REVISE

.wales

2.11 — Linear equations & inequalities

Mark schemes for the 2.11 question pack

Spec 2.2.1, 2.2.2, 2.2.3, 2.2.4 — Unit 2

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 45 questions in the corresponding revise.wales question pack (167 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

8.	$4n - 23 > n$ OR $n < 4n - 23$	✓✓	B2	B1 for $4n \pm \ldots > n$ OR B1 for $4n - 23 > an + b$ $a \neq 0$ OR B1 for $4n - 23 \geq n$ B0 for $4n - 23 < n$.
	(least number of marbles =) 8	✓✓	B2	F.T. from 'their inequality', if of equivalent difficulty. (e.g. $4n - 23 > n + 23$ giving an answer of 16) B1 for sight of $n > \frac{23}{3}$ or equivalent. (With similar F.T. answer e.g. $n > 46/3$ from above example of $4n - 23 > n + 23$) OR allow B1 for $n > 7$ OR $n \geq 8$ (With similar F.T. answer e.g. $n > 15$ from above example of $4n - 23 > n + 23$)

			use appropriate terminology, units, etc.
9.(a) $(x-6)(x+4)$ $(x =)\ 6$ AND $(x =)-4$		B2 B1	B1 for (x ... 6)(x ... 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.

14. (a) $2x^2 + x + 1 = 7$ OR $x^2 + x^2 + x + 1 = 7$ leading to $2x^2 + x - 6 = 0$		B1	Must be seen. Accept $1(x + 1)$ for $x + 1$.
14.(b) $(2x - 3)(x + 2)$ (=0)	✓✓	B2	B1 for $(2x \ldots. 3)(x \ldots.. 2)$
(Length of each side =) 1·5 (metres)	✓	B1	F.T. from 'their two brackets'. (If both F.T. solutions are of the same sign, then both are required for this B1.) Ignore presence of $x = -2$. *<u>Using quadratic formula.</u>* *(x =)* $\dfrac{-1 \pm \sqrt{[1^2 - 4(2)(-6)]}}{2(2)}$ *M1* *Allow one error, in sign or substitution, but not in the formula.* $= \dfrac{-1 \pm \sqrt{49}}{4}$ *A1* *x = 1·5 (metres) [ignore x = -2]* *A1* *<u>Using trial and improvement</u>* *Award B3 for a method leading to <u>both</u> solutions, namely x = 1·5 and x = -2, otherwise B0.*
Statement about ignoring $x = -2$ as would be a negative length.	✓	E1	F.T provided one solution is positive and the other is negative.

3(a) (Length) 6 (m) AND (width) 3 (m)	B2	Accept in either order in the answer space B1 for any 1 of the following: • sight of 18 ÷ 3 • sight of 18 ÷ 6 • either length or width correct (any order) • answers 12 (m) and 6 (m) (any order) • 1x + 2x + 1x + 2x = 18 or similar
3(b) x + 3 + x + 3 + x + x = 16 or x + 3 + x = 8 or equivalent	M1	Accept any variable for 'x'
4x + 6 = 16 or 4x = 16 – 6 or 4x = 10 or 2x + 3 = 8 or equivalent	m1	Depends on the previous M1 This m1 implies the previous M1
(Length) 5.5 (m) and (width, x) 2.5 (m)	A1	CAO Needs to be in the correct order in the answer space, or clearly labelled *Alternative method to work with y – 3 and y leading to y = 5.5* If no marks, allow SC1 for answers of 5.5(m) and 2.5(m) if no equation given or if 'their equation' not used to elicit these answers, OR SC1 for answers of 9.5(m) and 6.5(m) from sight of x + x + 3 = 16

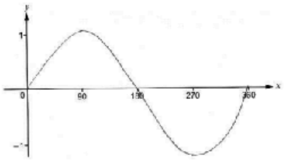
			Allow B1 for 5·6 × 10[illegible].
10. $4n - 8 > n + 17$	✓ ✓	B2	If not B2, allow B1 for sight of $4n - 8$ AND $n + 17$ in an inequality.
$3n > 25$	✓	B1	F.T. from 'their <u>inequality</u>', if of equivalent difficulty (2 terms on each side).
$n > 25/3$	✓	B1	F.T. from 'their an>b' or 'their an<b' provided a≠1.
(least value of n =) 9	✓	B1	F.T. from their '$n > 25/3$', provided n > 0. An answer of 9 without showing $4n - 8 > n + 17$ gains B3 only. Accept 'Rashid had 9 (sheep)'.
Accuracy of writing.	✓	W1	Accuracy of writing. 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

			lead to a proof before any marks are awarded.
13(a) Any two of the three lines correct. ($x + y = 6$ $y = x/2 + 3$ $x = -2$) Correct region identified.		B2 B1	B1 for any one line correct. CAO.
13.(b) (i) ($x =$) 2		B1	FT 'their region', if possible, for both B1 marks,

