(Section B)

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

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

Let $y = f(x)$

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

To isolate 'x'

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

$2yx - y = 3x + 2$

$2yx - y - 2 = 3x$

$(2y)$

$-y - 2 = 3x - 2yx$

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

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

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

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

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

Replacing x by y

$$f^{-1}(x) = \frac{-x-2}{3-2x}$$ → this is required equation.

Now to show

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

put fx in $f^{-1}(x)$

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

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

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

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

$= x$ → proved

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

CUTTING LINE

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

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

continuity to be proved at $x=1$

→ **STEP:1** To check whether $f(x)$ satifies at $x=1$

$f(x) = 4$

$f(1) = 4 \Rightarrow$ which is a real number so condition satisfied.

→ **STEP:2** To show $\lim_{x\to 1} fx$ holds.

Left hand Limit

$$\lim_{x\to 1^-} fx = \lim_{x\to 1} 3x-1$$

$= 3(1) - 1$ Limit applied

$= 2$

Right hand Limit

$$\lim_{x\to 1^+} fx = \lim_{x\to 1} 2x$$

Limit applied

$= 2(1)$

$= 2$

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

we can see 2^{nd} condition is satisfied.

STEP:3
for continuity

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

But we can see that $f(1) \neq \lim_{x\to 1} fx$

So we proved that the given function is not continuous for $x=1$

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

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

Taking derivative w.r.t x

$$\frac{dy}{dx} = \frac{d \cot(q \cot^{-1} x)}{dx}$$

$$y_1 = -\operatorname{cosec}^2(q \cot^{-1} x) \cdot -\frac{q}{1+x^2}$$ → which is the derivative of $\theta = q \cot^{-1} x$

$$(1+x^2) y_1 = +q \operatorname{cosec}^2(q \cot^{-1} x)$$

we know $1 + \cot^2 x = \operatorname{cosec}^2 x$

$$(1+x^2) y_1 = q(1 + \cot^2(q \cot^{-1} x)$$

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

so $\cot^2(q \cot^{-1} x) = y^2$

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

$(1+x^2) y_1 - q(1+y^2) = 0$ ⟹ So we have proved the required condition.

(Section B)

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

CUTTING LINE

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

$\sin 61^\circ$

consider $\sin(60+1) = f(x + \delta x)$

we ~~know~~ let that $(\sin)60 = x$

$1^\circ = \delta x$

As we know $f(x+\delta x) = f(x) + \delta y$

and we have $\delta x = 1^\circ$

and $f(x) = \sin 60^\circ$ where $x = 60^\circ$

so $f(x) = \sin x$

Take $f(x) = y$

$y = \sin x$

To find δy take differentials on both sides

$dy = \cos x \, dx$

put value x and δx or dx

$dy = \cos(60)(0.0174)$ As we know $1^\circ = 0.01745 = \frac{\pi}{180}$

$dy = 0.008725$

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

Now

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

$= \sin 60 + 0.008725$

$f(\sin 61) = 0.8747$ radians

$\Downarrow$

. This is the required answer.

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

$y = x^3 - 9x$

To find upper and lower limits we take $y = 0$

$0 = x^3 - 9x$

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

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

$(x-3)(x+3) = 0$

$x = 3 \quad x = -3$

So we have domain $[-3, 3]$

checking function at these values.

$f(x) = \cancel{y}x^3 - 9x$ at $x = -3 \rightarrow 0$

$x = -2 \rightarrow 10$

$x = -1 \rightarrow 8$

$x = 0 \rightarrow 0$

$x = 1 \rightarrow -8$

$x = 2 \rightarrow -10$

$x = 3 \rightarrow 0$

As we can see at $x(0, 3)$ the values are negative so while computing area

$$\text{Area} = \int_{-3}^{3} x^3 - 9x$$

we have ~~to~~ divide integral as

(Section B)

