$3x - 4y - 6 = 0$ 5

(b) Show that the circles $x^2 + y^2 + 2x - 2y - 7 = 0$ and $x^2 + y^2 - 6x + 4y + 9 = 0$ touch externally. 5

9. (a) Find an equation of the ellipse having foci $(\pm 5, 0)$ and passing through the point $\left(\frac{2}{3}, \sqrt{3}\right)$ 5

(b) A particle acted upon by constant forces $4\underline{i} + \underline{j} - 3\underline{k}$ and $3\underline{i} - \underline{j} - \underline{k}$ is displaced from A $(1, 2, 3)$ to B $(5, 4, 1)$. Find the work done. 5

Roll No : ---------- (To be filled in by the candidate)

(Academic Sessions 2014 – 2016 to 2016 – 2018)

MATHEMATICS 218-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – I Maximum Marks : 20

PAPER CODE = 8197

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If $y = \sqrt{1-x^2}$, $0 < x < 1$ *then* $\frac{dy}{dx} =$:				
	(A) $\sqrt{x^2-1}$	(B) $\frac{1}{\sqrt{1-x^2}}$	(C) $\frac{x}{\sqrt{1-x^2}}$	(D) $\frac{-x}{\sqrt{1-x^2}}$	
2	$\int 3^x dx =$:				
	(A) $3^x + c$	(B) $3^x \ell n 3 + c$	(C) $\frac{3^x}{\ell n 3} + c$	(D) $3 \ell n 3^x + c$	
3	$\int_0^{\frac{\pi}{2}} \cos x \, dx =$:				
	(A) 0	(B) 1	(C) 2	(D) 3	
4	If $f(x)$ has second derivative at "c" such that $f'(c) = 0$ *and* $f''(c) < 0$ then " c " is a point of :				
	(A) Maxima	(B) Minima	(C) Zero point	(D) Point of inflection	
5	If $y = e^{\sin x}$, then $\frac{dy}{dx} =$:				
	(A) $e^{\sin x}$	(B) $e^{\sin x} \cos x$	(C) $e^{\sin x} + \cos x$	(D) $-e^{\sin x} \cos x$	
6	$\cosh^2 x - \sinh^2 x =$:				
	(A) 1	(B) -1	(C) 0	(D) 2	
7	$\frac{d}{dx} \sin^{-1} x =$:				
	(A) $\frac{1}{\sqrt{1+x^2}}$	(B) $\cos^{-1} x$	(C) $\frac{1}{\sqrt{1-x^2}}$	(D) $\frac{1}{\sqrt{1-x}}$	
8	$\int \frac{1}{f(x)} \times f'(x) \, dx =$:				
	(A) $\ell nx + c$	(B) $\ell n[f'(x) + c]$	(C) $\frac{1}{f(x)} + c$	(D) $\ell n\lvert f(x)\rvert + c$	
9	The order of the differential equation $\frac{d^2y}{dx^2} - \frac{dy}{dx} + 2x = 0$ is :				
	(A) 2	(B) 1	(C) 0	(D) 3	

1-10	Let $f(x) = x^2 + \cos x$, *then* $f(x)$ *is* : (A) Odd function (B) Constant function (C) Even function (D) Neither even nor odd
11	The centroid of a triangle divides each median in ratio : (A) 2 : 1 (B) 1 : 2 (C) 2 : 3 (D) 1 : 1
12	The straight line $y = mx + c$ is tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ if : (A) $c^2 = a^2 m^2 - b^2$ (B) $c^2 = b^2 m^2 + a^2$ (C) $c^2 = b^2 m^2 - a^2$ (D) $c^2 = a^2 m^2 + b^2$
13	The perpendicular distance of line $3x + 4y - 10 = 0$ from the origin is : (A) 0 (B) 1 (C) $\frac{1}{2}$ (D) 2
14	Axis of the parabola $x^2 = 4ay$ is : (A) $y = 0$ (B) $x = 0$ (C) $x = y$ (D) $x = 1$
15	If α is the inclination of the line ℓ then $\frac{x - x_1}{\cos\alpha} = \frac{y - y_1}{\sin\alpha} = r$ (say) is called : (A) Point slope form (B) Normal form (C) Symmetric form (D) Intercept form
16	The direction cosines of y-axis are : (A) (0, 1, 0) (B) (1, 0, 0) (C) (0, 0, 1) (D) (0, 0, 0)
17	If α is the inclination of a line "ℓ" then it must be true that : (A) $0 \le \alpha < \frac{\pi}{2}$ (B) $\frac{\pi}{2} \le \alpha < \pi$ (C) $0 \le \alpha < \pi$ (D) $0 \le \alpha < 2\pi$
18	The equation $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle with centre : (A) $(-g, -f)$ (B) $(-f, +g)$ (C) (f, g) (D) (0, 0)
19	Length of the vector $2\underline{i} - \underline{j} - 2\underline{k}$ is : (A) 2 (B) 4 (C) 3 (D) 5
20	The feasible solution which maximizes or minimizes the objective function is called : (A) Exact solution (B) Optimal solution (C) Final solution (D) Objective solution

