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

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

$f(x) = \dfrac{3x+2}{2x-1}$

Let $f(x) = y$

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

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

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

$3x+2 = 2xy - y$

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

$2xy - 3x = y + 2$

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

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

$f^{-1}(y) = \dfrac{y+2}{2y-3}$

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

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

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

$f(x) = \dfrac{3x+2}{2x-3}$

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

$= \dfrac{3x+2+2(2x-3)}{2(3x+2)-3(2x-3)}$

$= \dfrac{3x+6+4x-6}{6x+4-6x}$

$= \dfrac{3x+2+4x-6}{6x+4-6x+9}$

$= 6x-4$

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

$= \dfrac{3x+\cancel{2}+4x-\cancel{2}}{6\cancel{x}+4-\cancel{6x}+3}$

$= \dfrac{\cancel{7}x}{\cancel{7}}$

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

Hence proved.

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

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

Continuity of function :

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

i- $f(1) = 4$

ii- Limit

$$\lim_{x \to 1^-} \cancel{f} f(x) = \lim_{x \to 1^+} f(x)$$

$$\lim_{x \to 1^-} (3x - 1) = \lim_{x \to 1} (2x)$$

$$3(1) - 1 = 2(1)$$

$$3 - 1 = 2$$

$$2 = 2$$

As $\lim_{x \to 1^-} (f(x) = \lim_{x \to 1^+} f(x)$

Limit exists.

iii. $f(1) \neq \lim_{x \to 1} f(x)$

$4 \neq 2$

Hence the function is discontinuous at $x = 1$ since $f(1) \neq \lim_{x \to 1} f(x)$.

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

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

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

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

Taking derivative on BHS.

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

$$\frac{1}{(1+y^2)} \times y_1 = q\left(\frac{1}{1+x^2}\right)$$

Cross multiplying.

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

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

Hence proved.

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

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

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

Let $y = \sin(x)$

where $x = 60^\circ$ $\quad$ $x + \delta x = 61^\circ$ $\quad$ $\delta x = 1^\circ$

$y = \sin x$

Taking differential on BHS

$dy = \cos x \; dx$

$dy = \cos(60)(1^\circ)$ $\qquad$ $1^\circ = 0.01745$ rad.

$dy = \cos(60) \times 0.01745$

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

$y = \sin(x)$

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

$\sin(60^\circ + 1^\circ) = \sin(60) + 8.725 \times 10^{-3}$

$\sin(61^\circ) = 0.87475$

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

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

Area bounded by curve = ?

$y = x^3 - 9x$

$\text{Area} = \int_a^b y\,dx$

for finding range

$x^3 - 9x = 0$

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

$x = 0 \qquad x^2 = 9$

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

$x^3 - 9x \geq 0 \quad [-3, 0)$ graph is above x-axis

$x^3 - 9x \leq 0 \quad [0, 3]$ graph is below x-axis.

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

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

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

$= -\left[\frac{-81}{4} \right] - \left[\frac{-81}{4} \right]$

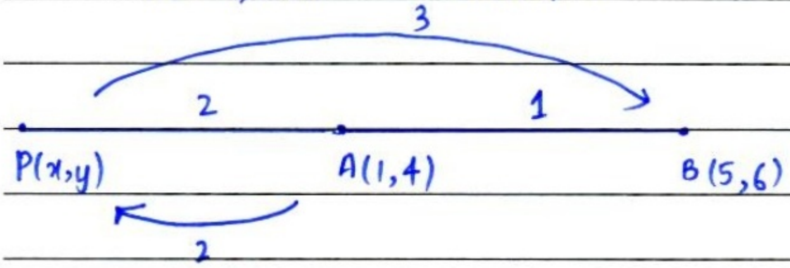
$= \frac{81}{4} + \frac{81}{4} = \frac{81}{2}$ square units.