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

$$= \int_{-3}^{0} x^3 - 9x + \left(- \int_{0}^{3} x^3 - 9x \right)$$

we insert negative to avoid negative area as area can never be negative

first $\int x^3 - 9x$

$$= \int x^3 - 9 \int x$$

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

so now with limits

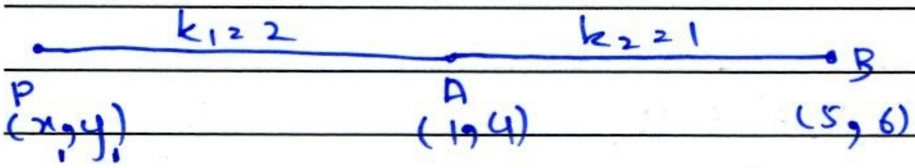
$$= \left| \frac{x^4}{4} \right|_{-3}^{0} - \left| \frac{9x^2}{2} \right|_{-3}^{0} - \left| \frac{x^4}{4} \right|_{0}^{3} + \left| \frac{9x^2}{2} \right|_{0}^{3}$$

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

$$= -\frac{81}{4} + \frac{81}{2} - \frac{81}{4} + \frac{81}{2}$$

$$= \frac{81}{2} \Rightarrow \text{required area.}$$

Q. No. 2 Part (vi) (Page 1) Let point P be (x_1, y_1)



Now firstly we know

that $x = \dfrac{k_1 x_2 + k_2 x_1}{k_1 + k_2}$

here $x_2 = 5$

$x_1 = x_1$

and $x = 1$

so $1 = \dfrac{(2)(5) + (1)(x_1)}{3}$

$3 = 10 + x_1$

$-7 = x_1$

Now we know

$y = \dfrac{k_1 y_2 + k_2 y_1}{k_1 + k_2}$

so we know

$y_2 = 6$

$y_1 = y_1$

$y = 4$

(Section B)

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

So

$$4 = \frac{2(6) + y_1}{3}$$

$$\cancel{12} = \cancel{12} + y_1$$

$$y_1 = 0$$

So point P is $(-7, 0)$

(Section B)

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

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

$$\int \sin^{-1} x \; \frac{x}{\sqrt{1-x^2}}$$

Using integration by parts we have

$$\sin^{-1} x \int \frac{x}{\sqrt{1-x^2}} - \int\int \frac{x}{\sqrt{1-x^2}} \; \frac{d}{dx} \sin^{-1} x$$

$$\frac{-1}{2} \sin^{-1} x \int \frac{-2x}{\sqrt{1-x^2}} + \frac{1}{2}\int\int \frac{-2x}{\sqrt{1-x^2}} \cdot \left[\frac{1}{\sqrt{1-x^2}}\right]$$

$$-\frac{1}{2} \sin^{-1} x \cdot \frac{(1-x^2)^{-\frac{1}{2}+1}}{-\frac{1}{2}+1} + \frac{1}{2}\int \frac{(1-x^2)^{-\frac{1}{2}+1}}{-\frac{1}{2}+1} \cdot \frac{1}{\sqrt{1-x^2}}$$

$$\Rightarrow \text{by} \quad f(x) \, f'(x) = \frac{f(x)^2}{2}$$

$$\frac{-1}{\cancel{2}} \sin^{-1} x \frac{(1-x^2)^{\frac{1}{2}}}{\frac{1}{\cancel{2}}} + \frac{1}{2} \int \frac{\cancel{\sqrt{1-x^2}}}{\frac{1}{2}} \cdot \frac{1}{\cancel{\sqrt{1-x^2}}}$$

$$- \sin^{-1} x \sqrt{1-x^2} + 1 \int 1$$

$- \sin^{-1} x \sqrt{1-x^2} + x + C \rightarrow$ This is the required answer.

