

2. Quadratic expressions and equation 2

1

x	-4	-3	-2	-1	0	1	2
$2x^3$	-128	-54	-16	-2	0	2	16
$5x^2$	80	45	20	5	0	5	20
-x	4	3	2	1	0	-1	-2
-6	-6	-6	-6	-6	-6	-6	-6
y	-50	-12	0	-2	-6	0	28

$$2x^3 + 5x^2 + x - 6 = y$$

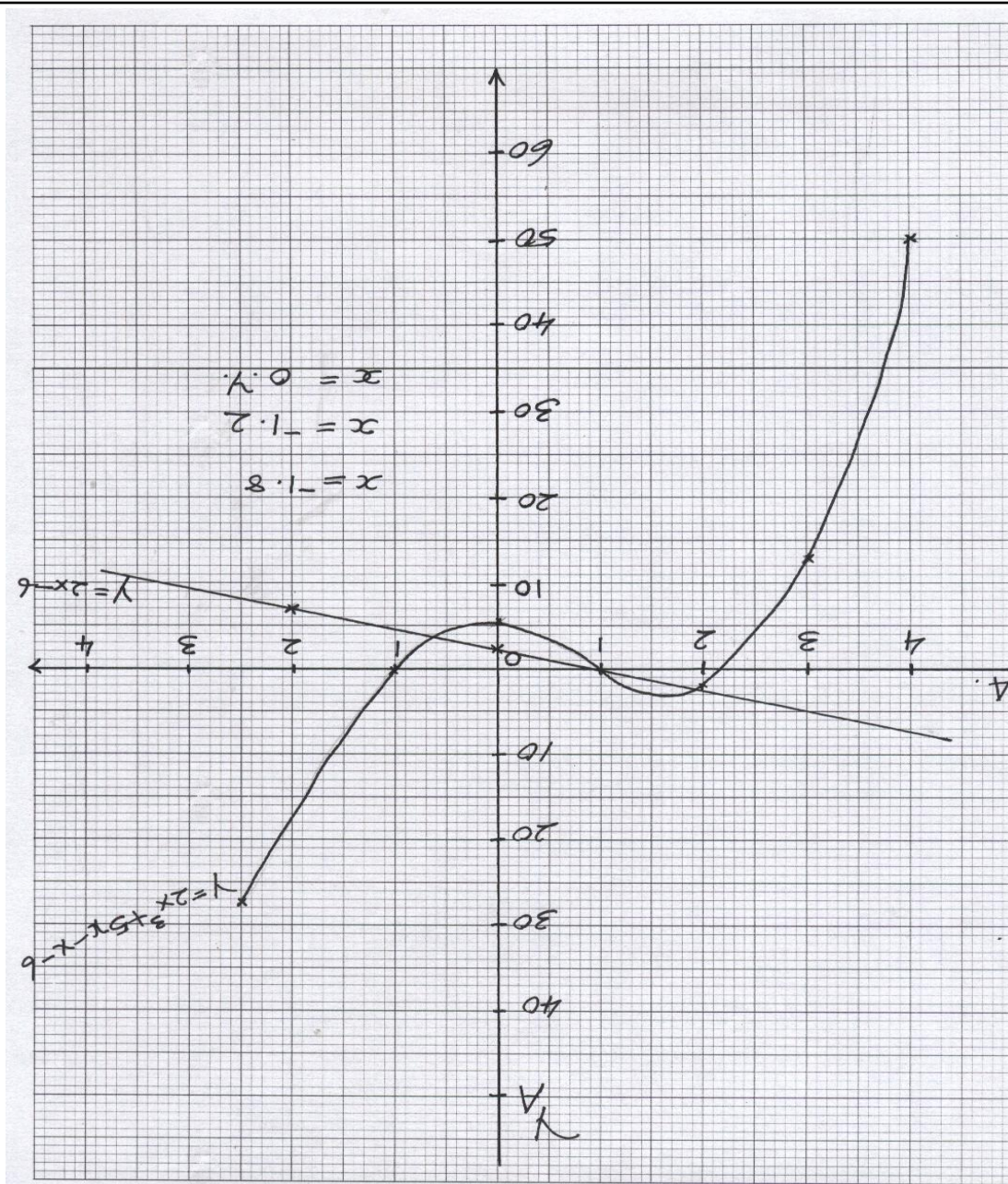
$$2x^3 + 5x^2x - 4 = 0$$

$$-2x - 2 = y$$

$$y = -2x - 2$$

X	0	2
Y	-2	-6

B₂



		10	
2	a) $\frac{dy}{dx} = 4x - 6$ b) $4x - 6 = 0 \therefore x = 1.5$ $y = 2(1.5)^2 - 6(1.5) + 9$ $= 4.5$ $\therefore$ Turning point $(1.5, 4.5)$ 1 1.5 2	B1 M1 M1 A1 B1	Equating to zero

	<table><tr><td>-</td><td>0</td><td>+2</td></tr><tr><td>1</td><td></td><td></td></tr><tr><td>\</td><td>-</td><td>/</td></tr></table> Minimum point d) (i) Gradient = 2 $\frac{y-5}{x-2}=2$ $\therefore y=2x+1$ (ii) $M_1 \times M_2 = -1$ $\therefore M_2 = -\frac{1}{2}$ $\frac{y-5}{x-2} = -\frac{1}{2}$ $\therefore y = -\frac{1}{2}x + 6$	-	0	+2	1			\	-	/	B1	
-	0	+2										
1												
\	-	/										
		B1	✓ gradient									
		B1										
		B1	✓ gradient of normal									
		B1										
		10										
3.	A = ½ x {(6+14) + 2(6 + 4 16)} = ½ (20 + 32) = 26 units	M1 M1 A1	Use of absolute values of y									
		03										

x	-2	-1	0	1	2	3	4	5	6
y	-17	-9	-3	1	3	3	1	-3	-9

1.

(a)

