



Unit 1 Revision Sheet B Algebra Higher

Note: Higher tier students must also revise using the foundation tier revision worksheets as this content can also be assessed on higher tier papers.

Questions

Q1.

(a) Write $\frac{x+3}{5} + \frac{x-2}{3}$ as a single fraction in its simplest form. (3)

(b) Simplify $(8a^9e^6)^{\frac{1}{3}}$ (2)

(c) Solve $\frac{2}{3}y + \frac{3}{8}y = 5$
Show clear algebraic working. (3)

(Total for question = 8 marks)

Q2.

(a) Expand and simplify $(m-8)(m+5)$ (2)

(b) Factorise fully $5y + 20y^2$ (2)

(c) Simplify $(p^2 + 3)^0$ (1)

(d) Solve $3(2x-5) = \frac{9-x}{2}$
Show clear algebraic working. (4)

(Total for question = 9 marks)



Q3.

(a) Simplify

(i) $a \times a \times a \times a$,

(ii) $5a \times 6b$,

(iii) $q^8 \div q^2$.

(3)

(b) Solve $5 - 2y = 12$

(2)

(c) $v = w^2 - 2w$.

Work out the value of v when $w = 6$

(2)

(Total for question = 7 marks)

Q4.

(a) Simplify fully $(8e^{15})^{\frac{2}{3}}$

(2)

(b) Express $\left(\frac{y}{2}\right)^{-4}$ in the form ay^n where a and n are integers.

(2)

(c) Solve $\frac{4x-2}{3} - \frac{5-3x}{4} = 6$

Show clear algebraic working.

(4)

(Total for question = 8 marks)

Q5.

$$\frac{6x^3 + 13x^2 - 5x}{4x^2 - 25}$$

Simplify fully

(Total for question = 3 marks)



Q6.

Given that $\frac{3^x}{9^{3x}} = 81$

find the value of x .

Show clear algebraic working.

(Total for question = 3 marks)

Q7.

Solve $\frac{2}{5x-2} = \frac{3}{6x+1}$

Show clear algebraic working.

(Total for question = 4 marks)

Q8.

Solve the equation $\frac{6}{x-2} - \frac{6}{x+1} = 1$

Show clear algebraic working.

(Total for question = 5 marks)

Q9.

The diagram shows a rectangular playground of width x metres and length $3x$ metres.

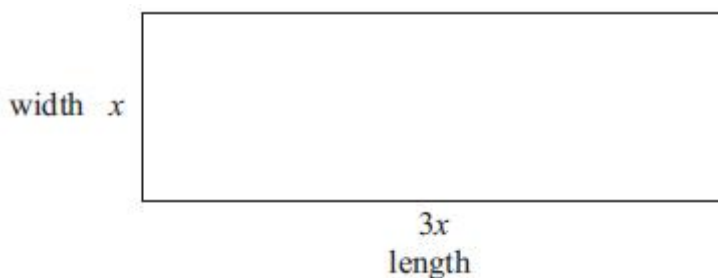


Diagram **NOT**
accurately drawn

The playground is extended, by adding 10 metres to its width and 20 metres to its length, to form a larger rectangular playground.

The area of the larger rectangular playground is double the area of the original playground.

(a) Show that $3x^2 - 50x - 200 = 0$

(3)

(b) Calculate the area of the original playground.

(5)

(Total for question = 8 marks)



Q10.

(a) Factorise $4x^2 - 1$

(2)

(b) Solve $\frac{4}{2x+1} + \frac{1}{4x^2-1} = 3$

Show clear algebraic working.

(4)

(Total for question = 6 marks)

Q11.

(a) Expand and simplify $(2x - 1)(x + 3)(x - 5)$

(3)

(b) Solve $3x^2 + 6x - 5 = 0$

Show your working clearly.

Give your solutions correct to 3 significant figures.

(3)

(Total for question = 6 marks)

Q12.

Solve the equation $5x^2 + 8x - 23 = 0$

Show your working clearly.

Give your solutions correct to 3 significant figures.

(Total for question = 3 marks)

Q13.

Express each of a , b and c in terms of q so that

$$q + 12x - qx^2$$

can be written as $a - b(x - c)^2$

(Total for question = 4 marks)



Q14.

$$f(x) = 17 - 3x^2 + 12x$$

Write $f(x)$ in the form $a - b(x - c)^2$ where a , b and c are constants.