(Section B)

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

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

$(-2, -5)$ $\quad\quad$ $3x+4y-24=0$
at point $(4, 3)$

Consider a circle with centre (h, k) so equation of circle will be $(x-h)^2+(y-k)^2=r^2$

and Line $3x+4y-24=0$ is tangent to circle at point $(4, 3)$

putting $(-2, -5)$ in the equation of circle as

$$(-2-h)^2+(-5-k)^2=r^2$$

and also
$(4, 3)$ in equation of circle as they pass through the circle

$$(4-h)^2+(3-k)^2=r^2$$

Equating the two equations we have

$$(-2-h)^2+(-5-k)^2=(4-h)^2+(3-k)^2$$
$$4+\cancel{h^2}+4h+25+\cancel{k^2}+10k=16+\cancel{h^2}-8h+9+\cancel{k^2}-6k$$

$$4h+8h+10k+6k+29-25=0$$
$$12h+16k+4=0$$
$$3h+4k+1=0 \rightarrow \text{equation } 1.$$

(Section B)

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

Now we know

Slope of tangent

is $3x+4y-24=0$

$3x-24=-4y$

$\frac{-3}{4}x+\frac{24}{4}=y$

so slope $m=-\frac{3}{4}$ by $y=mx+c$ form

we know normal is perpendicular to tangent and passes through centre so slope of normal of circle at point $(4,3)$ will be $\frac{4}{3}$

$\frac{(3-k)}{(4-h)}=\frac{4}{3}$

$9-3k=16-4h$

$4h-3k-7=0 \rightarrow$ Equation 2

Solving equation 1 & 2 we have

$h=1 \quad k=-1$

Now radius of circle is

$(-2-1)^2+(-5+1)^2=r^2$

$r^2=25$

$r=5$ (-5 neglected)

so equation is

$(x-1)^2+(y+1)^2=25$ OR

$x^2+y^2-2x-2y-23=0.$

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

~~(we have parabola with focus~~

~~(−3, 4) and directrix~~

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

~~let the parabola be at some centre)~~

we have linear inequalities

$5x+7y \le 35$ and $x-2y \le 4$

We know Associated equations

$5x+7y=35$ $\qquad\qquad$ $x-2y=4$

To find intercepts

$\frac{5x}{35}+\frac{7y}{35}=1$ $\qquad\qquad$ $\frac{x}{4}-\frac{y}{2}=1$

$\frac{x}{7}+\frac{y}{5}=1$ $\qquad\qquad$ so $(4,0)$ $(0,2)$ are intercepts.

so $(7,0)$ $(0,5)$ are intercepts

Checking $(0,0)$ test on both inequalities.

$5x+7y \le 35$ $\qquad\qquad$ $x-2y \le 4$

$5(0)+7(0) \le 35$ $\qquad\qquad$ $(0)-2(0) \le 4$

$0<35$ (TRUE, so $\qquad\qquad$ $0<4 \rightarrow$ TRUE

feasible region will be towards origin.)

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

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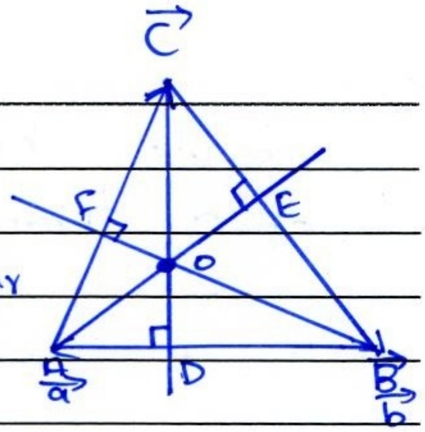
GRAPH PAPER.

