# C1, IYGB, PAPER H

**1. (a)** $f(x) = x^2 - 6x + 7$

$f(x) = (x-3)^2 - 9 + 7$

$f(x) = (x-3)^2 - 2$

**(b)** $f(x) = 0$ OR $y = 0$

$0 = x^2 - 6x + 7$

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

$2 = (x-3)^2$

$x - 3 = \pm\sqrt{2}$

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

$\therefore (3-\sqrt{2}, 0)$ & $(3+\sqrt{2}, 0)$

**2.** $\dfrac{2\sqrt{2}}{\sqrt{3}-1} - \dfrac{2\sqrt{3}}{\sqrt{2}+1} = \dfrac{2\sqrt{2}(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)} - \dfrac{2\sqrt{3}(\sqrt{2}-1)}{(\sqrt{2}+1)(\sqrt{2}-1)}$

$= \dfrac{2\sqrt{6}+2\sqrt{2}}{3+\sqrt{3}-\sqrt{3}-1} - \dfrac{2\sqrt{6}-2\sqrt{3}}{2-\sqrt{2}+\sqrt{2}-1} = \dfrac{2\sqrt{6}+2\sqrt{2}}{2} - \dfrac{2\sqrt{6}-2\sqrt{3}}{1}$

$= (\sqrt{6}+\sqrt{2}) - (2\sqrt{6}-2\sqrt{3}) = \sqrt{6}+\sqrt{2}-2\sqrt{6}+2\sqrt{3} = \sqrt{2}+2\sqrt{3}-\sqrt{6}$

$a = 1$
$b = 2$
$c = -1$

**3.** SOLVING SIMULTANEOUSLY

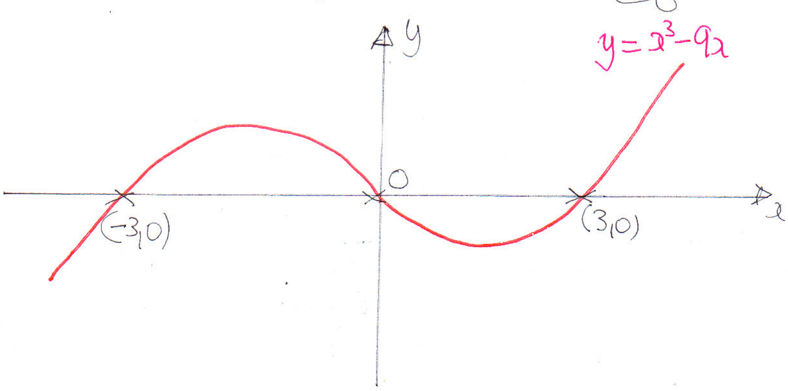
$$\left.\begin{array}{l} y = 1 - x \\ y = x^2 - 6x + 10 \end{array}\right\} \Longrightarrow x^2 - 6x + 10 = 1 - x$$

$\Longrightarrow x^2 - 5x + 9 = 0$

$b^2 - 4ac = (-5)^2 - 4 \times 1 \times 9 = 25 - 36 = -11 < 0$

$\therefore$ NO SOLUTIONS $\Longrightarrow$ NO INTERSECTIONS

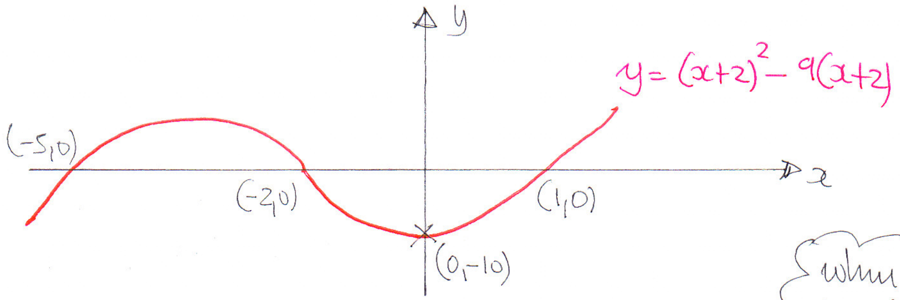
**4. (a)** $y = x^3 - 9x = x(x^2-9) = x(x+3)(x-3)$




- $+x^3 \Longrightarrow$ ∼
- $x = 0 \quad y = 0$

$y = 0 \quad x = 0, -3, 3$

b) THIS IS A TRANSLATION OF THE CURVE OF PART (a) BY 2 UNITS TO THE "LEFT"
I.E. $y = f(x+2)$



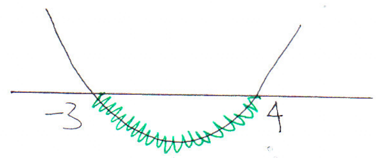

when $x=0$
$y=(0+2)^3-9(0+2)$
$y=8-18$
$y=-10$
$\therefore (0,-10)$

5.

