C1, IYGB, PAPER Q

1. $$\frac{(2+\sqrt{3})^2-(1-\sqrt{3})^2}{\sqrt{3}} = \frac{(4+4\sqrt{3}+3)-(1-2\sqrt{3}+3)}{\sqrt{3}}$$

$$= \frac{(7+4\sqrt{3})-(4-2\sqrt{3})}{\sqrt{3}} = \frac{3+6\sqrt{3}}{\sqrt{3}} = \frac{3}{\sqrt{3}} + \frac{6\cancel{\sqrt{3}}}{\cancel{\sqrt{3}}}$$

$$= \frac{3\sqrt{3}}{\sqrt{3}\sqrt{3}} + 6 = \frac{\cancel{3}\sqrt{3}}{\cancel{3}} + 6 = 6 + \sqrt{3}$$

2. $$\frac{dy}{dx} = 4 + \frac{1}{x^2} = 4 + x^{-2}$$

$$y = \int 4 + x^{-2}\,dx = 4x - x^{-1} + C = 4x - \frac{1}{x} + C$$

APPLY CONDITION $x=1,\ y=5$

$$5 = 4\times1 - \frac{1}{1} + C$$
$$5 = 4 - 1 + C$$
$$C = 2$$
$$\therefore\ y = 4x + \frac{1}{x} + 2$$

3. $$x^2 - 1.6x - 3.36 = 0$$

$$\Rightarrow (x-0.8)^2 - 0.8^2 - 3.36 = 0$$
$$\Rightarrow (x-0.8)^2 - 0.64 - 3.36 = 0$$
$$\Rightarrow (x-0.8)^2 = 4$$
$$\Rightarrow x - 0.8 = \begin{cases} 2 \\ -2 \end{cases}$$
$$\Rightarrow x = \begin{cases} 2.8 \\ -1.2 \end{cases}$$

C1, IYGB, PAPER Q

4.

$u_3 + u_6 + u_9 = 90$

$(a+2d)+(a+5d)+(a+8d)=90$

$3a+15d=90$

$a+5d=30$

$\boxed{a=30-5d}$

$S_{12}=408$

$\frac{12}{2}[2a+11d]=408$

$6(2a+11d)=408$

$3(2a+11d)=204$

$\boxed{2a+11d=68}$

$2(30-5d)+11d=68$

$60-10d+11d=68$

$d=8$

& $a=30-5d$

$a=30-40$

$a=-10$

5.