(Total for question = 4 marks)

Q15.

Given that $\left(\sqrt[3]{\frac{1}{x}}\right)^4 = x^m$

(a) find the value of m

(1)

Given that a , b and c are integers,

(b) express $3x^2 + 12x + 19$ in the form $a(x + b)^2 + c$

(2)

(Total for question = 3 marks)



Mark Scheme

Q1.

Q	Working	Answer	Mark	Notes
(a)	Eg $\frac{3(x+3)}{3 \times 5} + \frac{5(x-2)}{3 \times 5}$ or $\frac{3(x+3)+5(x-2)}{3 \times 5}$ oe Eg $\frac{3x+9+5x-10}{3 \times 5}$ or $\frac{3x+9}{3 \times 5} + \frac{5x-10}{3 \times 5}$ oe	$\frac{8x-1}{15}$	3	M1 For a common denominator as part of 1 or 2 fractions (must be a correct expression) M1 For a correct expansion of brackets as part of 1 or 2 fractions (must be a correct expression) A1 cao Do not ISW
(b)		$2a^3e^2$	2	M1 For two of 2, a^3 , e^2 in a product with three terms A1 Do not ISW
(c)	Eg $\frac{16+9}{24}y (= 5)$ or $\frac{16}{24}y + \frac{9}{24}y (= 5)$ or $\frac{25}{24}y (= 5)$ or $y(\frac{2}{3} + \frac{3}{8}) (= 5)$ or $y(0.\dot{6} + 0.375) (= 5)$ or $1.041\dot{6}y (= 5)$ or $24 \times \frac{2}{3}y + 24 \times \frac{3}{8}y = 24 \times 5$ Eg $25y = 5 \times 24$ or $25y = 120$ or $y = 5 \div 1\frac{1}{24}$ or $y = \frac{5}{1.041\dot{6}}$ or $y = \frac{5}{\frac{2}{3} + \frac{3}{8}}$	4.8	3	M1 For simplifying the LHS or multiplying both sides by 24 M1 Dep on 1 st M1 gained For the removal of the denominator(s) as part of a correct equation or for correctly isolating y A1oe Dep on 1 st M1 gained. ScM2 for $16y + 9y = 120$ M0A0 for trial and improvement NB: Decimals must be exact to gain any credit: Eg Award M0 for $y(0.667 + 0.375)$
Total 8 marks				



Q2.

Question	Working	Answer	Mark	Notes
(a)	$m^2 - 8m + 5m - 40$		2	M1 for any 3 correct terms or for 4 out of 4 correct terms ignoring signs for $m^2 - 3m \dots$ or for $\dots - 3m - 40$
		$m^2 - 3m - 40$		A1
(b)		$5y(1 + 4y)$	2	B2 If not B2 then award B1 for $5(y + 4y^2)$ or $y(5 + 20y)$ or $5y(a + 4y)$ where a is an integer and $a \neq 0$ or $5y(1 + by)$ where b is an integer and $b \neq 0$
(c)		1	1	B1
(d)	E.g. $6x - 15$ or $12x - 30$ oe		4	M1 for expansion of a correct bracket
	$2 \times 3(2x - 5) = 9 - x$ oe or $2('6x - 15') = 9 - x$ oe or $3(2x - 5) = \frac{9}{2} - \frac{x}{2}$ oe			M1 for removal of fraction or separating fraction (RHS) in an equation
	$12x + x = 9 + 30$ oe or $6x + \frac{x}{2} = \frac{9}{2} + 15$ oe			M1 ft (dep on 4 terms) for terms in x on one side of equation; number terms on the other
		3		A1 dep on at least M2 awarded
				Total 9 marks



Q3.

Q	Working	Answer	Mark	Notes
(a) (i)		a^4	1	B1 not a^4 accept upper case A
(a) (ii)		$30ab$	1	B1 accept $ab30$, $30ba$, $a30b$, $b30a$ (no x signs allowed) accept upper case A and/or B
(a) (iii)		q^5	1	B1 accept upper case Q
(b)	$5 - 12 = 2y$ oe	-3.5 oe	2	M1 or $5 - 12 \div 2$ or $12 - 5 \div -2$ A1 ans dependent on M1 (above numerical methods acceptable)
(c)	$6^2 - 2 \times 6$ oe	24	2	M1 accept $36 - 12$ A1
				Total 7 marks



Q4.

