1.

$$\left.\begin{array}{l} y = x^2 - 4x + 2 \\ y = x^2 - 8x \end{array}\right\} \Rightarrow x^2 - 4x + 2 = -x^2 - 8x$$

$$\Rightarrow 2x^2 + 4x + 2 = 0$$

$$\Rightarrow x^2 + 2x + 1 = 0$$

$$(x+1)^2 = 0$$

$$x = -1 \qquad y = -(-1)^2 - 8(-1)$$

$$y = -1 + 8 = 7$$

$$\therefore (-1, 7)$$

2. a)

$$u_{n+1} = (3 - u_n)^2$$

$$u_1 = 4$$

$$u_2 = (3 - u_1)^2 = (3-4)^2 = 1$$

$$u_3 = (3 - u_2)^2 = (3-1)^2 = 4$$

$$u_4 = (3 - u_3)^2 = (3-4)^2 = 1$$

b) $u_{10} = 1$

3.

$$\frac{2+y}{y} = \sqrt{2}$$

$$\Rightarrow 2 + y = \sqrt{2}\,y$$

$$\Rightarrow 2 = \sqrt{2}\,y - y$$

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

$$\Rightarrow y = \frac{2}{\sqrt{2} - 1}$$

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

$$\Rightarrow y = \frac{2\sqrt{2} + 2}{2 + \cancel{\sqrt{2}} - \cancel{\sqrt{2}} - 1}$$

$$\Rightarrow y = \frac{2\sqrt{2} + 2}{1}$$

$$\Rightarrow y = 2 + 2\sqrt{2}$$

$a = 2$
$b = 2$

4. a) $f(x) = x^2+4x+12 = (x+2)^2-2^2+12 = (x+2)^2-4+12$

$\therefore f(x) = (x+2)^2+8$

b) GREATEST VALUE OCCURS WHEN THE DENOMINATOR IS LEAST

$f(x)_{MIN} = 8$

$\therefore \frac{1}{f(x)}$ HAS LARGEST VALUE $\frac{1}{8}$

5. a) $4(4-2x)<30$

$\Rightarrow 16-8x<30$

$\Rightarrow -8x<14$

$\Rightarrow -4x<7$

$\Rightarrow x>-\frac{7}{4}$

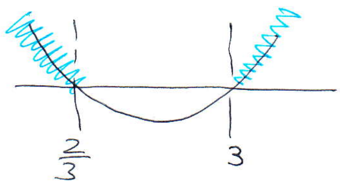
b) $x+3(x^2-4x+2)>0$

$\Rightarrow x+3x^2-12x+6>0$

$\Rightarrow 3x^2-11x+6>0$

$\Rightarrow (3x-2)(x-3)>0$

C.V. $= \begin{cases} 2/3 \\ 3 \end{cases}$



$x<\frac{2}{3}$ OR $x>3$

6. $\sum_{r=1}^{20}(3r+10) = \underbrace{13+16+19+\dots+70}_{\text{A.P WITH}}$

A.P WITH $\boxed{\begin{array}{l} a=13 \\ d=3 \\ l=70 \\ n=20 \end{array}}$

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

$S_{20} = \frac{20}{2}[13+70]$

$S_{20} = 10\times 83$

$S_{20} = 830$

OR

$S_n = \frac{n}{2}[2a+(n-1)d]$

$S_{20} = \frac{20}{2}[2\times13+19\times3]$

$S_{20} = 10[26+57]$

$S_{20} = 10\times 83 = 830$

7. a) GRADIENT $AB = \frac{y_2-y_1}{x_2-x_1} = \frac{-2-2}{7-1} = \frac{-4}{6} = -\frac{2}{3}$

