REVISE
.wales

2.08 — Expanding brackets & factorising

Mark schemes for the 2.08 question pack

Spec 2.1.11, 2.1.12, 2.1.13, 2.1.14, 2.1.15 — Unit 2

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 36 questions in the corresponding revise.wales question pack (131 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

4. (a) $6m = y - 7$ or $y - 7 = 6m$ or $-6m = 7 - y$ $m = \frac{y-7}{6}$ or $m = \frac{7-y}{-6}$ or $m = (y-7) \div 6$		B1 B1	F.T. only from $6m = y + 7$. B1B0 for $-m = \frac{7-y}{6}$ or equivalent. *Note* Unsupported $m = y - 7 \div 6$ is B0B0. Unsupported $\frac{y-7}{6}$ is B1BO ('m' missing)
4.(b) $6x(x-2)$		B2	B1 for any partial correct factorisation. OR B1 for $6x(x - \ldots)$ OR B1 for $6x(\ldots. - 2)$

			use appropriate terminology, units, etc.
9.(a) $(x - 6)(x + 4)$ $(x =) 6$ AND $(x =) - 4$		B2 B1	B1 for $(x \ldots 6)(x \ldots 4)$. Strict F.T. from their brackets. Allow the following. B2 for $x - 6 (=0)$ AND $x + 4 (=0)$ (B1) $(x =) 6$ AND $(x =) - 4$ (B1) B1 for $x + 6 (=0)$ AND $x - 4 (=0)$ (B0) $(x =) -6$ AND $(x =) 4$ (B1) FT B1 if only $(x =) 6$ AND $(x =) - 4$ seen (B1)
9.(b) $\frac{12x - 9 + 7x + 1}{(6)} = \frac{87}{(6)}$ $19x = 95$ $x = 5$	✓✓ ✓ ✓	B2 B1 B1	F.T. until 2nd error. B1 for 1 error. Subsequent work may show use of common denominator in order to award the B2. B0 for 95/19. If a F.T. answer is not a whole number then allow answer in form '*a* / *b*'. Mark final answer. Allow a correct embedded answer.

			OR $(x \ldots)(x \ldots)$
12.(b) $3(4x^2 - 9y^2)$ $3(2x + 3y)(2x - 3y)$		B1 B2	B1 for $3(2x \ldots 3y)(2x \ldots 3y)$ OR $(2x + 3y)(2x - 3y)$ *Alternative method* *Award B2 for:* $(6x + 9y)(2x - 3y)$ *or* $(2x + 3y)(6x - 9y)$ *SC2* $12(x + 1.5y)(x - 1.5y)$ *OR* $27\left(\frac{2}{3}x + y\right)\left(\frac{2}{3}x - y\right)$ *or equivalent.* *SC1* $(\sqrt{12}x + \sqrt{27}y)(\sqrt{12}x - \sqrt{27}y)$ *OR* $(2\sqrt{3}x + 3\sqrt{3}y)(2\sqrt{3}x - 3\sqrt{3}y)$ *o.e.*

				Correct answer of 1/3 gains B1 regardless.
8.(a)	$x(x^2 - 5)$		B1	
8.(b)	$2x^2 + 5x - 12$		B2	B1 for $2x^2 + kx - 12$ OR $2x^2 + 5x + k$

8.	(x – 9)(x + 2) (x =) 9 AND (x =) −2	B2 B1	B1 for (*x* ... 9)(*x* ... 2). Strict F.T. from their brackets. Penalise change of letter −1. If no factorising shown, allow the following. B2 for x − 9 (=0) AND x + 2 (=0) (B1) (x =) 9 AND (x =) −2 (B1) B1 for x + 9 (=0) AND x − 2 (=0) (B0) (x =) −9 AND (x =) 2 (B1) FT B1 if only (x =) 9 AND (x =) −2 seen. (B1)

11(a) $200\pi = \frac{40}{360} \times \pi \times \text{radius}^2$ $\text{radius}^2 = \frac{200\pi \times 360}{40\pi}$ or equivalent (radius =) $\sqrt{1800}$ Writing 1800 or as a product of 2 or more factors $30\sqrt{2}$ (m)	M1 A1 A1 M1 A1	 CAO e.g. $\sqrt{1800} = \sqrt{18} \times \sqrt{100}$, or $\sqrt{1800} = \sqrt{3} \times \sqrt{6} \times \sqrt{100}$, or $1800 = 900 \times 2$ FT 'their 1800' provided previous M1 awarded Needs to be in the form $a\sqrt{b}$ where b is a prime number
11(b) $(10 + 30\sqrt{2})^2$ $100 + 300\sqrt{2} + 300\sqrt{2} + 1800$ $= 1900 + 600\sqrt{2}$ (m^2)	M1 A1 A1	FT for all marks 'their $30\sqrt{2}$' provided of equivalent difficulty i.e $a\sqrt{b}$, where b does not need to be a prime number Allow A1 for any 3 correct terms Accept e.g. $100(19 + 6\sqrt{2})$ (m^2) Mark final answer

17. (Numerator) $4(3x + 4)$ (Denominator) $(3x + 4)(3x - 4)$ $\frac{4}{3x - 4}$	B1 B2 B1	 B1 for $(3x \ldots\ldots 4)(3x \ldots\ldots 4)$ Mark final answer. F.T. provided no more than 1 previous error and provided simplification required.

3.(a)	$5x^2 - 2x - 3x^2 + 6x - 21$	B2	B1 for sight of $5x^2 - 2x$. B1 for sight of $-3x^2 + 6x - 21$. Brackets must be removed. Allow both of the above B marks even if not part of a single expression. *FT for B2 if at least two x^2 terms AND at least two x terms to be simplified.* *FT for B1 if at least two x^2 terms OR at least two x terms to be simplified.*
	$= 2x^2 + 4x - 21$	B2	If B2 not awarded, allow B1 for correct collection of 'x^2 terms' ($2x^2$) OR B1 for correct collection of 'x terms' (+4x). This 2nd B2 (or B1) is for their **final** answer. Any compensating errors leading to a 'correct' answer is B0. Penalise −1 for any attempt to equate their expression to zero (and attempting to solve) OR incorrectly factorising.

