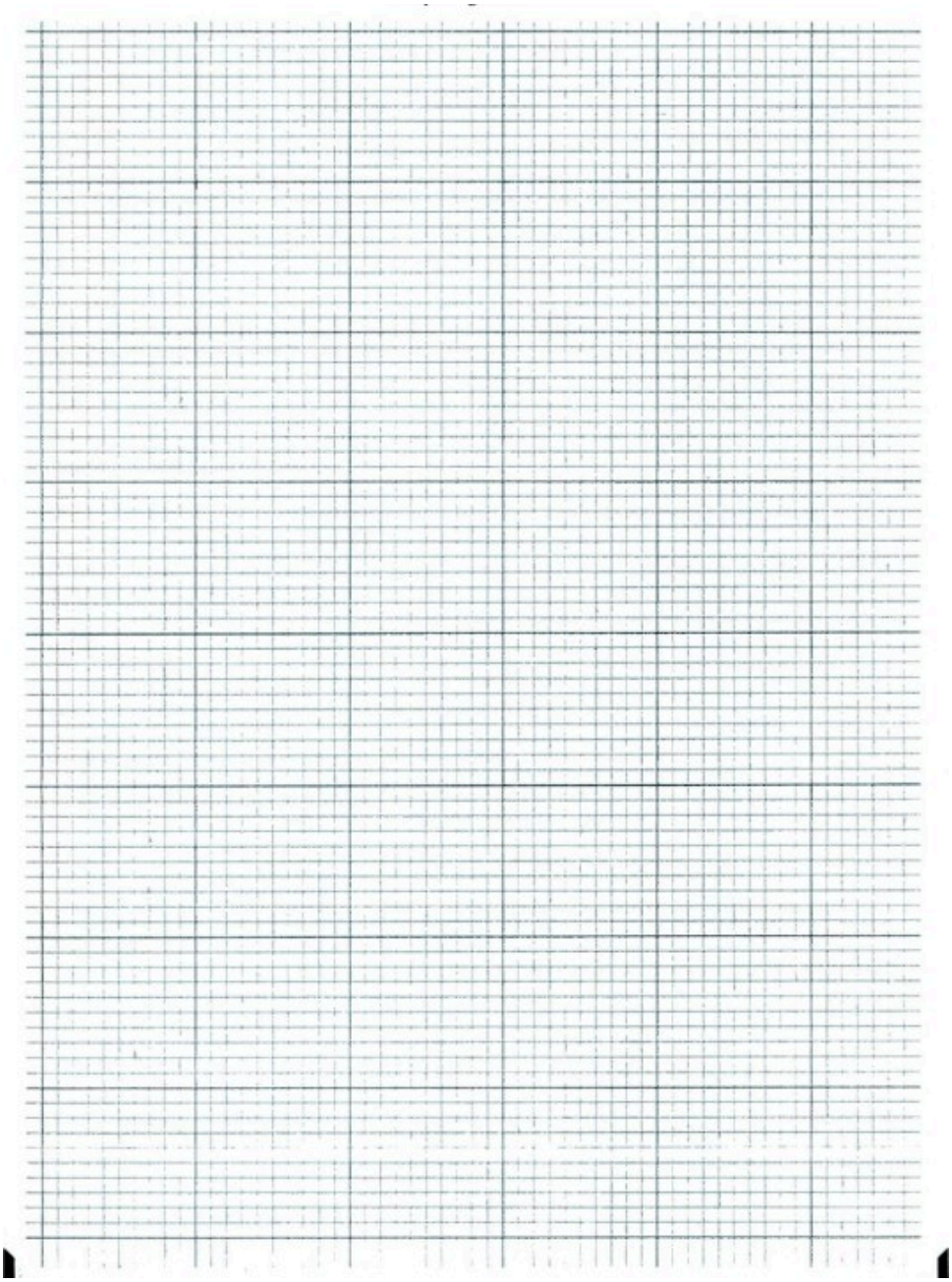
