

1. a) $\frac{(2\sqrt{3}-1)(2+\sqrt{3})}{(2-\sqrt{3})(2+\sqrt{3})}$
 $\frac{4\sqrt{3}-6-2-\sqrt{3}}{4+3\sqrt{3}}$

M1

M1

AI c.a.o

b) $2^2 \times 2^{\frac{1}{2}}$

M1

$2^{\frac{5}{2}}$ OR $x+2 = \frac{5}{2}$

M1

$x = \frac{1}{2}$

AI c.a.o

2. $\left(\frac{dy}{dx}\right) = 2x^{-\frac{1}{2}}$

M1

$\left(\frac{d^2y}{dx^2}\right) = -x^{-\frac{3}{2}}$

M1 \nearrow ~~ft~~

$-x^{-\frac{3}{2}} + \frac{8}{(4x^{\frac{1}{2}})^2} (2x^{-\frac{1}{2}})$

M1

$\frac{16x^{-\frac{1}{2}}}{16x}$

M1

CONVICINGLY CONCLUDES WITH $-x^{-\frac{3}{2}} + x^{-\frac{3}{2}} \text{ o.e.} = 0$

AI

3. a) $(a_2) k^2 - 4$

AI

$(a_3) (k^2-4)^2 - 4$ OR $(a_3) k^4 - 8k^2 + 12$

AI \searrow ~~ft~~

b) "THE a_2 " \neq "THE a_3 " = 26

$k^4 - 7k^2 - 18 = 0$

M1 \searrow ~~ft~~
AI

$(k^2-9)(k^2+2) = 0$ OR SIMILAR USING SUBSTITUTION

M1

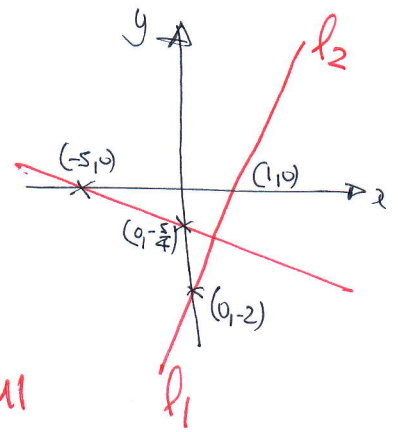
$k^2 = < \del{9}$

M1

$k = \pm 3$

AI c.a.o

4. a) STRAIGHT LINE THROUGH $(-5, 0)$ OR $(0, -\frac{5}{4})$ **B1**
 STRAIGHT LINE THROUGH $(-5, 0)$ AND $(0, -\frac{5}{4})$ **B1**
 STRAIGHT LINE THROUGH $(1, 0)$ OR $(0, -2)$ **B1**
 STRAIGHT LINE THROUGH $(1, 0)$ AND $(0, -2)$ **B1**



- b) ATTEMPTS TO SOLVE SIMULTANEOUS EQUATIONS **M1**
 SENSIBLE METHOD WITH AT LEAST ONE SIGNIFICANT STEP **M1**

$P(\frac{1}{3}, -\frac{4}{3})$, IGNORE LABEL OR NON COORDINATE FORMAT **A2**

- c) GRAD OF l_1 IS $-\frac{1}{4}$, IMPLIED OR SEEN **B1**
 GRAD OF $l_2 = 4$ **A1**
 $y - (-\frac{4}{3}) = "4"(x - "1")$ **M1**
 $12x - 3y = 8$ o.e. **A1 c.a.o**

5. $x^2 + (2k+1)x + k^2 - 2 = 0$ **B1**
 $b^2 - 4ac \geq 0$ **ACCEPT > 0 HERE** **M1**
 $(2k+1)^2 - 4 \times 1 \times (k^2 - 2) \geq 0$ **OR > 0** **M1**
 $4k \geq -9$ OR $4k > -9$ **A1**
 $k \geq -\frac{9}{4}$ **A1 c.a.o**

