Q. No. 2 Part (i) (Page 1)

INVERSE OF FUNCTION

Let $f(x) = \frac{3x+2}{2x-1} = y$

$$\frac{3x+2}{2x-1} = y$$

$$3x+2 = 2xy - y$$

$$3x - 2xy = -y - 2$$

$$x(3-2y) = -y-2$$

$$x = \frac{-y-2}{(3-2y)}$$

As $x = f^{-1}(y) = \frac{-y-2}{3-2y}$

To Find $f^{-1}(x)$ we replace y by x.

$$f^{-1}(x) = \frac{-x-2}{3-2x}$$

$f^{-1}(f(x)) = x$

L.H.S

$$f^{-1}(f(x))$$

$$= f^{-1}\left(\frac{3x+2}{2x-1}\right)$$

$$= \frac{-\frac{3x+2}{2x-1} - 2}{3 - 2\left(\frac{3x+2}{2x-1}\right)}$$

$$= \frac{\frac{-3x-2-4x+2}{2x-1}}{6x-3-6x-4}$$

(Section B)

Q. No. 2 Part (i) (Page 2)

$$= \frac{\frac{-3x - 2 - 4x + 2}{2x - 1}}{\frac{6x - 3 - 6x - 4}{2x - 1}}$$

$$= \frac{-7x}{-7}$$

$$= x$$

= R.H.S

Result

- hence $f^{-1}(x) = \frac{-x-2}{3-2x}$

and $f^{-1}(f(x)) = x$.

Q. No. 2 Part (ii) (Page 1)

$$f(x) = \begin{cases} 3x-1 & x<1 \\ 4 & x=1 \\ 2x & x>1 \end{cases}$$

There are 3 conditions for a continous function

① $f(c)$ is defined

$f(1) = 4$

hence 1st condition is satisfied

② limit at $x=c$ should exist

For limit to exist, left hand limit = Right hand limit

Left hand Limit :- $\lim_{x\to 1^-} f(x) = \lim_{x\to 1} (3x-1)$

$= 3(1)-1$

$= 2$

Right hand Limit :- $\lim_{x\to 1^+} f(x) = \lim_{x\to 1} 2x$

$= 2(1)$

$= 2$

L·H·L = R·H·L, so limit exist.

hence 2nd condition is satisfied

③ $f(c) = \lim_{x\to c} f(x)$

As $f(1)=4$ and $\lim_{x\to 1} f(x) = 2$, 3rd condition is not satisfied. So $f(x)$ is discontinous at $x=1$.

Q. No. 2 Part (ii) (Page 2)

Result

function is discontinous at $x=1$.

Q. No. 2 Part (iii) (Page 1)

GIVEN:

$$y = \cot(q \cot^{-1} x)$$

TO PROVE:

$$(1+x^2)y_1 - q(1+y^2) = 0.$$

PROOF:

As $y = \cot(q \cot^{-1} x)$

$\cot^{-1} y = q \cot^{-1} x$

Differentiating both sides:

$$\frac{d}{dx} \cot^{-1} y = q \frac{d}{dx} \cot^{-1} x$$

$$\cancel{-}\frac{1}{1+y^2} \frac{dy}{dx} = q \cancel{-}\frac{1}{1+x^2}$$

$$\frac{dy}{dx}\left(\frac{1}{1+y^2}\right) = \frac{q}{1+x^2}$$

$$(1+x^2)\frac{dy}{dx} = q(1+y^2)$$

$$(1+x^2)\frac{dy}{dx} - q(1+y^2) = 0$$

$$(1+x^2)y_1 - q(1+y^2) = 0$$

hence proved

RESULT:

If $y = \cot(q \cot^{-1} x)$ then $(1+x^2)y_1 - q(1+y^2) = 0.$

(Section B)

Q. No. 2 Part (iii) (Page 2)

(Section B)

Q. No. 2 Part (iv) (Page 1)

Approximate value of $\sin 61^\circ$.

By Taylor series:-

$$f(x+h) = f(x) + f'(x)h + f''(x)\frac{h^2}{\lfloor 2} + f'''(x)\frac{h^3}{\lfloor 3} + \cdots$$

Let $f(x) = \sin x$

$x = 60^\circ$ and $h = 1^\circ = 0.01745$

$f(x) = \sin x$

$f'(x) = \cos x$

$f''(x) = -\sin x$

$f'''(x) = -\cos x$

So:-

$$f(x+h) = f(x) + f'(x)h + f''(x)\frac{h^2}{\lfloor 2} + f'''(x)\frac{h^3}{\lfloor 3} + \cdots$$

$$\sin(x+h) = \sin x + \cos x \cdot h + \frac{h^2}{\lfloor 2}(-\sin x) + \frac{h^3}{\lfloor 3}(-\cos x) + \cdots$$

put $x = 60^\circ$, $h = 0.01745 = 1^\circ$

$$\sin(60+1) = \sin 60 + (\cos 60)(0.01745) + \frac{(0.01745)^2}{\lfloor 2}(-\sin 60) - \frac{\cos 60}{3!}(0.01745)^3 + \cdots$$

$$= \frac{\sqrt{3}}{2} + \frac{1}{2}(0.01745) - \frac{\sqrt{3}}{2\times 2}(0.01745)^2 - \frac{1}{2\times 6}(0.01745)^3 + \cdots$$

$= 0.874618$

SEE NEXT PAGE (Pg 10)