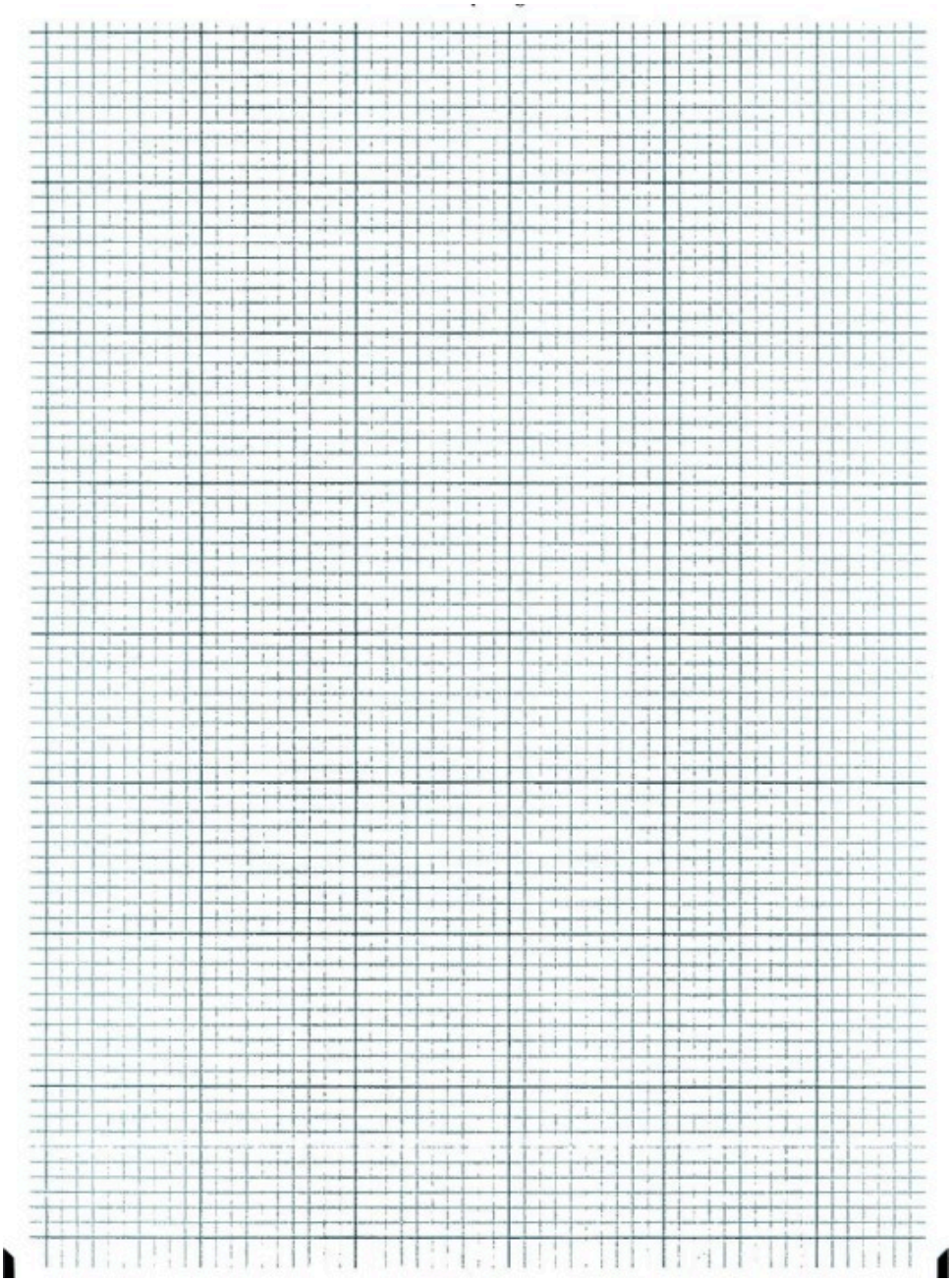