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

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

Ratio formula:

$A(1, 4) \qquad B(5, 6)$



$k_1 : k_2 = 2 : 3 \qquad A(x_1, y_1) = A(1, 4)$

$k_1 = 2 \qquad k_2 = 3. \qquad B(x_2, y_2) = B(5, 6)$

$$P(x,y) = \left(\frac{k_1x_2 + k_2x_1}{k_1 + k_2} , \frac{k_1y_2 + k_2y_1}{k_1 + k_2} \right)$$

$$P(x,y) = \left(\frac{(2)(5) + 3(1)}{2+3} , \frac{(2)(6) + (3)(4)}{2+3} \right)$$

$$P(x,y) = \left(\frac{10+3}{5} , \frac{12+12}{5} \right)$$

$$P(x,y) = \left(\frac{13}{5} , \frac{24}{5} \right)$$

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

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

Equation of line = ?

The normal form of equation of st. line is:

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

where $p =$ perpendicular distance from origin $= 8$
$\alpha =$ angle from +ve x-axis. $= 30°$

$x\cos(30°) + y\sin(30°) = 8$

$x\left(\frac{\sqrt{3}}{2}\right) + y\left(\frac{1}{2}\right) = 8$

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

$\frac{\sqrt{3}x}{2} + \frac{y}{2} = \frac{16}{2}$

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

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

Comparing with:

$y = mx + c$

$m = -\sqrt{3}$ $\quad c = 16$.

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

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

Graph:

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

Associated equations are:

$3x + 2y = 6$ $\qquad$ $x + y = 4$

For x-intercept ; $y = 0$

$3x + 0 = 6$ $\qquad$ $x + 0 = 4$

$x = 2$ $\qquad$ $x = 4$

$(2, 0)$ $\qquad$ $(4, 0)$

For y-intercept ; $x = 0.$

$0 + 2y = 6$ $\qquad$ $0 + y = 4$

$y = 3$ $\qquad$ $y = 4$

$(0, 3)$ $\qquad$ $(0, 4)$

Test point

$0 + 0 \geq 6$ $\qquad$ $0 + 0 \leq 4$

(False) $\qquad$ (True)

Corner points are

$(0, 4)$, $(0, 3)$, $(4, 0)$, $(2, 0)$

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

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

$F(-3,4)$ directrix : $3x+2y-3=0$

In parabola

$\frac{|PF|}{|PM|} = 1$ where $P(x,y)$ be a point on it.

$|PF| = |PM|$

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

Taking square on BHS.

$x^2+6x+9+y^2-8y+16 = \frac{(9x^2+4y^2+9+12xy-18x-12y)}{(\sqrt{13})^2}$

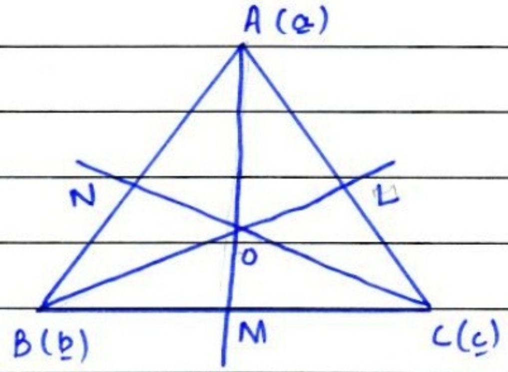
$13x^2+78x+117+13y^2-104y+208 = 9x^2+4y^2+9+12xy-18x-12y = 0$

$13x^2-9x^2+13y^2-4y^2+78x+18x-104y+12y-12xy+117-9=0$

$4x^2+9y^2+96x-92y-12xy+108=0$

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

Q. No. 2 Part (x) (Page 1) **Altitudes are concurrent.**



Consider a triangle ABC

$\vec{OA} = \underline{a}$

$\vec{OB} = \underline{b}$

$\vec{OC} = \underline{c}$

$\vec{AB} = \underline{b} - \underline{a}$

$\vec{BC} = \underline{c} - \underline{b}$

$\vec{AC} = \underline{a} - \underline{c}$

As we know

$\vec{AM} \perp \vec{BC}$

$\vec{AO} \perp \vec{BC}$

$(\vec{AO}) \cdot (\vec{BC}) = 0$

$\underline{a} \cdot (\underline{c} - \underline{b}) = 0$

$\underline{a}\underline{c} - \underline{a}\underline{b} = 0 \quad -①$

~~By~~ $\vec{CN} \perp \vec{AB}$

$\vec{CO} \perp \vec{AB}$

$\vec{CO} \cdot (\vec{AB}) = 0.$

$\underline{c}(\underline{b} - \underline{a}) = 0$

$\underline{c}\underline{b} - \underline{c}\underline{a} = 0 \quad -②$

Adding ① and ②

$\cancel{ac - bc + bc - ac = 0}$ $\quad \underline{a}\cancel{\underline{c}} - \underline{a}\underline{b} + \underline{b}\underline{c} - \cancel{\underline{a}}\underline{c} = 0$