Q	Working	Answer	Mark	Notes
a		$4e^{10}$	2	B2 (B1 for $4e^k$ or ke^{10})
b	<p>A correct first step eg</p> $\frac{y^{-4}}{2^{-4}} \text{ or } \left(\frac{y^4}{16}\right)^{-1} \text{ or } \frac{y^{-4}}{0.0625}$ $\text{or } \left(\frac{2}{y}\right)^4 \text{ or } \frac{16}{y^4}$ $\text{or } \left(\frac{1}{y/2}\right)^4 \text{ or } \frac{1}{(y/2)^4}$			M1 or for $16y^p$ where $p \neq -4$
		$16y^{-4}$	2	A1
c	<p>eg $12 \times \frac{4x-2}{3} - 12 \times \frac{5-3x}{4} = 12 \times 6$ or</p> <p>eg $4(4x-2) - 3(5-3x) = 12 \times 6$ or</p> <p>eg $\frac{4(4x-2)}{12} - \frac{3(5-3x)}{12} (= 6)$ or</p> <p>eg $\frac{4(4x-2) - 3(5-3x)}{12} (= 6)$ oe</p>			<p>M1 for clear intention to multiply all terms by 12 or a multiple of 12</p> <p>or to express LHS as two fractions over 12 or a multiple of 12 or as a single fraction with a denominator of 12 or a multiple of 12</p> <p>(if expanded numerator, allow one sign error)</p>
	eg $16x - 8 - 15 + 9x = 6 \times 12$			M1 expanding brackets and multiplying both sides by denominator with no more than one sign error
	eg $16x + 9x = 72 + 8 + 15$			M1 for correct rearrangement of a correct equation with terms in x isolated
		3.8	4	A1 oe, award full marks for a correct answer if at least M1 scored
				Total 8 marks



Q5.

Question		Working	Answer	Mark	Notes
		$x(2x + 5)(3x - 1)$ or $(2x + 5)(3x^2 - x)$ or $(2x + 5)(2x - 5)$ oe			M1 for a correct factorisation of the numerator into 2 or 3 factors where one of the factors must be $(2x + 5)$ or denominator into 2 brackets where one of the factors must be $(2x + 5)$
		$x(2x + 5)(3x - 1)$ or $(2x + 5)(3x^2 - x)$ and $(2x + 5)(2x - 5)$ oe			M1 for a correct factorisation of the numerator into 2 or 3 factors where one of the factors must be $(2x + 5)$ and denominator into 2 brackets where one of the factors must be $(2x + 5)$
			$\frac{x(3x-1)}{2x-5}$	3	A1 accept $\frac{3x^2-x}{2x-5}$ oe Do not ISW
					Total 3 marks



Q6.

Q	Working	Answer	Mark	Notes
	$3^4 = \frac{3^x}{9^{3x}} \text{ or } 81 = \frac{3^x}{(3^2)^{3x}}$	$9^2 = \frac{3^x}{9^{3x}} \text{ or } 81 = \frac{(9^{0.5})^x}{9^{3x}}$		M1 replacing 81 with 3^4 or 9^{3x} with $(3^2)^{3x}$ (or 3^{6x}) or replacing 81 with 9^2 or 3^x with $(9^{0.5})^x$ (in an equation)
	eg $4 + 6x = x$ or $4 = x - 2(3x)$ oe	eg $2 = 0.5x - 3x$ oe		M1 a correct equation using powers
		-0.8	3	A1 oe, dep on at least M1
				Total 3 marks



Q7.

Q	Working	Answer	Mark	Notes
	$2(6x+1) = 3(5x-2)$ or $\frac{2(6x+1)}{(5x-2)(6x+1)} = \frac{3(5x-2)}{(5x-2)(6x+1)}$		4	M1 Need to see both expressions in an equation May be implied by second M1; NB: Denominators must be correct
	$12x+2 = 15x-6$ or $\frac{12x+2}{(5x-2)(6x+1)} = \frac{15x-6}{(5x-2)(6x+1)}$			M1 Need to see both expressions in an equation NB: Denominators must be correct
	$3x = 8$ or $-3x = -8$ or $3x = 2 + 6$ or $-3x = -6 - 2$ or $15x - 12x = 8$ or $12x - 15x = -8$ or $3x - 8 = 0$			M1 dep on awarding first two method marks for correct rearrangement with x terms on one side and numbers on the other AND correct collection of terms on at least one side or for $3x - 8 = 0$
		$2\frac{2}{3}$ oe		A1 for $2\frac{2}{3}$ oe including decimal equivalent rounded or truncated to at least 2 decimal places Award 4 marks if first two method marks scored and answer correct.
				Total 4 marks



Q8.

