1)
$$1 - 2x < 4 + 3x$$
$$1 - 4 < 3x + 2x$$
$$-3 < 5x$$
$$-\frac{3}{5} < x$$

Answer $x > -\frac{3}{5}$

2)
$$s = \frac{1}{2}at^2$$
$$2s = at^2$$
$$\frac{2s}{a} = t^2$$
$$t = \pm\sqrt{\frac{2s}{a}}$$

3)
Converse
$2n$ an even integer $\Rightarrow$ $n$ an odd integer

False since

$2 \times 4 = 8$ is even but $4$ is also even

$\therefore$ not true for $n = 4$

4)
$$f(x) = x^3 + kx + c$$
$$f(0) = 0 + 0 + c = 6$$
$$\Rightarrow c = 6$$
$$\therefore f(x) = x^3 + kx + 6$$

If $(x-2)$ a factor then $f(2) = 0$

$$f(2) = 2^3 + 2k + 6 = 0$$
$$\Rightarrow 8 + 2k + 6 = 0$$
$$2k = -14$$
$$\Rightarrow k = -7$$

5)
i)
$$a^3 = 64x^{12}y^3$$
$$\Rightarrow a = 4x^4y$$

ii)
$$\left(\frac{1}{2}\right)^{-5} = \frac{1}{\left(\frac{1}{2}\right)^5} = \frac{1}{\left(\frac{1}{32}\right)}$$
$$= 32$$

6)
$$(3 - 2x)^5$$

Term in $x^3$ =
$$^5C_3 (3)^2(-2x)^3$$
$$= \frac{5 \times 4}{2 \times 1} \times 9 \times (-8x^3)$$
$$= -720x^3$$

Coeff of $x^3 = -720$

7)
$$\frac{4x + 5}{2x} = -3$$
$$4x + 5 = -6x$$
$$4x + 6x = -5$$
$$10x = -5$$
$$x = -\frac{1}{2}$$

11 i) cont)

$$2y - 14 = -(x-3)$$
$$2y - 14 = -x + 3$$
$$2y + x = 17$$

11 ii)

$$x + 2y = 17 \quad (1)$$
$$y = 2x - 9 \quad (2)$$

Subst for $y$ in (1)

$$x + 2(2x-9) = 17$$
$$x + 4x - 18 = 17$$
$$5x = 35$$
$$x = 7$$

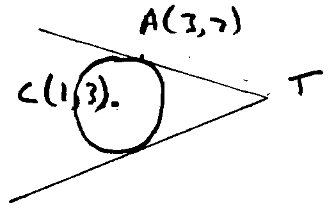
Subst for $x$ in (2)

$$y = 2\times 7 - 9 = 5$$

Point of intersection $T = (7,5)$

11 iii)

$$(x-1)^2 + (y-3)^2 = 20$$




Solve $(x-1)^2 + (y-3)^2 = 20 \quad (1)$

$$y = 2x - 9 \quad (2)$$

Subst for $y$ in (1)

$$(x-1)^2 + (2x-9-3)^2 = 20$$
$$(x-1)^2 + (2x-12)^2 = 20$$
$$x^2 - 2x + 1 + 4x^2 - 48x + 144 = 20$$
$$5x^2 - 50x + 125 = 0$$
$$x^2 - 10x + 25 = 0$$
$$(x-5)(x-5) = 0$$
$$\Rightarrow x = 5, \quad y = 2\times 5 - 9 = 1$$

$(5,1)$ only point of intersection

$\therefore$ line is tgt to circle

12) i)

$$4x^2 - 24x + 27$$
$$= 4\left(x^2 - 6x + \frac{27}{4}\right)$$
$$= 4\left[(x-3)^2 + \frac{27}{4} - 9\right]$$
$$= 4\left[(x-3)^2 - \frac{9}{4}\right]$$
$$= 4(x-3)^2 - 9$$

12 ii)

Min point $(3,-9)$

12 iii)

$$4x^2 - 24x + 27 = 0$$

$4\times 27 = 108$

$-6\times -18 = 108$

$$4x^2 - 6x - 18x + 27 = 0$$
$$2x(2x-3) - 9(2x-3) = 0$$
$$(2x-9)(2x-3) = 0$$
$$\Rightarrow x = \frac{9}{2} \text{ or } x = \frac{3}{2}$$

8) i) $\sqrt{98} - \sqrt{50}$

$= \sqrt{2\times 49} - \sqrt{2\times 25}$

$= 7\sqrt{2} - 5\sqrt{2} = 2\sqrt{2}$

ii)
$\frac{6\sqrt{5}}{2+\sqrt{5}} = \frac{6\sqrt{5}}{2+\sqrt{5}} \times \frac{(2-\sqrt{5})}{(2-\sqrt{5})}$