Q. No. 2 Part (iv) (Page 2) USING DIFFERENTIALS:-

Let $f(x) = \sin x$

As $f(x+\delta x) \approx f(x) + dy$

$f(x+\delta x) \approx f(x) + f'(x) \cdot dx \longrightarrow (1)$

- $f(x) = \sin x$ with $x = 60°$, $dx = 1° = 0.01745$

At $x = 60°$, $\sin 60 = \frac{\sqrt{3}}{2}$

- $dy = f'(x) \cdot dx$

$= \cos x \cdot (0.01745)$

$= \cos 60 \times 0.01745$

$= 8.725 \times 10^{-3}$

putting value of f(x) and dy in (1), we get:-

$\sin(60+1) \approx \sin 60 + dy$

$\approx 0.866 + 8.725 \times 10^{-3}$

≈ 0.874725

RESULT

hence by using differentials, approximate value of $\sin 61 = 0.874725$.

(Section B)

Q. No. 2 Part (v) (Page 1) AREA UNDER CURVE

$y = x^3 - 9x$

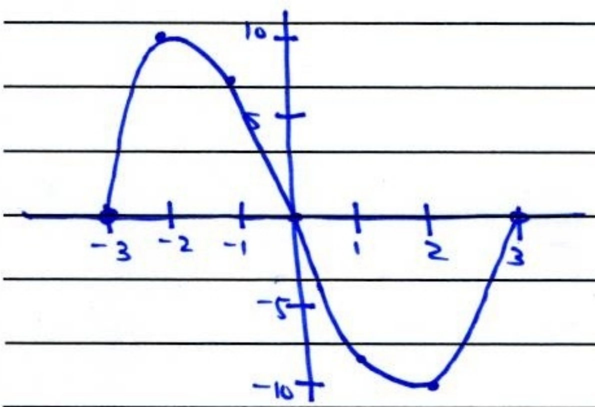
For x intercept ; put $y = 0$

$0 = x(x^2 - 9)$

$x = 0$ or $x^2 - 9 = 0$

$x = \pm 3$

so intervals are $[-3, 0]$ and $[0, 3]$



$x = -3 \Rightarrow y = 0$

$x = -2 \Rightarrow y = 10$

$x = -1 \Rightarrow y = 8$

$x = 0 \Rightarrow y = 0$

$x = 1 \Rightarrow y = -8$

$x = 2 \Rightarrow y = -10$

$x = 3 \Rightarrow y = 0$

To Find area under curve :-

$$A = \int_{-3}^{0} (x^3 - 9x) \cdot dx - \int_{0}^{3} (x^3 - 9x) \cdot dx$$

$$= \left| \frac{x^4}{4} \right|_{-3}^{0} - \frac{9}{2} \left| x^2 \right|_{-3}^{0} - \left| \frac{x^4}{4} \right|_{0}^{3} + \frac{9}{2} \left| x^2 \right|_{0}^{3}$$

$$= \frac{(0 - (-3)^4)}{4} - \frac{9}{2}(0 - (-3)^2) - \left(\frac{(3)^4 - 0}{4} \right) + \frac{9}{2}(9 - 0)$$

$$= \frac{-81}{4} - \frac{9}{2}(-9) - \frac{81}{4} + \frac{81}{2}$$

$$= \frac{81}{2} \text{ square units}$$

Q. No. 2 Part (v) (Page 2)

RESULT

- hence area under curve is $\frac{81}{2}$ sq UNITS.

Q. No. 2 Part (vi) (Page 1)

$$\frac{dy}{dx} = \frac{3}{4}x^3 + x - 3$$

$$dy = \left(\frac{3}{4}x^3 + x - 3\right)\cdot dx$$

integrating both sides, we have:-

$$\int dy = \frac{3}{4}\int x^3 dx + \int x \cdot dx - 3\int 1\, dx$$

$$y = \frac{3\,x^4}{4\times 4} + \frac{x^2}{2} - 3x + c$$

$$y = \frac{3x^4}{16} + \frac{x^2}{2} - 3x + c \longrightarrow (1)$$

Applying initial condition:-

$y = 0$ when $x = 2$

$$0 = \frac{3(2^4)}{16} + \frac{4}{2} - 3(2) + c$$

$$0 = 3 + 2 - 6 + c$$

$$0 = -1 + c$$

$$c = 1$$

put in (1):-

$$y = \frac{3x^4}{16} + \frac{x^2}{2} - 3x + 1$$

RESULT

- hence $y = \frac{3x^4}{16} + \frac{x^2}{2} - 3x + 1$ is solution of given differential equation.

(Section B)

Q. No. 2 Part (vi) (Page 2)

Q. No. 2 Part (vii) (Page 1)

NORMAL FORM OF EQUATION:-

$$x\cos\alpha + y\sin\alpha = p$$

put $\alpha = 30°$, $p = 8$.

$$\frac{\sqrt{3}}{2}x + \frac{1}{2}y = 8$$

$$\frac{1}{2}y = -\frac{\sqrt{3}}{2}x + 8$$

$$y = -\sqrt{3}\,x + 16 \rightarrow (1)$$

comparing with slope intercept form:-

$$y = mx + c$$

$m = -\sqrt{3}$; $c = 16$

RESULT

slope of line is $-\sqrt{3}$ and y intercept is 16.

