2. Quadratic expressions and equation 2

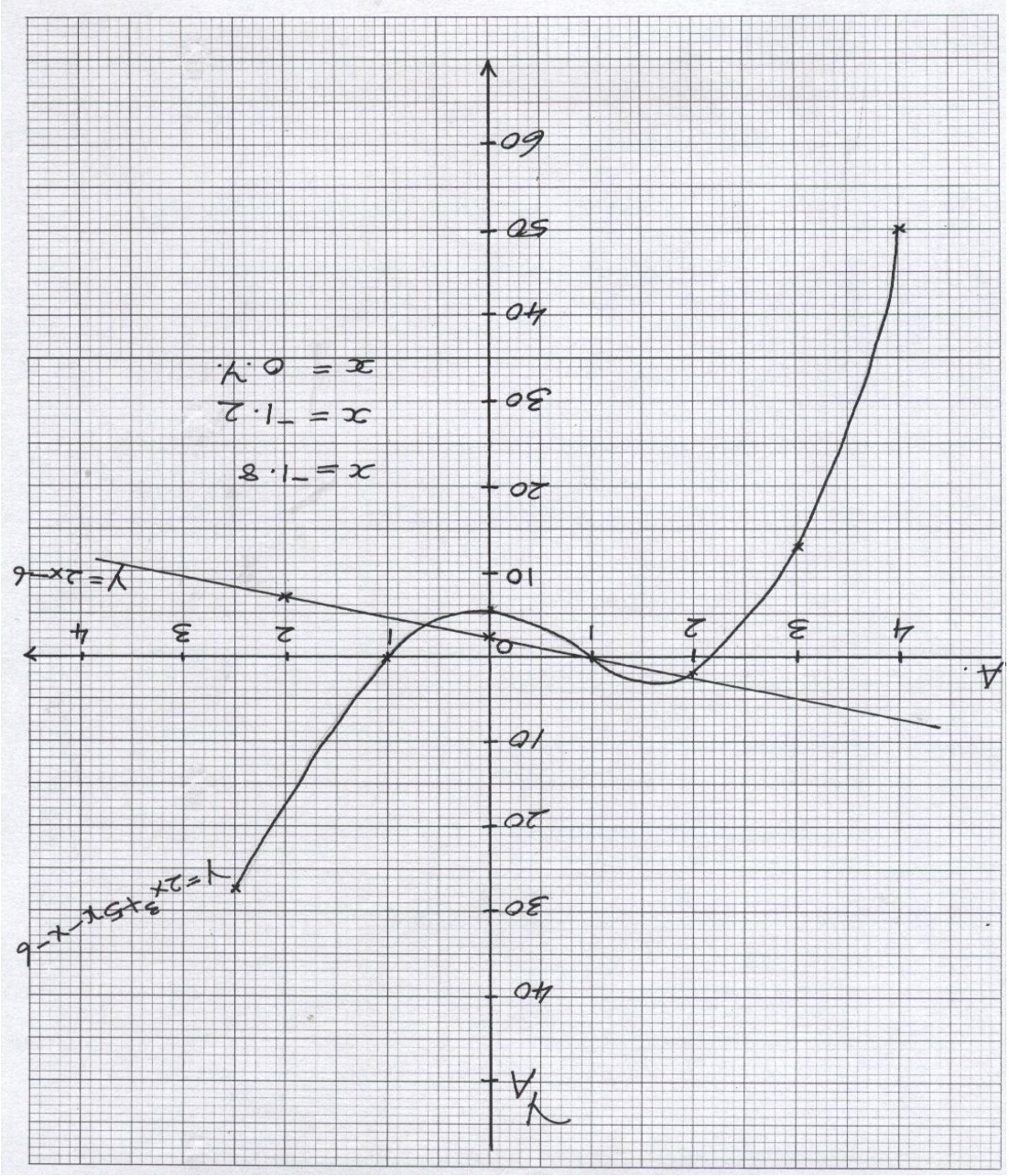
1

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

B_2

$$2x^3 + 5x^2 + x - 6 = y$$
$$2x^3 + 5x^2 x - 4 = 0$$
$$-2x - 2 = y$$
$$y = -2x - 2$$