There are two corner points
$(4,0)$ and $(0,2)$
including origin $(0,0)$

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



As we know
that altitudes are perpendicular
to sides

so we know
$\overrightarrow{AO}$ or $\overrightarrow{AE}$ both have same direction

$\overrightarrow{AO} \perp \overrightarrow{CB}$
so their dot product will be zero

$-a.(b-c) = 0$
$(-a.b) + (a.c)$
$a.c = a.b \rightarrow$ equation (1)

we know
$\overrightarrow{BF}$ or $\overrightarrow{BO} \perp \overrightarrow{AC}$

$-b(c-a) = 0$
$-b.c + b.a = 0$
$b.a = b.c \rightarrow$ equation.
we know that scalar product is
commutative so from 1 and 2 we know

$ac = b.c$
$ac - bc = 0$
$\vec{c}(\vec{a}-\vec{b}) = 0$
$-c(\vec{a}-\vec{b}) = 0$
So we find that $\overrightarrow{AB} \perp \overrightarrow{CO}$

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

So we have found that altitudes of a triangle are concurrent.

(Section B)

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

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

$8x^2+18y^2=144 \qquad x^2-y^2=3$

$8x^2+18y^2-144=0 \qquad x^2-y^2-3=0$

Multiplying second equation by 8 we see that

$8x^2-8y^2-24=0$

(~~Adding~~) Subtracting both equations

$$\cancel{8x^2}+18y^2-144=0$$
$$\underline{-\cancel{8x^2}+8y^2+24=0}$$
$$26y^2-120=0$$
$$26y^2=120$$
$$y^2=\frac{60}{13}$$
$$y=\frac{2\sqrt{195}}{13}$$

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

$$8x^2 + 18y^2 - 144 = 0$$

$$8x^2 + 18\left(\sqrt{\frac{60}{13}}\right)^2 - 144 = 0$$

$$8x^2 + 18\left(\frac{60}{13}\right) - 144 = 0$$

$$8x^2 = \frac{792}{13}$$

$$x^2 = \frac{99}{13}$$

$$x = \frac{3\sqrt{143}}{13}$$

So points of intersection are $x = \frac{3\sqrt{143}}{13}$, $y = \frac{2\sqrt{195}}{13}$

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

we find out the resultant

force first $= (i-2j) + (3i+2j-\hat{k}) + (5j+2k)$

so $\vec{F} = 4\hat{i} + 5\hat{j} + \hat{k}$

we find moment arm

$\vec{r} = \overrightarrow{MP}$

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

$= (2-1)\hat{i} + (0-1)j + (1-1)\hat{k}$

$= \hat{i} - \hat{j} + 0\hat{k}$

Now moment $= \vec{r} \times \vec{F}$

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

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

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

$= -i - j + 9\hat{k}$

(Section B)

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

So Moment $= |-i-j+9k|$

$= \sqrt{1^2+1^2+9^2}$

Moment $= \sqrt{83}$

So the required moment is $\sqrt{83}$

(Section C)

Q. No. 3 (Page 1) Q3

(b)

We know volume of cube is given by

$$V = x^2 h \quad \text{where } h = \text{height}, \; x = \text{side}$$

$$V = x^2 h$$

we know

$$V = 32 \text{ cm}^3$$

$$32 \text{ cm}^3 = x^2 h$$

$$\text{so } h = \frac{32}{x^2}$$

so now we know for

$$\text{Surface} = x^2 + 4hx$$

Substituting value of h in equation

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

↳ this is the required function

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

Now we find first derivative of this function

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

Q. No. 3 (Page 2) for stationary points we have to put value of $f'(x) = 0$

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

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

$$x^3 = \frac{128}{2}$$

$$x^3 = 64$$

$$x = 4$$

so we take second derivative to check whether the function is minimized or maximized at given value of $x=4$

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

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

Now putting $x = 4$

$$= 2 + \frac{128}{4^3}$$

$= 4$ we can see that $4>0$

so at $x = 4$ function has minimum value.

so we know find the dimensions as

Q. No. 3 (Page 3)

$x = 4cm \rightarrow$ length and width of the box

and $V = x^2 h$

$$\frac{32}{x^2} = h$$

$$\frac{32}{16} = h$$

$h = 2cm$

So we found out that the dimensions are 2cm, 2cm and 4cm.

