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

$$2y^3 - 3xy^2 + 2x^2y + 5x = 6$$

Differenciate wrt x

$$6y^2\frac{dy}{dx} - 3\left(x\,2y\frac{dx}{dx} + y^2(1)\right) - 2\left(x^2\frac{dy}{dx} + 2xy\right) + 5 = 0$$

$$6y^2\frac{dy}{dx} - 6x\frac{dy}{dx} - 3y^2 - 2x^2\frac{dy}{dx} - 4xy + 5 = 0$$

$$\frac{dy}{dx}\left(6y^2 - 6x - 2x^2\right) = 3y^2 + 4xy - 5$$

$$\boxed{\frac{dy}{dx} = \frac{3y^2 + 4xy - 5}{6y^2 - 6x - 2x^2}}$$

$$\left.\frac{dy}{dx}\right|_{(1,1)} = \frac{3(1)^2 + 4(1)(1) - 5}{6(1)^2 - 6(1) - 2(1)^2}$$

$$= \frac{3 + 4 - 5}{\cancel{6} - \cancel{6} - 2}$$

$$= \frac{\cancel{2}}{-\cancel{2}}$$

$$\boxed{\left.\frac{dy}{dx}\right|_{(1,1)} = -1}$$

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

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

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

Discuss continuity at $x=1$

$f(x) = 4$

$f(1) = 4$

$LHL = \lim_{x \to 1^-} 3x-1 = 3(1)-1$

$= 2$

$RHL = \lim_{x \to 1^+} 2x = 2(1)$

$= 2$

$LHL = RHL \neq f(x)$

Hence it is not continuous.

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

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

Evaluate $\lim_{\theta \to 0} \frac{\sec\theta - 1}{\theta \sec\theta}$ $\left(\frac{0}{0}\right)$ $\frac{1}{\cos\theta} - 1$

~~differentiate~~

$\lim_{\theta \to 0} \frac{\frac{1}{\cos\theta} - 1}{\theta \cdot \frac{1}{\cos\theta}} = \frac{(1-\cos\theta)/\cancel{\cos\theta}}{\theta \;/\; \cancel{\cos\theta}}$

$\frac{2\sin^2\theta/2}{\theta}$

$\lim_{\theta \to 0} = \cancel{\sin\theta}\ \frac{2\sin^2\theta/2}{\theta}$

$= \lim_{\theta \to 0} \left(\frac{\sin^2\theta/2}{\theta/2}\right) \lim_{\theta \to 0} \sin\theta/2$

$= 1 \cdot 0$

$= 0$

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

Q. No. 2 Part (iv) (Page 1) $x = 60^\circ \quad dx = \delta x = 1^\circ$

$f(x)\ \sin 60^\circ \quad = y$

$f'(x) = \cos 60^\circ$

$dx = 1^\circ$

$dy = f'(x)dx$

$\sin(x + \delta x) = y + dy$

$= \sin 60^\circ + \cos 60 \,(1^\circ)$

$= \frac{\sqrt{3}}{2} + \frac{1}{2}(0.01745)$

$(\sin 61^\circ) = 0.874$

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

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

$$y = x^3 - 9x$$

$$x^3 - 9x = 0$$

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

$$x = 0 \qquad x = \pm 3$$

$$(-3, 0) \quad , \quad (3, 3)$$

$$y = x^3 - 9x \qquad -3 < x < 0 \qquad +ve$$

$$y = x^3 - 9x \qquad 0 < x < 3 \qquad -ve$$

$$\text{Area} = \int_{-3}^{0} (x^3 - 9x)\,dx + \int_{0}^{3} -(x^3 - 9x)\,dx$$

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

$$= \left(0 - \left(-\frac{81}{4}\right)\right) - \left(-\frac{81}{4} - 0\right)$$