$\cancel{a(}$ $\quad \underline{b}(\underline{c} - \underline{a}) = 0$

$\vec{OB} \cdot (\vec{AC}) = 0$

$\overline{OB} \perp \overline{AC}$

This proves that altitudes pass through O hence are concurrent.

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

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

Point of intersection:

$$\frac{x^2}{18} + \frac{y^2}{8} = 1 \quad - (1) \qquad \frac{x^2}{3} - \frac{y^2}{3} = 1 \quad - (2)$$

Multiplying (2) by 1/6

$$\left(\frac{x^2}{3} - \frac{y^2}{3} = 1\right) \times \frac{1}{6}$$

$$\frac{x^2}{18} - \frac{y^2}{18} = \frac{1}{6} \quad - (3)$$

Subtracting (3) and (1)

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

$$\underset{-}{\overset{(+)}{}}\cancel{\frac{x^2}{18}} \;\underset{+}{\overset{(-)}{}}\frac{y^2}{18} \;\underset{-}{\overset{(+)}{=}}\frac{1}{6}$$

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

$$\frac{13}{72} y^2 = \frac{5}{6}$$

$$y^2 = \frac{5}{6} \times \frac{72}{13} = \frac{60}{13}. \qquad y = \pm 2\sqrt{\frac{15}{13}}$$

$$\frac{x^2}{3} - \frac{60/13}{3} = 1$$

$$\frac{x^2}{3} = 1 + \frac{60}{13(3)}$$

$$\frac{x^2}{3} = \frac{33}{13} = \frac{99}{13} \qquad x = \pm 3\sqrt{\frac{11}{13}}$$

$$P(x, y) = P\left(\pm 3\sqrt{\frac{11}{13}}, \pm 2\sqrt{\frac{15}{13}}\right)$$

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

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

Moment of force =?

$\vec{F_1} = \hat{i} - 2\hat{j}$
$\vec{F_2} = 3\hat{i} + 2\hat{j} - \hat{k}$
$\vec{F_3} = 5\hat{j} + 2\hat{k}$

$\vec{F_1} + \vec{F_2} + \vec{F_3} = \hat{i} - \cancel{2\hat{j}} + 3\hat{i} + \cancel{2\hat{j}} - \hat{k} + 5\hat{j} + 2\hat{k}$
$= (3+1+0)\hat{i} + 5\hat{j} + (-1+2)\hat{k}$
$\vec{F_1} + \vec{F_2} + \vec{F_3} = 4\hat{i} + 5\hat{j} + \hat{k}$

$O(1,1,1)$ $P(2,0,1)$

$\vec{OP} = [2-1]i + [0-1]j + [1-1]k$
$\vec{OP} = i - j + 0$
$\vec{r} = \vec{OP} = i - j$

Moment of force $= \vec{r} \times \vec{F}$

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

$= \hat{i}(-1+0) + -\hat{j}(1+0) + \hat{k}(5+4)$
$= -(1)i - \hat{j}(1) + \hat{k}(9)$
$\mu = -\hat{i} - \hat{j} + 9\hat{k}$

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

Q. No. 3 (Page 1)

Let $l = w = x$ and $h = y$

$V = 32\ dm^3$

$x \cdot x \cdot y = 32$

$x^2 \cdot y = 32$

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

Area $= x^2 + 4xy$

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

$= x^2 + \dfrac{128}{x}$

$f(x) = x^2 + 128x^{-1}$

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

$f''(x) = 2 + 2 \times 128x^{-3}$

$= 2 + 2 \times 128(x)^{-3}$

$= 2 + 256x^{-3}$

For critical point.