Question	Working	Answer	Mark	Notes
	$\frac{6(x+1)-6(x-2)}{(x-2)(x+1)} \text{ or}$ $\frac{6(x+1)}{(x-2)(x+1)} - \frac{6(x-2)}{(x-2)(x+1)} (=1)$ <p>oe</p> $6(x+1) - 6(x-2) = (x+1)(x-2) \text{ oe}$ $(18 = x^2 - x - 2)$ $x^2 - x - 20 (=0)$ $(x+4)(x-5) (=0)$		5	<p>M1 Correct single fraction or 2 fractions with the same correct common denominator If expanded, condone 1 error in numerator</p> <p>M1 Correct removal of denominator (M2 if a candidate goes straight to this stage) if expanded, condone 1 error</p> <p>A1 Correct 3 part quadratic (eg $x^2 - x - 20 (=0)$ or $x^2 - x = 20$ or $x^2 = x + 20$)</p> <p>M1 $(x+4)(x-5) (=0)$ or a fully correct substitution into the quadratic formula eg $\frac{-(-1) \pm \sqrt{(-1)^2 - 4 \times 1 \times -20}}{2 \times 1}$ Condone no brackets around -1 or $\frac{1 \pm \sqrt{81}}{2}$</p> <p>A1 dep on last M1</p>
		$x = 5, x = -4$		Total 5 marks



Q9.

Q	Working	Answer	Mark	Notes
(a)	$2 \times 3 \times x \times x = (x + 10)(3x + 20)$ or $6x^2 = (x + 10)(3x + 20)$ $6x^2 = 3x^2 + 50x + 200$		3	M2 If not M2 then M1 for $2 \times 3x \times x$ or $2 \times 3x^2$ or $6x^2$ or $(x + 10)(3x + 20)$ A1 Dependent on at least M1
(b)	$(3x + 10)(x - 20)$ $(=0)$ Marks can be awarded in b) if seen in a) $20 \times 3 \times 20$	$x = 20$ 1200	5	M2 or $x = \frac{50 \pm \sqrt{2500 + 2400}}{6}$ If not M2 then M1 for $(3x \pm 10)(x \pm 20)$ or $x = \frac{- -50 \pm \sqrt{-50^2 - 4 \times 3 \times -200}}{2 \times 3}$ condone 1 sign error A1 dep on M1 in b). Ignore negative root (- 3.3 rec) M1 A1 dep on 1 st M1 in b)
				Total 8 marks



Q10.

Q	Working	Answer	Mark	Notes
a			2	M1 $(2x \pm 1)(2x \pm 1)$
		$(2x - 1)(2x + 1)$		A1 cao
b	$\frac{4(2x-1)}{(2x-1)(2x+1)} + \frac{1}{4x^2-1} [= 3] \text{ or}$ $\frac{4(4x^2-1)}{(2x+1)(4x^2-1)} + \frac{(2x+1)}{(2x+1)(4x^2-1)} [= 3] \text{ or}$ $\frac{4(4x^2-1)}{2x+1} + \frac{1(4x^2-1)}{4x^2-1} = 3(4x^2-1) \text{ or}$ $4(4x^2-1) + (2x+1) = 3(2x+1)(4x^2-1)$		4	M1 multiply all terms by $(4x^2 - 1)$ or correct equation with fractions with a common denominator NB $(4x^2 - 1)$ may be factorised throughout
	$4(2x-1) + 1 = 3(4x^2-1) \text{ oe or}$ $4(4x^2-1) + 2x + 1 = 3(2x+1)(4x^2-1) \text{ oe}$			M1 correct equation with no fractions
	$12x^2 - 8x = 0 \text{ or } 8x - 12x^2 = 0 \text{ or}$ $24x^3 - 4x^2 - 8x = 0 \text{ or } 8x + 4x^2 - 24x^3 = 0$			M1 correct simplified equation with all terms on one side
		$0, \frac{2}{3}$		A1 dep on M2
				Total 6 marks



Q11.