X	0	2
Y	-2	-6



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

1	1.5	2
- 1	0	+2

	\ _ / Minimum point	B1	✓gradient
	d) (i) Gradient = 2		
	$\frac{y-5}{x-2}=2$ $\therefore y=2x+1$	B1	
	(ii) $M_1 \times M_2 = -1$ $\therefore M_2 = -\frac{1}{2}$	B1	✓gradient of normal
	$\frac{y-5}{x-2}=-\frac{1}{2}$ $\therefore y=-\frac{1}{2}x+6$	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	

1.
(a)

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

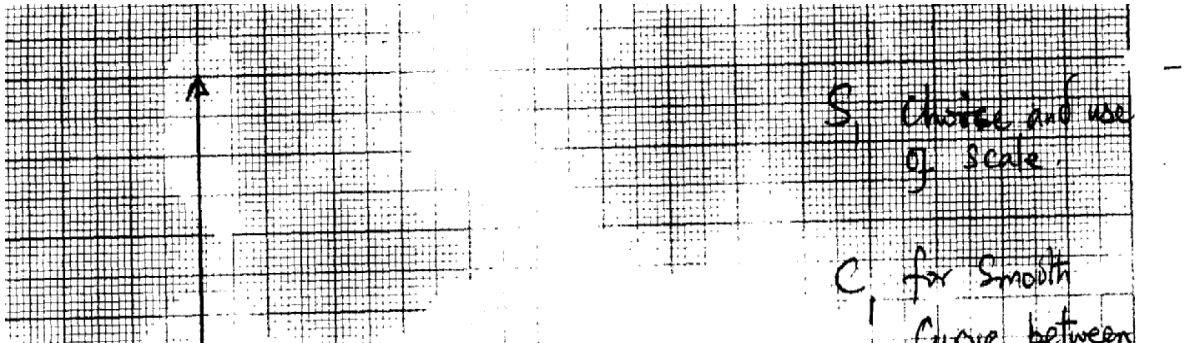
(b) $y = 5x - x^2 - 3$
$\underline{0 = 5x - x^2 - 3}$
$y = 0$
$x = \underline{0.75 \text{ or } 4.3 \pm 0.1}$

(c) $y = 5x - x^2 - 3$
$\underline{0 = 2x - x^2 + 3}$
$y = 3x - 6$

x	*0*	*-1*	*2*
y	*-6*	*-9*	*0*

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

x = -1 or 3 $\underline{+}$ 0.1



2. $(x - 2.5 - \sqrt{3})(x - 2.5 + \sqrt{3}) = 0$

$x^2 - 2.5x + x\sqrt{3} - 2.5x + 6.25 - 2.5\sqrt{3}$

$x\sqrt{3} + 2.5\sqrt{3} = 0$

$x^2 - 5x + 6.25 - 3 = 0$

$x^2 - 5x + 3.25 = 0$

$4x^2 - 20x + 13 = 0$

3. $17.35 \times 13.85 = 240.3$

$17.35 \times 13.75 = 237.2$

$\therefore 17.3 \times 13.8 = 238.7$

Max err $240.3 - 238.7 = 1.5$

Min err $238.7 - 237.2 = 1.6$

Max err $= \frac{1.6 + 1.5}{2} = \frac{3.1}{2} = 1.55$

Product 238.7 ± 1.55

Last product 240

Max err $= 1.55$

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

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

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) $x^2 + 3x - 6 = 0$

$x = -4.5$ *or* 1.5 ± 0.2

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

$x^2 + 3x - 2$

$y = -4$

$x = 5$ *or* 4 ± 0.2

5.