(Section B)

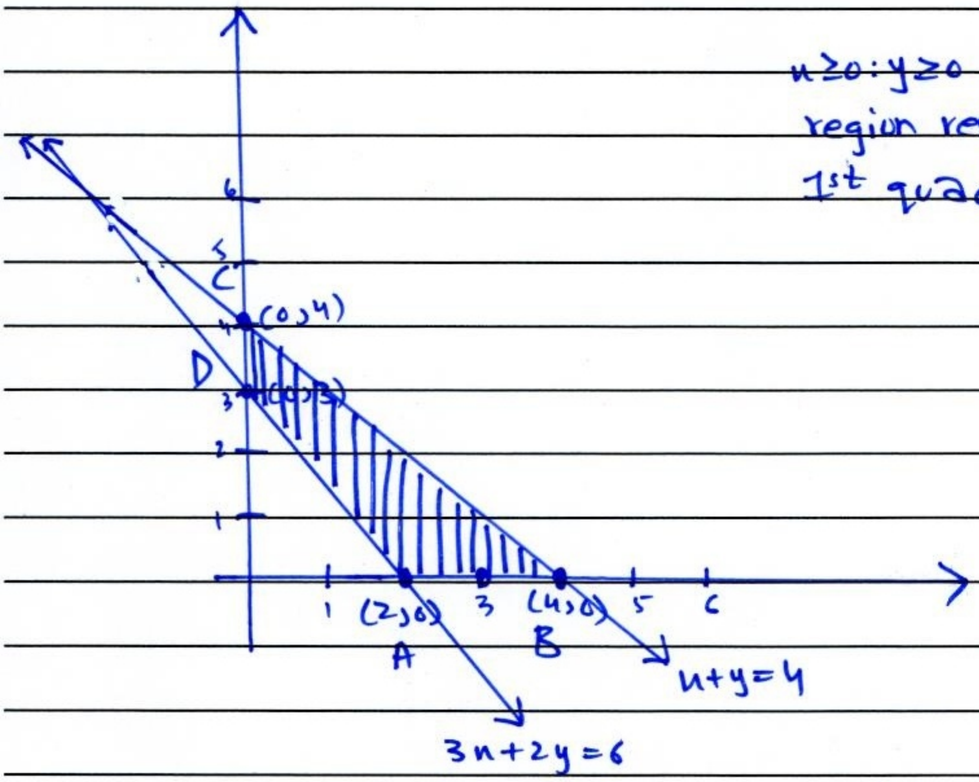
Q. No. 2 Part (vii) (Page 2)

(Section B)

Q. No. 2 Part (viii) (Page 1)

ASSOCIATED EQUATIONS	$3x+2y=6$	$x+y=4$
INTERCEPTS	$\frac{x}{2}+\frac{y}{3}=1$ (2,0) (0,3)	$\frac{x}{4}+\frac{y}{4}=1$ (4,0) (0,4)
INEQUALITIES	$3x+2y>6$	$x+y<4$.
TESTPOINT (0,0)	$0+0>6$ False	$0+0<4$ TRUE
SOLUTION REGION	lies away from (0,0)	lies toward (0,0)

$x\geq 0 : y\geq 0$



$x\geq 0 : y\geq 0$ mean solution region restricted to 1st quadrant.

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GRAPH ON GRAPH sheet as well.

(Section B)

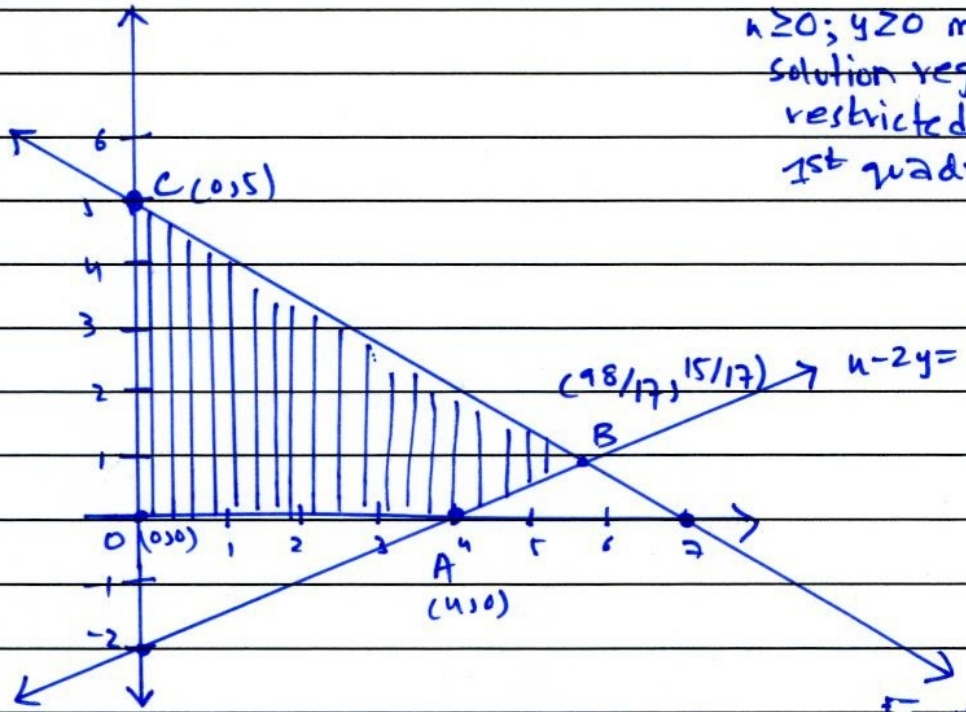
Q. No. 2 Part (viii) (Page 2)