$f''(x) = 6x - 6$. $12 - 6 = 6$. area $= \frac{1}{2}(2)(6)$.

$\int 3x - 4\,dx$.

$x^2 + y^2 = 25$.

$\frac{y^2}{2} = \frac{x^2}{2} + C$.

$y^2 = x^2 + 2C$.

$15 - 16$.

$\frac{-1}{16}$

$-\frac{1}{9}$

Q. No. 2 Part (i) (Page 1) (a) $f(x) = \frac{2x-3}{x+1}$

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

$yx + y = 2x - 3$

$yx - 2x = -3 - y$

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

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

Replace x with y & y with x:

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

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

Domain $= (-\infty, 2) \cup (2, \infty)$

Range of $f^{-1}(x)$ is equal to the domain of $f^{-1}(x)$.

Range $= (-\infty, -1) \cup (-1, \infty)$

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

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

$y = e^{2x} \ln(x)$

taking derivative on both sides.

$$\frac{dy}{dx} = \frac{d}{dx} e^{2x} \ln(x)$$

By applying product rule;

$$\frac{dy}{dx} = f(x) g'(x) + g(x) f'(x).$$

$$\frac{dy}{dx} = (e^{2x}) \frac{d}{dx}(\ln(x)) + \ln(x) \frac{d}{dx}(e^{2x})$$

$$\frac{dy}{dx} = \frac{1}{x} \cdot e^{2x} + 2e^{2x} \ln(x)$$

$$\frac{dy}{dx} = 2e^{x} \ln(x) + \frac{e^{2x}}{x}.$$

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

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

$$= \int \sin^2 x \, dx.$$

$$= \int \left(\frac{1+\cos 2x}{2}\right) \qquad \left(\because \frac{\sin^2 x}{2} = \frac{1+\cos 2x}{2}\right)$$

$$= \int \frac{1}{2} dx + \int \frac{\cos 2x}{2} dx$$

$$= \frac{1}{2}\int 1 dx + \frac{1}{2}\int \cos 2x \, dx$$

$$= \frac{1}{2} x + \frac{1}{2} \cdot \frac{1}{2} \sin 2x + C.$$

$$= \frac{x}{2} + \frac{1}{4} \sin 2x + C.$$

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

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

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

By seperating the differential.

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

$$\frac{dy}{y+1} = \frac{dx}{x-2}.$$

$$\int \frac{1}{y+1}\, dy = \int \frac{1}{x-2}\, dx.$$

$$\ln|y+1| + \ln c = \ln|x-2| + \text{[illegible]}.$$

$$e^{\ln(y+1)\cdot c} = e^{\ln(x-2)}$$

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

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

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

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

$3x^2 - 5xy + 2y^2 = 0.$ [both $(x,y) = (0,0)$. $3(0)^2 - 5(0)y + 2(0) = 0$. $0 = 0$ through the origin]

$3x^2 - 3xy - 2xy + 2y^2 = 0.$

$3x(x-y) - 2y(x-y) = 0.$

$(3x - 2y)(x - y) = 0.$

$3x - 2y = 0.$; $x - y = 0.$

$-2y = -3x.$; $y = x + 0$

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

We can see that

→ Both lines intercept at $c = 0$.

→ when $c = 0$, two lines are represented from the origin.

individual lines are $y = x + 0$ and $2y = 3x + 0$ or $y = \frac{3x}{2} + 0.$

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

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

$r(t) = \langle t^2 - 1, 3t, \ln(t+1) \rangle$,
$r'(t)$? , magnitude of $r'(2)$?

$r'(t) = (t^2-1)\hat{i} + 3t(\hat{j}) + (\ln(t+1))\hat{k}$

$r'(t) = 2t\hat{i} + 3\hat{j} + \frac{1}{t+1}\hat{k}$.

$r'(2) = 2(2)\hat{i} + 3\hat{j} + \frac{1}{(2)+1}\hat{k}$

$r'(2) = 4\hat{i} + 9\hat{j} + \frac{1}{3}\hat{k}$

$r'(2) = \sqrt{(4)^2 + (9)^2 + (\frac{1}{3})^2}$

$r'(2) = \sqrt{16 + 81 + \frac{1}{9}}$.

$r'(2) = \frac{\sqrt{144 + 81 + 1}}{9}$

$r'(2) = \frac{\sqrt{226}}{3}$.