Question	Working	Answer	Mark	Notes
a	$2x^2 - x + 6x - 3$ or $2x^2 + 5x - 3$ or $x^2 + 3x - 5x - 15$ or $x^2 - 2x - 15$ or $2x^2 - 10x - x + 5$ or $2x^2 - 11x + 5$ eg. $2x^3 + 5x^2 - 3x - 10x^2 - 25x + 15$ or $2x^3 - 4x^2 - 30x - x^2 + 2x + 15$ or $2x^3 - 11x^2 + 5x + 6x^2 - 33x + 15$	$2x^3 - 5x^2 - 28x + 15$	3	M1 for expansion of any 2 of the 3 brackets (at least 3 of 4 terms correct) M1 (dep) ft for at least half of their terms correct in second expansion (the correct number of terms must be present) A1
	Alternative scheme			
	$2x^3 - 10x^2 - x^2 + 5x + 6x^2 - 30x - 3x + 15$	$2x^3 - 5x^2 - 28x + 15$	3	M2 for a complete expansion with 8 terms present, at least 4 of which must be correct A1



b	$\frac{-6 \pm \sqrt{96}}{6} \text{ or } \frac{-6 \pm \sqrt{6^2 - 4 \times 3 \times -5}}{2 \times 3}$ <p>Accept 9.79 – 9.8(0) in place of $\sqrt{96}$</p> <p>NB: denominator must be 2×3 or 6 and there must be evidence for correct order of operations in the numerator</p>	0.633, -2.63	3	<p>M2 If not M2 then award M1 for</p> $\frac{-6 \pm \sqrt{6^2 - 4 \times 3 \times -5}}{2 \times 3}$ <p>condone one sign error in substitution; allow evaluation of individual terms e.g 36 in place of 6^2</p> <p>A1 dep on M1 for answers in range 0.63 to 0.633, -2.63 to -2.633 Award M2A1 for correct answer with correct working that would gain at least M1</p>
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	<p>Alternative scheme e.g $3((x+1)^2 - 1) - 5 (= 0)$ or $(x+1)^2 - 1 - \frac{5}{3} (= 0)$</p> $(x =) -1 \pm \sqrt{\frac{5}{3}} + 1 \text{ oe}$	0.633, -2.63	3	<p>M1 for completing the square</p> <p>M1 for correct method to isolate x</p> <p>A1 dep on M1 for answer in range 0.63 to 0.633, -2.63 to -2.633 Award M2A1 for correct answer with correct working that would gain at least M1</p>
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Q12.

Question	Working	Answer	Mark	Notes
	$\frac{-8 \pm \sqrt{524}}{10} \quad \text{or}$ $\frac{-8 \pm \sqrt{8^2 - 4 \times 5 \times -23}}{2 \times 5} \quad \text{oe or}$ $\frac{-8 \pm 2\sqrt{131}}{10}$ <p>NB: denominator must be 2×5 or 10 and there must be evidence for correct order of operations in the numerator</p>		3	<p>M2 If not M2 then M1 for</p> $\frac{-8 \pm \sqrt{8^2 - 4 \times 5 \times -23}}{2 \times 5}$ <p>condone one sign error in substitution; allow partial correct evaluation</p>
		1.49, -3.09		<p>A1 for answers in range 1.489 to 1.489105 and -3.089 to -3.0891045</p> <p>Award M2 A1 for answers in range 1.489 to 1.489105 and -3.089 to -3.0891045 with sufficient correct working that would gain at least M1</p>
	Alternative scheme			
	$5[(x + \frac{4}{5})^2 - \frac{16}{25}] \text{ oe}$		3	M1 for completing the square
	$-\frac{4}{5} \pm \sqrt{\frac{23}{5} + \frac{16}{25}} \text{ oe}$			M1
		1.49, -3.09		A1 for answers in range 1.489 to 1.489105 and -3.089 to -3.0891045
				Total 3 marks



Q13.