∴ CORNER POINTS are

1) A(2,0)
2) B(4,0)
3) C(0,4)
4) D(0,3)

Q. No. 2 Part (ix) (Page 1)

ASSOCIATED EQUATIONS	$5x + 7y = 35$	$x - 2y = 4$	$x \geq 0 ; y \geq 0$
INTERCEPTS	$\frac{x}{7} + \frac{y}{5} = 1$ $(7,0)$ $(0,5)$	$\frac{x}{4} + \frac{y}{-2} = 1$ $(4,0)$ $(0,-2)$	
INEQUALITIES	$5x+7y < 35$	$x-2y < 4$	
TEST POINT $(0,0)$	$0+0 < 35$ TRUE	$0-0 < 4$ TRUE	
SOLUTION REGION	lies toward $(0,0)$	lies toward $(0,0)$	



$x \geq 0; y \geq 0$ mean solution region restricted to 1st quadrant

Graph on graph sheet as well
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Q. No. 2 Part (ix) (Page 2)

∴ CORNER POINTS ARE:-

1) O (0,0)
2) A (4,0)
3) B $\left(\frac{98}{17}, \frac{15}{17}\right)$
4) C (0,5)

$$\therefore \; 5x + 7y = 35$$
$$\pm 5x \mp 10y = \pm 20$$
$$17y = 15$$
$$y = 15/17$$
$$x = 98/17$$

Q. No. 2 Part (x) (Page 1) VALUE OF C

$5x+2y+c=0$

$m=\frac{-5}{2}$

$\frac{x^2}{4}-\frac{y^2}{9}=1.$

$a^2=4 \quad b^2=9$

c for this type of hyperbola is given as:-

$c=\sqrt{a^2m^2-b^2}$

$c=\sqrt{\left(\frac{25}{4}\right)\cdot 4-9}$

$c=\sqrt{16}$

$c=\pm 4.$

RESULT

- $5x+2y+c=0$ will touch the hyperbola if $c=\pm 4$

(Section B)

Q. No. 2 Part (x) (Page 2)

Q. No. 2 Part (xi) (Page 1) POINT OF INTERSECTION:-

$$\frac{x^2}{18} + \frac{y^2}{8} = 1 \rightarrow ① ; \quad \frac{x^2}{3} - \frac{y^2}{3} = 1 \rightarrow ②$$

Multiply eq ② with $\frac{1}{6}$ and subtract from ①.

$$\frac{x^2}{18} + \frac{y^2}{8} = 1$$

$$\underline{\overset{+}{-}\frac{x^2}{18} \overset{-}{+} \frac{y^2}{18} \overset{=+}{-}\frac{1}{6}}$$

$$\frac{y^2}{8} + \frac{y^2}{18} = 1 - \frac{1}{6}$$

$$\frac{13y^2}{\cancel{72}_{12}} = \frac{5}{\cancel{6}_1}$$

$$13y^2 = 12 \times 5$$

$$13y^2 = 60.$$

$$y^2 = \frac{60}{13}$$

$$y = \pm\sqrt{\frac{60}{13}}$$

put in ① :-

$$\frac{x^2}{18} + \frac{\left(\frac{60}{13}\right)}{8} = 1$$

$$\frac{x^2}{18} = 1 - \frac{15}{26}$$

$$x^2 = 18 \times \frac{11}{26}$$

$$x = \pm\sqrt{\frac{99}{13}}$$

Q. No. 2 Part (xi) (Page 2)

RESULT

Hence there are 4 point of intersection:

1) $\left(\sqrt{\frac{99}{13}}, \sqrt{\frac{60}{13}}\right)$ 2) $\left(\sqrt{\frac{99}{13}}, -\sqrt{\frac{60}{13}}\right)$

3) $\left(-\sqrt{\frac{99}{13}}, \sqrt{\frac{60}{13}}\right)$ 4) $\left(-\sqrt{\frac{99}{13}}, -\sqrt{\frac{60}{13}}\right)$

Q. No. 2 Part (xii) (Page 1)

MOMENT OF FORCE :-

$\tau = \bar{r} \times \bar{F}$

$\bar{F}_{net} = \bar{F}_1 + \bar{F}_2 + \bar{F}_3$
$= (\underline{i} - 2\underline{j}) + (3\underline{i} + 2\underline{j} - \underline{k}) + (5\underline{j} + 2\underline{k})$
$= 4\underline{i} + 5\underline{j} + \underline{k}$

$\bar{r}$ = (About point)(Point of application)
$= (2, 0, 1) - (1, 1, 1)$
$= (1, -1, 0)$.

$\tau = \bar{r} \times \bar{F}$

$$= \begin{vmatrix} i & j & k \\ 1 & -1 & 0 \\ 4 & 5 & 1 \end{vmatrix}$$

$= i(-1) - j(1) + k(5+4)$
$= -i - j + 9k$

Magnitude $= \sqrt{1+1+81} = \sqrt{83}$.