(b) $y = 5x - x^2 - 3$

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

$$y = 0$$

$$x = 0.75 \text{ or } 4.3 \pm 0.1$$

(c) $y = 5x - x^2 - 3$

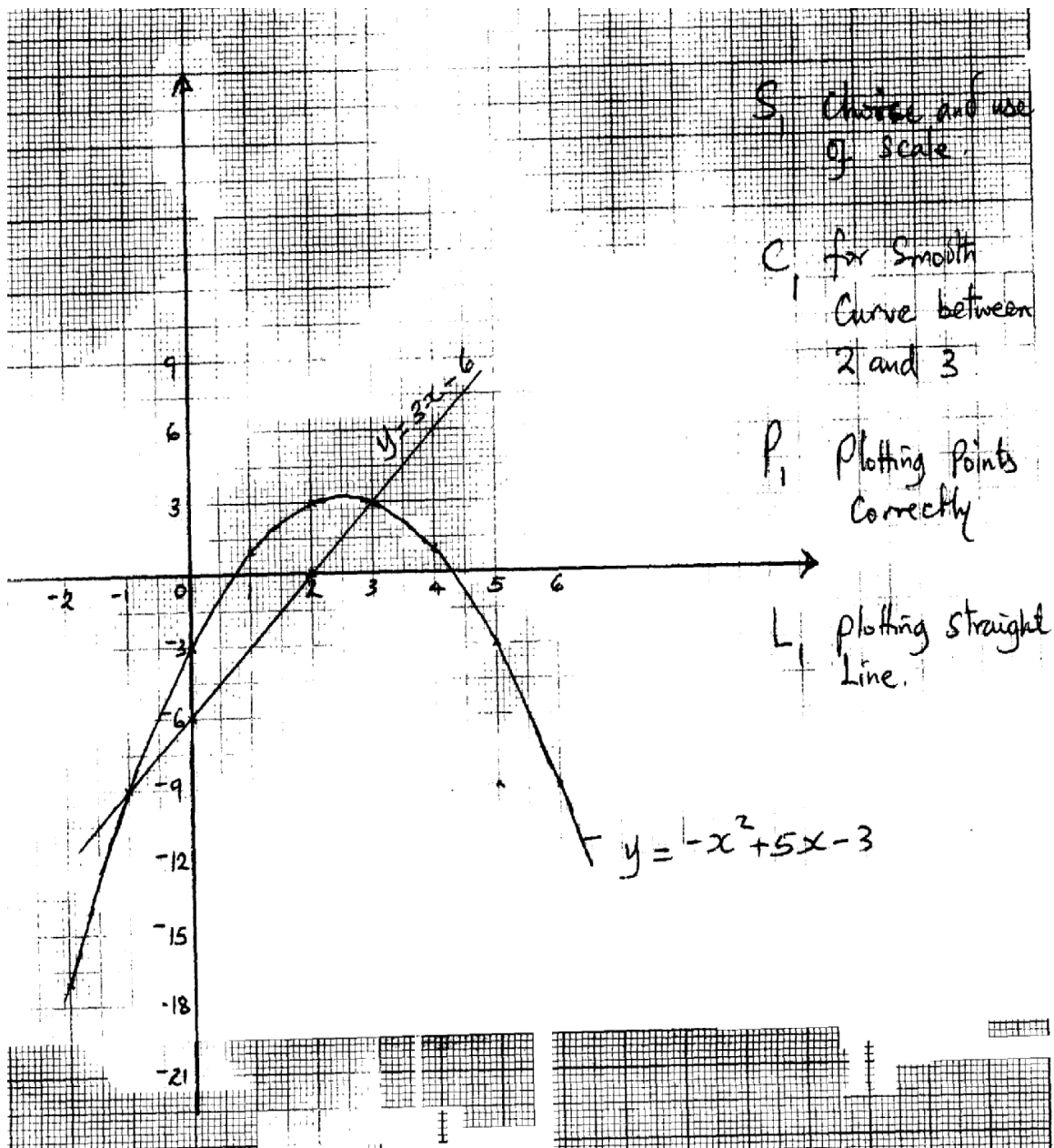
$$0 = 2x - x^2 + 3$$

$$y = 3x - 6$$

x	0	-1	2
y	-6	-9	0

**For all ✓ values of y
B1 for at least 5 ✓ values.**

$$x = -1 \text{ or } 3 \pm 0.1$$



- 2.
- $$x - 2.5 - \sqrt{3} \quad x - 2.5 + \sqrt{3} = 0$$
- $$x^2 - 2.5x + x\sqrt{3} - 2.5x + 6.25 - 2.5\sqrt{3}$$
- $$x\sqrt{3} + 2.5\sqrt{3} = 0$$
- $$x^2 - 5x + 6.25 - 3 = 0$$
- $$x^2 - 5x + 3.25 = 0$$
- $$4x^2 - 20x + 13 = 0$$
- 3.
- $$17.35 \times 13.85 = 240.3$$
- $$17.35 \times 13.75 = 237.2$$
- $$\therefore 17.3 \times 13.8 = 238.7$$
- $$\text{Max err} \quad 240.3 - 238.7 = 1.5$$
- $$\text{Min err} \quad 238.7 - 237.2 = 1.6$$
- $$\text{Max err} \quad = \frac{1.6 + 1.5}{2} = \frac{3.1}{2} = 1.55$$
- $$\text{Product} \quad 238.7 \pm 1.55$$
- $$\text{Last product} \quad 240$$

$$\text{Max err} = 1.55$$

$$\text{Relative err} = \frac{1.55}{28.1\%}$$

$$\text{error} = 1.55 \times 100 = 0.6\% \quad 28.1$$

$$\text{Relative err} = \frac{1.55}{238.7}$$

4.

x	-6	-5	-4	-3	-2	-1	0	1	2	3	4
y		04	-2		-8	-8		-2	4	12	

$$(c) (i) x^2 + 3x - 6 = 0$$

$$x = -4.5 \text{ or } 1.5 \pm 0.2$$

$$(ii) y = x^2 + 3x - 6$$

$$x^2 + 3x - 2$$

$$y = -4$$

$$x = 5 \text{ or } 4 \pm 0.2$$

5.