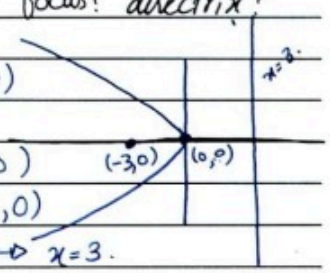
Q. No. 2 Part (vi) (Page 2)

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

Parabola $y^2 = -12x$. vertex? focus? directrix?

$y^2 = -12x$.

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



(i) vertex $(h, k) = (0,0)$

(ii) focus $(-a, 0) = (-3,0)$

(iii) directrix $(x = h + a \Rightarrow x = 3$.

(iv) length of latus rectum $4a \Rightarrow 12$.

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

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

$f(x) = x^3 - 2x - 5$. $[2,3]$.

$f(2) = (2)^3 - 2(2) - 5$.

$= -1$.

$f(3) = (3)^3 - 2(3) - 5$.

$= 16$.

1st Iteration: $\frac{x_0 + x_1}{2} \Rightarrow \frac{2+3}{2}$.

$x_2 = \frac{5}{2}$ $x_2 = 2.5$.

$f(2.5) = (2.5)^3 - 2(2.5) - 5$.

$= 5.625$.

$[2, 2.5]$.

2nd Iteration: $\frac{x_1 + x_2}{2} \Rightarrow \frac{2+2.5}{2}$.

$x_3 = \frac{9}{4} \Rightarrow x_3 = 2.25$.

$f(2.25) = (2.25)^3 - 2(2.25) - 5$.

$= 1.890625$.

$[2, 2.25]$.

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

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

$\int_0^1 x e^x dx$. Integration by parts.

by using formula:

$u \cdot \int v\,dx - \int \left(\int v\,dx \cdot \frac{d}{dx}(u)\right) dx$.

let $x = u$, $v = e^x$.

$= x \cdot \int e^x dx - \int \left(\int e^x dx \cdot \frac{d}{dx}(x)\right) dx$.

$= x \cdot e^x - \int (e^x \cdot (1))\, dx$.

$= xe^x - e^x$.

$= \left| e^x (x-1) \right|_0^1$.

$= \left| xe^x - e^x \right|_0^1$

$= \left| (1)e^1 - e^1 - [(0)e^0 - e^0] \right|$

$= \left| 0 - [0-1] \right|$

$= \left| +1 \right| = +1$ answer.

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

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

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

$$\int_1^3 x^2 + 2 \, dx.$$

$$= \left| \frac{x^3}{3} + 2x \right|_1^3$$

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

$$= 15 - 7/3.$$

$$= 38/3.$$

Area bounded by the curve $= \frac{38}{3}$.

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

$$\sin x = (2x+1)$$

Domain = Real Number $\mathbb{R}$

Range = $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

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

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

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

By using quotient rule.

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

$f(x) = x^2+1 \quad g(x) = x^2-1$

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

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

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

$$= \frac{-4x}{(x^2-1)^2}$$

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

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

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

$y = \sqrt{x-1}$.

$y^2 = x - 1$.

$y^2 + 1 = x$.

$x = y^2 + 1$.

Replacing x with y and y with x.

$y = x^2 + 1$.

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

hence $f(x) = \sqrt{x-1}$ and $f^{-1}(x) = x^2 + 1$.

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

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

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

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

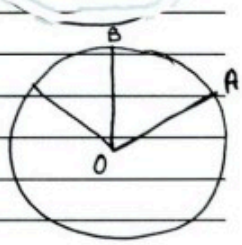
So, L.H.S = R.H.S.

$x = x$

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

(Section C)

Q. No. 3 (Page 1)



We know radius of circle are equal. $OA = OB = OC$

$OA = OB$ —(i) $OB = OC$ —> (ii)

(i) $OA = OB$

$\sqrt{(h-0)^2 + (k-0)^2} = \sqrt{(h-2)^2 + (k-0)^2}$

$(h-0)^2 - (k-0)^2 = (h-2)^2 + (k-0)^2$

$h^2 - k^2 = h^2 - 4h + 4 + k^2$

$0 = -4(h-1)$

$h - 1 = 0$

$h = 1$.