- $6-2(7-3x) \geq 8-(3x+7)$
$\Rightarrow 6-14+6x \geq 8-3x-7$
$\Rightarrow 6x-8 \geq -3x+1$
$\Rightarrow 9x \geq 9$
$\Rightarrow x \geq 1$

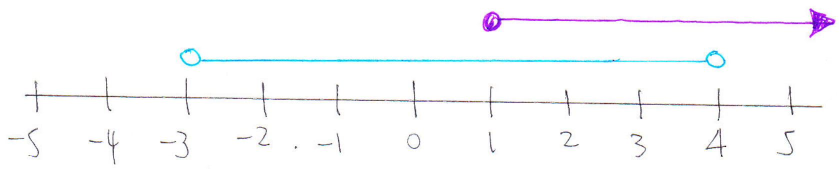
- $(2x-3)(x+4) < x(x+6)$
$\Rightarrow 2x^2+8x-3x-12 < x^2+6x$
$\Rightarrow x^2-x-12 < 0$
$\Rightarrow (x+3)(x-4) < 0$

C.V = 4, −3




$\therefore -3 < x < 4$

- COMBINE RESULTS




$\therefore 1 \leq x < 4$

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6. (a) $\boxed{x_{n+1} = \frac{a+2x_n}{x_n}}$

- $x_1 = 2$
- $x_2 = \frac{a+2x_1}{x_1} = \frac{a+2\times 2}{2} = \frac{a+4}{2}$
- $x_3 = \frac{a+2x_2}{x_2} = \frac{a+\cancel{2}\left(\frac{a+4}{\cancel{2}}\right)}{\frac{a+4}{2}} = \frac{a+a+4}{\frac{a+4}{2}} = \frac{2a+4}{\frac{a+4}{2}}$

$= \frac{\frac{2a+4}{1}}{\frac{a+4}{2}} = \frac{2(2a+4)}{a+4}$ // OR $\frac{4a+8}{a+4}$

(b) $\frac{4a+8}{a+4} = 12 \implies 4a+8 = 12a+48$

$-40 = 8a$

$a = -5$ //

7. (a) $f'(x) = 3x^2 - 8x + 4$

$\implies f(x) = \int 3x^2 - 8x + 4 \, dx$

$\implies f(x) = x^3 - 4x^2 + 4x + C$

"GOES THROUGH ORIGIN" $\implies x=0$, $y=0$

$\therefore 0 = 0 - 0 + 0 + C$

$C = 0$

$\therefore f(x) = x^3 - 4x^2 + 4x$ //

(b) $f(x) = 0$

$\implies x^3 - 4x^2 + 4x = 0$

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

$\implies x(x-2)^2 = 0$

$x = \begin{cases} 0 \leftarrow O \\ 2 \leftarrow P \end{cases}$

$\therefore P(2,0)$ //

8. $y = ax^2 - 4\sqrt{x} + \frac{8}{x}$

$\implies y = ax^2 - 4x^{\frac{1}{2}} + 8x^{-1}$

$\implies \frac{dy}{dx} = 2ax - 2x^{-\frac{1}{2}} - 8x^{-2}$

$\implies \boxed{\frac{dy}{dx} = 2ax - \frac{2}{\sqrt{x}} - \frac{8}{x^2}}$

$\therefore \left.\frac{dy}{dx}\right|_{x=4} = 0$

$\implies 2a\times 4 - \frac{2}{\sqrt{4}} - \frac{8}{4^2} = 0$

$\implies 8a - 1 - \frac{1}{2} = 0$

$\implies 8a = \frac{3}{2}$

$\implies a = \frac{3}{16}$ //

9.

$a = 60$
$d = 3.5$
$L = u_n = 144$

• "NEED $n$"

• $u_n = a + (n-1)d$

$\Rightarrow 144 = 60 + (n-1) \times 3.5$
$\Rightarrow 84 = 3.5(n-1)$
$\Rightarrow 168 = 7(n-1)$
$\Rightarrow 168 = 7n - 7$
$\Rightarrow 175 = 7n$

$\boxed{n = 25}$

USING $S_n = \frac{n}{2}[a + L]$

$S_{25} = \frac{25}{2}[60 + 144]$

$S_{25} = \frac{25}{2} \times 204$

$S_{25} = 25 \times 102$

$S_{25} = 2550$ cm

$\therefore$ LENGTH IS 25.5 m

10. (a) $y = x^2 - 10x + 23$

$\frac{dy}{dx} = 2x - 10$

$\left.\frac{dy}{dx}\right|_{x=4} = 2 \times 4 - 10 = -2$

$y = 4^2 - 4 \times 10 + 23$
$= 16 - 40 + 23$
$= -1$

$\therefore P(4, -1)$

$\Rightarrow y - y_0 = m(x - x_0)$
$\Rightarrow y + 1 = -2(x - 4)$
$\Rightarrow y + 1 = -2x + 8$
$\Rightarrow y = -2x + 7$

(b) $\left.\begin{array}{l} y = x^2 - 10x + 23 \\ y = \frac{1}{2}x - 3 \end{array}\right\} \Rightarrow$