3.(b)	$22 - f = 3 \times 6$ or equivalent. $22 - 18 = f$ OR $-f = 18 - 22$ $f = 4$	M1 A1 A1	CAO. Accept $4 = f$. M1A1A0 for $-f = -4$. Mark final answer. Allow all 3 marks for $\frac{22-4}{3} = 6$ with no further work. Allow 2 marks for $\frac{22-4}{3} = 6$ followed by '$f \neq 4$'. If no marks gained, Allow SC1 for an unsupported $f = -4$. Allow SC1 for sight of 18 from 3×6.

6.	$3x(4x + y)$	B2	Accept $3x(4x + 1y)$ B1 for $3x(4x \pm ....)$ or $3x(.....+ y)$ B1 for $3(4x^2 + xy)$ or $x(12x + 3y)$.

	(DE) = 7·6(…)(cm) ISW	A1	
10.	$(2m+17)(2m-17)$	B2	B1 for $(2m \ldots 17)(2m \ldots 17)$ OR B1 for $(2m+\sqrt{289})(2m-\sqrt{289})$ OR $4(m+8.5)(m-8.5)$ OR $(4m+34)(m-8.5)$ OR $(4m-34)(m+8.5)$. Mark final answer. Penalise -1 further work, e.g.

10		
15. (a) $x = 0{\cdot}2454545.....$ and $100x = 24{\cdot}54545....$ with an attempt to subtract	M1	Or $10x$ and $1000x$, or equivalent. Or a complete alternative method.
243/990 or 27/110 or equivalent.	A1	An answer of 24·3/99 gains M1 only. ISW
Alternative method *$0{\cdot}2 + 0{\cdot}0454545.....$ = 1/5 + 45/990 or equivalent* *243/990 or 27/110 or equivalent*	*M1* *A1*	*ISW*
15. (b) $8 \times 5 + 8\sqrt{7} - 5 \times 3\sqrt{7} - 3(\sqrt{7})^2$ or equivalent	M1	
$= 19 - 7\sqrt{7}$	A1	Mark final answer. If no marks awarded, SC1 for 3 of the 4 terms correct.

1.(a) $3x^3 - 6x$	B2	Must be in an expression for B2. B1 for sight of $(+)3x^3$ or $-6x$. Mark final answer.
1.(b) $3g = 2 - f$ or $f - 2 = -3g$ $g = \frac{2-f}{3}$ or $g = \frac{f-2}{-3}$ or $g = \frac{2}{3} - \frac{f}{3}$	B1 B1	F.T only from $(\pm)3g = \pm f \pm 2$. B1B0 for $-g = \frac{f-2}{3}$. B1B0 for $g = 2 - f \div 3$. B1B0 for $\frac{2-f}{3}$ ('g' missing). Mark final answer.
1.(c)(i) $7x < 32$ $x < 32/7$ or $x < 4\frac{4}{7}$	B1 B1	Use of '=' is B0B0 unless replaced for final answer. FT from $7x < k$. Allow $x < 4{\cdot}57(\ldots)$. Do not allow $x < 4{\cdot}6$ or $x < 4{\cdot}5$ unless $x < 4{\cdot}57(\ldots)$ seen. Mark final answer. Penalise consistent use of '≤' by –1.
1.(c)(ii) 4	B1	OR F.T. 'their answer (inequality) in (c)(i)' if $x < a$. No FT from $x \leq a$. 4x is B0.

13.(a) $c(c+d)(c-d)$	B3	Mark final answer for B3. Award B2 for $(c+d)(c^2-cd)$ or $(c-d)(c^2+cd)$ OR allow B2 for $c(c\ldots d)(c\ldots d)$ OR for sight of $(c+d)(c-d)$. Award B1 for sight of $c(c^2-d^2)$.
13.(b) $(e-1)(5e-2)$	B2	B1 for $(e-1)(5(e-1)+3)$ or $(e-1)(5e+k)$ with $k \neq 0$.
Alternative method $5(e-1)^2+3(e-1)=5e^2-7e+2$ $=(e-1)(5e-2)$	B2	*No mark for the expansion and collection of terms.* *B1 for (e…1)(5e…2) from collection of terms.* *Award B1 for a correct factorisation, if possible, on FT of 'their derived quadratic expression', provided no more than one error.* *SC1 for an answer of* $(e-1)(5e+k)$ with $k \neq 0$.

8. One correct evaluation $1 \le x \le 2$ 2 correct evaluations $1{\cdot}55 \le x \le 1{\cdot}75$, one < 0, one > 0. 2 correct evaluations $1{\cdot}55 \le x \le 1{\cdot}65$, one < 0, one > 0. $x = 1{\cdot}6$	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if 'too high' or 'too low'. If evaluations not seen accept 'too high' or 'too low'.* x $2x^3 + x - 10$ (or check $2x^3 + x = 10$) 1 −7 1·1 −6·238 1·2 −5·344 1·3 −4·306 1·4 −3·112 1·45 − 2·452... 1·5 −1·75 1·55 − 1·002... **1·6 −0·208 1·65 0·634...** **1·7 1·526** 1·75 2·468... 1·8 3·464 (1·62 0·123..) 1·9 5·618 (1·63 0·291..) 2 8 (1·64 0·461..)
9. 85% ≡ 6154 $\frac{6154}{85} \times 100$ OR $\frac{6154}{0{\cdot}85}$ = 7240	B1 M1 A1	Accept any indication. Implies the B1.
10. x = 54(°) Opposite angles (of a) cyclic quad. (add up to 180°). y = 108(°) Angle at the centre (is twice the angle at the circumference).	B1 E1 B1 E1	 Dependent on an attempt at 180 – 126. FT 2 × 'their 54' only if less than 360° Dependent on an attempt at 2 × 'their 54'.
11. Correct enlargement	B2	Otherwise B1 for 2 correct vertices within a triangle. OR for 3 correct vertices in the correct location not joined to form the triangle OR triangle of correct shape, size and orientation in incorrect position OR consistent correct use of an incorrect negative scale factor.
12(a). $(9p+1)(9p-1)$	B2	B1 for $(9p \ldots 1)(9p \ldots 1)$
12(b). $(7t-2)(t+3)$	B2	B1 for $(7t \ldots 2)(t \ldots 3)$
13. Sight of 297.5 AND 6.5 297.5 ÷ 6.5 = 45.77(km/h)	B1 M1 A1	Accept 6 hours 30 minutes, but not 6.3 hours. If other calculations shown, then the relevant calculation must be identified. Award M1 for their values provided 295≤d<300 AND 6<t≤7 (but not 6 hours 30 minutes). CAO. Correct answer must be clearly identified.
14. sin BAD = (2×70)/(8×19) or equivalent (BAD=) 67(.08…°) (Area of sector ABD=) 67(.08…)/360×π×8^2 Accept answers in the range 37.4(cm^2) to 37.5(cm^2) OR 37(cm^2)	M2 A1 M1 A1	Allow any unambiguous indication of angle BAD. M1 for the correct use of the formula when sinBAD is not the subject, for example: 70 = 1/2×8×19×sinBAD. Allow any answer that rounds to 67(°). Accept 292.9(…)/360×π×8^2 OR 293/360×π×8^2 for the area of the major sector ABD. FT their derived or stated value of angle BAD. Accept an answer in the range 163.5(cm^2) to 163.7(cm^2) OR 164(cm^2) for the area of the major sector ABD.