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

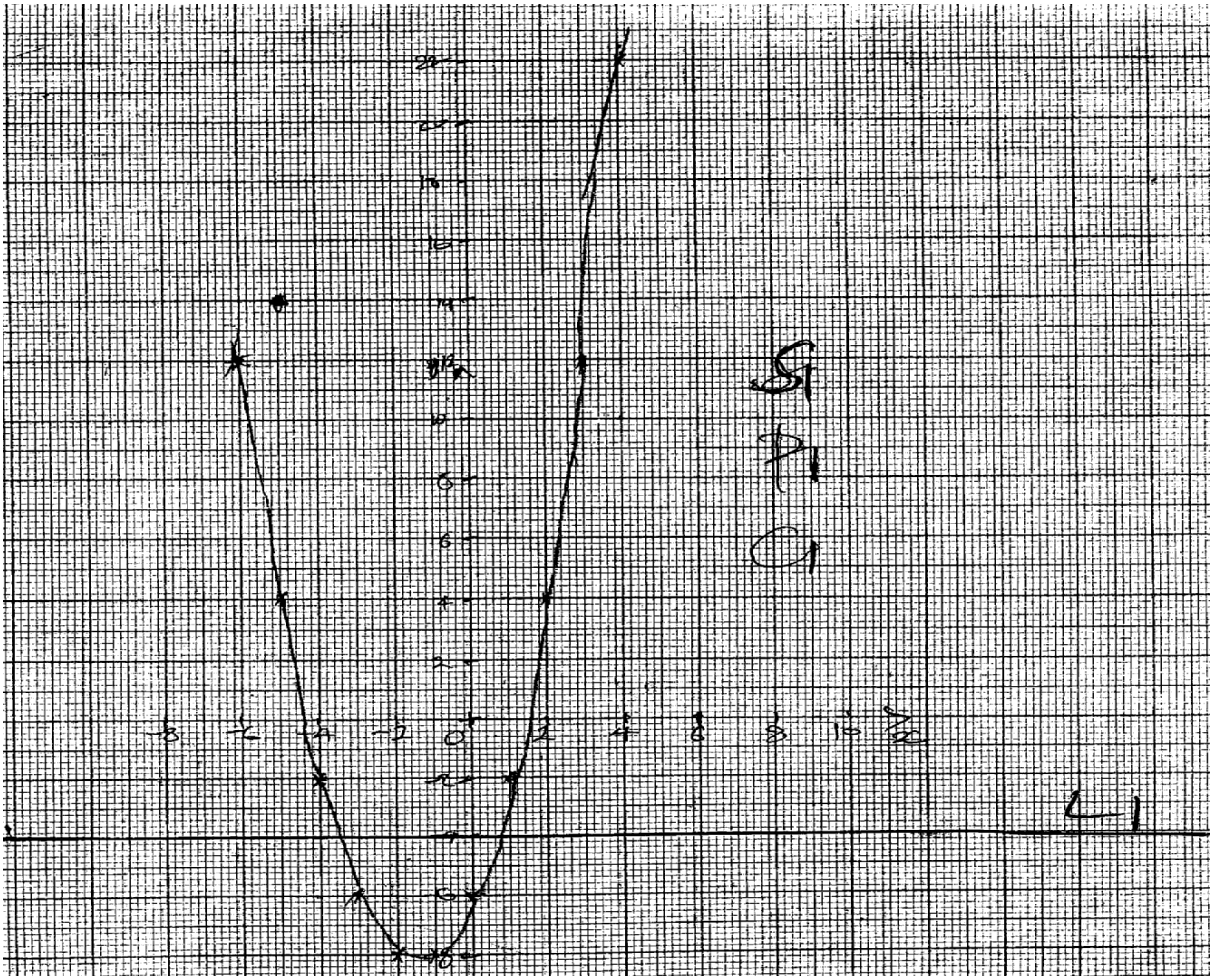
(c) $2x^2 + 3x + 1 = 0$

$\underline{2x + 4x - 3 = 0}$

$-x + 2 = y$

$x = 0.6$ *or* $x = -2.6 \pm 0.1$

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



6. a) i $\underline{480{,}000}$ */=*
x

ii) $\left(\underline{480{,}000}\right)$*/=*
$x - 4$

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

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

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

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

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

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

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

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

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

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

$\simeq 0.8571$ hectares

7. 19.