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2014 – 2016 to 2016 – 2018)

MATHEMATICS 218-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) State sandwitch theorem.

(ii) Express the area " A " of a circle as a function of its circumference " C ".

(iii) If $f(x) = \begin{cases} x+2 & , x \le -1 \\ c+2 & , x > -1 \end{cases}$, find " c " so that $\lim_{x \to -1} f(x)$ exists

(iv) Define differentiation.

(v) Differentiate $\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2$ *wrt* x

(vi) Find $\frac{dy}{dx}$ if $xy + y^2 = 0$

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

(viii) Prove that $\frac{d}{dx}(\cos^{-1} x) = \frac{-1}{\sqrt{1-x^2}}$, $x \in (-1, 1)$

(ix) Find $\frac{dy}{dx}$ if $y = x e^{\sin x}$

(x) Define power series.

(xi) Find extreme values for $f(x) = x^2 - x - 2$

(xii) Find $\frac{dy}{dx}$ if $y = \sin h^{-1}(\frac{x}{2})$

3. Write short answers to any EIGHT (8) questions : **16**

(i) Find $\frac{dy}{dx}$ using differentials if $xy - \log_e x = c$

(ii) Evaluate the integral $\int \frac{x}{x+2} . dx$

(iii) Evaluate the integral $\int \frac{1}{a^2 - x^2} . dx$

(iv) Evaluate the integral $\int x \sin x \cos x \, dx$

(v) Evaluate the integral $\int x^2 e^{ax} . dx$

(vi) Evaluate the integral $\int e^{3x}\left(\frac{3\sin x - \cos x}{\sin^2 x}\right) dx$

(vii) Prove that $\int_a^b f(x).dx = -\int_a^b f(x).dx$

(viii) Evaluate the definite integral $\int_0^3 \frac{dx}{x^2+9}$

(ix) Find the area bounded by cos function from $x = -\frac{\pi}{2}$ to $x = \frac{\pi}{2}$

3. (x) Solve the differential equation $\sin y \operatorname{cosec} x \frac{dy}{dx} = 1$

(xi) Define optimal solution and feasible solution.

(xii) Graph the region indicated by $4x - 3y \le 12$, $x \ge -\frac{3}{2}$

4. **Write short answers to any NINE (9) questions :** 18

(i) Show that the points A (3 , 1) , B (– 2 , – 3) and C (2 , 2) are vertices of an isosceles triangle.

(ii) Find an equation of a line through the points (– 2 , 1) and (6 , – 4)

(iii) Find an equation of the line bisecting the first and third quadrants.

(iv) Find an equation of the line with x-intercept : – 3 and y – intercept : 4

(v) Convert $2x - 4y + 11 = 0$ into slope intercept form.

(vi) Write an equation of the parabola with focus (– 1 , 0) , vertex (– 1 , 2)

(vii) Find the focus and directrix of the parabola $y = 6x^2 - 1$

(viii) Find an equation of the ellipse with centre (0 , 0) , focus (0 , – 3) , vertex (0 , 4)

(ix) Find the eccentricity and directrices of the ellipse whose equation is $25x^2 + 9y^2 = 225$

(x) Define unit vector.