x	-4	-3	-2	-1	0	1	2	3
y	21	10	3	0	1	6	15	28

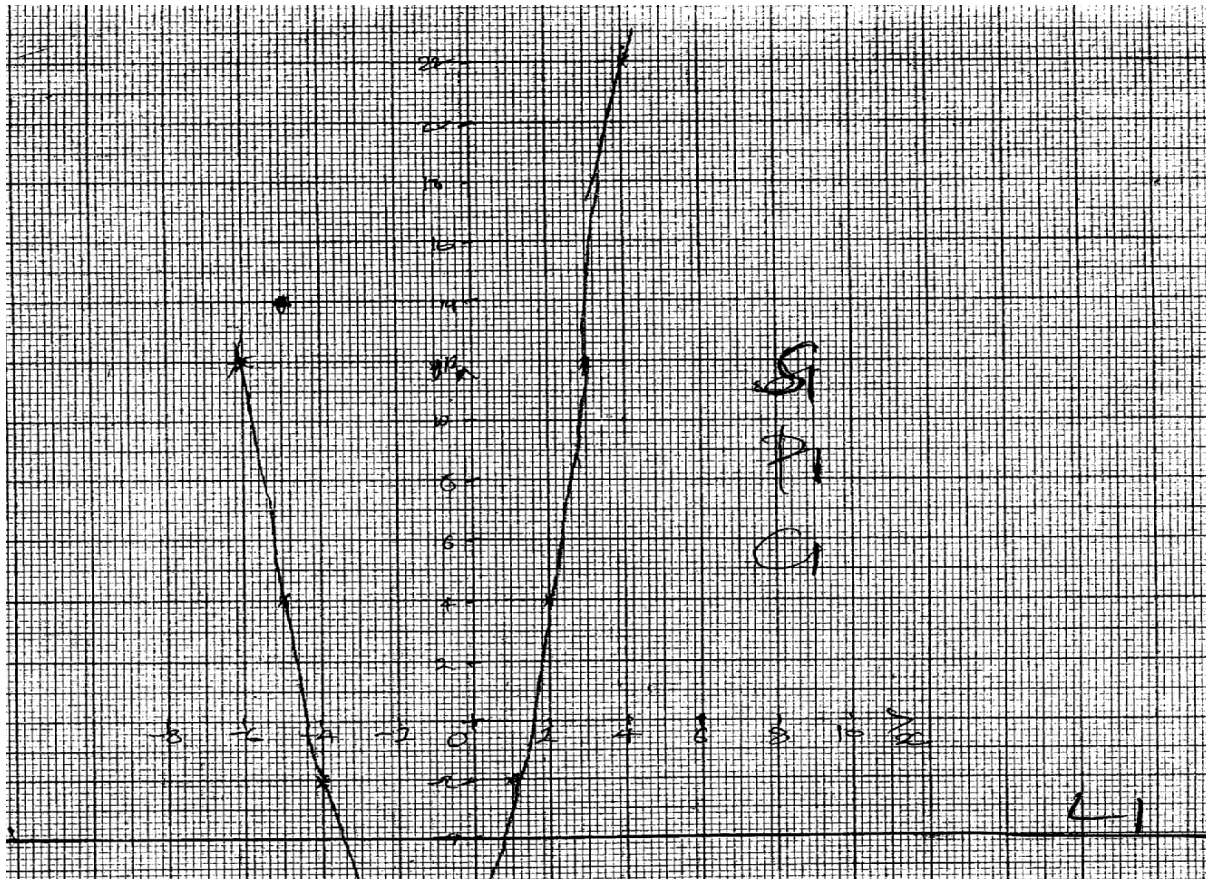
$$(c) \quad 2x^2 + 3x + 1 = 0$$

$$2x + 4x - 3 = 0$$

$$-x + 2 = y$$

$$x = 0.6 \text{ or } x = -2.6 \pm 0.1$$

$$(d) x = 0.30 \quad -x = -1.8 \pm 0.1$$



6. a) i) $\frac{480,000}{x-4} \neq$

ii) $\left[\frac{x}{x-4} \right] \neq$

b) $\frac{480,000}{x-4} = \frac{480,000}{x} + 20,000$

Multiply all hr' by L.C.M.