Q. No. 3 (Page 4) Q4

(b)

$$x^2/128 + y^2/18 = 1$$

Given line

$3x+8y+1=0$

so we know that equation of tangent for ellipse is

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

from equation we see $a^2 = 128$

$b^2 = 18$

and to find m we take slope of line parallel to tangent as tangent lines have equal slopes.

$$3x+8y+1=0$$
$$3x+1=-8y$$
$$y = -\frac{3x}{8} - \frac{1}{8}$$

So by $y = mx + c$ we see slope is $-\frac{3}{8}$

Q. No. 4 (Page 1) Q4

(b)

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

so we know that Given Line
equation of tangent for $3x+8y+1=0$

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

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

from equation we see $a^2 = 128$
$b^2 = 18$

and to find m we take slope of line parallel to tangent as lines parallel have equal slopes.

$3x+8y+1=0$

$3x+1 = -8y$ so by $y = mx+c$

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

we see $m = -\frac{3}{8}$

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

Q. No. 4 (Page 2)

putting in equation

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

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

So we have two equations as

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

$$8y = -3x + 48 \qquad\qquad y = \frac{-3x}{8} - 6$$

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

↳ first equation

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

↳ second equation

To find point of contacts
for $3x + 8y - 48 = 0$

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

we se $8y = -3x + 48$

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

putting in equation of ellipse

(Section C)

Q. No. 4 (Page 3)

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

$$\frac{x^2}{128} + \frac{(9x^2+2304-288x)}{\cancel{(64)}\ 1152} = 1$$

$$\cancel{\left(\frac{x^2}{128} + \frac{2\,(9x^2+2304-288x)}{128} = 1\right.}$$

$$\cancel{x^2 + 18x^2 + 4608 - 576x = 128}$$

$$\cancel{19x^2 - 576x + 4480 = 0\,)}$$

$$\frac{9x^2 + 9x^2 + 2304 - 288x}{1152} = 1$$

$$18x^2 - 288x + 1152 = 0$$

$x = 8 \Rightarrow$ point of contact is $\boxed{x = 8}$

and $y = \frac{-3(8)+48}{8}$ $\boxed{y = 3}$

To find point of contacts for

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

$$\frac{x^2}{128} + \frac{y^2}{18} = 1 \qquad \text{where } y = \frac{-3x-48}{8}$$

$$\frac{x^2}{128} + \frac{(9x^2+2304+288x)}{1152}$$

$$9x^2 + 9x^2 + 2304 + 288x = 1152$$

$$18x^2 + 288x + 1152 = 0$$

$x = -8$ and $y = -3$

Q. No. 4 (Page 4)

So the required points of contacts are $(8, 3)$ and $(-8, -3)$.

(Section C)

Q. No. 5 (Page 1) (a)

Equation of sides $\overline{AB}$ and $\overline{AC}$

for side $\overline{AB}$ we use two point formula

$A(-3,-4)$ $B(4,6)$

x_1 y_1 x_2 y_2

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

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

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

$$\left(\frac{y+4}{2} = \frac{x+3}{7}\right)$$

$$\left(\begin{aligned} 7y-28 &= 2x+6 \\ 0 &= 2x-7y+34 \Rightarrow \text{so equation of line segment } \overline{AB} \end{aligned}\right)$$

$7y+28 = 10x+30$

$0 = 10x - 7y + 2 \rightarrow$ **required equation**

for side $\overline{AC}$ we use two point formula again

$A(-3,-4)$ $C(4,-3)$

Now we use two point formula

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

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

$7y+28 = x+3$

(Section C)

Q. No. 5 (Page 2)

$$0 = x - 7y + 3 - 28$$

$$0 = x - 7y - 25 \rightarrow$$ Required equation of AC

(b)

$\angle A$

for interior angle $\angle A$ we have to find angle between line $\overrightarrow{AB}$ and $\overrightarrow{AC}$