RESULT

→ Moment of force is $-j - i + 9k$ with magnitude $= \sqrt{83}$

(Section B)

Q. No. 2 Part (xii) (Page 2)

MOMENT OF FORCE :-

$\tau = r \times F$

[illegible]

[illegible]

$\tau = r \times F$

[illegible]

Magnitude = [illegible]

RESULT

[illegible]

Q. No. 3 (Page 1)

APPLICATION OF EXTREME VALUES

Let length of square base $= x$, height $= h$.

GIVEN:-

$$V = x^2 h$$

$$32 = x^2 h$$

$$h = \frac{32}{x^2} \longrightarrow (1)$$

As surface of box will be:-

$$A = x^2 + 4hx$$

putting value of h from (1).

$$A = x^2 + 4\left(\frac{32}{x^2}\right)x$$

$$A = x^2 + \frac{128}{x}$$

Let $A = f(x)$, so

$$f'(x) = 2x - \frac{128}{x^2} \longrightarrow (2)$$

$$f''(x) = 2 + \frac{256}{x^3} \longrightarrow (3)$$

For stationary point:- we take $f'(x) = 0$

$$f'(x) = 2x - \frac{128}{x^2}$$

$$0 = 2x - \frac{128}{x^2}$$

$$\frac{128}{x^2} = 2x$$

$$64 = x^3$$

$$\Rightarrow x = 4$$

put $x = 4$ in (3)

Q. No. 3 (Page 2)

$$f''(x) = 2 + \frac{256}{x^3}$$

$$f''(4) = 2 + \frac{256}{64} = 6$$

As $f''(4) = 6 > 0$, hence $x = 4$ leads to a minimum value.

Thus $h = \frac{32}{x^2} = \frac{32}{(4)^2} = \frac{32}{16} = 2$

Result

Thus for least material requirements, length of square base of box will be 4 and height will be 2

(Section C)

Q. No. 3 (Page 3)

(Section C)

Q. No. 3 (Page 4)

Q. No. 4 (Page 1)

EQUATION OF TANGENT

we have to find equation of tangent that are parallel to $3x+8y+1=0$.

- → slope of this line $= -3/8$
- → slope of tangents $= -3/8$

$$\frac{x^2}{128} + \frac{y^2}{18} = 1$$

Ellipse is of the form :- $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
where $a^2 = 128, b^2 = 18$

Equation of tangent to ellipse is :-

$$y = mx \pm \sqrt{a^2m^2 + b^2}$$

put value of m, a^2, b^2

$$y = \frac{-3}{8}x \pm \sqrt{\frac{128 \cdot 9}{64} + 18}$$

$$y = \frac{-3}{8}x \pm \sqrt{18+18}$$

$$y = \frac{-3}{8}x \pm \sqrt{36}$$

$$y = \frac{-3}{8}x \pm 6$$

$$8y = -3x \pm 6$$

$$3x + 8y \pm 6 = 0$$

Result

Required equation of tangents are $3x+8y\pm6=0$

Q. No. 4 (Page 2)

POINT OF CONTACT

$$3x + 8y + 1 = 0$$

$$3x = -1 - 8y$$

$$x = \frac{-1 - 8y}{3} \rightarrow (1)$$

put $x = \frac{-1-8y}{3}$ in equation of ellipse :-

$$\frac{x^2}{128} + \frac{y^2}{18} = 1$$

$$\frac{(-1-8y)^2}{9 \times 128} + \frac{y^2}{18} = 1$$

$$\frac{64y^2 + 16y + 1}{1152} + \frac{y^2 \times 64}{18 \times 64} = 1$$

$$64y^2 + 16y + 1 + 64y^2 = 1152$$

$$128y^2 + 16y - 1151 = 0$$

$y = 2.93$ $\quad\quad$ $y = -3.06$

$x = -8.14$ $\quad\quad$ $x = 7.82$

Thus point of contacts are $(-8.14, 2.93)$ and $(7.82, -3.06)$

(Section C)

Q. No. 4 (Page 3)

(Section C)

Q. No. 4 (Page 4)

Q. No. 5 (Page 1) $A(-3,-4)$ $B(4,6)$ $C(4,-3)$

A)

Equation of side AB:-

$$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$$

$$\frac{y+4}{6+4} = \frac{x+3}{4+3}$$

$$\frac{y+4}{10} = \frac{x+3}{7}$$

$$7y+28 = 10x+30$$

$$10x-7y+2=0$$

Equation of side AC:-

$$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$$

$$\frac{y+4}{-3+4} = \frac{x+3}{4+3}$$

$$\frac{y+4}{1} = \frac{x+3}{7}$$

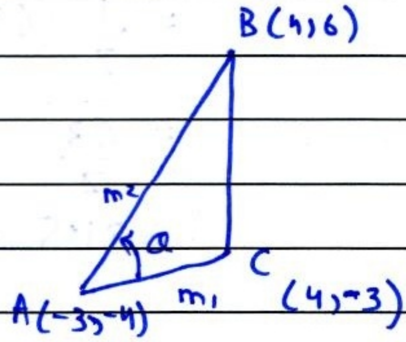
$$7y+28 = x+3$$

$$x-7y-25=0$$

B)

slope of $AB = m_2 = \frac{10}{7}$

slope of $AC = m_1 = \frac{1}{7}$



$$\tan\theta = \frac{m_2-m_1}{1+m_1m_2}$$

Q. No. 5 (Page 2)

$$\tan\theta = \frac{\frac{10}{7} - \frac{1}{7}}{1+\left(\frac{10}{7}\right)\left(\frac{1}{7}\right)}$$