$y - y_0 = m(x - x_0)$

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

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

$2x + 3y = 8$

b) GRADIENT OF l_2 IS $\frac{3}{2}$ & PASSES THROUGH $B(7,-2)$

$y - y_0 = m(x - x_0)$

$y + 2 = \frac{3}{2}(x-7)$

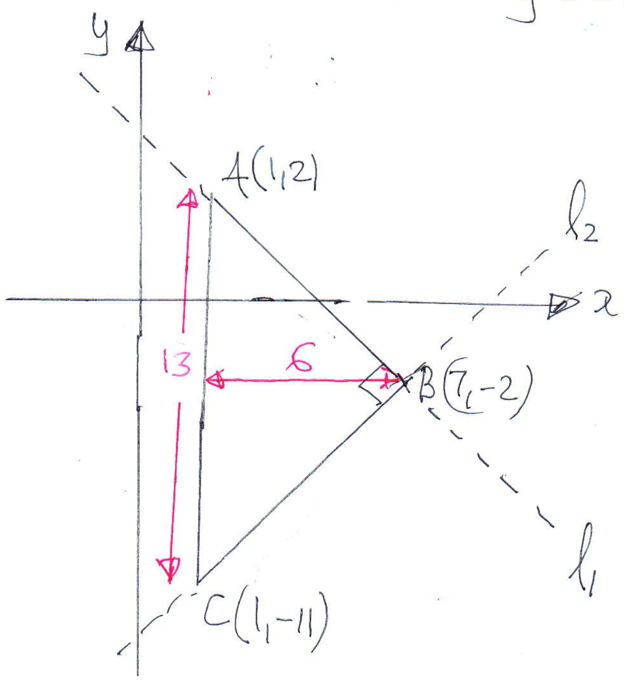
$2y + 4 = 3x - 21$

$2y = 3x - 25$

c) $\left.\begin{array}{l} 2y = 3x - 25 \\ x = 1 \end{array}\right\} \Rightarrow 2y = 3 - 25$

$2y = -22$

$y = -11$ $\quad\therefore C(1,-11)$



AREA $= \frac{1}{2} \times 13 \times 6 = 39$

ALTERNATIVE

$|AB| = \sqrt{(-2-2)^2 + (7-1)^2}$

$= \sqrt{16+36}$

$= \sqrt{52}$

$= 2\sqrt{13}$

$|BC| = \sqrt{(-2+11)^2 + (7-1)^2}$

$= \sqrt{81+36}$

$= \sqrt{117}$

$= 3\sqrt{13}$

$\therefore$ AREA $= \frac{1}{2} \times 2\sqrt{13} \times 3\sqrt{13}$

$= 3 \times 13$

$= 39$

C1, IYGB, PAPER K

8. a)

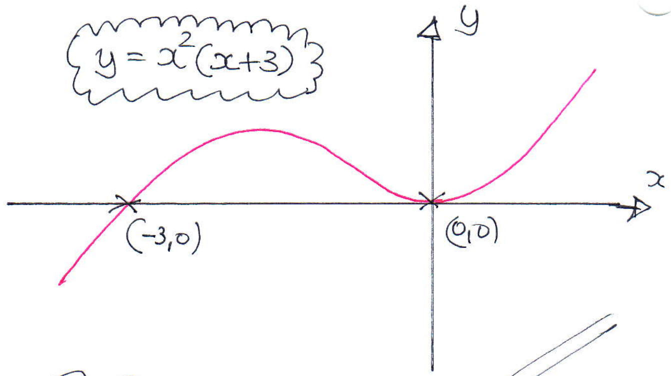
$y = x^2(x+3)$

$+x^3 \Rightarrow \sim$

TOUCHES AT $x=0$

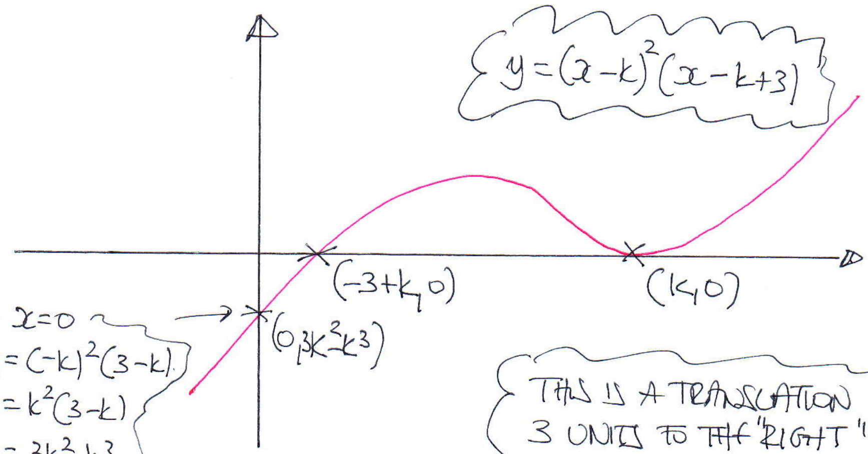
CROSSES AT $x=-3$

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



b)

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



$x=0$

$y=(-k)^2(3-k)$

$y=k^2(3-k)$

$y=3k^2-k^3$

THIS IS A TRANSLATION 3 UNITS TO THE "RIGHT"

9. a)