17.(b) *Alternative method* $1-\left[\left(\frac{96}{100}\times\frac{95}{99}\right)+\left(2\times\frac{3}{100}\times\frac{96}{99}\right)+\left(2\times\frac{1}{100}\times\frac{96}{99}\right)\right]$ $=\frac{12}{9900}\left(=\frac{1}{825}\right)$ *ISW*	*M2* *A1*	*M1 for sight of:* $\left[\left(\frac{96}{100}\times\frac{95}{99}\right)+\left(2\times\frac{3}{100}\times\frac{96}{99}\right)+\left(2\times\frac{1}{100}\times\frac{96}{99}\right)\right]$ *OR* $1-\left[\left(\frac{96}{100}\times\frac{95}{99}\right)+\left(\frac{3}{100}\times\frac{96}{99}\right)+\left(\frac{1}{100}\times\frac{96}{99}\right)\right]$ *Allow 1(.21…)×10^{-3} OR 0.001(21…) or equivalent.* *An unsupported answer of 0.00121(2…) gains M2A1.* *A0 for 0.001(21…)%.* *SC1 for working with replacement leading to an answer of 12/10000 (3/2500) OR 0.001(2) [may be unsupported].*
18. (cos CAB =) $(13^2 + 17^2 - 23^2) / (2\times13\times17)$ (=-71/442 OR -0.16(06…)) (CAB =) 99(.2…°)	M2 A1	M1 for $23^2 = 13^2 + 17^2 - 2\times13\times17\times\cos CAB$ SC1 for the correct evaluation of either of the two other angles. ABC = 33(.9...) and ACB = 46(.8...).
19. Sight of $9x^2 - 6x - 6x + 4$ Sight of $x^2 + x + 2x + 2$ $8x^2 - 15x + 2 = 0$ $x=\frac{-(-15)\pm\sqrt{(-15)^2-4\times8\times2}}{2\times8}$ $x=\frac{15\pm\sqrt{161}}{16}$ $x = 1.73$ with $x = 0.14$ (answers to 2dp)	B1 B1 B1 M1 A1 A1	Or equivalent. Or equivalent. FT expansions of equivalent level of difficulty provided B1 previously awarded. '= 0' required, but may be implied by an attempt to use the quadratic formula or if $a = 8, b = -15$, $c = 2$ used in the quadratic formula. This substitution into the formula must be seen for M1. FT 'their derived quadratic equation' equated to zero of equivalent difficulty (a, b and c must be non-zero). Allow one slip in substitution **for M1 only**, but must be correct formula. Can be implied from at least one correct value of x evaluated. CAO for their quadratic equation but not if complex roots. M0A0A0 if trial and improvement used or for unsupported answers.
20. Volume scale factor: $\left(\sqrt{199/47}\right)^3$ (=8.712…) OR $\left(\sqrt{47/199}\right)^3$ (=0.114…) or equivalent. Volume of larger solid $350\times\left(\sqrt{199/47}\right)^3$ OR $350\div\left(\sqrt{47/199}\right)^3$ or equivalent. 3049(.305…cm^3)	B2 M1 A1	May be seen in parts. Award B1 for a linear scale factor: $\sqrt{(199/47)}$ (= 2.057…) OR $\sqrt{(47/199)}$ (= 0.485…) or equivalent OR Award B1 for (199/47)^3 (= 75.904…) OR (47/199)^3 (= 0.013...). CAO. Not from premature approximation.

			BC = 25(cm) A1
10.	$9k^2 - 25n^2$ $(3k + 5n)(3k - 5n)$	B1 B2	Allow $9k^2 - k + k - 25n^2$ ISW. B1 for $(3k \ldots 5n)(3k \ldots 5n)$ Mark final answer. Ignore $(3k - 5n)(3k + 5n) = 0$, but penalise -1 for further work e.g. $(3k - 5n) = 0$ or $(3k + 5n) = 0$.

4. (One part =) (£)210 ÷ 3 = (£)70 (Total amount =) 14 × (£)70 OR (£)210 + 4 ×(£)70 + 7 × (£)70 = (£)980	M1 A1 m1 A1	FT 'their (£)70' only if M1 gained. Allow m1 for sight of 210 AND 280 AND 490 together as the three shares. *For 210 ÷ 3 × 14 M3* *= 980 A1*
Organisation and Communication. Accuracy of writing.	OC1 W1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means For W1, candidates will be expected to: • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc
5. 4 5 11 12 OR 4 6 10 12 OR 4 7 9 12	B3	May be written in any order. B1 for Range = 8. B1 for Median = 8. B1 for Total = 32. Penalise –1 **once only** for repeated values, negatives or fractional answers e.g. 4, 8, 8, 12 earns B1 B1 B1 –1 (2 marks), 8, 8, 8, 8 earns B0 B1 B1 –1 (1 mark).
6.(a) $(x - 4)(x - 3)$ $(x =) 4$ AND $(x =) 3$	B2 B1	B1 for $(x \ldots 4)(x \ldots 3)$. Ignore '= 0'. Strict FT from their brackets. Allow the following. B2 for x − 4 (=0) AND x − 3 (=0) (B1) (x =) 4 AND (x =) 3 (B1) B1 for x + 4 (=0) AND x + 3 (=0) (B0) (x =) −4 AND (x =) −3 (B1) FT B1 if only (x =) 4 AND (x =) 3 seen. (B1)
6(b) $25x^2 - 20x + 4$	B2	Otherwise B1 for sight of $25x^2 \pm kx + 4$ (allow k = 0) B1 for sight of $25x^2 - 20x - 4$ Mark final answer.