$$\tan\theta = \frac{\frac{9}{7}}{\frac{49+10}{49}} = \frac{\frac{9}{7}}{\frac{59}{49}} = \frac{9\times 7}{59} = \frac{63}{59}$$

$$\theta = \tan^{-1}\left(\frac{63}{59}\right)$$

$$\theta = 46.8°$$

c)

$$\text{Area of } \Delta = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$

$$\text{Area of } \Delta ABC = \frac{1}{2}\begin{vmatrix} 4 & 6 & 1 \\ -3 & -4 & 1 \\ 4 & -3 & 1 \end{vmatrix}$$

$$= \frac{1}{2}\left[4(-4+3) - 6(-3-4) + 1(9+16)\right]$$

$$= \frac{1}{2}(63)$$

$$= \frac{63}{2}$$

$$= 31.5 \text{ square units}$$

hence area of ΔABC is $\frac{63}{2}$ sq units.

Q. No. 5 (Page 3)

D)

perpendicular distance from C to $\overline{AB}$.

$$d = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2+b^2}}$$

so distance of C from $\overline{AB}$ is:-

$\overline{AB}$ equation :- $10x - 7y + 2 = 0$

$$d = \frac{|10(4) + (-7)(-3) + 2|}{\sqrt{10^2 + 7^2}}$$

$$d = \frac{40+2+21}{\sqrt{149}}$$

$$d = \frac{63}{\sqrt{149}}$$

hence distance of C from $\overline{AB}$ is $\frac{63}{\sqrt{149}}$ UNITS.

(Section C)

Q. No. 5 (Page 4)

Q. No. 6 (Page 1)

ELEMENTS OF CONIC

$$9x^2 - y^2 - 12x - 2y + 2 = 0$$

$$9\left(x^2 - \frac{12}{9}x\right) - (y^2 + 2y) + 2 = 0$$

$$9\left(x^2 - 2\left(\frac{2}{3}\right) + \frac{4}{9}\right) - \frac{9 \times 4}{9} - (y^2 + 2y + 1) + 1 + 2 = 0$$

$$9\left(x - \frac{2}{3}\right)^2 + 3 - 4 - (y+1)^2 = 0$$

$$9\left(x - \frac{2}{3}\right)^2 - (y+1)^2 = 4 - 3$$

$$9\left(x - \frac{2}{3}\right)^2 - (y+1)^2 = 1$$

$$\frac{\left(x - \frac{2}{3}\right)^2}{\frac{1}{9}} - (y+1)^2 = 1 \longrightarrow (1)$$