18. $x(5x-3)=7$ OR $7=x(5x-3)$ OR $5x^2-3x=7$ OR $7=5x^2-3x$	✓	M1	
$5x^2-3x-7=0$	✓	A1	'= 0' required, but may be implied by an attempt to use the quadratic formula or if $a=5, b=-3$, $c=-7$ used in the quadratic formula.
$x=\dfrac{-(-3)\pm\sqrt{(-3)^2-4\times5\times(-7)}}{2\times5}$	✓	M1	FT 'their quadratic equation' of equivalent difficulty (3 terms with at least one negative term). Allow one slip in substitution, but must be correct formula.
$=(3\pm\sqrt{149})/10$	✓	A1	
$x=1.52$ with $x=-0.92$ (answers to 2dp)	✓	A1	CAO for their quadratic equation. If none of the last 3 marks awarded for solving the given equation or the correct quadratic (irrespective if any of the opening two marks awarded), and trial and improvement used, then award: SC3 for both correct solutions given, correct to 2 decimal places: $x=1.52$ with $x=-0.92$, OR SC2 for both correct solutions given, but correct to 3 (or more) decimal places: $x=1.520(6\ldots)$ with $x=-0.920(6\ldots)$ Note: no marks to be awarded for 1 correct solution from trial and improvement

9.(a) $10w^2 - 10w + 3w - 3$ $4 - 6w - 6w + 9w^2$ $10w^2 - 10w + 3w - 3 - 4 + 6w + 6w - 9w^2$ $(=)w^2 + 5w - 7$	B1 B1 B1 B1	Or equivalent. Or equivalent. FT if at least B1 awarded for equivalent level of difficulty, ie. at least three terms for each expansion. Penalise any further error. CAO (convincing). Dependent on B1B1B1.
9.(b) $w = \frac{-(5)\pm\sqrt{(5)^2-4\times1\times(-7)}}{2\times1}$ $= \frac{-5\pm\sqrt{53}}{2}$ $w = 1.14$ AND $w = -6.14$	 M1 A1 A1	Trial and improvement method gains M0. Allow one slip in substitution, but must be correct formula. CAO

11. $y \geq -2$ or equivalent $y \leq 3x + 1$ or equivalent	B1 B2	Accept '>' Accept '<'. B1 for $y = 3x + 1$ or $y > 3x + 1$ or $y \geq 3x + 1$ B1 for $y \leq kx + 1$ or $y < kx + 1$ (with $k \neq 3$ and $k > 0$) B1 for $y \leq 3x + c$ or $y < 3x + c$ (with $c \neq 1$)

		calculating 'with replacement'.
14.(a) 	C1	Clear Intention to draw a curve. Curve must pass through (0,0), (180,0) and (360,0) AND intention to have maximum at (90,1) and minimum at (270,-1). Ignore curve shown for values x < 0° or x > 360°.
14.(b)(i) 17 AND 163 OR 17.5 AND 162.5 OR 17.4(576…) AND 162.5(423…)	B2	If more than two answers offered award B1 for sight of one correct angle. Allow embedded answers. Rounded angles must add up to 180°. B1 for sight of one correct angle OR, B1 for two angles which total 180°. Allow different degrees of accuracy in rounding.
14.(b)(ii) 270(°)	B1	Allow an embedded answer.