$$= \frac{81}{4} + \frac{81}{4}$$

$$\boxed{\text{Area} = \frac{81}{2}}$$

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

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

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

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

$$y = \frac{3x^4}{4.4} + \frac{x^2}{2} - 3x + c$$

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

Ag

At $(y=0)$ $(x=2)$

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

$$0 = 3 + 2 - 6$$

$$0 = -1 + c$$

$$\boxed{c = 1}$$

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

req equation

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

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

$$\frac{-1}{2}\int x \frac{\sin^{-1}x}{\sqrt{1-x^2}}(-2)\,dx$$

$$= \frac{-1}{2}\int \underset{II}{-2x(1-x^2)^{-1/2}}\ \underset{I}{\sin^{-1}x}\ dx$$

$$= -\frac{1}{2}\left[\sin^{-1}x\int -2x(1-x^2)^{-1/2}dx - \int \frac{1}{\sqrt{1-x^2}}\int -2x(1-x)^{-1}\right.$$

$$= \frac{-1}{2}\left[\sin^{-1}x\,\frac{(1-x^2)^{1/2}}{1/2} - \int \frac{2\cancel{(1-x^2)^{1/2}}}{\cancel{\sqrt{1-x^2}}} + c\right.$$

$$= \frac{-1}{2}\left[2\sin^{-1}x\sqrt{(1-x)^2} - 2\int 1\,dx + c\right.$$

$$= -\sin^{-1}x\sqrt{(1-x)^2} + x + c$$

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

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

$3x + 2y \geq 6$ $\quad$ $x + y \leq 4$ $\quad$ $x \geq 0$ $y \geq 0$

corresponding eq

$3x + 2y = 6$

x	0	2
y	3	0
	A	B

$x + y = 4$

x	0	4
y	4	0
	C	D

Test points

$0 \geq 6$ (F) $\quad$ $0 \leq 4$ (T)

On graph (2)

Corner points

A (0, 3)

B (2, 0)

C (0, 4)

D (4, 0)

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

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

equation of Parabola → let $P(x, y)$ be a point on parabola

$F(-3, 4)$

directric $3x + 2y - 3 = 0$

$|PF| = |PM|$

$$\sqrt{(x+3)^2+(y-4)^2} = \frac{|3x+2y-3|}{\sqrt{9+4}}$$

$$\left(\sqrt{13}\sqrt{x^2+9+6x+y^2+16-8y}\right)^2 = (3x+2y-3)^2$$

$$13(x^2+6x+25+y^2-8y) = 9x^2+4y^2+9+2(3x)(2y) + 2(2y)(-3)+2(-3)(3x)$$

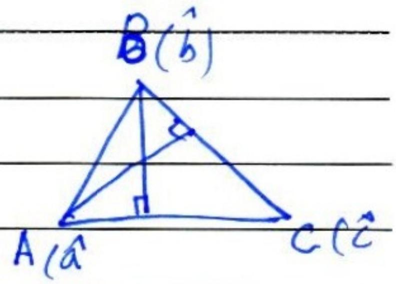
$$13x^2+78x+325+13y^2-104y = 9x^2+4y^2+9+12xy - 12y - 18x$$

$$\boxed{4x^2+9y^2+96x-92y+316-12xy = 0}$$

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

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

A



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

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

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

$$8x^2 + 18y^2 = 144$$

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

$$x^2 - y^2 = 3$$

$$x^2 = 3 + y^2$$

$$8(3 + y^2) + 18y^2 = 144$$

$$24 + 8y^2 + 144y^2 = 144$$

$$152y^2 = 120$$

$$y^2 = \frac{15}{19}$$

$$\boxed{y = \pm\sqrt{\frac{15}{19}}}$$

$$x^2 = 3 + y^2$$

$$= 3 + \frac{15}{19}$$

$$x^2 = \frac{72}{19}$$

$$x = \pm\sqrt{\frac{72}{19}}$$

intersection conics

$$\left(\pm\sqrt{\frac{72}{19}}, \pm\sqrt{\frac{15}{19}}\right)$$

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

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

$B = (1,1,1)$ Net Force $= 3i + 5j + k$

$P = (2, 0, 1)$

~~PP~~

$BP = OP - OB$

$= (2,0,1) - (1,1,1)$

$r = (1, -1, 0)$

$$\tau = r \times F' = \begin{vmatrix} i & j & k \\ 1 & -1 & 0 \\ 3 & 5 & 1 \end{vmatrix}$$