$$480,000x = 480,000(x-4) + 20,000(x^2 - 4x)$$

Dividing by 10,000

$$48x = 48x - 192 + 2x^2 - 4x$$

$$48x - 48x + 4x - 2x^2 + 192 = 0$$

$$4x - 2x^2 + 192 = 0$$

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

$$= \frac{-4 \pm \sqrt{1552}}{-4}$$

$$= \frac{-4 \pm 39.3954}{-4}$$

$$x = \frac{-4 + 39.3954}{-4} \quad \text{or} \quad x = \frac{-4 - 39.3954}{-4}$$

But x cannot be -ve hence

$$x = \frac{-43.3954}{-4} = 10.8489$$

$$= 11$$

c) Original : new cont.

$$\frac{480,000}{11} : \frac{480,000}{7}$$

d) Size of land bought = 6 hectares

$$\frac{6}{7} = 0.857143$$

$$\approx 0.8571 \text{ hectares}$$

7.

x	-3	-2	-1	0	1	2
y	13	4	-1	-2	1	8

19.

(iii) $y = 2x^2 + x - 2$

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

$$y = -x + 1$$

x	-3	-2	-1	0	1	2
y	5	3	2	1	0	-1

$$y = 2x^2 + x - 2$$

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

$$y = \frac{3}{2}$$

8. (a) Dist. traveled in 3hrs s. drawing

$$\text{Plane A} - 400 \times 3 = 1200\text{km} - \text{cm}$$

$$\text{Plane B} - 500 \times 3 = 7.5\text{cm}$$

$$\text{Plane C} - 300 \times 3 = 900\text{km} - 4.5\text{cm}$$

(b) Dist. BA = 12.8 0.1 x 200 = 2560km 20km

$$T = \frac{D}{S} = \frac{2560}{500} \text{ hrs}$$

$$S = 500$$

$$= 5.12\text{hrs of 5hrs, 7.2mins}$$

$$\approx 5\text{hrs, 7min (nearest min)}$$

(c) Bearing of B from C = $360^\circ - 20^\circ = 340^\circ$

$$\text{Dist. BC} = (10.9 \pm 0.1 \times 200)\text{km}$$

$$= 2180\text{km} \pm 20\text{km}$$

9. a)

x	-2	-1.5	-1	-0.5	0	0.5	1
x^2	4	2.25	1	0.25	0	0.25	1
$4x$	-8	-6	4	-2	0	2	4

$$4 \quad 4 \quad 4 \quad 4 \quad 4 \quad 4 \quad 4 \quad 4$$

$$y \quad 0 \quad 0.25 \quad 9 \quad 2.25 \quad 4 \quad 6.25 \quad 9$$

$$A = \frac{1}{2} h \left\{ \begin{array}{l} \\ \\ \\ \end{array} \right\} = \frac{1}{2} \times \frac{1}{2} \left\{ \begin{array}{l} \\ \\ \\ \end{array} \right\} 5 \quad \checkmark$$

$$= \frac{1}{4} \left\{ \begin{array}{l} \\ \\ \\ \end{array} \right\} \checkmark$$

$$= \underline{13.25 \text{ sq. units}} \checkmark$$

$$b) \int_2^0 (x^2 + 4x + 4) dx + \int_0^1 (x^2 + 4x + u) dx$$

$$\left[\begin{array}{l} 0 \\ 2 \end{array} \right] + \left[\begin{array}{l} 1 \\ 0 \end{array} \right] \checkmark$$

$$= \left(-\frac{8}{3} + 8 - 8 \right) + \left(\frac{1}{3} + 2 + 4 \right) \checkmark$$

$$= 9 \checkmark$$

$$\text{Error} = 13.25 - 9 = 4.125$$

$$\% = \frac{4.125}{9} \times 100$$

$$9$$

$$= \underline{45.84\%}$$

10. a)

x	-2	-1.5	-1	-0.5	0	0.5	1
x^2	4	2.25	1	0.25	0	0.25	1
$4x$	-8	-6	4	-2	0	2	4

$$\begin{array}{cccccccc} 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 \\ y & 0 & 0.25 & 9 & 2.25 & 4 & 6.25 & 9 \end{array}$$