13. (a)	$4 = 1 + 8t - 5t^2$ or $1 + 8t - 5t^2 = 4$ leading to $5t^2 - 8t + 3 = 0$	B1	Must be convincing.
13. (b)	$(5t - 3)(t - 1)$ (=0) (t =) 3/5 AND 1	B2 B1	B1 for (5*t*.… 3)(t ….. 1) Strict FT from 'their two brackets'. (Both solutions are required for this B1.) *<u>Using quadratic formula.</u>* *(t =)* $\dfrac{8 \pm \sqrt{[(-8)^2 - 4(5)(3)]}}{2(5)}$ *M1* *Allow one error, in sign or substitution, but not in the formula.* $t = \dfrac{8 \pm \sqrt{4}}{10}$ *A1* *t = 3/5 AND 1* *A1* *<u>Using trial and improvement</u>* *Award B3 for a method leading to <u>both</u> solutions, namely t = 3/5 AND t = 1, otherwise B0.*

13. (c) Valid statement	E1	e.g. 2 different values of *t* representing the ball on its way up and on its way down OR e.g. the ball reaches its highest point after 4/5 s. FT provided both solutions are positive.

16. (a) x: −2, −1, 0, 1, 2 y: $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, 4	B1	Any 3 correct pairs of coordinates (need not be for integer values of x.) Must include one negative value of x.
Suitable choice of <u>uniform</u> scales through the origin, x from – 2 to 2 and y from 0 to 4, AND plotting at least 3 points correctly.	B1	FT their evaluations of y if shown (provided they do not produce a straight line). Must include one negative value of x. Tolerance for accuracy ± $\frac{1}{2}$ a small square.
Joining with a <u>curve.</u>	C1	CAO. Exponential curve which passes through (-2, $\frac{1}{4}$), (0, 1) and (2, 4). Must not intercept x axis anywhere, including beyond the required range of x values. Tolerance for accuracy ± $\frac{1}{2}$ a small square. If no table or evaluations of coordinates are given (for at least 3 pairs of values, including one negative value of x), then B1 B1 may be implied by C1 <u>or</u> if C0, B1 B1 may be implied by 3 correctly plotted points for $y = 2^x$ (including one negative value of x).

x	–2	–1	0	1	2
y	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4

16. (b) Reading from their graph for $x = 1{\cdot}4$ $(y \approx 2{\cdot}6)$	B1	FT 'their curve'. (No FT for a straight line.) Tolerance for accuracy $\pm \frac{1}{2}$ a small square.
16. (c) Reading from their graph for $y = 1{\cdot}4$ $(x \approx 0{\cdot}5)$	B1	Accept an embedded answer. FT 'their curve'. (No FT for a straight line.) Must include all relevant readings if 'their graph' is not one-to-one. Tolerance for accuracy $\pm \frac{1}{2}$ a small square.

		out of 200' gains full marks.
17. $6x^2 - 22x + 15x - 55$ (= 7)	B1	
$6x^2 - 7x - 62 = 0$	B1	CAO. '= 0' may be implied in further working.
$(x =) \dfrac{-(-7)\pm\sqrt{(-7)^2-4\times6\times(-62)}}{2\times6}$	M1	FT 'their derived quadratic equation' set to zero and of equivalent level of difficulty (a, b and c are non-zero). Allow one slip in substitution, but must be correct formula.
$= \dfrac{7\pm\sqrt{1537}}{12}$	A1	If one slip seen award A0.
x = 3.85 AND x = –2.68 (answers to 2dp)	A1	CAO for 'their equation'. Note: no marks to be awarded for 1 correct solution from trial and improvement

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 (±)3g = ± f ± 2. B1B0 for $-g = \frac{f-2}{3}$. B1B0 for g = 2 – f ÷ 3. B1B0 for $\frac{2-f}{3}$ (‘g’ missing). Mark final answer.
1.(c)(i) 7x < 32 x < 32/7 or $x < 4\,^4/_7$	B1 B1	Use of ‘=’ is B0B0 unless replaced for final answer. FT from 7x < k. Allow x < 4·57(….). Do not allow x < 4·6 or x < 4·5 unless x < 4·57(….) 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 ≤ a. 4x is B0.

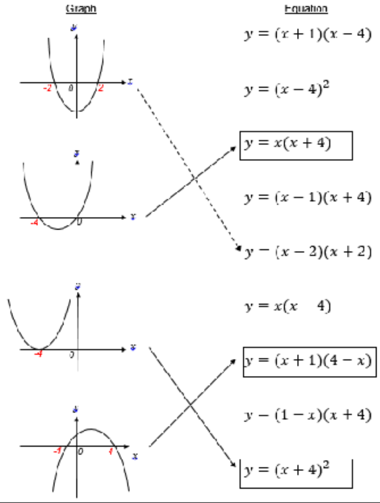
9. Sight of at least two correct different surface areas.	B1	Sight of two of 35(cm^2), 5x(cm^2), 7x(cm^2).
2 × (35 + 5x + 7x) = 142 or equivalent	M2	Allow M1 for 'sum of at least 3 correct surface areas = 142'.
x = 3	A1	C.A.O. If M0, allow SC1 for x = 3 with no prior equation shown.