$= \frac{12\sqrt{5} - 30}{2^2 - (\sqrt{5})^2}$

$= \frac{12\sqrt{5} - 30}{-1}$

$= 30 - 12\sqrt{5}$

9)
i) $y = x^2 - 4$

$21 = x^2 - 4$

$25 = x^2$

$\Rightarrow x = \pm 5$

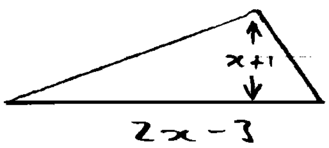
$x$ coords are $+5$ and $-5$

9ii)

Translation by $\begin{pmatrix}2\\0\end{pmatrix}$ gives

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

10)



Area $= \frac{1}{2}$ base $\times$ height

Area $= \frac{1}{2} \times (2x-3) \times (x+1)$

Given that area $= 9\text{ cm}^2$

$\therefore \frac{1}{2}(2x-3)(x+1) = 9$

$(2x-3)(x+1) = 18$

$2x^2 - 3x + 2x - 3 = 18$

$2x^2 - x - 21 = 0$

10ii)

$2x^2 - x - 21 = 0$

$(2x-7)(x+3) = 0$

$\Rightarrow 2x - 7 = 0$ or $\cancel{x = -3}$

$2x = 7$

$x = \frac{7}{2}$

In this context $x > 0$

Base $= 2 \times \frac{7}{2} - 3 = 4$ cm

Height $= \frac{7}{2} + 1 = 4.5$ cm

Section B

11 i) $A(3,7)$
$C(1,3)$

Gradient of $AC = \frac{y_1 - y_2}{x_1 - x_2}$

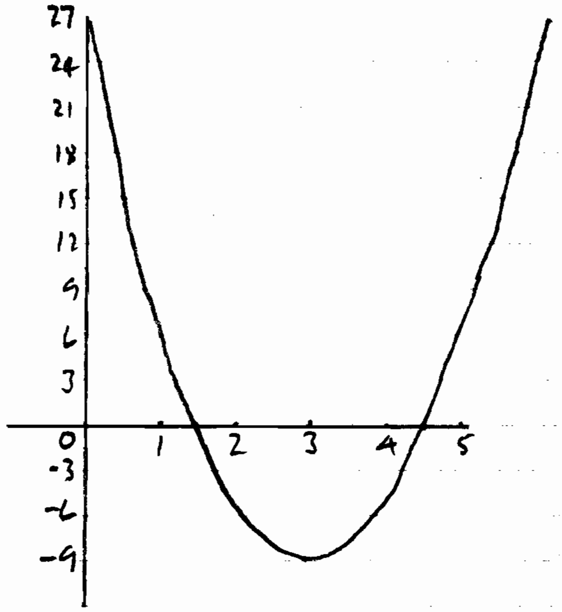
$= \frac{7-3}{3-1} = \frac{4}{2} = 2$

Tgt is $\perp$ to radius so gradient of tgt $= -\frac{1}{2}$

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

$y - 7 = -\frac{1}{2}(x - 3)$

12iv)




Cuts axes at $\left(\frac{3}{2},0\right)$, $\left(\frac{9}{2},0\right)$

and $(0,27)$ Min point $(3,-9)$

13 i)

$f(x) = 2x^3 - x^2 - 11x - 12$

$(x-3)(2x^2+5x+4)$

$= 2x^3 + 5x^2 + 4x$
$\quad - 6x^2 - 15x - 12$

$= 2x^3 - x^2 - 11x - 12$

For $2x^2+5x+4=0$

$b^2 - 4ac = 25 - 32 = -7$

$b^2 - 4ac < 0$ $\therefore$ no real roots

$\therefore$ only root is $x=3$

13ii)

$f(2) = 2\times 2^3 - 2^2 - 11\times 2 - 12$

$= 16 - 4 - 22 - 12$
$= -22$

$\therefore$ $x=2$ is root of $f(x) = -22$

If $2x^3 - x^2 - 11x - 12 = -22$

$2x^3 - x^2 - 11x + 10 = 0$

$$\begin{array}{r|l} & 2x^2 + 3x - 5 \\ \hline (x-2) & 2x^3 - x^2 - 11x + 10 \\ & 2x^3 - 4x^2 \\ \hline & \quad 3x^2 - 11x \\ & \quad 3x^2 - 6x \\ \hline & \quad\quad -5x + 10 \\ & \quad\quad -5x + 10 \\ \hline \end{array}$$

$(x-2)(2x^2+3x-5) = 0$

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

$\Rightarrow$ $x=2$
or $x = -5/2$
or $x = 1$

13iii)