$\Rightarrow x^2 - 10x + 23 = \frac{1}{2}x - 3$
$\Rightarrow 2x^2 - 20x + 46 = x - 6$
$\Rightarrow 2x^2 - 21x + 52 = 0$
$\Rightarrow (2x - 13)(x - 4) = 0$

$x = \begin{cases} 4 \\ \frac{13}{2} \end{cases}$

$y = \begin{cases} \frac{1}{2} \times 4 - 3 = -1 \\ \frac{1}{2} \times \frac{13}{2} - 3 = \frac{13}{4} - 3 = \frac{1}{4} \end{cases}$

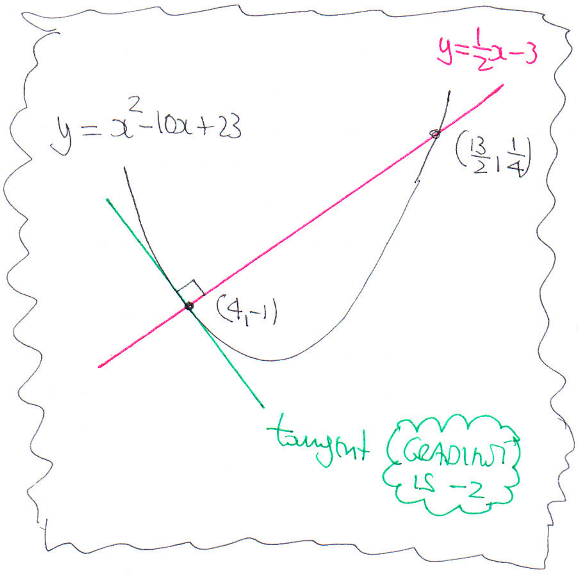
$\therefore (4, -1)$ & $\left(\frac{13}{2}, \frac{1}{4}\right)$

- GRAD OF L IS $\frac{1}{2}$

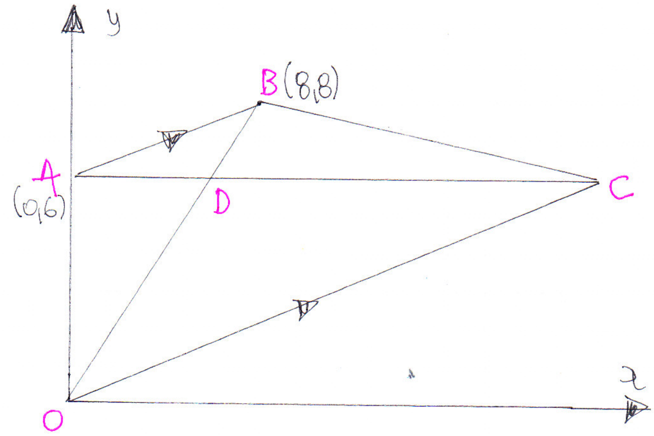
$$\left.\frac{dy}{dx}\right|_{x=4} = 2\times4-10 = -2$$

$\therefore$ L IS A NORMAL

LOOK AT DIAGRAM OPPOSITE




11.




- GRADIENT AB $= \frac{y_2-y_1}{x_2-x_1} = \frac{8-6}{8-0} = \frac{1}{4}$

- EQUATION OF LINE THROUGH O & C IS $\boxed{y=\frac{1}{4}x}$

- EQUATION OF LINE THROUGH A & C IS $\boxed{y=6}$

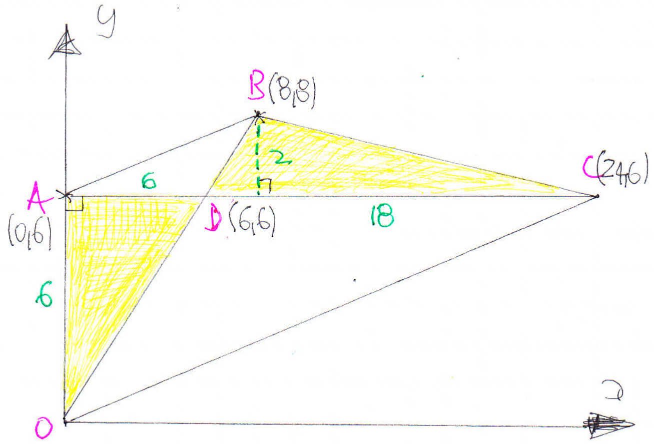
- COORDINATES OF C SATISFY

$$\left.\begin{array}{l} y=\frac{1}{4}x \\ y=6 \end{array}\right\} \Rightarrow \frac{1}{4}x=6$$
$$x=24$$
$$\therefore \boxed{C(24,6)}$$

- GRADIENT OF LINE THROUGH O & B IS 1 (0,0) TO (8,8)

$\therefore$ EQUATION IS $y=x$

$\therefore \boxed{D(6,6)}$




- AREA OF $\hat{ADO} = \frac{1}{2}\times6\times6 = 18$

AREA OF $\hat{DBC} = \frac{1}{2}\times18\times2 = 18$

INDEED EQUAL