$$\begin{aligned} A &= \frac{1}{2} h \left\{ \right. \\ &= \frac{1}{2} x \frac{1}{2} \left\{ \right. \\ &= \frac{1}{4} \left\{ \right. \\ &= \underline{13.25 \text{ sq. units}} \checkmark \end{aligned}$$

$$b) \int_{-2}^0 (x^2 + 4x + 4) dx + \int_0^1 (x^2 + 4x + u) dx$$

$$\begin{aligned} &\left[\right]_{-2}^0 + \left[\right]_0^1 \checkmark \\ &= \left(-\frac{8}{3} + 8 - 8 \right) + \left(\frac{1}{3} + 2 + 4 \right) \checkmark \\ &= \underline{9} \checkmark \\ \text{Error} &= 13.25 - 9 = 4.125 \end{aligned}$$

$$\begin{aligned} \% &= \frac{4.125}{9} \times 100 \\ &= \underline{45.84\%} \end{aligned}$$

$$11. \quad y = 2x^2 - 4x - 5$$

$$y = 2x + 3$$

X	-3	-2	0	1	2	3	4	5			x	-4	-2	0	2
$2x^2$	18	2	0	2	8	18	32	50			y	-5	-1	3	7
$4x$	-12	-8	-4	0	4	8	12	16	20						
5	5	5	5	5	5	5	5	5	5						
y	25	11	1	-5	-7	1	11	25	11	B_2					

$$(a) \quad x = 1$$

$$(b) \quad -0.9 \times 2.8$$

$$x = -1 \text{ and } x = 4$$

12.

X	-1.5	-1	0	1.5	2	2.5	3.5
Y	-4	0	5	5	3	0	-9

$$(0.75, 6.125)$$

$$Y = -2$$

$$\text{Range of values } -1.3 < x < 2.75$$

$$\text{Integral values; } -1, 0, 1, 2$$

13. a)

x	-4	-3	-2	-1	0	1	2
$2x^2$	32	18	8	2	0	2	8
$4x - 3$	-19	-15	-11	-7	-3	1	5
y	13	3	-3	-5	-3	3	13

(b) Roots for $x = -2.6 \pm 0.1$

$$x = 0.6 \pm 0.1$$

$$y = 2x^2 + 4x - 3$$

-

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

$$y = 3x + 2$$

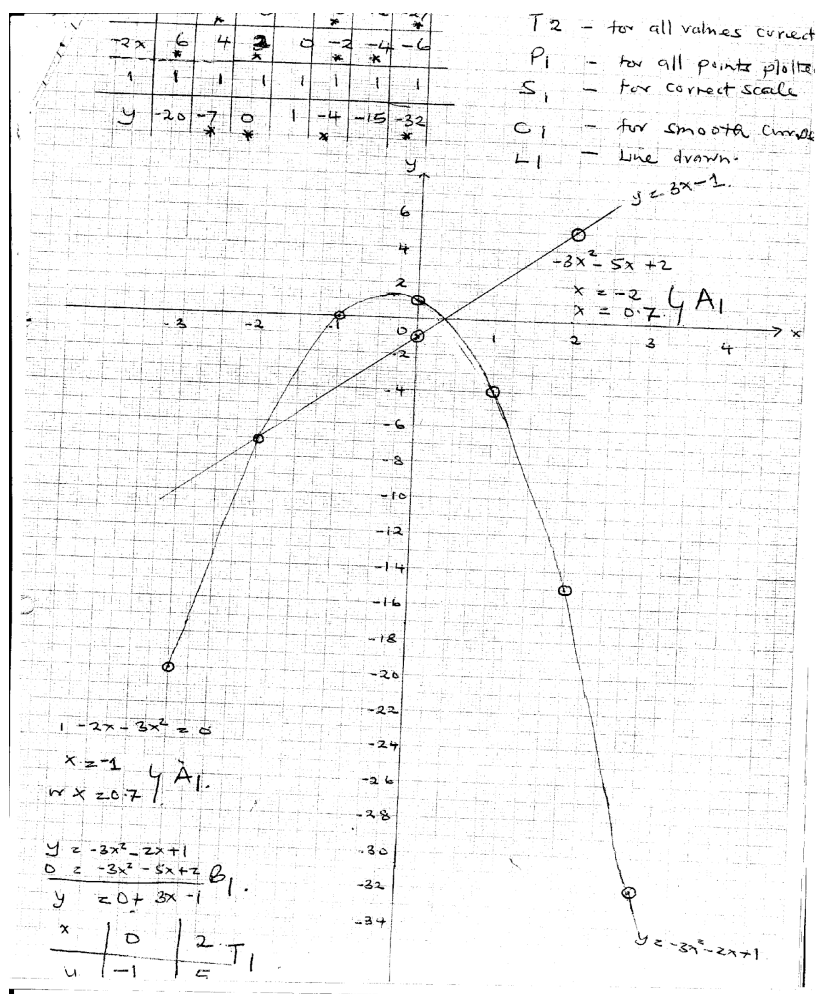
Roots read from the 2 pts of intersection of the line and curve.