(ii) $OB = OC$

$\sqrt{(h-2)^2 + (k-0)^2} = \sqrt{(h-0)^2 + (k-2)^2}$

$h^2 - 4h + 4 + k^2 = h^2 + k^2 - 4k + 4$.

$-4h + 4k = 0$.

put value of h.

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

$-4 + 4k = 0$.

$k = 1$.

Radius = OA.

$= \sqrt{(h-0)^2 + (k-0)^2}$

$= \sqrt{1+1}$

$\sqrt{2}$

Equation of circle.

$(x-h)^2 + (y-k)^2 = r^2$

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

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

Q. No. 3 (Page 2)

taking derivative on b/s.

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

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

$$\frac{dy}{dx} = \frac{1-x}{y-1}$$

put point $P(0,2)$

$$\frac{dy}{dx} = \frac{1-0}{2-1}$$

we know $\frac{dy}{dx}$ is slope.

$$m_1 = 1$$

Tangent to circle:

$$y - y_1 = m(x - x_1)$$
$$y - 2 = 1(x - 0)$$
$$y - 2 = x$$
$$y = x + 2$$

Normal to tangent:

$$m_2 = -\frac{1}{m_1} \quad \text{so} \quad \boxed{m_2 = -1}$$

$$y - y_1 = m(x - x_1)$$
$$y - 2 = -1(x - 0)$$
$$y - 2 = -x$$
$$y = -x + 2$$

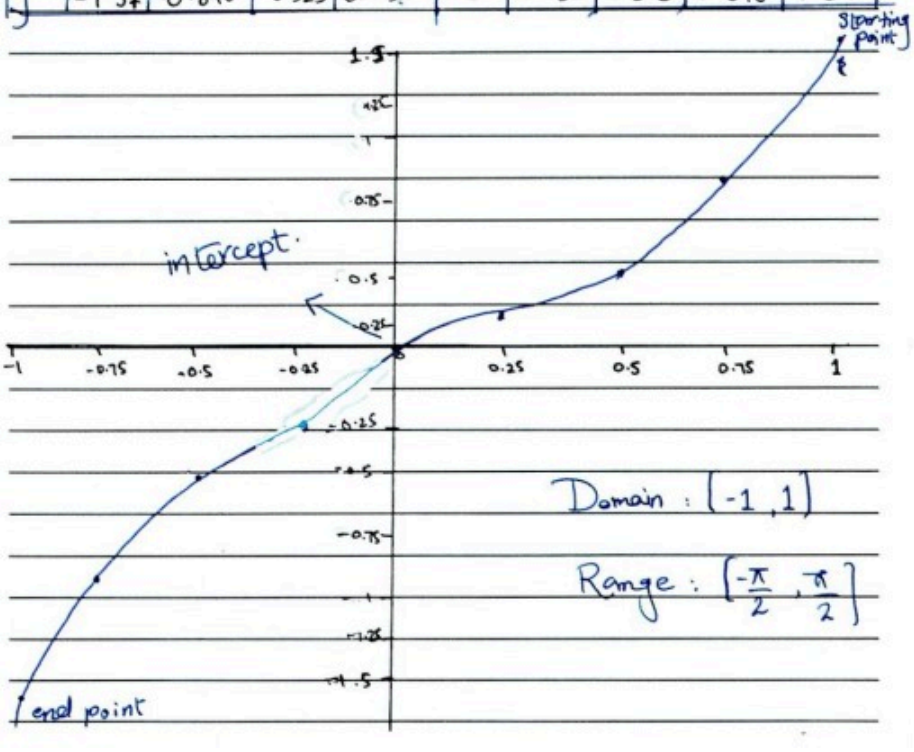
Q. No. 3 (Page 3)

Q. No. 3 (Page 4)

Q. No. 4 (Page 1)

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

x	-1	-0.75	-0.5	-0.25	0	0.25	0.5	0.75	1
y	-1.57	-0.848	-0.523	-0.252	0	0.252	0.523	0.848	1.57