$f'(x) = 0$

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

$2x^3 - 128 = 0$

$2(x^3 - 64) = 0$

$(x^3 - 64) = 0$

$\cancel{(x^3 - 8^3) = 0}$ $\qquad$ $(x^3 - 4^3) = 0$

$\cancel{(x-2)(x^2 + 2x + 4) = 0}$ $\qquad$ $(x-4)(x^2 + 4x + 16) = 0.$

$(x-4) = 0$ $\qquad$ $x^2 + 4x + 16 = 0$

Q. No. 3 (Page 2)

$x = 0 + 4$

$\boxed{x = 4}$

Placing in $f''(x)$

$f''(4) = 2 + \frac{256}{4^3}$

$= 2 + \frac{256}{64}$

$f''(4) = 2 + 4 = 6 > 0$

As $f''(4)$ is +ve so the least value will be acquired.

$\boxed{x = 4}$

$y = \frac{32}{x^2} = \frac{32}{16}$ $\boxed{y = 2}$

$\boxed{x = 4}$ $\boxed{y = 2}$

$x^2 + 4x + 16 = 0$

$x = \frac{-4 \pm \sqrt{16 - 4(1)(16)}}{2(1)}$

$= \frac{-4 \pm \sqrt{16 - 64}}{2}$

$= \frac{-4 \pm \sqrt{48}\, i}{2}$

$= \frac{-4 \pm 4\sqrt{3}\, i}{2}$

$= -2 \pm \sqrt{3}\, i$

(imaginary roots)
(not possible).

Q. No. 3 (Page 3)

Q. No. 3 (Page 4)

Q. No. 4 (Page 1)

$$\int \frac{2x^2 - x - 7}{(x+2)^2 (x^2+2x+5)} \, dx$$

First we consider:

$$\frac{2x^2-x-7}{(x+2)^2(x^2+2x+5)} = \frac{A}{(x+2)} + \frac{B}{(x+2)^2} + \frac{Cx+D}{(x^2+2x+5)}$$

$$2x^2-x-7 = A(x+2)(x^2+2x+5) + B(x^2+2x+5) + (Cx+D)(x+2)^2$$

Let $x+2=0$

$x=-2$

$$2(-2)^2-(-2)-7 = A(0) + (Cx+D)(0) + B(4-4+5)$$

$$3\cancel{9} = B(5)$$

$$\boxed{B = \frac{3\cancel{9}}{5}}$$

$$2x^2-x-7 = A(x^3+2x^2+5x+2x^2+4x+10) + B(x^2+2x+5)$$
$$+ (Cx+D)(x^2+4x+4)$$

$$2x^2-x-7 = A(x^3+4x^2+9x+10) + B(x^2+2x+5)$$
$$+ Cx^3 + 4Cx^2 + 4Cx + Dx^2 + 4Dx + 4D$$

comparing coefficients:

$A + C = 0$

$A = -C$

$4A + B + 4C + D = \cancel{0}\,2$

$4\cancel{A} + B + 4(\cancel{-A}) + D = 2$

$B + D = 2$

$$\boxed{D = +\frac{7}{5}}$$

$10A + 5B + 4D = -7$

$10A + 5\left(\frac{3}{5}\right) + 4\left(\frac{7}{5}\right) = -7$

$10A = -7 - \frac{4\times 7}{5} - \frac{5\times 3}{5}$

$10A = -\frac{78}{5} = -\frac{39}{25}$

$$\boxed{C = \frac{39}{25}}$$

$$\boxed{A = -\frac{39}{25}}$$

Q. No. 4 (Page 2)

$$\frac{2x^2-x-7}{(x+2)^2(x^2+2x+5)} = \frac{-39}{25(x+2)} + \frac{3}{5(x+2)^2} + \frac{\frac{39}{25}x+\frac{7}{5}}{x^2+2x+5}$$

$$= \frac{-39}{25(x+2)} + \frac{3}{5(x+2)^2} + \frac{39x+35}{25(x^2+2x+5)}$$

Taking integral on BHS.