$a=77$

$d=3$

$l=500$

$n=?$

$u_n = a+(n-1)d$

$500 = 77+(n-1)\times 3$

$500 = 77+3n-3$

$426 = 3n$

$n = \frac{426}{3} = \frac{420+6}{3} = 140+2$

$\boxed{n=142}$

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

$S_{142} = \frac{142}{2}[77+500]$

$S_{142} = 71 \times 577$

$S_{142} = 40967$

$$\begin{array}{r} 577 \\ 71 \\ \hline 577 \\ 4039 \\ \hline 40967 \end{array}$$

or $S_n = \frac{n}{2}[2a+(n-1)d]$

$S_{142} = \frac{142}{2}[2\times 77+141\times 3]$

$S_{142} = \ldots$

$\ldots$

C1, IYGB, PAPER K

b) $\left\{\begin{array}{l} a = 80 \\ L = 500 \\ d = 6 \\ n = 71 \end{array}\right\}$

$S_n = \frac{n}{2}(a+L)$

$S_{71} = \frac{71}{2}[80+500]$

$S_{71} = \frac{71}{2} \times 580$

$S_{71} = 71 \times 290$

$S_{71} = 20590$

$$\begin{array}{r} 29 \\ 71 \\ \hline 29 \\ 203 \\ \hline 2059 \end{array}$$

10. (a) $y = \frac{(2x+1)^2}{(3x^2)^2} = \frac{4x^2+4x+1}{9x^4} = \frac{4x^2}{9x^4} + \frac{4x}{9x^4} + \frac{1}{9x^4}$

$\therefore y = \frac{4}{9}x^{-2} + \frac{4}{9}x^{-3} + \frac{1}{9}x^{-4}$

(b)(I) $\frac{dy}{dx} = -\frac{8}{9}x^{-3} - \frac{12}{9}x^{-4} - \frac{4}{9}x^{-5}$

$\frac{dy}{dx} = -\frac{8}{9}x^{-3} - \frac{4}{3}x^{-4} - \frac{4}{9}x^{-5}$

(II) $\int \frac{4}{9}x^{-2} + \frac{4}{9}x^{-3} + \frac{1}{9}x^{-4}\,dx$

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

$= -\frac{4}{9}x^{-1} - \frac{4}{18}x^{-2} - \frac{1}{27}x^{-3} + C$

$= -\frac{4}{9}x^{-1} - \frac{2}{9}x^{-2} - \frac{1}{27}x^{-3} + C$

(P.T.O)

11. $x^2 + 2mx + 3x + m^2 = 0$

$x^2 + (2m+3)x + m^2 = 0$

EQUAL ROOTS $\Rightarrow b^2 - 4ac = 0$

$\Rightarrow (2m+3)^2 - 4 \times 1 \times m^2 = 0$

$\Rightarrow \cancel{4m^2} + 12m + 9 - \cancel{4m^2} = 0$

$\Rightarrow 12m = -9$

$\Rightarrow m = -\frac{3}{4}$

12. a) $y = 4x^3 - 7x - 1$

$\frac{dy}{dx} = 12x^2 - 7$

$\left.\frac{dy}{dx}\right|_{x=1} = 12 \times 1^2 - 7 = 5$

when $x = 1$

$y = 4 - 7 - 1$

$y = -4$

$\therefore A(1,-4)$

$y - y_0 = m(x - x_0)$

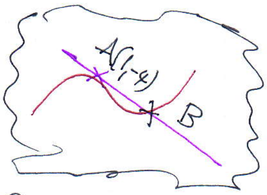
$y + 4 = 5(x-1)$

$y + 4 = 5x - 5$

$y = 5x - 9$

b) $y = 4x^3 - 7x - 1$

$y = 5x - 9$



$\Rightarrow 4x^3 - 7x - 1 = 5x - 9$

$\Rightarrow 4x^3 - 12x + 8 = 0$

$\Rightarrow x^3 - 3x + 2 = 0$

$\Rightarrow (x-1)^2(x+2) = 0$

$x = \begin{cases} 1 & \leftarrow A \\ -2 & \leftarrow B \end{cases}$

POINT OF TANGENCY

CHECK!

$$\boxed{\begin{aligned} &(x+2)(x^2-2x+1) \\ &= x^3 - \cancel{2x^2} + x \\ &\quad\ \ \cancel{2x^2} - 4x + 2 \\ &= x^3 - 3x + 2 \end{aligned}}$$

$\therefore A(-2,-19)$

$y = 5x - 9$