$\overrightarrow{AB} = 10x - 7y + 2$
$\overrightarrow{AC} = x - 7y - 25$

by these we find slope of $\overrightarrow{AB}$ as $m_1 = \frac{10}{7}$ (using $y = mx + C$
$y = \frac{10}{7}x + \frac{2}{7}$

and $\overrightarrow{AC}$ as $m_2 = \frac{1}{7}$

Now by formula

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

$$\tan\theta = \frac{\frac{10}{7} - \frac{1}{7}}{1 + \left[\frac{10}{7}\right]\left[\frac{1}{7}\right]} = \frac{\frac{9}{7}}{\frac{54}{49}}$$

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

$$\theta = 46.87^\circ \rightarrow \text{so } \angle A = 46.87^\circ$$

Q. No. 5 (Page 3) or 0.818 radians.

we know Area of triangle

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

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

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

As Area can never be negative so we neglect Negative

Area $= \frac{63}{2}$ → this is required area.

(d)

We know distance between point and line formula line AB = $10x-7y+2$ and point C $(4,-3)$

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

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

$$= \frac{63\sqrt{149}}{149}$$ → distance

(Section C)

Q. No. 5 (Page 4) So we see

distance is $\frac{63\sqrt{149}}{49}$

Q. No. 6 (Page 1)

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

first of all to find conic

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

Completing squares by adding and subtracting 4

$$(3x)^2 - 2(3x)(2) + 4 - 4 - y^2 - 2y + 2 = 0$$

$$(3x)^2 - 2(3x)(2) + (2)^2 \quad - y^2 - 2y + 2 - 4 = 0$$

$$(3x - 2)^2 \quad - y^2 - 2y + 2 - 4 = 0$$

Now completing y square by adding and subtracting '1'

$$(3x-2)^2 \quad - \quad (y)^2 - 2(y)(1) - 1 + 1 + 2 - 4 = 0$$

$$(3x-2)^2 \quad - \quad [y^2 + 2(y)(1) + 1] + 1 + 2 - 4 = 0$$

$$(3x-2)^2 \quad - \quad (y+1)^2 - 1 = 0$$

$$(3x-2)^2 - (y+1)^2 - 1 = 0$$

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

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

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

Q. No. 6 (Page 2) We can see that given equation is of hyper bola

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

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

first of all for centre

$(X = 0 \;,\; Y = 0)$

$\left(x - \frac{2}{3} = 0 \;,\; y+1 = 0\right)$

$\left(x = \frac{2}{3} \;,\; y = -1\right)$

$\left(\frac{2}{3}, -1\right) \rightarrow$ This is required centre.

foci $\rightarrow$ as we see it is of form $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

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

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

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

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

Q. No. 6 (Page 3) we know focii for this case are

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

$\left(x - \frac{2}{3} = \pm \frac{\sqrt{10}}{3}, \; y + 1 = 0\right)$

$\left(x = \pm \frac{\sqrt{10}}{3} + \frac{2}{3}, \; y = -1\right)$

$x = +\frac{\sqrt{10}}{3} + \frac{2}{3}$ $\quad$ $x = \frac{-\sqrt{10}}{3} + \frac{2}{3}$

$x = \frac{\sqrt{10} + 2}{3}$ $\quad$ $x = \frac{-\sqrt{10} + 2}{3}$

So focii are

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

vertices.

we know in this case vertices are

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

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

$\left(x - \frac{2}{3} = \pm \frac{1}{3}, \; y + 1 = 0\right)$

(Section C)

Q. No. 6 (Page 4) $\left[x = \pm\frac{1}{3} + \frac{2}{3} \quad , y = -1\right]$

$x = \frac{1}{3} + \frac{2}{3}$ So vertices are

$= \frac{3}{3}$ $(1, -1)$ and $\left(\frac{1}{3}, -1\right)$

$= 1$

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

$= \frac{1}{3}$

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

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

$e = \sqrt{10}$

As in this case directrices

$X = \pm \frac{c}{e^2}$ $x = +\frac{\sqrt{10}}{30} + \frac{2}{3}$.

