1. (a) $(1+\sqrt{2})^2 = 1 + 2\times1\times\sqrt{2} + (\sqrt{2})^2 = 1+2\sqrt{2}+2 = 3+2\sqrt{2}$

(b) $2\sqrt{75} + \dfrac{3+\sqrt{3}}{3-\sqrt{3}} - \sqrt{2}\times\sqrt{2} = 2\sqrt{25}\sqrt{3} + \dfrac{(3+\sqrt{3})(3+\sqrt{3})}{(3-\sqrt{3})(3+\sqrt{3})} - 2$

$= 2\times5\times\sqrt{3} + \dfrac{9+3\sqrt{3}+3\sqrt{3}+3}{9\cancel{+3\sqrt{3}}\cancel{-3\sqrt{3}}-3} - 2$

$= 10\sqrt{3} + \dfrac{12+6\sqrt{3}}{6} - 2$

$= 10\sqrt{3} + 2 + \sqrt{3} - 2$

$= 11\sqrt{3}$

2. a) $u_{n+1} = \dfrac{1}{1-u_n}$

$u_1 = 2$

$u_2 = \dfrac{1}{1-u_1} = \dfrac{1}{1-2} = \dfrac{1}{-1} = -1$

$u_3 = \dfrac{1}{1-u_2} = \dfrac{1}{1-(-1)} = \dfrac{1}{2}$

$u_4 = \dfrac{1}{1-u_3} = \dfrac{1}{1-\frac{1}{2}} = \dfrac{1}{\frac{1}{2}} = 2$

(b)

2	-1	$\frac{1}{2}$
u_1	u_2	u_3
u_4	u_5	u_6
u_7	u_8	u_9
u_{10}	u_{11}	u_{12}

$\therefore u_{12} = \frac{1}{2}$

(c) $\displaystyle\sum_{r=1}^{12} u_r = u_1+u_2+u_3+\dots+u_{12}$

$= 4(u_1+u_2+u_3)$

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

$= 4\times1.5$

$= 6$

3. (a)

$f(x) = x^2+6x+10$

$f(x) = (x+3)^2-9+10$

$f(x) = (x+3)^2+1$

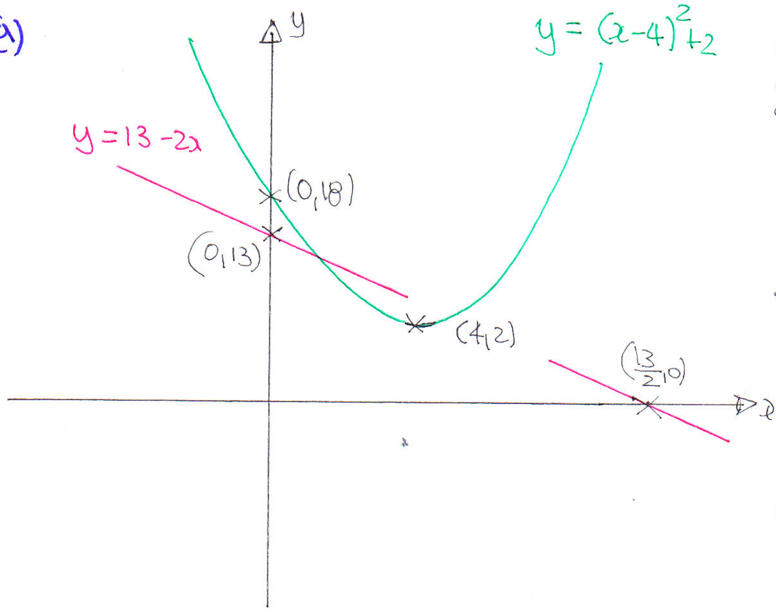
(b)

$x^2 \longmapsto (x+3)^2 \longmapsto (x+3)^2+1$

TRANSLATION, 3 UNITS TO THE "LEFT" — TRANSLATION 1 UNIT UPWARDS

OR TRANSLATION BY $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$

4. (a)