$= i(-1+0) - j(1-0) + k(5+3)$

$$\boxed{\tau = -\hat{i} - \hat{j} + 8\hat{k}}$$

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

Q. No. 3 (Page 1)

~~Let x be the base of box and y be height and volume of open box be $V = 32dm^3$~~

~~$V = x \cdot x \cdot h = x^2h = x^2y$~~

~~$32 = x^2y$~~

~~$y = \dfrac{32}{x^2}$~~

~~$f(x)$ = Volume of open box = area of base + 4(Surface area of sides)~~

~~$= x^2 + \dfrac{32}{x^2} = x^2 + 32x^{-2}$~~

~~$f(x) = x^2 + 32x^{-2}$~~

~~$f'(x) = 2x$~~

$$f(x) = \begin{cases} px+2 & 0 \le x < 2 \\ 7-qx & 2 \le x < 4 \\ 2x+1 & 4 \le x < 6 \end{cases}$$

* As $f(x)$ is continuos at $\boxed{x=2}$

$f(x) = LHL = RHL$

$7-qx = \lim_{x \to 2^-} px+2 = \lim_{x \to 2^+} 7-qx$

$7-2q = 2p+2 = 7-2q \rightarrow (1)$

* $f(x)$ is cont at $\boxed{x=4}$

$f(x) = LHL = RHL$

$2x+1 = \lim_{x \to 4^-} 7-qx = \lim_{x \to 4^+} 2x+1$

$2(4)+1 = 7-4q = 2(4)+1$

$8+1 = 7-4q = 9 \rightarrow (2)$

From (2) $9 = 7-4q$

$q = \dfrac{7-9}{4} = = -\dfrac{2}{4}$

Q. No. 3 (Page 2)

$$\boxed{q = \frac{-1}{2}}$$

from (1)

$$7 - 2q = 2p + 2$$

$$7 - \cancel{2}\left(-\frac{1}{\cancel{2}}\right) = 2p + 2$$

$$7 + 1 = 2p + 2 \quad \Rightarrow 8 = 2p + 2$$

$$6 = 2p$$

$$\boxed{p = 3}$$

$$7 - q(x)$$
$$7 - \left(-\frac{1}{2}\right)x$$

$$f(x) = \begin{cases} 3x + 2 & 0 \leq x < 2 \\ 7 + \frac{1}{2}x & 2 \leq x < 4 \\ 2x + 1 & 4 \leq x < 6 \end{cases}$$

x	0	1	1.99	2	3	3.99	4	5	5.99	
$y = 3x + 2$	2	5	7.99	8 ×						
$y = 7 + \frac{1}{2}x$				8	17/2 (8.5)	8.99	9 ×			
$y = 2x + 1$							9	11	12.99	13 ×

(graph - page 43)

Q. No. 3 (Page 3)

Q. No. 3 (Page 4)

Q. No. 4 (Page 1) tangent equation

$\frac{x^2}{128} + \frac{y^2}{18} = 1 \longrightarrow$ A $\quad 18x^2 + 128y^2 = 2304 \to$ B

$3x + 8y + 1 = 0$

$m = \text{slope} = -\frac{3}{8}$ (slope of tangent)

$a^2 = 128$

$b^2 = 18$

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

$y = -\frac{3}{8}x \pm \sqrt{128\left(-\frac{3}{8}\right)^2 + 18}$

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

$y = -\frac{3}{8}x \pm 6$ (Xply by 8)

$8y = -3x \pm 48$

$\boxed{3x + 8y \pm 48 = 0} \to$ (1) Required tangents of ellipse.

from (1) $3x + 8y \mp 48 = 0$

$\boxed{x = \frac{48 - 8y}{3}}$ put ,

Put in (B)