Q. No. 4 (Page 2)

Q. No. 4 (Page 3)

Q. No. 4 (Page 4)

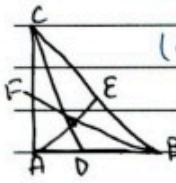
Q. No. 5 (Page 1)

$$\frac{x^2+3x+4}{(x^2+2x+5)(x-1)} = \frac{Ax+B}{x^2+2x+5} + \frac{C}{x-1} \quad \ldots(i)$$

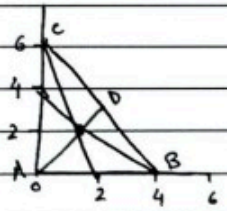
$$x^2+3x+4 = Ax+B(x-1)+C(x^2+2x+5)$$

$$x^2+3x+4 = Ax(x-1)+B(x-1)+C(x^2+2x+5).$$

Triangle with vertices A(0,0), B(4,0), C(0,6)



(0,0) (4,0).



midpoint of AB $\Rightarrow$ D = (2,0)
midpoint of BC $\Rightarrow$ E = (2,3)
midpoint of AC $\Rightarrow$ F = (0,3)

Slope of CD $= \frac{y_2-y_1}{x_2-x_1} \Rightarrow \frac{0-6}{2-0} \Rightarrow -3.$

Slope of AE $= \frac{y_2-y_1}{x_2-x_1} \Rightarrow \frac{3-0}{2-0} = \frac{3}{2}.$

Slope of BF $= \frac{y_2-y_1}{x_2-x_1} \Rightarrow \frac{0-3}{4-0} = \frac{-3}{4}.$

Q. No. 5 (Page 2)

by taking two points from the equation.

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

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

$$2y - 6 = 3x - 6$$

$$\boxed{-3x + 2y = 0}$$

CD $\Rightarrow$ $y - 0 = 3(x - 2)$

$$y = -3x + 6.$$

$$\boxed{3x + y - 6 = 0.}$$

AF, $y - 3 = \frac{-3}{4}(x - 0)$

$$4y - 12 = -3x$$

$$\boxed{3x + 4y - 12 = 0}$$

by taking determinant

$$\begin{vmatrix} -3 & 2 & 0 \\ 3 & 1 & -6 \\ 3 & 4 & -12 \end{vmatrix}$$

$$= -3 \begin{vmatrix} 1 & -6 \\ 4 & -12 \end{vmatrix} - 2 \begin{vmatrix} 3 & -6 \\ 3 & 12 \end{vmatrix} + 0$$

$$= -3(-12 + 24) - 2(36 + 18)$$

$$= -3(12) - 2(-18)$$

Q. No. 5 (Page 3)

$= -36 + 36$

$= 0.$

Since determinant equals to zero, this means medians are concurrent. Centroid.

Comparing equations AE and CD.

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

$3x + y - 6 = 0$

$3y - 6 = 0$

$y = 2$

put in (i)

$-3x + 4 = 0$

$x = \frac{4}{3}$

centroid is $\left(\frac{4}{3}, 2\right)$

Q. No. 5 (Page 4)

Q. No. 6 (Page 1)

$$\frac{dy}{dx} = \frac{x^2+y^2}{xy} \quad \cdots (i)$$

let $y = ux$

$$\frac{dy}{dx} = u + x\frac{du}{dx} \quad \cdots (ii)$$

compare (i) and (ii)

$$u + x\frac{du}{dx} = \frac{x}{y} + \frac{y}{x}.$$

$$x\frac{du}{dx} = \frac{1+u-u}{u}$$

$$x\frac{du}{dx} = \frac{1}{u}$$

$$x \cdot \frac{1}{dx} = \frac{1}{u}\,du$$

$$\int \frac{1}{x}\,dx = \int u\,du.$$

$$\ln(x) = \frac{y^2}{2} + C.$$

put $u = \frac{y}{x}$.

$$\ln(x) = \frac{y^2}{2x^2} + C$$ answer:

Q. No. 6 (Page 2)

Q. No. 6 (Page 3)

Q. No. 6 (Page 4)