- QUADRATIC ⇒ ∪
- MIN (4,2)
- DOES NOT CROSS x AXIS
- $x=0 \quad y=18$

LINE

$x=0 \quad y=13 \quad (0,13)$

$y=0 \quad x=\frac{13}{2} \quad (\frac{13}{2},0)$

(b)

$(x-4)^2+2 = 13-2x$

$x^2-8x+16+2 = 13-2x$

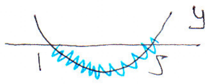
$x^2-6x+5=0$

$(x-1)(x-5)=0$

$x = \begin{cases} 1 \\ 5 \end{cases}$

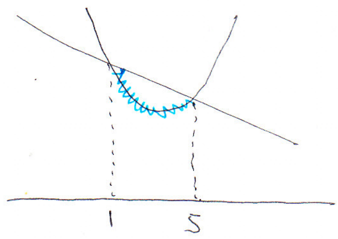
(c) CONTINUE FROM PART (b)

$C.V = \begin{cases} 1 \\ 5 \end{cases}$



$1 < x < 5$

ALTERNATIVE FROM PART (a)



$\therefore \ 1 < x < 5$

5.

$f(x) = (k-1)x - 2 - 8x^2$

$f(x) = 0$

$(k-1)x - 2 - 8x^2 = 0$

$\boxed{8x^2 - (k-1)x + 2 = 0}$

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

$\Rightarrow [-(k-1)]^2 - 4\times 8\times 2 = 0$

$\Rightarrow (k-1)^2 = 64$

$\Rightarrow k-1 = \begin{cases} 8 \\ -8 \end{cases}$

$\Rightarrow k = \begin{cases} 9 \\ -7 \end{cases}$

6.

$y = 4\sqrt{x^5} - 1$

$\boxed{y = 4x^{\frac{5}{2}} - 1}$

- $\frac{dy}{dx} = 10x^{\frac{3}{2}}$
- $\frac{d^2y}{dx^2} = 15x^{\frac{1}{2}}$

THUS $4x^2\frac{d^2y}{dx^2} - 15y = 4x^2(15x^{\frac{1}{2}}) - 15\times(4x^{\frac{5}{2}} - 1)$

$= 60x^{\frac{5}{2}} - 60x^{\frac{5}{2}} + 15$

$= 15$

AS REQUIRED

$(\therefore k = 15)$

7.

$f'(x) = 3 - 4x$

$f(x) = \int 3 - 4x \, dx$

$\boxed{f(x) = 3x - 2x^2 + C}$

NOW $f(1) = 2f(2)$

$3 - 2 + C = 2[6 - 8 + C]$

$1 + C = 2(C - 2)$

$1 + C = 2C - 4$

$\boxed{5 = C}$

$\therefore \boxed{f(x) = 5 + 3x - 2x^2}$

- NOW $x = 0 \quad y = 5$

$\therefore R(0, 5)$

- $y = 0 \qquad 0 = 5 + 3x - 2x^2$

$2x^2 - 3x - 5 = 0$

$(2x - 5)(x + 1) = 0$

$x = \begin{cases} -1 \\ \frac{5}{2} \end{cases}$

$\therefore P(-1, 0)$

$Q(\frac{5}{2}, 0)$

8. (a) $a = X$, $d = 2Y$

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

$S_9 = \frac{9}{2}[2X + 8(2Y)]$ ← SCHEME 1

$S_9 = \frac{9}{2}[2X + 16Y]$

$S_9 = 9[X + 8Y]$ // AS REQUIRED

(b) For "SCHEME 2"

$a = X + 2000$

$d = Y$

$S_9 = \frac{9}{2}[2(X+2000) + 8Y]$ ← SCHEME 2

$S_9 = \frac{9}{2}[2X + 4000 + 8Y]$

$S_9 = 9[X + 4Y + 2000]$

Now $\underbrace{9[X + 8Y]}_{\text{SCHEME 1}} = \underbrace{9[X + 4Y + 2000]}_{\text{SCHEME 2}} + 3600$