$18\left(\frac{48 - 8y}{3}\right)^2 + 128y^2 = 2304$

$\frac{2}{1}\cancel{\frac{18}{9}}\left(2304 + 64y^2 - 768y\right) + 128y^2 = 2304$

$4608 + 128y^2 - 1536y + 128y^2 - 2304 = 0$

$256y^2 - 1536y + 2304 = 0$

$256(y^2 - 6y + 9) = 0$

Q. No. 4 (Page 2)

$y^2 - 6y + 9 = 0$

$y^2 - 3y - 3y + 9 = 0$

$y(y-3) - 3(y-3) = 0$

$(y-3)^2 = 0$

$\boxed{y = 3}$

Put y in $\frac{48 - 8y}{3} = x$

$\boxed{x = 8}$

$(8, 3)$ is the point of contact.

Q. No. 4 (Page 3)

Q. No. 4 (Page 4)

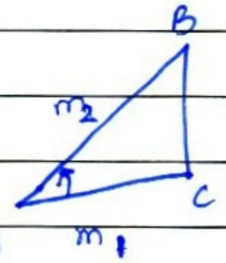
63

Q. No. 5 (Page 1)

$A\ (-3,-4) \qquad (x_1, y_1)$

$B\ (4,6) \qquad (x_2, y_2)$

$C\ (4,-3) \qquad (x_3, y_3)$



let m_1 and m_2 be the slopes of AB and AC.

$$\text{slope of } AB = \cancel{m} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6-(-4)}{4-(-3)} = \frac{6+4}{4+3} = \frac{10}{7} \quad (m_2)$$

$$\text{slope of } AC = \cancel{m_2} = \frac{-3-(-4)}{4-(-3)} = \frac{-3+4}{4+3} = \frac{1}{7} \quad (m_1)$$

(a)

i) **Equation of AB side:**

$$y - y_1 = m(x - x_1)$$

$$y-(-4) = \frac{10}{7}(x-(-3))$$

$$7(y+4) = 10(x+3)$$

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

$$\boxed{10x - 7y + 2 = 0}$$

ii) **Equation of AC side:**

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

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

$$\boxed{x - 7y - 25 = 0}$$

(b) $\angle A = ?$

$$\tan\theta = \frac{m_2 - m_1}{1 + m_1 m_2} = \frac{\frac{10}{7} - \frac{1}{7}}{1 + \left(\frac{10}{7}\right)\left(\frac{1}{7}\right)} = \frac{9/7}{59/49}$$

$$\tan\theta = \frac{63}{59}$$

$$\theta = \tan^{-1}(63/59)$$

$$A = \theta = 46.8 = 46°52'$$

$$\boxed{\angle A = 46.8°}$$

Q. No. 5 (Page 2)

c) Area of Δ ABC:

$$\Delta = \frac{1}{2}\begin{vmatrix} -3 & -4 & 1 \\ 4 & 6 & 1 \\ 4 & -3 & 1 \end{vmatrix}$$ (Expanding by C_3)

$$\therefore = \frac{1}{2}[1(-12-24)-1(9+16)+1(-18+16)]$$

$$= \frac{1}{2}[-36-25-2]$$

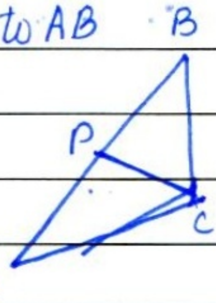
$$= -63/2$$ (ignore -ve)

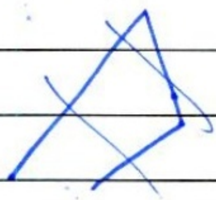
$$\boxed{\Delta = 63/2 \text{ sq units.}}$$

(d) Take Point P on AB ie CP is $\perp$ to AB

Slope of CP = $\frac{-1}{\text{Slope of AB}}$

$= \frac{-1}{\frac{10}{7}}$





$$\boxed{\text{Slope of CP} = \frac{-7}{10}}$$

~~For~~ Point P(x, y) and C(4, -3)

Equation of line.