let $x - \frac{2}{3} = X$ and $y + 1 = Y$

so equation (1) becomes:-

$$\frac{X^2}{\frac{1}{9}} - Y^2 = 1 \longrightarrow (2)$$

$a^2 = \frac{1}{9}$; $b^2 = 1$

In hyperbola:- $c^2 = a^2 + b^2$

$$c^2 = 1 + \frac{1}{9} = \frac{10}{9}$$

$$c = \pm\frac{\sqrt{10}}{3}$$

$a = \pm\frac{1}{3}$, $b = \pm 1$

Q. No. 6 (Page 2)

centre

centre of ② is :-

$X=0 \qquad Y=0$

$x-\frac{2}{3}=0 \qquad y+1=0$

$x=\frac{2}{3} \qquad y=-1$

Thus centre of hyperbola is $\left(\frac{2}{3},-1\right)$

Focii

Focii of ② is :-

$X=\pm c \qquad Y=0$

$x-\frac{2}{3}=\pm\frac{\sqrt{10}}{3} \qquad y+1=0$

$y=-1$

$x=\frac{2}{3}\pm\frac{\sqrt{10}}{3}$

$x=\frac{2\pm\sqrt{10}}{3}$

Thus focii of hyperbola are $\left(\frac{2\pm\sqrt{10}}{3},-1\right)$

Eccentricity

eccentricity $e=\frac{c}{a}$

$e=\frac{\frac{\sqrt{10}}{3}}{\frac{1}{3}}$

$e=\sqrt{10}$

vertices

vertices of ② are :-

$X=\pm a \qquad Y=0$

$x-\frac{2}{3}=\pm\frac{1}{3} \qquad y+1=0$

$x=\frac{2}{3}\pm\frac{1}{3} \qquad y=-1$

Q. No. 6 (Page 3)

$x = \frac{2}{3} + \frac{1}{3} = \frac{3}{3} = 1$

OR

$x = \frac{2}{3} - \frac{1}{3} = \frac{1}{3}$

Thus vertices of hyperbola are $(\frac{1}{3}, -1)$ and $(1, -1)$

Directrices

$X = \pm \frac{a}{e}$

$x - \frac{2}{3} = \pm \frac{\frac{1}{3}}{\sqrt{10}}$

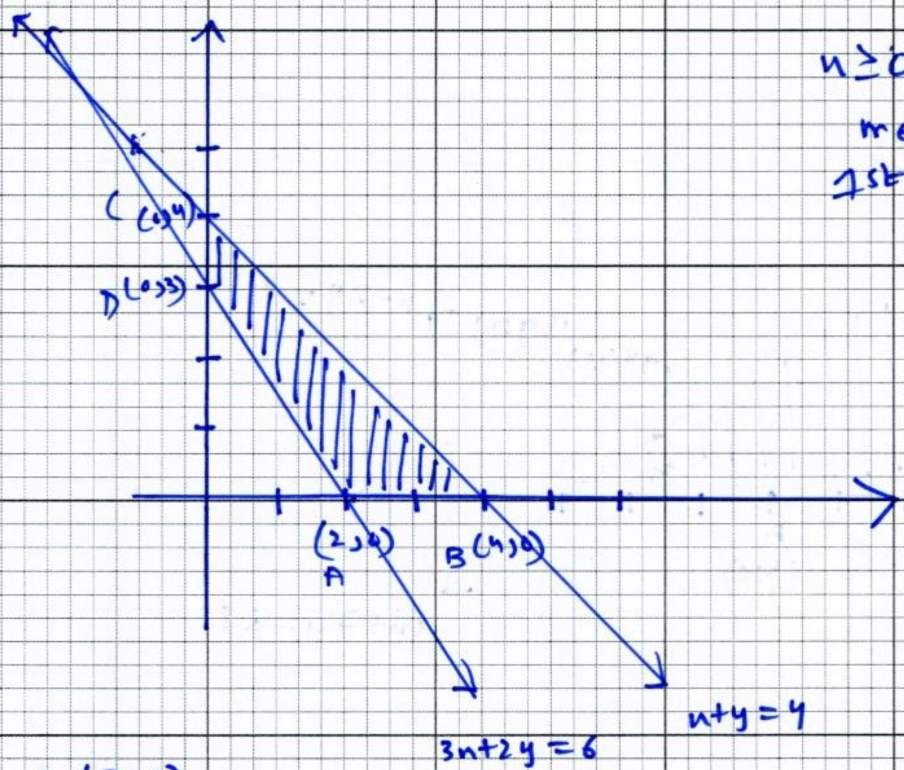
$x = \frac{2}{3} \pm \frac{1}{3\sqrt{10}}$

Thus directrices of hyperbola are $x = \frac{2}{3} \pm \frac{1}{3\sqrt{10}}$

(Section C)

Q. No. 6 (Page 4)

Q2 (viii)

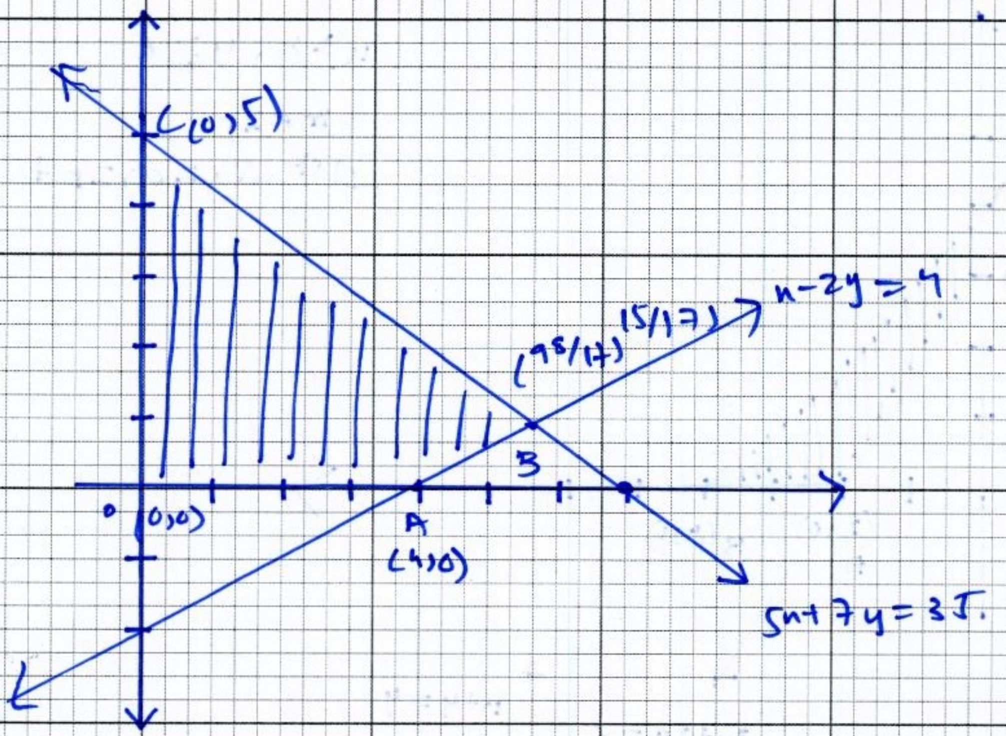


x ≥ 0, y ≥ 0
mean :
1st Quadrant

A (2,0)
B (4,0)
D (0,3)
C (0,4)

Q2(ix)

x≥0 y≥0
mean 1st quadrant



O (0,0)
A (4,0)
B (98/17, 15/17)
C (0,5)