• $A<60$

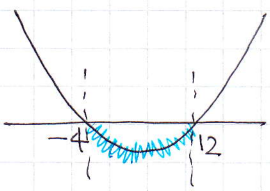
$(x-2)(x-6)<60$

$x^2-8x+12<60$

$x^2-8x-48<0$

$(x+4)(x-12)<0$

C.V = -4, 12



$\boxed{-4<x<12}$

• $P>14$

$2[(x-2)+(x-6)]>14$

$2(2x-8)>14$

$2x-8>7$

$2x>15$

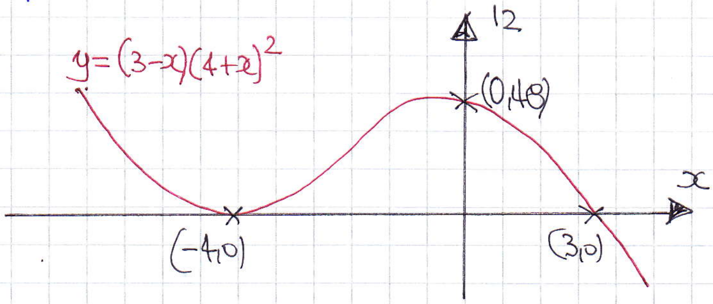
$\boxed{x>7.5}$

TO SATISFY BOTH

$7.5<x<12$

C1, IYGB, PAPER Q

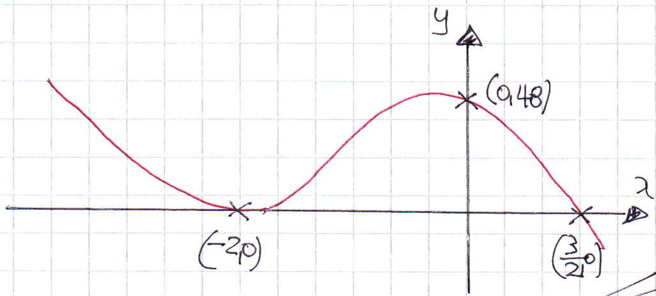
6. a) $y=(3-x)(4+x)^2$



- SHAPE
- $x=0 \quad y=3\times4^2=48$
- $y=0 \quad (3,0)$
  $(-4,0) \leftarrow$ TOUCHING POINT

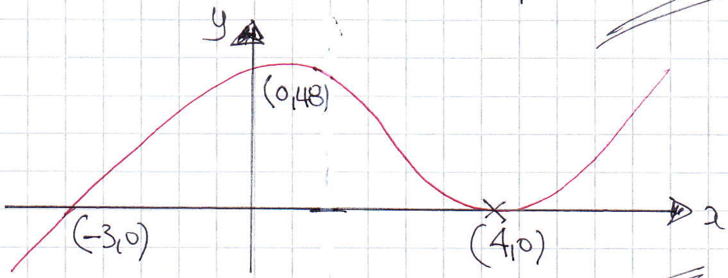
b) (I) HORIZONTAL STRETCH BY SCALE FACTOR $\frac{1}{2}$

I.E $f(2x)$



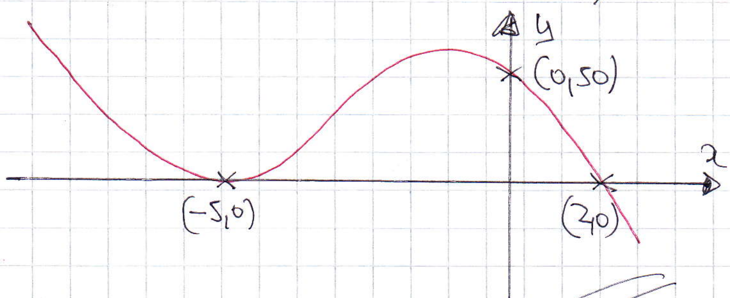
(II) REFLECTION IN THE y AXIS

IE $f(-x)$



(III) TRANSLATION BY ONE UNIT TO THE "LEFT"

IE $f(x+1)$



7. a) $A(2,6) \xrightarrow[+4]{-4} D(6,2) \xrightarrow[+4]{-4} C(p,q)$

$\therefore p=10$
$q=-2$

b)
- GRAD AC $= \dfrac{y_2-y_1}{x_2-x_1} = \dfrac{-2-6}{10-2} = \dfrac{-8}{8} = -1$

$A(2,6)$
$C(10,-2)$

- GRAD OF l IS 1

- EQUATION OF l MUST BE $\quad y-y_0=m(x-x_0)$

$D(6,2)$

$$y-2=1(x-6)$$
$$y-2=x-6$$
$$\boxed{y=x-4}$$

C1, IYGB, PAPER Q

NOW AB IS HORIZONTAL SINCE $A(2,6)$ & $B(11,6)$, SO THE y CO-ORD OF E MUST ALSO BE 6

THUS
$$y = x - 4$$
$$6 = x - 4$$
$$x = 10$$

$\therefore E(10,6)$

8.

$$2 - \frac{1}{x} = \frac{1}{2-x} \quad \Big) \times x$$
$$\Rightarrow 2x - 1 = \frac{x}{2-x} \quad \Big) \times (2-x)$$
$$\Rightarrow 2x(2-x) - 1(2-x) = x$$
$$\Rightarrow 4x - 2x^2 - 2 + \cancel{x} = \cancel{x}$$
$$\Rightarrow 0 = 2x^2 - 4x + 2$$
$$\Rightarrow x^2 - 2x + 1 = 0$$