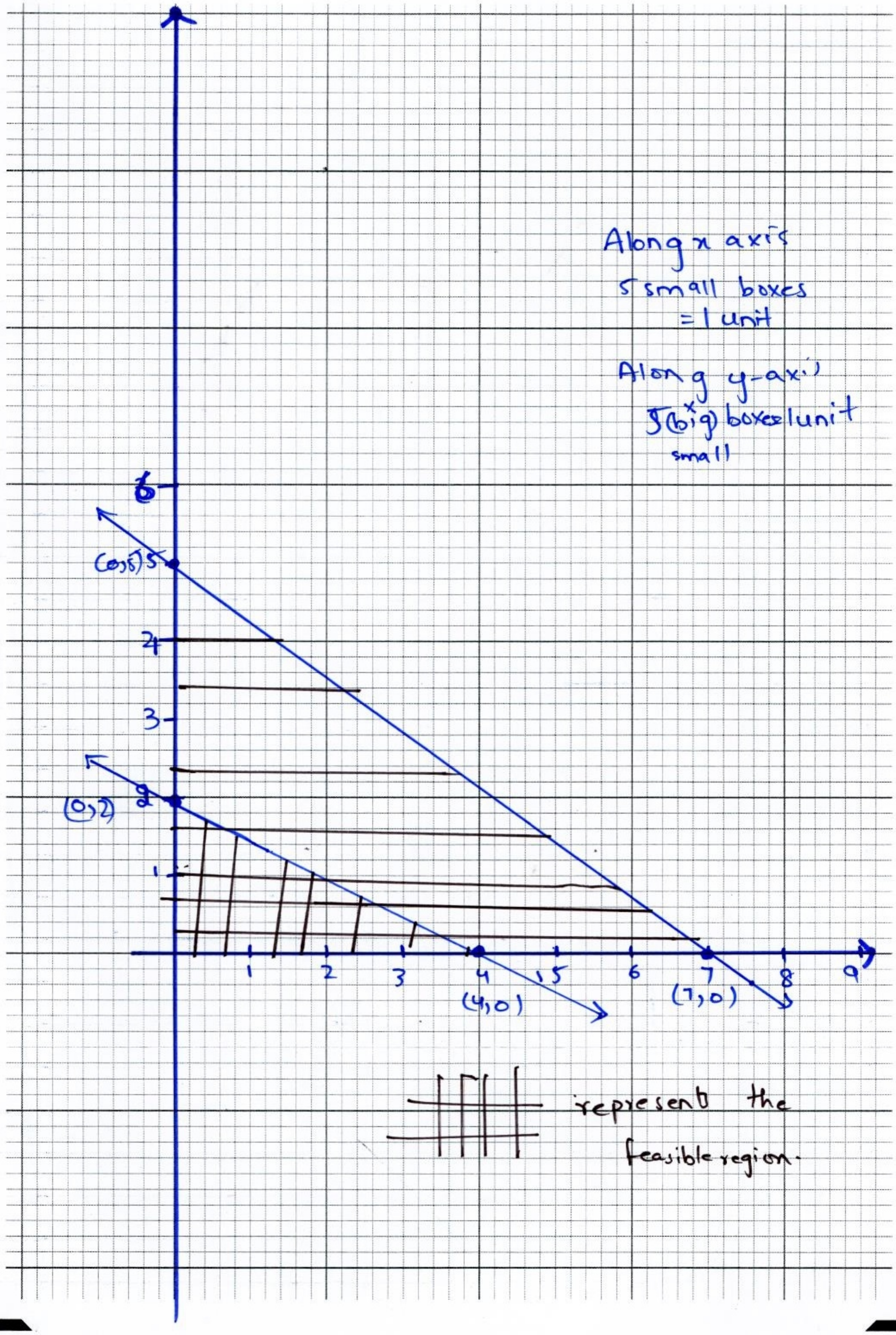
$X - \frac{2}{3} = \pm \frac{\frac{\sqrt{10}}{3}}{(\sqrt{10})^2}$ $x = \frac{20 + \sqrt{10}}{30}$