6. a) $6 + 9 \times 5$ $M1$
 51 $A1$

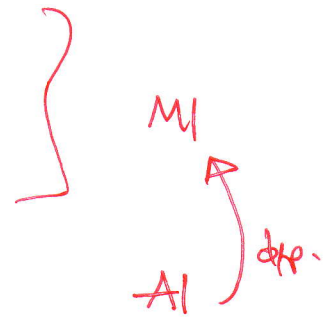
b) $\frac{10}{2} [6 + 51]$ OR $\frac{10}{2} [2 \times 6 + 9 \times 5]$ $M1$
 5×57 OR $30 + 225$, THEN EQUALS TO 255 $A1$ \uparrow ddp

c) $\frac{k}{2} (12 + (k-1)5) \leq 1200$ (MAY BE IN n)
 $\frac{k}{2} (12 + 5k - 5) \leq 1200$ OR $k(12 + (k-1) \times 5) \leq 2400$ $M1$
 $k(5k + 7) \leq 2400$ $A1$ \uparrow ddp

d) ATTEMPTS TRIAL & ERROR OF SOME SORT

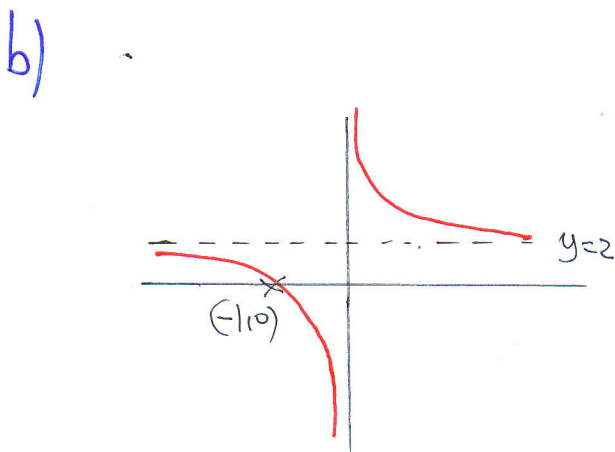
e.g. $20 \times 107 = 2140$
 $21 \times 112 = 2352$
 $22 \times 117 = 2574$

$k=21$



7 a) TRANSLATION $M1$
 2 UNITS $A1$ \uparrow ddp
 'RIGHT' OR SIMILAR $A1$ \uparrow ddp

TRANSLATION $M1$
ACCEPT VECTOR $A1$
 $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$ $\leftarrow A1$
 $\leftarrow A1$



SHAPE TRANSLATED 'up' $A1$
 $y=2$ MARKED OR STATED $A1$
 $(-1, 0)$ $B1$

7 CONTINUES

c)

$$\frac{2}{x-2} = \frac{2}{x} + 2$$

MULTIPLY BY x MULTIPLY BY $(x-2)$

$$x = x-2 + x^2 - 2x \quad \& \text{ STATE } x^2 - 2x - 2 = 0 \quad \text{AI}$$

M1 — THESE IN ANY ORDER & DEPENDENT ON
M1

d)

$$(x-1)^2 - 3 = 0 \quad \underline{\text{OR}} \quad (x-1)^3 = 3 \quad \text{M1}$$

$$x-1 = \pm \sqrt{3} \quad (\pm \text{ MUST APPEAR HERE}) \quad \text{M1}$$

$$x = 1 \pm \sqrt{3} \quad \text{AI}$$

8. a)

$$\left(\frac{dy}{dx} =\right) 6x^2 - 12x + 3$$

$$6 \times 2^2 - 12 \times 2 + 3$$

$$\text{GEO} = 3$$

$$y-3 = "3"(x-2)$$

$$\text{OR } y = 3x - 3$$

M1

M1 ~~ft.~~AI ~~ft.~~AI ~~ft.~~

b)

$$6x^2 - 12x + 3 = -\frac{1}{3}$$

$$9x^2 - 18x + 5 = 0 \quad \text{OR} \quad 18x^2 - 36x + 10 = 0 \quad \text{M1}$$

$$x = \frac{1}{3}, \frac{5}{3} \quad \text{BOTH}$$

M1

M1

AI

9. a) $\int 3x^2 + 4x + k \, dx$ B1

$(y=) x^3 + 2x^2 + kx + C$ A2 -1 eeo0

$-1 = (-2)^3 + 2(-2)^2 + k(-2) + C$ OR $C - 2k = -1$ M1 ~~ft~~

$-4 = 1^3 + 2 \times 1^2 + k \times 1 + C$ OR $k + C = 7$ M1 ~~ft~~

$k = -2$ A1

$C = -5$ OR $y = x^3 + 2x^2 - 2x - 5$ A1

b) SOLVES SIMULTANEOUSLY " $x^3 + 2x^2 - 2x - 5 = -3x - 5$ " M1 ~~ft~~

$x(x^2 + 2x + 1) = 0$ M1

$x(x+1)^2$ + COMMON ROOT REPEATED ROOT SO TANGENT A1

$(-1)(-2)$ A2