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

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

$$7x + 10y + 2 = 0 \longrightarrow (A)$$

$$10x - 7y + 2 = 0 \longrightarrow (B)$$

Point of intersection of AB is P(x, y)

$$\frac{x}{\begin{vmatrix} 10 & 2 \\ -7 & 2 \end{vmatrix}} = \frac{-y}{\begin{vmatrix} 7 & 2 \\ 10 & 2 \end{vmatrix}} = \frac{1}{\begin{vmatrix} 7 & 10 \\ 10 & -7 \end{vmatrix}}$$

Q. No. 5 (Page 3)

$$\frac{x}{(20+14)} = \frac{-y}{(14-20)} = \frac{1}{(-49-100)}$$

$$\frac{x}{34} = \frac{-y}{-6} = \frac{1}{-149}$$

$$x = -\frac{34}{149} \qquad y = -\frac{6}{149}$$

$$P(x,y) = \left(-\frac{34}{149}, -\frac{6}{149}\right) \qquad C(4,-3)$$

distance CP (perpendicular distance)

$$|CP| = \sqrt{\left(4+\frac{34}{149}\right)^2 + \left(-3+\frac{6}{149}\right)^2}$$

$$= \sqrt{17.87 + 8.76}$$

$$= \sqrt{26.63}$$

$$\boxed{|CP| = 5.16 \text{ units}} \quad \text{or} \quad \frac{63}{\sqrt{149}}$$

Q. No. 5 (Page 4)

$-(y^2+2(4)(1)\ \ +1)$
$-y^2-2(y)$

Q. No. 6 (Page 1)

$9x^2 - y^2 - 12x - 2y + 2 = 0$ (Add -1 and 4 to b.

$(3x)^2 - 2(3x)(2) + 4) - (y^2 + 2(y) + (1)) = -2 + 4 - 1$

$(3x-4)^2 - (y+1)^2 = 1$

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

$9\left(x^2 - \frac{\cancel{12}^{4}x}{\cancel{9}_{3}}\right) - 1(y^2 + 2(y)^{(1)} + 1) = -2 - 1$

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

$9\left(x^2 - 2(x)\left(\frac{2}{3}\right) + \left(\frac{2}{3}\right)^2\right) - (y+1)^2 = -3 + \frac{\cancel{18}\,6}{\cancel{3}}$

$9(x - 2/3)^2 - (y+1)^2 = 3$ (÷ by 3)

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

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

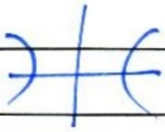
Centre

$\boxed{C = (2/3, -1)}$ as shifted parabola.

$a^2 = \frac{1}{3} \Rightarrow a = \frac{1}{\sqrt{3}}$

$b^2 = 3$

$c^2 = 10/3 \Rightarrow c = \sqrt{\frac{10}{3}}$



Foci $(\pm c, 0) = \left(\frac{2}{3} \pm \sqrt{\frac{10}{3}}, -1\right)$

$\boxed{\text{Foci} = F\left(\frac{2 \pm \sqrt{30}}{3}, -1\right)}$

Vertices $= (\pm a, 0)$ $\quad c\left(2/3, -1\right)$

$$= \left(\frac{2}{3} \pm \frac{1}{\sqrt{3}}, -1\right)$$

$$\boxed{\text{Vertices} = \left(\frac{2 \pm \sqrt{3}}{3}, -1\right)}$$

Eccentricity $e = \frac{c}{a} = \frac{\sqrt{10}/\cancel{\sqrt{3}}}{1/\cancel{\sqrt{3}}}$