$$= \frac{-39}{25}\int\frac{dx}{(x+2)} + \frac{3}{5}\int\frac{dx}{(x+2)^2} + \frac{39}{25}\int\frac{x+\frac{35}{39}}{x^2+2x+5}\,dx$$

$$= -\frac{39}{25}\ln(x+2) + \frac{3}{5}\frac{(x+2)^{-2+1}}{-2+1} + \frac{39}{50}\int\frac{2x+\frac{70}{39}}{x^2+2x+5}\,dx$$

$$= -\frac{39}{25}\ln(x+2) - \frac{3}{5(x+2)} + \frac{39}{50}\int\frac{2x+2}{(x^2+2x+5)} + \frac{39}{50}\int\frac{\frac{70}{39}-2}{(x^2+2x+1)+(4)}$$

$$= -\frac{39}{25}\ln(x+2) - \frac{3}{5(x+2)} + \frac{39}{50}\ln(x^2+2x+5) + -\frac{4}{25}\times\frac{1}{2}\tan^{-1}\left(\frac{x+1}{2}\right)+c$$

$$= -\frac{39}{25}\ln(x+2) - \frac{3}{5(x+2)} + \frac{39}{50}\ln(x^2+2x+5) - \frac{2}{25}\tan^{-1}\left(\frac{x+1}{2}\right)+c.$$

Q. No. 4 (Page 3)

Equation of tangent :?

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

$3x+8y+1=0$

slope $= \frac{-a}{b} = -\frac{3}{8}$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

$a^2=128 \qquad b^2=18$

Let eq of tangent be:

$y = mx + c$

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

$y = -\frac{3}{8}x \pm \sqrt{(128)\left(\frac{9}{64}\right)+18}$

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

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

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

$8y = -3x \pm 48$

$3x+8y \pm 48=0$

$3x+8y+48=0 \qquad 3x+8y-48=0.$

Point of contact.

$3x+8y+48=0.$

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

$$\frac{\left(\frac{-48-8y}{3}\right)^2}{128} + \frac{y^2}{18} = 1$$

Q. No. 4 (Page 4)

$$\frac{8}{9}\frac{(y+6)^2}{(128)} + \frac{y^2}{18} = 1$$

$$\frac{1}{16\times 9}(y^2+12y+36) + \frac{y^2}{18} = 1$$

$$\frac{18(y^2+12y+36)+16y^2}{16\times 18\times 9} = 1$$

$$18y^2 + 216y + 648 + 16y^2 = 288$$

$$34y^2 + 216y + 360 = 0$$

$$18y^2 + 216y + 648 + 144y^2 = 2529$$

$$162y^2 + 216y - 1881 = 0$$

$$y = (2.8) \qquad y = -4.1387$$

$$\frac{1}{2\times 8\times 9}(y^2+12y+36) + \frac{y^2}{9\times 2} = 1$$

$$(y^2+12y+36) + 8y^2 = 144$$

$$9y^2 + 12y - 108 = 0$$

$$y = \frac{6 \pm 6\sqrt{22}}{7} \qquad x = -8\left(\frac{6-y}{3}\right)$$

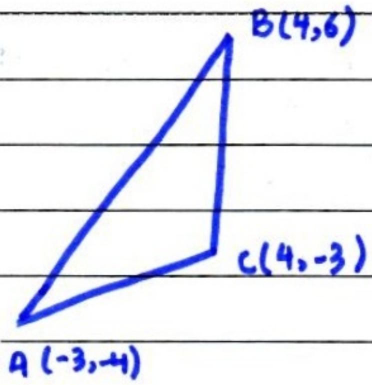
$$x = -8\left(6 - \frac{6\pm 6\sqrt{22}}{7}\right)$$

$$= -8\frac{(42 \pm 6 \pm 6\sqrt{22})}{7}$$

$$= 8\frac{(36 \pm 6\sqrt{22})}{7}$$

$$P(x, y) = P\left(\frac{8(36 \pm 6\sqrt{22})}{7}, \frac{6\pm 6\sqrt{22}}{7}\right).$$

Q. No. 5 (Page 1)



i- Equation of sides :

$\overline{AB}$:

Slope of $\overline{AB} = m_1 = \dfrac{y_2 - y_1}{x_2 - x_1}$

$$m_1 = \frac{6+4}{4+3} = \frac{10}{7}$$

From point slope form.