10.(a)(i) Correct reason given. e.g. 'An angle at the circumference subtended by a diameter is a right angle'. ' line AC is a diameter'	E1	Accept any correct unambiguous wording. The key word is 'diameter'. Allow eg 'angle in a semicircle is 90°', 'line AC goes through the centre'. 'opposite a diameter' Do not accept 'because it's a right angle'.
10.(a)(ii) $\tan x = \frac{7{\cdot}5}{4{\cdot}7}$ $x = \tan^{-1}(7{\cdot}5 / 4{\cdot}7)$ or $\tan^{-1} 1.6$ or $\tan^{-1} 1.59(\ldots)$ $= 57{\cdot}9(\ldots)(°)$ or $57{\cdot}8(\ldots)(°)$ or $58(°)$	M1 m1 A1	 Implies M1. C.A.O. *Alternative method to find x* *A correct and complete method (using Pythagoras's theorem and a trigonometric relationship). M2* *x = 57·9(…)(°) or 57·8(…)(°) or 58(°) CAO A1*
10.(b) (y =) 58(°) Correct circle theorem given. e.g. 'angles (at the circumference) subtended by the same chord (or arc) are equal', 'angles in the same segment (are equal)'.	B1 E1	Strict FT of 'their x'. Accept any correct unambiguous wording. Allow eg 'angles on the same chord (are equal)' Do not accept e.g. 'they are equal' on its own.
11. 2^{400}	B2	B1 for $(2^{100})^4$ OR sight of 2^4
12. (Height =) $\frac{3\times5533}{825}$ OR $\frac{5533}{\frac{1}{3}\times825}$ = 20·1(2 cm)	M2 A1	M1 for $5533 = 1/3 \times$ height $\times 825$ or equivalent. Allow an answer of 20(cm) from correct working.
Alternative method (finding the radius first): *Use $A = \pi r^2$ to evaluate r or r^2.* *(Height =)* $\frac{3\times5533}{\pi\times16.2(05\ldots)^2}$ *OR* $\frac{5533}{\frac{1}{3}\times\pi\times16.2(05\ldots)^2}$ *OR* $\frac{3\times5533}{\pi\times262.6(\ldots)}$ *OR* $\frac{5533}{\frac{1}{3}\times\pi\times262.6(\ldots)}$ *= 20·1(2… cm)*	 *M2* *A1*	*Allow use of π = 3·14, 3·142 or 3·14(59…).* *When using the π button on the calculator,* *r = 16·2(05…) OR r^2 = 262·6(…).* *There will be no FT for any radius other than r = 16cm, from working seen.* *M1 for $5533 = 1/3 \times$ height $\times \pi \times 16.2(05\ldots)^2$ or equivalent.* *Allow M1 for use of r = 16 (cm)* Allow an answer of 20(cm) from correct working. *Accept an answer in the range 20·10 to 20·143(cm)* *FT base radius = 16 cm: Allow an answer in the range 20·6(cm) to 20·65(cm) OR 21(cm) from correct working.*
13.(a) $(2x+9)(2x-9)$	B2	B1 for $(2x \ldots 9)(2x \ldots 9)$
13.(b) $(7x-4)(x+2)$	B2	B1 for $(7x \ldots 4)(x \ldots 2)$
13.(c) $(x+2)^2(x+7)$ OR $(x+2)(x+2)(x+7)$	B2	B1 for $(x+2)^2(x+2+5)$ OR $(x+2)[(x+2)^2+5(x+2)]$ OR $(x+7)(x^2+4x+4)$ OR $(x+2)(x^2+9x+14)$. Allow B1 for $(x+2)^2(x+k)$ where $k \neq 0$, 2 or 7.
14. $-½$ or equivalent	B2	B1 for -2 or ½.
15. $2n^2+1$ or equivalent = 20 001	B2 B1	B1 for sight of $2n^2$ OR for sight of consistent 2nd difference 4. FT from their $2n^2 \pm k$, where $k \neq 0$ OR from their $2n^2 \pm an$, where $a \neq 0$ OR from their $2n^2 \pm an \pm k$, where $a \neq 0, k \neq 0$. An unsupported answer of 20 001 gains all 3 marks. If no marks, award SC1 for an unsupported answer of 20 000.

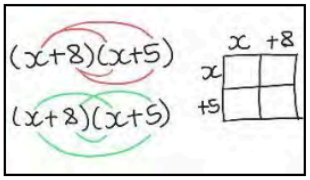
12. $6(2x+1)-4(3x-5)$ as a <u>numerator</u> within a single fraction $(3x-5)(2x+1)$ as a <u>denominator</u> h26 / $(3x-5)(2x+1)$	M1 M1 A1	Allow intention of brackets, e.g. $6\times 2x+1-4\times 3x-5$ CAO. Allow $26/(6x^2-7x-5)$ (If expanded, the denominator must be correct.) If M1 M1 A1, penalise further incorrect work –1. If no marks awarded, then SC1 for sight of 26.
13. (Linear scale factor =) $\sqrt[3]{}(1280/20)$ (= 4) $\sqrt[3]{}(1280/20)\times 2{\cdot}3$ = 9·2 (cm)	B1 M1 A1	Or equivalent. Accept a method based on ratios e.g. 1 : 4 (from 20 : 1280 = 1 : 64 = 1 : 4^3) FT their derived scale factor (from $\sqrt[3]{}$). SC1 for an answer of 18.4 (using s.f. of 8, from $\sqrt{64}$).
<u>Alternative method</u> (using reciprocal scale factor) *(Linear scale factor =) $\sqrt[3]{}(20/1280)$ (= 1 / 4)* *2·3 ÷ $\sqrt[3]{}(20/1280)$ OR 1 / $\sqrt[3]{}(20/1280)\times 2{\cdot}3$* *= 9·2 (cm)*	*B1* *M1* *A1*	*Or equivalent.* *Accept a method based on ratios.* *FT their derived scale factor (from $\sqrt[3]{}$).*
14. (a) $10x = 8{\cdot}121212.....$ and $1000x = 812{\cdot}1212....$ <u>with</u> an attempt to subtract on both sides 804/990 (= 402/495 = 134/165)	M1 A1	Or x and $100x$, or equivalent. Or a <u>complete</u> alternative method. An answer of 80·4/99 gains M1 only. ISW
<u>Alternative method</u> *0·8 + 0·0121212..... = 8/10 + 12/990 or equivalent* *804/990 (= 402/495 = 134/165)*	*M1* *A1*	*ISW*
14. (b) $6\sqrt{2}$	B1	
14. (c) $7\times 3+7\sqrt{5}-3\times 2\sqrt{5}-2(\sqrt{5})^2$ or equivalent $= 11+\sqrt{5}$	M1 A1	 Mark final answer. Accept $11+1\sqrt{5}$. If no marks awarded, SC1 for 3 correctly simplified terms i.e. 21, $7\sqrt{5}$, $-6\sqrt{5}$, -10.
15. • *FG = HG* (since *G* is the midpoint of *FH*) • *EG* is a common side • Angle *EGF* = Angle *EGH* (since *EG* and *FH* are perpendicular) SAS (or two sides and the <u>included</u> angle) so that EFG and EHG are congruent triangles.	B1 B1 B1 B1	Do not accept indications on the diagram. FT from B2 previously awarded. Must be convincing. Do not allow 'two sides and an angle'.
<u>Allow alternative method</u> • *FG = HG (since G is the midpoint of FH)* • *EG is a common side* • *EF = EH using Pythagoras* *SSS (or all corresponding sides equal) so that EFG and EHG are congruent triangles.*	*B1* *B1* *B1* *B1*	*Do not accept indications on the diagram.* *Must be convincing. An unsupported statement that EF = EH, or that triangle is 'isosceles', is insufficient.* *FT from B2 previously awarded. Allow RHS.* *Must be convincing.*