(xi) Find a unit vector in the direction of the vector $\underline{v} = \frac{1}{2}\underline{i} + \frac{\sqrt{3}}{2}\underline{j}$

(xii) Find a vector whose magnitude is '4' and is parallel to $2\underline{i} - 3\underline{j} + 6\underline{k}$

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

SECTION – II

Note : Attempt any THREE questions.

5. (a) If $f(x) = \begin{cases} \dfrac{\sqrt{2x+5} - \sqrt{x+7}}{x-2} & , x \neq 2 \\ k & , x = 2 \end{cases}$ 5

Find value of k so that f is continuous at $x = 2$

(b) Show that $y = x^x$ has maximum value at $x = \frac{1}{e}$ 5

6. (a) Evaluate $\int e^{2x} \cos 3x \, dx$ 5

(b) The three points A (7 , – 1) , B (– 2 , 2) and C (1 , 4) are consecutive vertices of a parallelogram, find the fourth vertex. 5

7. (a) Find the area bounded by the curve $y = x^3 - 4x$ and x-axis. 5

(b) Minimize $z = 2x + y$ subject to the constraints 5

$x + y \ge 3$, $7x + 5y \le 35$, $x \ge 0$, $y \ge 0$

8. (a) Find the condition that the line $y = mx + c$ touches the circle $x^2 + y^2 = a^2$ at a single point. 5

(b) Find x so that points A (1 , – 1 , 0) , B (– 2 , 2 , 1) and C (0 , 2 , x) form triangle with right angle at C. 5

9. (a) Find the centre, foci, eccentricity, vertices and equations of directices of $\frac{y^2}{4} - x^2 = 1$ 5

(b) Find volume of the tetrahedron with the vertices A (2, 1, 8) , B (3, 2, 9) , C (2, 1, 4) and D (3, 3, 10) 5

Roll No _____ _____ (To be filled in by the candidate)

(Academic Sessions 2014 – 2016 to 2016 – 2018)

MATHEMATICS 218-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – II Maximum Marks : 20

PAPER CODE = 8198

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	$\frac{d}{dx}\ell og_a x =$:			
	(A) $\frac{1}{x}$	(B) $x\ell nx - x$	(C) $\frac{1}{x}\ell na$	(D) $\frac{1}{x\ell na}$
2	$\int \sin x \cos x dx$:			
	(A) $\frac{1}{2}\cos 2x$	(B) $-\frac{1}{2}\cos 2x$	(C) $\frac{\sin^2 x}{2}$	(D) $\frac{\cos^2 x}{2}$
3	$\int \frac{1}{x\sqrt{x^2-1}} dx$:			
	(A) $\sin^{-1} x$	(B) $\tan^{-1} x$	(C) $\sec^{-1} x$	(D) $\cos ec^{-1} x$
4	If $x = f(\theta), y = g(\theta)$ then $\frac{dy}{dx}$:			
	(A) $\frac{dy}{d\theta}\frac{d\theta}{dx}$	(B) $\frac{dx}{d\theta}\frac{d\theta}{dy}$	(C) $\frac{d\theta}{dy}\frac{dx}{d\theta}$	(D) $\frac{dy}{d\theta}\frac{dx}{d\theta}$
5	$\frac{d}{dx}\sec hx =$:			
	(A) $\sec hx \tanh x$	(B) $-\sec hx \tanh x$	(C) $\tan h^2 x$	(D) $\sec h^2 x$
6	If at least one vertical line meets the curve at more than two points then curve is :			
	(A) A function	(B) Not a function		
	(C) One – to – one function	(D) Onto function		
7	$\frac{d}{dx}\cosh x =$:			
	(A) $-\sin hx$	(B) $\sec hx$	(C) $-\sec hx$	(D) $\sin hx$
8	$\int \sec^2 x dx$:			
	(A) $\tan x$	(B) $\frac{\sec^3 x}{3}$	(C) $\tan^2 x$	(D) $\sec x \tan x$
9	Solution of $\frac{dy}{dx} = \frac{-y}{x}$ is :			
	(A) $\frac{x}{y} = c$	(B) $\frac{y}{x} = c$	(C) $y = cx$	(D) $xy = c$