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

(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

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

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

$y = 3$

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

Plane A – 400 x 3 = 1200km – cm

Plane B – 500 x 3 – 7.5cm

Plane C – 300 x 3 = 900km – 4.5cm

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

$T = \underline{D} = \underline{2560}$ hrs
$S \quad 500$
$= 5.12$hrs of 5hrs, 7.2mns
$\approx$5hrs, 7min (nearest min)

(c) Bearing of B from C $= 360^o - 20^o = 340^o$
Dist. BC $= (10.9 \pm 0.1 \times 200)$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	4	4	4	4	4	4	4
y	0	0.25	9	2.25	4	6.25	9

$A = \frac{1}{2} h \left\{ (y_1 + y_7) + 2(y_2 \ldots\ldots\ldots\ldots\ldots y_6) \right\}$

$= \frac{1}{2} \times \frac{1}{2} \left\{ (0 + 9) + 2 (0.25 + 9 + 2.25 + 4 + 0.25 \right\}$ ✓

$= \frac{1}{4} \left\{ 9 + 4.25 \right\}$ ✓

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

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

$\left(\frac{x^3}{3} + 2x^2 + 4x \right)_{-2}^{0} + \left(\frac{x^3}{3} + 2x^2 + ux \right)_{0}^{1}$ ✓

$= (- \frac{8}{3} + 8 - 8) + (\frac{1}{3} + 2 + 4)$ ✓

$= \underline{\underline{9}}$ ✓

Error $= 13.25 - 9 = 4.125$

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

$= \underline{45.84\%}$

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

4	4	4	4	4	4	4	4
y	0	0.25	9	2.25	4	6.25	9

$A = \frac{1}{2} h \left\{ (y_1 + y_7) + 2(y_2 \ldots\ldots\ldots\ldots\ldots y_6) \right\}$

$= \frac{1}{2} \times \frac{1}{2} \left\{ (0 + 9) + 2 (0.25 + 9 + 2.25 + 4 + 0.25 \right\}$ ✓

$\left\{ \quad \right\}$

= ¼ 9 + 4.25 ✓

= 13.25 sq. units ✓

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

$\left[\frac{x^3}{3} + 2x^2 + 4x\right]_{-2}^{0} + \left[\frac{x^3}{3} + 2x^2 + ux\right]_{0}^{1}$ ✓