4. $5x - 17 + 2x + 9 + x + 20 = 180$ $8x = 168$ $x = 21$ Substituting x = 21 into at least one expression. $(5x - 17 =)\ 88(°)\ \ (2x + 9 =)\ 51(°)\ \ (x + 20 =)\ 41(°)$ (So not a right-angled triangle)	M1 A1 A1 M1 A1	 F.T. from ax = b. Allow all 3 marks for x = 21. If $x \neq 21$ FT 'their derived value of x'. F.T. for this A1 if $x \geq 4$. Any **two** of these expressions correctly evaluated with no incorrect evaluation, provided the sum of the two found is > 90. (statement not required). *Note* ***If further work indicates that the values found are not treated as angles (e.g. showing $51^2 + 41^2 \neq 88^2$) then award final M0A0.***
Alternative method *$5x - 17 = 90$ OR $2x + 9 = 90$ OR $x + 20 = 90$* *$x = 21{\cdot}4$ AND $x = 40{\cdot}5$ AND $x = 70$* *Then verifying:* *If $x = 21{\cdot}4$: $5x - 17 + 2x + 9 + x + 20 = 183.2$* *AND* *If $x = 40{\cdot}5$: $5x - 17 + 2x + 9 + x + 20 = 336$* *AND* *If $x = 70$: $5x - 17 + 2x + 9 + x + 20 = 572$* *(So not a right-angled triangle)*	*M1* *A2* *A2*	 *Award A1 for any one of these:* *$x = 21{\cdot}4$ OR $x = 40{\cdot}5$ OR $x = 70$* *Award A1 for any one of these:* *If $x = 21{\cdot}4$: $5x - 17 + 2x + 9 + x + 20 = 183.2$* *OR* *If $x = 40{\cdot}5$: $5x - 17 + 2x + 9 + x + 20 = 336$* *OR* *If $x = 70$: $5x - 17 + 2x + 9 + x + 20 = 572$*
5. (AB =) $13{\cdot}8 \times \cos 41$ OR $13{\cdot}8 \times \sin 49$ $= 10{\cdot}4(\ldots)$ (cm)	M2 A1	M1 for $\cos 41 = \frac{AB}{13{\cdot}8}$ OR $\sin 49 = \frac{AB}{13{\cdot}8}$
Alternative method: ***Correct** use of 'two-step' method.* *(AB) = 10·4(…)(cm)*	*M2* *A1*	*A partial trigonometric method is M0.* *Accept an answer that rounds to 10·4(cm)*
6.a(i) $x^3 + 7x$	B2	B1 for sight of $x^3 + \ldots\ldots$ OR $\ldots\ldots + 7x$. Do not accept $x \times x \times x + x \times 7$ etc. Mark final answer.
6(a)(ii) $3x^2 - 4x - 15x + 20$ $3x^2 - 19x + 20$	B1 B1	Must be an expression. FT from an error in only one term (out of 4) only if of the form $ax^2 \pm bx \pm cx \pm d$.
6.(b)(i) $5n - 27 < n$ OR $n > 5n - 27$	B2	Allow B2 for an equivalent correct inequality. e.g. $4n - 27 < 0$. B1 if ≤ or ≥ used in a 'correct' inequality. OR B1 for $5n - 27 > n$ OR $n < 5n - 27$
6.(b)(ii) $4n < 27$ $n < \frac{27}{4}$ (Greatest number of clocks =) 6	B1 B1 B1	FT 'their inequality' if of equivalent difficulty. FT only from an < b OR an ≤ b OR an > b OR an ≥ b. FT only from n < c where c is positive OR n ≤ d where d is positive and not an integer An answer of 6 gains all 3 marks.
7.(a) N ÷ 1·04	B1	
7.(b) 248·832	B2	Allow B2 if 248·832 seen then corrected to a final answer of 249 or 248·8(..). If B2 not awarded, B1 for final answer of 249 or 248·(…) i.e. 248·832 not seen. B1 for sight of $100 \times 1{\cdot}2^5$ or for equivalent calculations, e.g. $144 \times 1{\cdot}2^3$ or $100 \times 1{\cdot}2 \times 1{\cdot}2 \times 1{\cdot}2 \times 1{\cdot}2 \times 1{\cdot}2 \times 1{\cdot}2$ (may be seen in stages) B1 for a final answer of 298·5984.