$b^2 - 4ac =$
$(-2)^2 - 4 \times 1 \times 1$
$= 4 - 4$
$= 0$

$\therefore$ REPEATED ROOT

SO CURVES TOUCH EACH OTHER

9. a)

$$\boxed{u_{n+1} = k + (-1)^n u_n}$$

- $u_1 = 4$
- $u_2 = k + (-1)^1 u_1 = k - u_1 = k - 4$
- $u_3 = k + (-1)^2 u_2 = k + u_2 = k + (k-4) = 2k - 4$
- $u_4 = k + (-1)^3 u_3 = k - u_3 = k - (2k-4) = -k + 4$
- $u_5 = k + (-1)^4 u_4 = k + u_4 = k + (-k+4) = 4$

b)

(4)	$(k-4)$	$(2k-4)$	$(-k+4)$
u_1	u_2	u_3	u_4
u_5	u_6	u_7	u_8
u_9	u_{10}	u_{11}	u_{12}
⋮	⋮	⋮	⋮
			u_{24}
u_{25}	u_{26}		

$\therefore u_{26} = k - 4$

C1, IYGB PAPER Q

c) $\sum_{r=1}^{4} u_r = 6 \implies u_1 + u_2 + u_3 + u_4 = 6$

$4 + (k-4) + (2k-4) + (-k+4) = 6$

$\cancel{4} + \cancel{k} - \cancel{4} + 2k - \cancel{4} - \cancel{k} + \cancel{4} = 6$

$2k = 6$

$k = 3$

d) $\sum_{r=1}^{26} u_r = \sum_{r=1}^{24} u_r + u_{25} + u_{26}$

$= \left(6 \times \frac{6}{4}\right) + 4 + \underbrace{(3-4)}_{k-4} = 36 + 4 - 1 = 39$

IT REPEATS EVERY 4 AND THE SUM OF 4 IS 6

10. a) FIRSTLY $y = \frac{1}{4}(x^2 - 12x + 35)$

$y = \frac{1}{4}(x-7)(x-5)$

$\therefore P(5,0) \quad Q(7,0)$

$\frac{dy}{dx} = \frac{1}{4}(2x - 12)$

$\left.\frac{dy}{dx}\right|_{x=7} = \frac{1}{4} \times 2 = \frac{1}{2}$

EQUATION OF TANGENT

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

$y - 0 = \frac{1}{2}(x - 7)$

$y = \frac{1}{2}x - \frac{7}{2}$

b) GRAD L_2 IS -2

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

$\frac{1}{4}(2x - 12) = -2$

$2x - 12 = -8$

$2x = 4$

$x = 2$

$y = \frac{1}{4}(2^2 - 12 \times 2 + 35) = \frac{15}{4}$

EQUATION OF l_2

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

$y - \frac{15}{4} = -2(x - 2)$

$4y - 15 = -8(x - 2)$

$4y - 15 = -8x + 16$

$4y + 8x = 31$

C1, IYGB, PAPER Q

c) $\left.\begin{array}{l} y = \frac{1}{2}x - \frac{7}{2} \\ 4y + 8x = 31 \end{array}\right\} \Rightarrow 4\left(\frac{1}{2}x - \frac{7}{2}\right) + 8x = 31$

$2x - 14 + 8x = 31$

$10x = 45$

$x = \frac{9}{2}$

$y = \frac{1}{2}\left(\frac{9}{2}\right) - \frac{7}{2}$

$y = \frac{9}{4} - \frac{7}{2}$

$y = \frac{9}{4} - \frac{14}{4}$

$y = -\frac{5}{4}$

$\therefore S\left(\frac{9}{2}, -\frac{5}{4}\right)$ //