1-10	Domain of $f(x) = x^2 + 1$: (A) R (B) $R - \{1\}$ (C) $R - \{-1\}$ (D) $[1, \infty)$
11	Equation of line bisecting II and IV quadrant : (A) $y = x$ (B) $y = -x$ (C) $y = \frac{1}{x}$ (D) $x + y = 1$
12	Set of all points equidistant from a fixed point form : (A) Ellipse (B) Parabola (C) Hyperbola (D) Circle
13	Joint equation of two lines is $ax^2 + 2hxy + by^2 = 0$, if θ is angle between them, then $\tan\theta =$: (A) $\frac{2\sqrt{h^2 + ab}}{a+b}$ (B) $\frac{2\sqrt{h^2 - ab}}{a+b}$ (C) $\frac{\sqrt{h^2 + ab}}{a+b}$ (D) $\frac{\sqrt{h^2 - ab}}{a+b}$
14	Focal chord perpendicular to axis of parabola is called : (A) Latus Rectum (B) Eccentricity (C) Vertex (D) Axis
15	Horizontal line through $(7, -9)$ is : (A) $x = 7$ (B) $x = -9$ (C) $y = 7$ (D) $y = -9$
16	Projection of vector $\vec{u}$ on vector $\vec{v}$ is : (A) $\frac{\vec{u} \cdot \vec{v}}{\lvert v \rvert}$ (B) $\frac{\vec{u} \cdot \vec{v}}{\lvert u \rvert}$ (C) $\frac{\vec{u} \times \vec{v}}{\lvert v \rvert}$ (D) $\frac{\vec{u} \times \vec{v}}{\lvert u \rvert}$
17	Distance of (x_1, y_1) from line $ax + by + c = 0$ is : (A) $\frac{\lvert ax_1 + by_1 + c \rvert}{\sqrt{a^2 + b^2}}$ (B) $\frac{\lvert ax_1 + by_1 - c \rvert}{\sqrt{a^2 + b^2}}$ (C) $\frac{\lvert ax_1 + by_1 + c \rvert}{\sqrt{a+b}}$ (D) $\frac{\lvert ax_1 + by_1 - c \rvert}{\sqrt{a+b}}$
18	For ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $(a > b)$ then eccentricity $e =$: (A) $\frac{\sqrt{a^2 - b^2}}{a}$ (B) $\frac{\sqrt{a^2 + b^2}}{a}$ (C) $\frac{\sqrt{b^2 - a^2}}{a}$ (D) $\frac{\sqrt{b^2 - a^2}}{b}$
19	If $\vec{v}$ is any vector then vector of magnitude 5 opposite to $\vec{v}$ is : (A) $5\vec{v}$ (B) $-5\vec{v}$ (C) $5\frac{\vec{v}}{\lvert v \rvert}$ (D) $-5\frac{\vec{v}}{\lvert v \rvert}$
20	System of linear inequalities involved in the problem is called : (A) Coefficients (B) Solution (C) Problem constraints (D) Boundaries

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2014 – 2016 to 2016 – 2018)

MATHEMATICS 218-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(i) Prove that $\cosh^2 x + \sinh^2 x = \cosh 2x$

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

(iii) Evaluate $\lim\limits_{x \to 0} \dfrac{\sec x - \cos x}{x}$

(iv) Find $\dfrac{dy}{dx}$ if $y = \dfrac{a + x}{a - x}$

(v) Find $\dfrac{dy}{dx}$ if $x^2 - 4xy - 5y = 0$

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

(vii) Differentiate $\sin^{-1}\sqrt{1 - x^2}$ *w.r.t* x

(viii) Find $\dfrac{dy}{dx}$ if $y = \ell n\left(x + \sqrt{x^2 + 1}\right)$

(ix) Find $\dfrac{dy}{dx}$ if $y = e^{-2x}\sin 2x$

(x) Find $\dfrac{d^2y}{dx^2}$ if $y^3 + 3ax^2 + x^3 = 0$

(xi) Find y_2 if $y = \cos^3 x$

(xii) Find $\dfrac{dy}{dx}$ if $y = \ell n\left(\dfrac{x^2 - 1}{x^2 + 1}\right)^{\frac{1}{2}}$