$$\boxed{e = \sqrt{10}}$$

Directrices $\cancel{x} = \pm \frac{a^2}{c}$

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

$$x - \frac{2}{3} = \pm \frac{1}{\sqrt{30}}$$

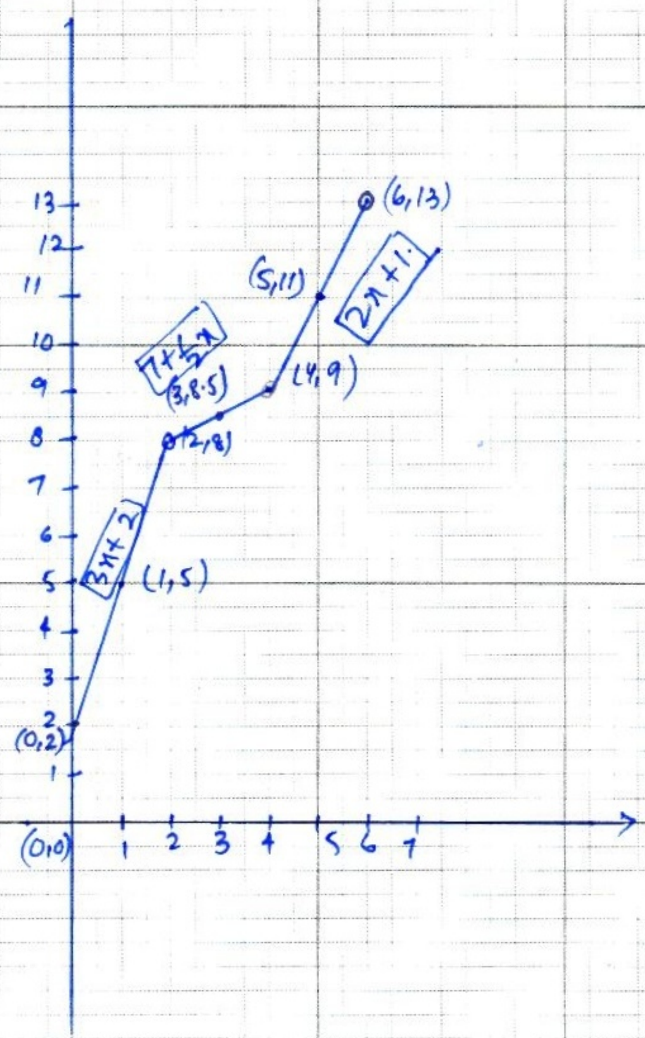
$$\boxed{x = \frac{2}{3} \pm \frac{1}{\sqrt{30}}}$$

Q. No. 6 (Page 3)

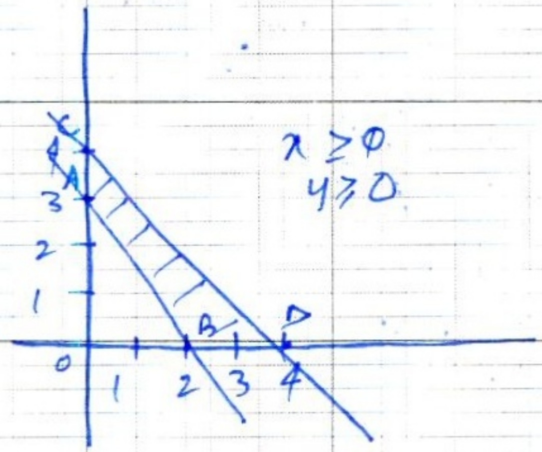
Q. No. 6 (Page 4)

Q # 3
(Long)

Scale
x + y axis
2 small boxes = 1 unit.



2 small boxes
= 1 unit



$V = x^2 y$

$x^2 + \frac{32}{x}$

$x^2 + 32x^{-2}$

$f'(x)\ x^2 - 64x^{-3}$

$x^2+y^2+2x-4y$

$= 5+\frac{1}{3} = \frac{\sqrt{6}}{\sqrt{3}}$

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

$-\frac{3}{k}$

$2x+2$

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

$e^{\sin x}$

$-\int e^{\sin x^2}$

2

$-\frac{\sqrt{2}}{x}$

$(2,0)$

$(0,-4)$

$\frac{-4}{-2}$ (2)

$y-0 = 2(x-2)$

$y = 2x-4$

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

$2\left(\frac{x^2}{2} - kx\right)$

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

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

$-2\alpha \quad -5$

$2x+2$

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

$\frac{1}{4} - 4$

$(e^{\sin x})^2$

$\frac{1}{2}\int e$