8. $(x - 6)(x + 2)$ $(x =) 6$ AND $(x =) -2$	B2 B1	B1 for $(x \ldots 6)(x \ldots 2)$. Strict F.T. from their brackets. Penalise change of letter −1. Allow the following. B2 for $x - 6 (=0)$ AND $x + 2 (=0)$ (B1) $(x =) 6$ AND $(x =) -2$ (B1) B1 for $x + 6 (=0)$ AND $x - 2 (=0)$ (B0) $(x =) -6$ AND $(x =) 2$ (B1) FT B1 if only $(x =) 6$ AND $(x =) -2$ seen. (B1) Use of quadratic formula would only lead to this B1. Mark final answer.
9. (Arc length =) $\frac{212}{360} \times 2 \times \pi \times 7{\cdot}3 =$ $26{\cdot}99$ to $27{\cdot}0143$ (cm) or $\frac{3869\pi}{450}$ (Perimeter = their arc length + 2 × 7·3) = 42 or 41·6 (cm)	M1 A1 B1	 Seen or implied. Accept 41·59 to 41·6143 (cm). FT 'their derived arc length' + 14.6, provided M1 awarded.
Alternative version $\frac{212}{360} \times 2 \times \pi \times 7{\cdot}3 + 2 \times 7{\cdot}3 =$ $= 42$ or $41{\cdot}6$ (cm)	 M2 A1	 Accept 41·59 to 41·6143 (cm).
Organisation and Communication. Accuracy of writing.	OC1 W1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means For W1, candidates will be expected to: • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc
10. *(a)(i)* $y \propto 1/\sqrt{x}$ OR $y = k/\sqrt{x}$ $65 = k / \sqrt{51{\cdot}84}$ OR $65 = k / 7{\cdot}2$ OR $k = 65 \times \sqrt{51{\cdot}84}$ OR $k = 65 \times 7{\cdot}2$ OR $k = 468$ $(y =) 468 / \sqrt{x}$	B1 M1 A1	Allow $y \propto k/\sqrt{x}$ M1 implies B1 F.T. for B0 M1 from $y \propto 1/x^n$ with $n > 0$ and $n \neq 1/2$ No F.T. from direct proportion May be seen explicitly in part *(ii)*.
10. *(a)(ii)* x | 51·84 | 15·21 | **36** y | 65 | **120** | 78	B2	Check working space (if table left blank). B1 for one correct value. F.T. for consistent use of 'their expression' for inverse proportion only, but not for $y = 1/x$
10. (b) c is multiplied by 4	B1	

2. (a) $8m = w + 3$ or $w + 3 = 8m$ or $-8m = -w - 3$ $m = \frac{w+3}{8}$ or $\frac{w+3}{8} = m$ or $m = \frac{-w-3}{-8}$	B1 B1	Allow $-8m = -(w + 3)$. FT only from $\pm 8m = \pm w \pm 3$, stated or implied. (note: $8m = w + 3$ or $-8m = -w - 3$ will have already gained the previous B1). B1B0 for $-m = \frac{-3-w}{8}$ or equivalent. Mark final answer. Note Allow B1B0 for $m = (w + 3) \div 8$ with or without brackets. Allow B1B0 for $\frac{w+3}{8}$ ('$m =$' missing).

2. (b)	$y^2 + y - 20$ ISW	B2	Allow $y^2 + 1y - 20$. Award B1 for one of the following: • $y^2 + 5y - 4y - 20$ • $y^2 + 5y \ - 4y + - 20$ • $y^2 + 5y + - 4y - 20$ • $y^2 + 5y + - 4y + - 20$ • $y^2 + ky - 20$ (where $k \neq 0$ or 1) • $y^2 + (1)y + t$ (where $t \neq -20$) • for sight of y^2 AND $+5y$ AND $-4y$ AND -20 but not in an expression.

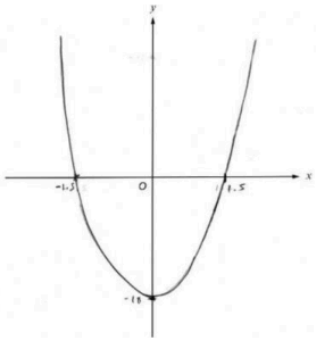
5. (a) $2x(4x+3y)$	B2	Award B1 for $2x(4x \pm \ldots\ldots)$ or $2x(\ldots\ldots+3y)$ Award B1 for a partial factorisation. i.e. $2(4x^2+3xy)$ or $x(8x+6y)$. Mark final answer.
5. (b)(i) $(x+8)(x+5)$ ISW	B2	B1 for $(x \ldots 8)(x \ldots 5)$.
5. (b)(ii) Any valid explanation e.g. "you could expand the two brackets" "expanding is the opposite of factorising" "multiply the brackets together" "solve $(x+8)(x+5)=0$, and then substitute the value(s) of x into $x^2+13x+40$. It should give 0." "replace x in the brackets and expression with the same value. You should get the same answer."	E1	Allow "the two numbers need to add to 13, but multiply to make 40" "Use FOIL (CAMO) to check" or other names explaining the method. Allow method shown to expand brackets for example:  Do not accept "$(x+8)(x+5)=x^2+13x+40$" without further working "taking out the brackets" "reverse the calculation"

18. (Numerator) 3 (2x - 5) (Denominator) (2x + 5) (2x − 5) $\frac{3}{2x+5}$.	B1 B2 B1	 B1 for (2x ….. 5) (2x ….. 5) FT from one error, provided equivalent difficulty. Mark final answer.

10.(a) $10h^2 - 14ht + 15ht - 21t^2$ $10h^2 + (1)ht - 21t^2$	B2 B1	Penalise alternative notation, such as tt for t^2, -1, once only. B1 for any three terms correct. $mh^2 + (1)ht + nt^2$, where m and n are integers (and provided not from incorrect working) implies the middle two terms correct. Mark final answer. Implies previous B2. FT their expression, provided it is a quadratic with 4 terms to consider and there are like terms to collect.
10.(b) $7(d+5)^{10}$	B1	Mark final answer.