3. Write short answers to any EIGHT (8) questions : 16

(i) Find δy and dy : $y = \sqrt{x}$, when x changes from 4 to 4.41

(ii) Evaluate $\int \dfrac{e^{2x} + e^x}{e^x} dx$

(iii) Evaluate $\int (a - 2x)^{3/2} dx$

(iv) Evaluate $\int \dfrac{x + b}{(x^2 + 2bx + c)^{\frac{1}{2}}} dx$

(v) Evaluate $\int xe^x dx$

(vi) Evaluate $\int e^x \left(\dfrac{1}{x} + \ell nx\right) dx$

(vii) Evaluate $\int_{-1}^{3} (x^3 + 3x^2)\, dx$

(viii) Evaluate $\int_{0}^{\pi/3} \cos^2\theta \sin\theta\, d\theta$

3. (ix) Find the area between the x-axis and the curve $y = 4x - x^2$ from $x = 0$ to $x = 4$

(x) Define differential equation.

(xi) Solve $\frac{dy}{dx} = \frac{y^2+1}{e^{-x}}$

(xii) Solve $\frac{dy}{dx} = 2x$

4. Write short answers to any NINE (9) questions : **18**

(i) Write down equation of straight line with x-intercept (2 , 0) and y-intercept (0 , – 4)

(ii) Find an equation of a line bisecting 2nd and 4th quadrants.

(iii) Find an equation of a line with x-intercept : – 9 and slope : – 4 .

(iv) Prove that if the lines are perpendicular, then product of their slopes = – 1

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

(vi) Find focus and vertex of the parabola $y = 6x^2 - 1$

(vii) Find equation of latus rectum of parabola $y^2 = -8(x - 3)$

(viii) Find an equation of an ellipse with foci (± 3 , 0) and minor axis of length 10.

(ix) Find the foci and length of the latus rectum of the ellipse $9x^2 + y^2 = 18$

(x) Define direction angles and direction cosines of a vector.

(xi) Find the projection of vector $\underline{a}$ along vector $\underline{b}$ and projection of vector $\underline{b}$ along $\underline{a}$ when $\underline{a} = \hat{i} - \hat{k}$, $\underline{b} = \hat{j} + \hat{k}$

(xii) Find a vector perpendicular to each of the vectors $\underline{a} = 2\hat{i} + \hat{j} + \hat{k}$ and $\underline{b} = 4\hat{i} + 2\hat{j} - \hat{k}$

(xiii) Convert $2x - 4y + 11 = 0$ into slope intercept form.

SECTION – II

Note : Attempt any THREE questions.

5. (a) Prove that $\lim_{x \to 0} \frac{a^x - 1}{x} = \log_e a$ 5

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

6. (a) Show that $\int \frac{dx}{\sqrt{x^2 - a^2}} = \ell n(x + \sqrt{x^2 - a^2}) + c$ 5

(b) The points A (– 1 , 2) , B (6 , 3) and C (2 , – 4) are vertices of a triangle, then show that the line joining the mid-point " D " of $\overline{AB}$ and mid-point " E " of $\overline{AC}$ is parallel to $\overline{BC}$ and $\overline{DE} = \frac{1}{2}\overline{BC}$. 5

7. (a) Evaluate $\int_0^{\frac{\pi}{4}} \cos^4 t \, dt$ 5

(b) Graph the feasible region of system of linear inequalities and find the corner points
$2x + 3y \le 18, x + 4y \le 12$, $3x + y \le 12$ $x \ge 0, y \ge 0$ 5

8. (a) Find an equation of parabola having its focus at the origin and directrix parallel to y-axis. 5

(b) Prove that the line segment joining the mid-points of two sides of a triangle is parallel to the third side and half as long. 5

9. (a) Find the centre, foci, eccentricity, vertices and equations of directices of $\frac{y^2}{4} - x^2 = 1$ 5

(b) Find the value of α, in the coplanar vectors $\alpha\hat{i} + \hat{j}$, $\hat{i} + \hat{j} + 3\hat{k}$, $2\hat{i} + \hat{j} - 2\hat{k}$ 5