$\Rightarrow [X + 8Y] = [X + 4Y + 2000] + 400$

$\Rightarrow \cancel{X} + 8Y = \cancel{X} + 4Y + 2400$

$4Y = 2400$

$Y = 600$ //

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

$36000 = X + 10(2Y)$

$36000 = X + 20Y$

$36000 = X + 20 \times 600$

$36000 = X + 12000$

$\therefore X = 24000$ //

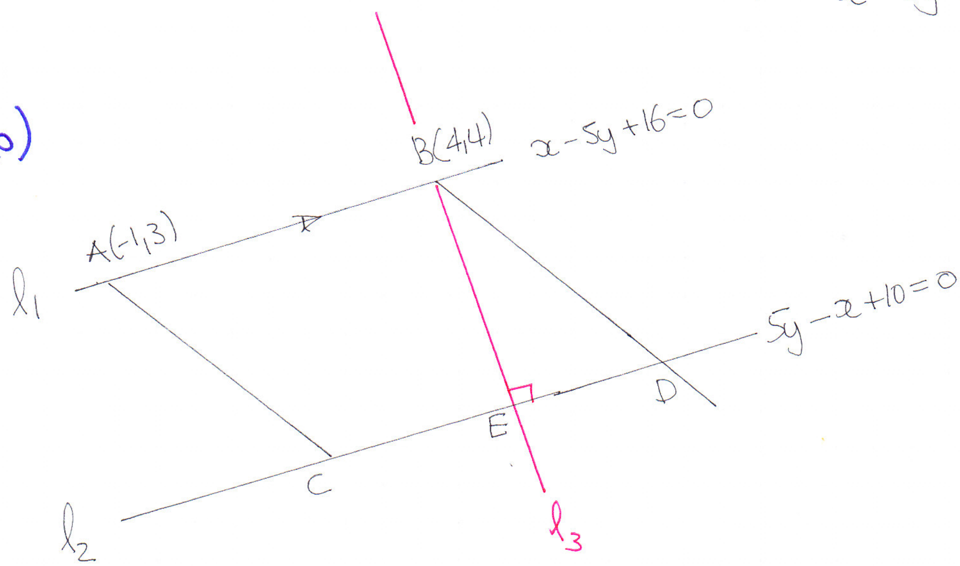
P.T.O

C1, IYGB, PAPER E

9. (a) GRAD $l_1 = \dfrac{y_2-y_1}{x_2-x_1} = \dfrac{4-3}{4+1} = \dfrac{1}{5}$

$$y - y_0 = m(x - x_0)$$
$$y - 4 = \tfrac{1}{5}(x-4)$$
$$5y - 20 = x - 4$$
$$5y - x - 16 = 0$$
OR $x - 5y + 16 = 0$

(b)



- GRAD l_3 IS -5
- LINE l_3: $y - y_0 = m(x-x_0)$
  $y - 4 = -5(x-4)$
  $y - 4 = -5x + 20$
  $\boxed{y = 24 - 5x}$
- FIND COORDS OF POINT E

$$\left.\begin{aligned} l_2&: 5y - x + 10 = 0 \\ l_3&: y = 24 - 5x \end{aligned}\right\} \Rightarrow$$

$5(24-5x) - x + 10 = 0$
$120 - 25x - x + 10 = 0$
$130 = 26x$
$\boxed{x = 5}$
$\therefore y = 24 - 5\times 5 = -1$
$\boxed{y=-1}$
$\therefore E(5,-1)$

- FINALLY B(4,4)
  E(5,-1)

$$|BE| = \sqrt{(y_2-y_1)^2 + (x_2-x_1)^2}$$
$$= \sqrt{(4+1)^2 + (4-5)^2}$$
$$= \sqrt{25+1}$$
$$= \sqrt{26}$$