and $x = -\frac{\sqrt{10}}{30} + \frac{2}{3}$

$x - \frac{2}{3} = \pm\frac{\sqrt{10}}{30}$

$x = \frac{20 - \sqrt{10}}{30}$

These are the required equations.


Along x axis
5 small boxes
= 1 unit
Along y-axis
5 (big) boxes/unit
small
(0,5) 5
(0,2)
(4,0)
(7,0)
represent the
feasible region.

Graph Page No. 1

90°

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

$$\frac{y-0}{-4-0} = \frac{x-2}{0-2}$$

$0 = 3|-2a+3| + 1|-10+6| - 2|5-2a|$

$= -6a + 9 - 4 - 10 + 4a$

$-2y = -4x + 8$

$4x - 2y - 8$

$\cot^2 = 2\cos\sec^2$ $x^2 + 2xy - y^2 = 0$

$2x - y - 4$

$\frac{\cos^4\theta}{\sin^2\theta}$

$\cos^2\theta \cot^2\theta$ $x^2 +$

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

$[\cos^2\theta \, [\mathrm{cosec}^2\theta - 1]]$

$-2y = -4x + 8$

$+$

$4x - 2y - 8$

$2x - y - 4$

CUTTING LINE

$\int_0^{\frac{\pi}{2}} \cos x (e^{\sin}$

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

$(\pm c, 0)$

1.718 $\frac{4}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

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

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

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

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

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

$1+t^2 = 9$ $x = \pm \frac{c}{e^2}$

$\frac{a}{c}$

$t^2 = 8$

$a \div \frac{c}{a}$ $a \times \frac{a}{c}$ $\frac{a^2}{ac}$ $\frac{c}{\frac{c^2}{a^2}}$ $= \pm \, c \div \frac{c^2}{a^2}$

$\frac{c}{a^2}$ $\frac{e}{a}$ $\frac{c}{a}$ $c \div \frac{c^2}{a^2} = \frac{a^2}{c}$ $= c \times \frac{a^2}{c^2}$

$\frac{a^2}{c}$ $c \times \frac{a^2}{c^2}$

$\frac{a^2}{c}$

Space for rough work page 3

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

$1-\cos$

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

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

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

$1+\frac{dy}{dx} = \cos(x+y/3$

$= \cos(x+y$

$\sqrt{3}$ $\frac{1}{\sqrt{3}}$

$f(x)\, e^{\ln(\sin x)}$

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

$= e^{\ln(\sin x)} \cdot \frac{\cos x}{\sin x}$ $2x+2=0$ $x=-1$

$\sqrt{3x^2+5}$ $= \frac{\cos(x+y)}{1-\cos(x+y)}$

2^e $\frac{1-\cos x}{\sin^2(-x)}$ $F(x) = \sqrt{x+5}$ $= \frac{\cos(x-y)-1}{-(\cos(x-y)-}$

2

$F(gx) = 3x$ $f(x+fx)$

$(-x-5)^2$

$(-1)^2(x+5)$ $f(x) = \sqrt{9x^2-5}$ $= f(x+fx)\,f$

$2x+2=0$

$2x=-2$

$\boxed{x=-1}$

$\frac{x^2-16}{-x-4}$

$= \sqrt{9x^2}$

$= 3x$

$\cos x - 1\,\frac{(-x)}{2}$

$(-1)^2-$

$1-2-3$

x^2+1+

$x^2+1-2x + y^2+1+2y = 25$

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