Graph Page No. 1

$1+\frac{dy}{dx} = \cos(x+y)\left(1+\frac{dy}{dx}\right)$

$x^2+y^2+2x-4y+\frac{1}{3}$

$3x^2+3y^2+6x-12y+1.$

$1+\frac{dy}{dx} = \cos(x+y) + \cos(x+y)\frac{dy}{dx}$

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$\frac{16}{3}$

$1-\cos(x+y) = \cos(x+y)\frac{dy}{dx} - \frac{dy}{dx}$

$\frac{4}{\sqrt{3}}$

$\frac{1-\cos(x+y)}{-(1-\cos(x+y))} = \frac{dy}{dx}(\cos(x+y)-1)$

$c^2=a^2-b^2$

$c=\pm 3$

$2h=$

$\frac{\pi}{\sqrt{2}} \cdot \frac{k}{3} = -1$

$a=1 \quad b=-1$

$\frac{2\sqrt{h^2-ab}}{a+b}$

$k = \frac{-3\sqrt{2}}{\pi}$

$\tan\theta=\infty$

$\pi x+\sqrt{2}y+\sqrt{7}=0$

$\frac{x}{2}+\frac{y}{-4}=1$ θ

$\frac{\pi}{\sqrt{2}} \cdot \frac{k}{3} = -1$

$-4x+2y=-8$

$k = \frac{-1\times 3\sqrt{2}}{\pi}$

$4x-2y=8$

$t^2+1=9$

$t^2=8$

$4x-2y-8=0$

$\sin^2\alpha+\cos^2\alpha$

$\sqrt{1+t^2} = 3$

$2x-y-4=0$

$-4x+2y=-8$

$4x-2y=8$

$2x-y=4$

$\frac{\sqrt{3}}{3}i - \frac{\sqrt{3}}{3}j + \frac{\sqrt{3}}{3}k$

$\frac{1}{\sqrt{3}}i - \frac{1}{\sqrt{3}}j + \frac{1}{\sqrt{3}}k$

$\cos|\alpha|$ $\frac{1}{2}$

$\cos\beta = \frac{y}{|r|} = \frac{\sqrt{3}}{\sqrt{4}} = \frac{1}{2}$

$\sqrt{\sin^2\alpha+\cos^2\alpha+t^2} = 3$

$\sqrt{1+t^2} = 3$

$t^2+1=9$

$t^2=8$

$$\begin{vmatrix} 3 & -1 & -2 \\ 5 & \alpha & -3 \\ 2 & 1 & -2 \end{vmatrix} = 0$$

$y-6=\frac{10}{7}(x-4)$

$7y-42=10x-40$

$10x-7y+2=$

$3|-2$

$3(-2\alpha+3)+1(-10+6)-2(5-2\alpha)=0$

$-6\alpha+9-4-10+4\alpha=0$

$-2\alpha=5$

$(\sin(-x))^2$

$-\sin$

$3(-2\alpha+3)$

$-6\alpha+9 \quad +1(-10+6) - 2(5-2\alpha)$

$-4+9-10+4\alpha$

$-5 \quad -2\alpha=0$

$\alpha=-2.5$

$\frac{6+4}{4+3}$

$\frac{10}{7}$

$\frac{-3+4}{4+3} \quad \frac{1}{7}$

$\frac{-3+4}{4+3} = \frac{1}{7}$

$x\cos\alpha + y\sin\theta = 8$

$\frac{\sqrt{3}x}{2} \times \frac{y}{2} = 8$

$2 \times \frac{y}{2} = -\frac{\sqrt{3}x}{2} \times 2 + 8 \times 2$

$y = -\sqrt{3}x + 16$

$y+4=\frac{1}{7}(x+3)$

$7y+28=x+3$

$x-7y-25=$

Space for rough work page 3

$1 + \frac{dy}{dx} = \cos(x+y) \cdot \left[1 + \frac{dy}{dx}\right]$

$\sqrt{3x+5}$

$\frac{dy}{dx} + 1 = \cos(x+y) + \frac{dy}{dx}(\cos(x+y))$

$\sqrt{(9x^2+5) - 5} =$

$1 - \cos(x+y) =$

$\sqrt{9x^2 - 5 + 5}$

$\frac{6+4}{4+3}$

$\frac{2\sin^2 x/2}{2\sin x/2 \cos x/2}$

$\sqrt{9x^2}$

$\sqrt{9x^2}$

$\frac{10}{7}$

$\sqrt{9x^2+5-5}$

$\sqrt{(9x^2-5)+5}$

$1 - \cos x$

$\sqrt{ar^2 - 8 + 8}$

$f \quad D \quad R$

$y = 3 + \sqrt{x-2}$

inv → R

f → D

f^{-1}

$x^2 + 4hx$

$2x + 2 = 0$

$x = -1$

$2 > 0$

$f(x) = \ln(\sin x)$

$e^{\sin x}$

$f(x) = \sin x$

$e^{\sin \pi/2} - e^{\sin 0}$

$f'(x) = \cos x$

$e^1 - e^0$

$f'(\pi/2) = \cos 90$

$e - 1$

$f(x) = \sin x$

$f'(x) = \cos x$

$\frac{1}{x^2+1} \cdot 2x$

$\frac{1}{2} \frac{1}{x^2+1} 2x + 0$

$2\left|\frac{x^2}{2}\right|_0^2 - 2k(2-0) = 1$

$\frac{1}{2} \frac{2x}{x^2+1}$

$\frac{1}{2} \frac{1}{x^2+1} 2x +$

$(4-0) - 4k = 1$

$\frac{1}{2}\int \frac{2x}{x^2+1}$

$3 = 4k$

$k = 3/4$

$\frac{1}{2} \ln|x^2+1|$

$2\left|\frac{x^2}{2}\right|_0^2 - 2k|x|_0^2$

$(2^2 - 0) - 2k(2-0)$

$4 - 4k = 1$

$4k = 3$

$k =$

$x(x^2 - a)$

$x = 0$

$x = x^3$