$$X = -1.9 \pm 0.1$$

$$X = 1.4 \pm 0.1$$

14.

x	-3	-2	-1	0	1	2	3
$-3x^2$	-27	-12 *	-3	0	-3*	-12	-27*
$-2x$	6 *	4	2 *	0	-2 *	-4 *	-6
1	1	1	1	1	1	1	1
y	-20	-7 *	0 *	1	-4 *	-15	-32 *



$$\begin{aligned}
 1 - 2x - 3x^2 &= 0 \\
 x &= -1 \\
 \text{or } x &= 0.7
 \end{aligned}
 \left. \vphantom{\begin{aligned} 1 - 2x - 3x^2 &= 0 \\ x &= -1 \\ \text{or } x &= 0.7 \end{aligned}} \right\} A_1$$

$$\begin{aligned}
 y &= -3x^2 - 2x + 1 \\
 0 &= -3x^2 - 5x + 2 \\
 y &= 0 + 3x - 1
 \end{aligned}
 \left. \vphantom{\begin{aligned} y &= -3x^2 - 2x + 1 \\ 0 &= -3x^2 - 5x + 2 \\ y &= 0 + 3x - 1 \end{aligned}} \right\} B_1$$

x	0	2
y	-1	5

 $\left. \vphantom{\begin{array}{cc} x & 0 & 2 \\ y & -1 & 5 \end{array}} \right\} T_1$

15. $x^2 + ax - b = 0$
 $(x-1)(x+5) = x^2 + ax - b$
 $x^2 + 4x - 5 = x^2 + ax - b$
 $a = 4, b = 5$

16. Let $a = 1.5 + \sqrt{2}$
 $b = 1.5 - \sqrt{2}$
 $\therefore (x-a)(x-b) = 0$
 $x^2 - xb - ax + ab = 0$

$$x^2 - x(1.5 - \sqrt{2}) - x(1.5 + \sqrt{2}) + ab = 0$$

$$x^2 - 1.5x + x\sqrt{2} - x(1.5 - \sqrt{2}) = 0$$

$$x^2 - 3x + ab$$

$$x^2 - 3x + (1.5 + \sqrt{2})(1.5 - \sqrt{2}) = 0$$

$$x^2 - 3x + 2.25 - 2 = 0$$

$$x^2 - 3x + \frac{1}{4} = 0$$

$$4x^2 - 12x + 1 = 0$$

$$17. \quad a) \quad i) \quad a^2 + b^2 = 89 \quad a + b = 13$$

$$a^2 + 2ab + b^2 = (a + b)^2 = 13^2 = 169$$

$$ii) \quad 2ab = 169 - 89$$

$$= 80$$

$$iii) \quad a^2 - 2ab + b^2 = a^2 + b^2 - 2ab$$

$$= 89 - 80 = 9$$

$$iv) \quad (a - b)^2 = 9$$

$$a - b = \pm 3$$

$$b) \quad a + b = 13$$

$$\underline{a - b = 3}$$

$$2a = 16$$