16.	$kp(k+p)(k-p)$	B3	Mark final answer for B3. Award B2 for a correct expression involving two binomial factors, e.g. $(k-p)(k^2p+kp^2)$ or $k(k+p)(kp-p^2)$ or $(k^2+kp)(kp-p^2)$ Allow B2 for $kp(k\ldots p)(k\ldots p)$ Award B1 for any of the following: • $(k+p)(k-p)$ • $k(k\ldots p)(kp\ldots p^2)$ • $k(kp\ldots p^2)(k\ldots p)$ • $kp(k^2-p^2)$

			FT until 2nd error.
1.(a)	$7+5x-10=3x+8$ or equivalent.	B1	Bracket must be expanded or correct division by 5 e.g $x-2=\frac{3x}{5}+\frac{1}{5}$ (but not $x-2=\frac{3x+1}{5}$)
	$2x=11$ OR $-11=-2x$	B1	Or equivalent Correctly simplifying the equation to a single x term and number term (e.g. $2x-11=0$).
	$x=\frac{11}{2}$ or 5·5 or equivalent.	B1	Mark final answer. Correct answer implies B1B1B1. Do not allow $-x=\frac{-11}{2}$ or $x=\frac{-11}{-2}$ A final answer of '11 ÷ 2' is B1B1B0. If FT leads to a whole number answer, it must be shown as a whole number. Otherwise, accept a fraction. Allow any decimal answer to be rounded or truncated to 1 or more decimal place. Allow B1B1B1 for a correct embedded answer BUT only B1B1B0 if contradicted by $x\neq\frac{11}{2}$ or equivalent. Note: $12x-24=3x+8$ B0 $9x=32$ B1 (FT) $x=\frac{32}{9}$ or $3\cdot5(55\ldots)$ or $3\cdot6$. B1 (FT) If no marks awarded, award SC1 for sight of one of the following: • $5x-10$ • $12x-24$.
1.(b)	$2f=13-h$ or $h-13=-2f$	B1	Or equivalent.
	$f=\frac{13-h}{2}$ or $\frac{h-13}{-2}=f$ or equivalent	B1	Or equivalent. Must not come from incorrect working. Mark final answer. FT only from $\pm2f=\pm13\pm h$. Unsupported $f=\frac{\pm13\pm h}{\pm2}$ implies B0B1 unless B2. Award B1B0 for $-f=\frac{h-13}{2}$ or equivalent. **If no marks**, award SC1 for a final answer of either: • $f=(13-h)\div2$ with or without brackets • $f=(h-13)\div-2$ with or without brackets • $\frac{13-h}{2}$ ('$f=$' missing). • $\frac{h-13}{-2}$ ('$f=$' missing).
1.(c)	$5(3x-7y)$	B1	Mark final answer. Allow $-5(-3x+7y)$ or $5(3x+-7y)$.

12.(a) $2(2x+3)(2x-3)$	B3	Award B3−1 for a correct answer followed by further incorrect work. Award B2 for the sight of any one of the following: • $(4x+6)(2x-3)$ • $(4x-6)(2x+3)$ • $8(x+3/2)(x-3/2)$ • $(2x+3)(2x-3)$ • $2(2x+3)(2x+3)$ • $2(2x-3)(2x-3)$ Award B1 for the sight of any one of the following: • $2(4x^2-9)$ • $8(x^2-9/4)$ • $(4x+6)(2x+3)$ • $(4x-6)(2x-3)$ • $(x+3/2)(x-3/2)$ If no marks: Allow SC2 for $(2\sqrt{2}x+3\sqrt{2})(2\sqrt{2}x-3\sqrt{2})$ o.e. OR other valid, equivalent 'factorisation', e.g. $(8x-12)(x+1.5)$ o.e. Allow SC1 for $(\sqrt{8}x+\sqrt{18})(\sqrt{8}x-\sqrt{18})$ o.e.
12.(b) 3/2 AND -3/2	B1	Or equivalent for either roots. FT if possible, provided exactly 2 possible distinct solutions.
12.(c) A <u>positive</u> quadratic curve passing through (0,-18) as a minimum with -18 indicated on the y-axis AND passing through (–3/2,0) and (3/2,0) which are indicated on the x-axis.  	B2	FT for x-axis intersections, provided exactly 2 possible distinct solutions. Award B1 for any one of the following: A positive quadratic curve passing through (0, –18) as a minimum with –18 indicated on the y-axis OR A quadratic curve (either positive or negative) passing through (–3/2,0) and (3/2,0) which are indicated on the x-axis. If the conditions for B2 are met, then only allow B1 for concave and/or convex curvature above the *x*-axis.

17.(a) $4 + 4 \times \sqrt{6} - (1 \times) \sqrt{6} - 6$ or equivalent $= 3\sqrt{6} - 2$ or $-2 + 3\sqrt{6}$	M1 A1	$(\sqrt{6})^2$ or $\sqrt{6}\sqrt{6}$ is insufficient for 6. Mark final answer. If no marks awarded, SC1 for 3 of the 4 terms correct.
17.(b)(i) Any square number greater than 5 e.g. 9, 16, 25, 36, …	B1	
17.(b)(ii) Any cube number greater than 5 e.g. 8, 27, 64, 125, 216, ...1000, …	B1	
17.(b)(iii) Any value of n^6 where n is an integer > 1. e.g 64 , 729, … 1 000 000, …	B1	Allow 2^6 or 3^6 or …

9. $(x-10)(x+2)$	B2	B1 for one of the following: • $(x \ldots 10)(x \ldots 2)$. • two brackets which multiply to give x^2-8x+k • two brackets which multiply to give $x^2+kx-20$.
$(x=)\ 10$ AND $(x=)\ -2$	B1	**Strict FT** from their pair of brackets. If no factorising shown, allow the following. B2 for $x-10\ (=0)$ AND $x+2\ (=0)$ (B1) $(x=)\ 10$ AND $(x=)\ -2$ (B1) B1 for $x+10\ (=0)$ AND $x-2\ (=0)$ (B0) $(x=)\ -10$ AND $(x=)\ 2$ (B1) FT B1 if only $(x=)\ 10$ AND $(x=)\ -2$ seen (B1)