= (- $^8/_3$ + 8 – 8) + ($^1/_3$ + 2 + 4) ✓

= 9 ✓

Error = 13.25 – 9 = 4.125

% = $\frac{4.125}{9}$ ✓ x 100

= 45.84%

11. $y = 2x^2 – 4x – 5$ $y = 2x + 3$

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) x =1

(b) -0.9 x 2.8

x = -1 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

Range of values -1.3, < x < 2.75

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 ± 0.1

x = 0.6 ± 0.1

$y = 2x^2 + 4x – 3$

-

$0 = 2x^2 + x – 5$

$y = 3x + 2$

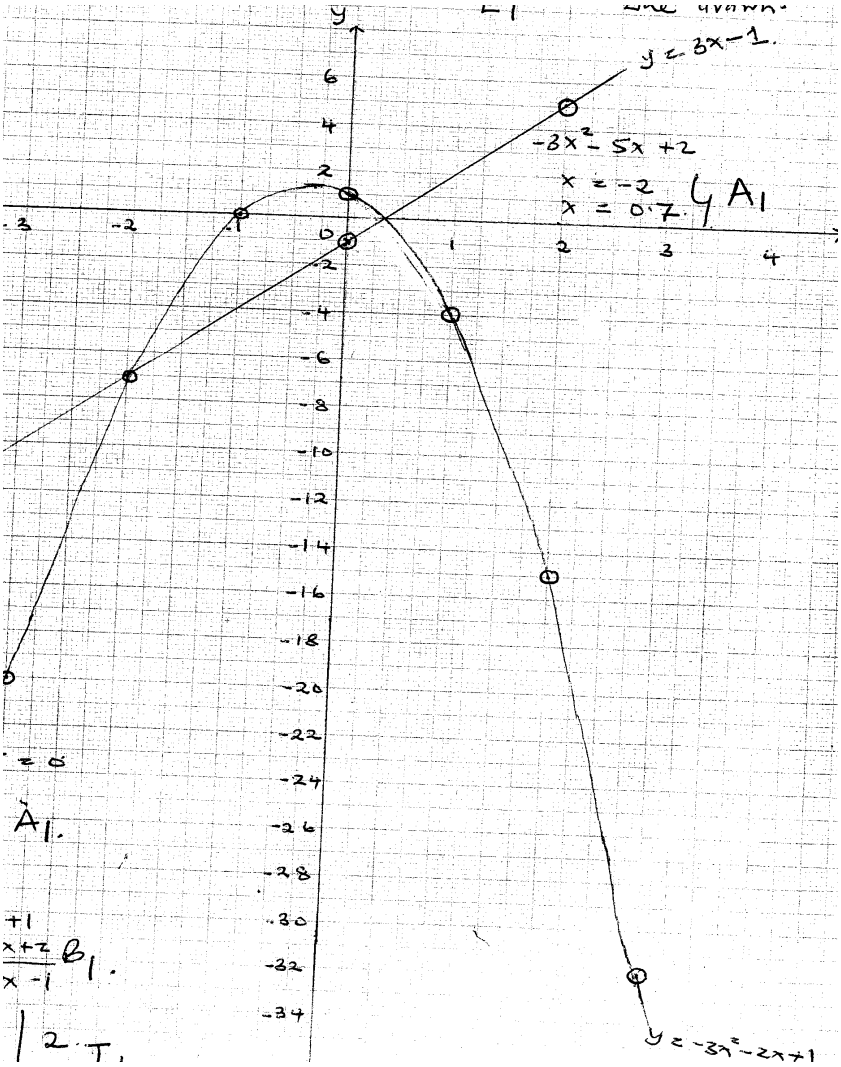
Roots read from the 2 pts of intersection of the line and curve.

$X = -1.9 \pm 0.1$

$X = 1.4 \pm 0.1$

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 *



$1 - 2x - 3x^2 = 0$

$x = -1$

$\text{or } x = 0.7$ } A_1

$y = -3x^2 - 2x + 1$

$\underline{0 = -3x^2 - 5x + 2}$

$y = 0 + 3x - 1$ } B_1

x	0	2
y	-1	5

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 $a = 1.5 + \sqrt{2}$
$b = 1.5 - \sqrt{2}$
$\therefore (x - a)(x - b) = 0$
$x^2 - xb - ax + ab = 0$
$x^2 - x(1.5 - \sqrt{2}) - x(1.5 + \sqrt{2}) + ab = 0$
$x^2 - 1.5x + x\sqrt{2}) - x\ 1.5x - \sqrt{2}) = 0$
$x^2 - 3x + ab$
$x^2 - 3x + (1.5 + \sqrt{2})(1.5 - \sqrt{2}) = 0$
$x^2 - 3x + 2.25 - 2 = 0$
$x^2 - 3x + \frac{1}{4} = 0$
$4x^2 - 12x + 1 = 0$

17. a) i) $a^2 + b^2 = 89 \qquad a + b = 13$
$a^2 + 2ab + b^2 = (a + b)^2 = 13^2 = 169$

ii) $2ab = 169 - 89$
$= 80$

iii) $a^2 - 2ab + b^2 = a^2 + b^2 - 2ab$
$= 89 - 80 = 9$

iv) $(a - b)2 = 9$
$a - b = \pm 3$

b) $a + b = 13$
$a - b = 3$
$2a = 16$