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

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

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

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

$\overline{AC}$:

Slope of line $\overline{AC} = m_2 = \dfrac{y_2 - y_1}{x_2 - x_1}$

$$m_2 = \frac{-3+4}{4+3} = \frac{1}{7}$$

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

$$y + 4 = m(x+3)$$

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

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

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

For interior angle A:

Let $\overline{AC} = l_2$

Let $\overline{AB} = l_1$

$\theta : l_2 \rightarrow l_1$ $\quad m_1 = \frac{10}{7} \quad m_2 = \frac{1}{7}$

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

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

$$= \frac{\frac{9}{7}}{1 + \frac{10}{49}} = \frac{\frac{9}{7}}{\frac{59}{49}}$$

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

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

$$\theta = 46.87°$$

$$\boxed{\angle A = 46.87°}$$

Area of ΔABC:

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

$$= \frac{1}{2} \begin{vmatrix} 4 & 6 & 1 \\ 4 & -3 & 1 \\ -3 & -4 & 1 \end{vmatrix}$$

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

$$= \frac{1}{2} [4 - 42 - 25] = \frac{1}{2} [-63]$$

Q. No. 5 (Page 3)

Since area is +ve so;

Area = $\frac{63}{2}$ sq units.

d. Distance from C(4, -3) to AB

Eq of line $\overline{AB}$ = $10x - 7y - 2 = 0$ $\qquad$ $C(4,-3) = C(x_1, y_1)$

Distance from point to line = $\frac{|ax_1 + by_1 + c|}{\sqrt{a^2+b^2}}$

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

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

$$= \frac{\cancel{17}}{\cancel{\sqrt{149}}} \text{ units.} \quad \frac{59}{\sqrt{149}} = 1 \text{ unit}$$

Q. No. 5 (Page 4)

Q. No. 6 (Page 1)

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

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

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

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

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

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

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

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

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

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

Centre:

$\cancel{e(x,}$ $\quad X = x - \frac{2}{3} \qquad Y = y + 1$

So eq becomes

$$\frac{X^2}{1/9} - \frac{Y^2}{1} = 1 \qquad \text{(hyperbola)}$$

$$C(X, Y) = C(0, 0)$$

$X = 0 \qquad Y = 0$

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

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

$$C\left(2/3, -1\right)$$

Q. No. 6 (Page 2)

Focii:

$F(X, Y) = F(\pm c, 0)$

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

$c^2 = a^2 + b^2$

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

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

$F(X, Y) = F\left(\pm\frac{\sqrt{10}}{3}, 0\right)$

$X = \pm\frac{\sqrt{10}}{3}$ $\quad Y = 0$

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

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

$F\left(\frac{2 \pm \sqrt{10}}{3}, -1\right)$

Vertices:

$V(X, Y) = V(\pm a, 0)$

$a^2 = \frac{1}{9}$; $a = \pm\frac{1}{3}.$

$V(X, Y) = V\left(\pm\frac{1}{3}, 0\right)$

Q. No. 6 (Page 3)

$X = \pm \frac{1}{3}$ $\qquad Y = 0$

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

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

$V(1, -1)$ $\qquad V\left(\frac{1}{3}, -1\right)$

Eccentricity:

$c = ae$

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

$e = \sqrt{10}$

Directrix:

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

$X = \pm \frac{1/3}{\sqrt{10}}$

$X = \pm \frac{1}{3\sqrt{10}}$

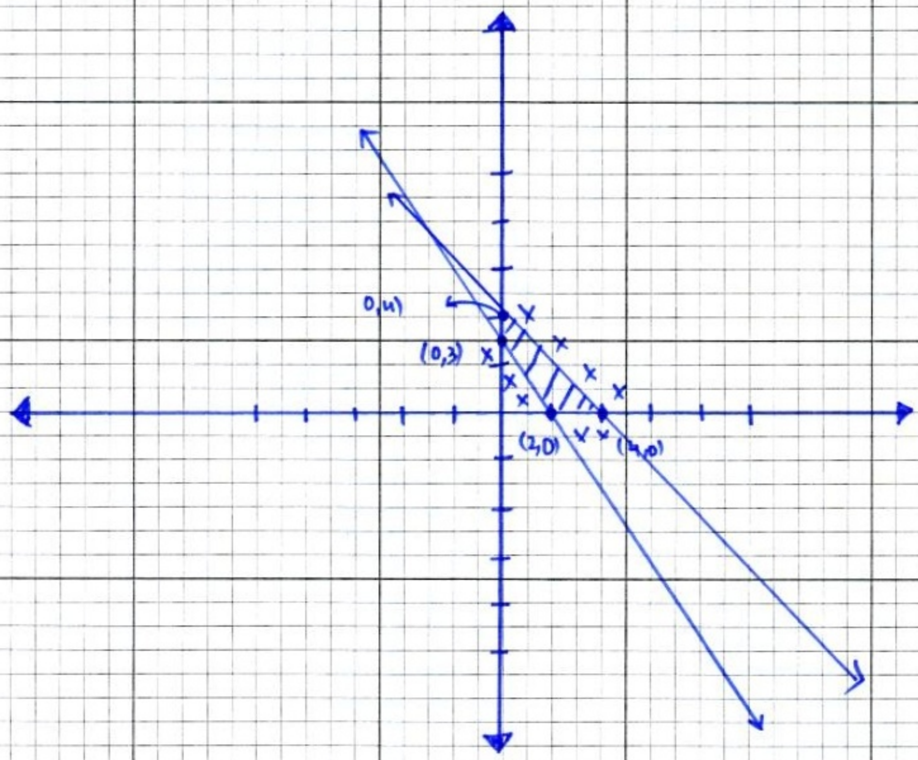
$x - \frac{2}{3} = \pm \frac{1}{3\sqrt{10}}$

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

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

Q. No. 6 (Page 4)

Q:2
(viii) Graph



1 square along x = 1 unit.
1 square along y = 1 unit.

$y = (-\sqrt{2})x$

$y = (-1+\sqrt{2})x$

$y = (-1-\sqrt{2})x.$

$f'(x) = \frac{x}{x^2+1}$

$x^2y + y = x$

$x^2y - x = -y$

x

$y = \ln(x^2+1)$

$y = \frac{1}{2}\Big|\frac{2x}{x^2+1}$

$\frac{1}{2}\ln(x^2+1)$

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

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

$3($

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

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

$1 + t^2 = 9$

$t^2 = 9 - 1 = 8$

$g(x) = f^{-1}(3x)$

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

$y^2 = x + 5$

$y^2 + 5 = x$

$y^2 + 5 = f^{-1}(x)$

$9x^2 + 5$

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

$\frac{dy}{dx}$

$2\left[\frac{x^2}{2} - kx\right]_0^2 = 1$

$2\left[\frac{2^2}{2} - 2k\right] = 1$

$[2 - 2k] = \frac{1}{2}$

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

$x^2 + y^2 + 2x - 4x + \frac{1}{3} = 0$

$4 + 1 + 4 - 4 + \frac{1}{3} = 0$

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

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

$3 - 6\alpha + 9 - 4 - 10 + 4\alpha = 0$

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

$x^2 y + y = x$

$x^2 y - x = y$

$2x + 2 = 0$

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

$1 - 2 - 3$

$f'(x) = e^{\ln \sin x} \times \frac{1}{\sin x} \times \cos x$

$= e^{\ln(1)}$

$\sin x = y$

$dy = \cos x\, dx$

$\int_0^{\pi/2} e^y\, dy$

$\left| e^{\sin x} \right|_0^{\pi/2}$

$e^1 - e^0$

$e - 1$

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

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

$3 - 6\alpha + 9 - 10 + 6 - 10 + 4\alpha = 0$

$-2\alpha + 6 - 1$

$3(6) + 1(4) - 2(3)$

$3(4+3) + 1(-4) - 2(5+1)$

$21 - 4 - 81$

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

$x^2 y + y = x$

$x^2 y - x = -y$

$-y = x - x^2 y$

$y = x(1 - xy)$

$\left(\frac{-\pi}{\sqrt{2}}\right)\left(\frac{-k}{3}\right) = -1$

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

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

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

$2x - y = 4$

$2x - y - 4 = 0$

$2x + 2 = 0$

$x = -1$

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

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

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

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