11.(a) $(2x+5)(3x+2)$ ISW	B2	B1 for one of the following: • $(2x \ldots 5)(3x \ldots 2)$ • A pair of brackets which leads to the expansion of $6x^2+bx+c$ where either $b=19$ or $c=10$ • $\frac{(2ax+5a)(3bx+2b)}{ab}$ [e.g. $(x+2.5)(6x+4)$]`
11.(b) $m(m+5)(m-5)$	B3	Mark final answer for B3. B2 for one of the following: • $(m+5)(m^2-5m)$ • $(m-5)(m^2+5m)$ • $m(m \ldots 5)(m \ldots 5)$ • $(m+5)(m-5)$ B1 for one of the following: • sight of $m(m^2-25)$ • sight of $(m+5)(m-5)$ included within an expression, e.g. $m^2(m+5)(m-5)$ • $(m \ldots 5)(m \ldots 5)$
11.(c) $(p+7)(p+31)$ ISW	B2	B1 for $(p+7)(p+29+2)$ OR Allow B1 for $(p+7)(p+k)$ with $k \neq 0$ or 2 or 7 or 29.
Alternative method $(p+7)(p+29)+2(p+7)=p^2+38p+217$ $=(p+7)(p+31)$ ISW	*B2*	*No mark for the expansion and collection of terms.* *Award B1 for a correct factorisation, if possible, on FT from 'their derived quadratic expression', provided no more than one error.* *SC1 for an answer of* $(p+7)(p+k)$ *with* $k \neq 0$ or 7

8. $(x+8)(x-5)$	B2	Award B1 for one of the following: • $(x \ldots 8)(x \ldots 5)$ • two brackets which multiply to give x^2+3x+k • two brackets which multiply to give $x^2+mx-40$.
$(x=)\ -8$ AND $(x=)\ 5$	B1	**Strict FT** from their brackets. If no factorising shown, allow the following. B2 for $x+8\ (=0)$ AND $x-5\ (=0)$ (B1) $(x=)\ -8$ AND $(x=)\ 5$ (B1) OR B1 for $x-8\ (=0)$ AND $x+5\ (=0)$ (B0) $(x=)\ 8$ AND $(x=)\ -5$ (B1) FT OR B1 if only $(x=)\ -8$ AND $(x=)\ 5$ seen. (B1)

14.	$(2x-5)(x-6)$	B2	B1 for $(2x \ldots 5)(x \ldots 6)$ B1 for two brackets which multiply to give $2x^2-17x+k$ or $2x^2+mx+30$ SC1 for sight of the two correct factors, but not as a product.

Unit 1: Higher Tier	Mark	Comments
16. (a) (Numerator) $4y\,(y + 2x)$	B1	
(Denominator) $(y + 2x)(y - 2x)$	B2	B1 for $(y \ldots 2x)(y \ldots 2x)$
$\frac{4y}{y-2x}$ or equivalent.	B1	Mark final answer. FT provided no more than one previous error and provided simplification required.
16. (b)		FT until 2nd error for equivalent level of difficulty.
Sight of $hf^2 - m = 9f^2$	B1	Squaring Allow $3^2 f^2$ or $(3f)^2$ or $(3f)(3f)$ for $9f^2$.
$hf^2 - 9f^2 = m$ or equivalent	B1	Isolating terms in f^2. FT a formula with three or more terms AND with at least two terms in f^2.
$f^2(h-9) = m$ or equivalent	B1	Factorising fully.
$f^2 = \frac{m}{h-9}$ OR $f^2 = \frac{-m}{9-h}$	B1	Isolating f^2.
$f = \pm\sqrt{\frac{m}{h-9}}$ OR $f = \pm\sqrt{\frac{-m}{9-h}}$	B1	Mark final answer. Allow omission of $\pm$.

7.(a)	Sight of $x^2 + 8x + 15 = 120$ (leading to $x^2 + 8x - 105 = 0$)	B2	Must be convincing. Award B1 for one of the following • $(x+5)(x+3) = 120$ • $x^2 + 5x + 3x + 15$ • $x^2 + 8x + 15$ • $x^2 + kx + 15 = 120$ $(k \neq 0)$ • $x^2 + 8x + k = 120$ $(k \neq 0$ or $-105)$.
7.(b)			May be seen in part (a) or (c), provided not contradicted in (b).
	$(x + 15)(x - 7)$	B2	Award B1 for one of the following: • $(x \ldots 15)(x \ldots 7)$ • two brackets which multiply to give $x^2 + 8x + k$ but not $(x + 5)(x + 3)$ • two brackets which multiply to give $x^2 + kx - 105$.
	$(x =) -15$ AND $(x =) 7$	B1	Mark final answer. **Strict FT** from their brackets, provided not from $(x + 5)(x + 3)$. If no factorising shown, allow the following: B2 for $x + 15$ (=0) AND $x - 7$ (=0) (B1) $(x =) -15$ AND $(x =) 7$ (B1) B1 for $x - 15$ (=0) AND $x + 15$ (=0) (B0) $(x =) 15$ AND $(x =) -7$ (B1) FT B1 if only $(x =) -15$ AND $(x =) 7$ seen. (B1)

7.(c)		Allow dimensions and/or justification to be seen in part (a) or (b), provided not contradicted in (c). Answer lines take precedence.
Length = 12 (cm), width = 10 (cm)	B1	FT 'their 7' + 5 and 'their 7' + 3 provided • one x value from (b) > -3 **AND** one x value from (b) < -3 • both length and width are positive. If not on answer line, must clearly be length and width. Unsupported answers are awarded B1
Statement about ignoring $x = -15$ **as it leads to negative lengths** or that x must be > -3	E1	Allow "you can't have a negative length (on the rectangle)" "the width can't be negative" Do not accept incorrect or vague explanations e.g. "x can't be negative" "x must be positive" "it can't be negative"

14. $((2x+3)+4)((2x+3)-4)$ $(2x+7)(2x-1)$	B2 B2	B1 for $((2x+3)\ldots4)((2x+3)\ldots4)$ Mark final answer. Accept $(-2x-7)(1-2x)$ OR $-(2x+7)(1-2x)$. FT provided B1 previously awarded. Ignore an attempt to solve their quadratic set to '=0'.
14. Alternative method $4x^2+12x-7$ $(2x+7)(2x-1)$	B2 B2	*B1 for sight of* $4x^2+6x+6x+9\ (-16)$ *or equivalent.* *Mark final answer.* *Accept* $(-2x-7)(1-2x)$ *OR* $-(2x+7)(1-2x)$. *FT for B2 or B1 provided B1 previously awarded and −16 used.* *Award B1 for one of the following:* • $(2x\ldots7)(2x\ldots1)$ • *two brackets that multiply to give* $4x^2+12x+k$, $k\neq0$ • *two brackets that multiply to give* $4x^2+mx-7$, $m\neq0$, *e.g.* $(4x\pm7)(x\mp1)$ *OR* $(4x\pm1)(x\mp7)$. *Ignore an attempt to solve 'their quadratic' set to '=0'.*

End of solutions