Q	Working	Answer	Mark	Notes
	$-q\left(x^2 - \frac{12}{q}x\right) + q$ or $-q\left(x^2 - \frac{12}{q}x - \frac{q}{q}\right)$ oe		4	M1 for a correct factorisation of the expression or $b = q$ (must be stated)
	$-q\left[\left(x - \frac{12}{2q}\right)^2 \dots\right]$ oe or $-q\left[\left(x - \frac{6}{q}\right)^2 \dots\right]$ oe			M1 for starting the correct process to complete the square
	E.g. $-q\left(x - \frac{6}{q}\right)^2 + \frac{36}{q} + q$ oe or $-q\left(x - \frac{12}{2q}\right)^2 + \frac{144q}{4q^2} + q$ oe			M1 for a complete process of completing the square. (Does not need to be simplified)
		$a = \frac{36}{q} + q$ $b = q$ $c = \frac{6}{q}$		A1 oe a and c must come from a correct process of completing the square. (Does not need to be simplified)
				Total 4 marks



Q	Working	Answer	Mark	Notes
ALT	$a - bx^2 + 2bcx - bc^2$ oe or $-bx^2 + 2bcx - bc^2 + a$ oe or $b = q$		4	M1 for correctly multiplying out $a - b(x - c)^2$
	$2bc = 12$ or $a - bc^2 = q$ oe			M1 for correctly equating coefficients
	$c = \frac{12}{2q}$ or $a = q\left(\frac{12}{2q}\right)^2 + q$ or $c = \frac{6}{q}$ or $a = q\left(\frac{6}{q}\right)^2 + q$			M1 for correctly finding a or c (Does not need to be simplified)
		$a = \frac{36}{q} + q$ $b = q$ $c = \frac{6}{q}$		A1 oe (Does not need to be simplified)
				Total 4 marks

Q14.

Q	Working	Answer	Mark	Notes
	$\pm 3(x^2 \pm 4x)$ or $\pm 3(x^2 \pm 4x)$ or $b = 3$		4	M1 for factorising $-3x^2 + 12x$ or stating the correct value of b or $b = 3$ embedded in an incorrect final answer in the form $a - 3(x - c)^2$
	$-3[(x - 2)^2 \dots\dots\dots]$ or $-3(x - 2)^2 \dots\dots\dots$			M1 for a correct first step to complete the square
	$-3[(x - 2)^2 - (2)^2] \dots\dots\dots$ oe or $-3(x - 2)^2 + 12 \dots\dots\dots$ or $-3[(x - 2)^2 - (2)^2 \dots\dots\dots]$ oe			M1 for a correct second step to complete the square
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$29 - 3(x - 2)^2$		A1 oe eg $-3(x - 2)^2 + 29$
				Total 4 marks



ALT	$-bx^2 + 2bcx - bc^2 + a$ oe or $b = 3$		4	M1 for multiplying out $a - b(x - c)^2$ or stating the correct value of b or $b = 3$ embedded in an incorrect final answer in the form $a - 3(x - c)^2$
	$2bc = 12$ or $a - bc^2 = 17$ oe			M1 for equating coefficients
	$2 \times "3" \times c = 12$ or $a - "3" \times "2" = 17$ oe			M1 for finding at least 2 from a or b or c
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$29 - 3(x - 2)^2$		A1 oe eg $-3(x - 2)^2 + 29$
				Total 4 marks



Q15.

Q	Working	Answer	Mark	Notes
(a)		$-\frac{4}{3}$	1	B1
(b)	$3(x^2 + 4x) + 19$ and $3[(x + 2)^2 - 2^2] + 19$ or $3\left(x^2 + 4x + \frac{19}{3}\right)$ and $3\left((x + 2)^2 - 2^2 + \frac{19}{3}\right)$ or $a = 3$ and $2ab = 12$ oe and $b^2a + c = 19$ oe or $a = 3$ and $b = \frac{12}{2 \times 3}$ oe and $c = -\frac{12^2}{4 \times 3} + 19$ oe			M1 for correctly taking out a factor of 3 and correctly completing the square or for equating coefficients by expanding $a(x + b)^2 + c = ax^2 + 2abx + b^2a + c$ or for equating coefficients by using $ax^2 + bx + c = a\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a} + c$
		$3(x + 2)^2 + 7$		A1 accept $a = 3, b = 2, c = 7$
				Total 3 marks