11. Lines $x = -1$, $y + 2x = 1$ and $y = x$ all correct.	B2	B1 for any 2 correct lines. If $x = -1$ and $y = -1$ are both shown, do not award a mark unless $x = -1$ is selected for the region or clearly labelled.
Correct region identified.	B1	FT provided region is closed and B1 awarded. Accept indication by 'shading out'.

18. $(7x+1)(x+3) = 5x+2$ Sight of $7x^2+21x+x+3$ $7x^2+17x+1=0$	B1 B1 B1	 Or equivalent. '= 0' required, but may be implied by an attempt to use the quadratic formula or if $a = 7, b = 17$, $c = 1$ used in the quadratic formula. FT from B1B0 from one error only.
$x = \dfrac{-17 \pm \sqrt{17^2 - 4\times 7\times 1}}{2\times 7}$	M1	This substitution into the formula must be seen for M1. FT 'their derived quadratic equation' of equivalent difficulty (a, b and c must be non-zero). Award M1A0A0 for only one slip in substitution, but must be correct formula.
$x = \dfrac{-17 \pm \sqrt{261}}{14}$	A1	Can be implied from at least one correct value of x evaluated.
$x = -0.06$ with $x = -2.37$ (answers to 2dp)	A1	CAO for their quadratic equation. If trial and improvement used, then award: SC3 for <u>both</u> correct solutions given, correct to 2 decimal places: x = -0.06 with x = —2.37, OR SC2 for <u>both</u> correct solutions given, but correct to 3 (or more) decimal places: x = -0.060(3…) with x = –2.368(2…) Note: no marks to be awarded for 1 correct solution from trial and improvement.

	= 0·14 ISW	A1	
9.(a)	5n < 3n + 7 or equivalent ISW	B2	2n < 7 OR n < 7/2 implies B2. Ignore use of a different letter e.g. 5x < 3x + 7. Use of '≤' is B1. B1 for sight of 3n + 7 in an inequality.
9.(b)	2n < 7 OR n < 7/2	B1	FT 'their inequality' if of equivalent difficulty. May be seen in part (a).
	(Greatest amount =) (£)3	B1	FT 'their n < k'. B0 if they have 'n>k'. B0 if it leads to n<1. An answer of (£)3 gains B1B1 (unless from incorrect algebra work).

		incorrect algebra work).
10. Lines $x=-2$, $y+x=1$ and $2y=x$ all correct.	B2	B1 for any 2 correct lines. If $x=-2$ and any other vertical or horizontal line shown e.g. y = ± 2 or x = 2, do not award a mark unless $x=-2$ is selected for the region or clearly labelled.
Correct region identified.	B1	FT provided region is closed and B1 awarded. Accept indication by 'shading out'.

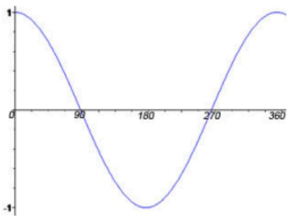
15. 	B2	B1 for any 1 or 2 correct.
16.(a) General sine curve with appropriate orientation and position. -1 and 1 indicated on the y-axis, curve passes through (-180°,0), (0°,0) and (180°,0) and approximately (-90°,-1) and (90°,1).	M1 A1	Ignore curve shown for values x< -180° or x> 180°.
16(b). -30(°) AND -150(°)	B2	Accept embedded answers. Penalise further incorrect answer(s) -1. Ignore further answer(s) outside of the range. Award B1 for sight of an answer -30(°) or -150(°) (but not for sight of -30 as part of working).
17.(a) $\frac{3}{100}\times\frac{1}{99}$ $= \frac{3}{9900}\left(=\frac{1}{3300}\right)$ ISW	M1 A1	 Allow 3(.03…)×10^{-4} OR 0.0003(03…) or equivalent. A0 for 0.0003(03…)%. An unsupported 0.000303(…) gains M1A1. An unsupported 3/10000 OR 0.0003 gains no marks.
17(b) $2\times\frac{3}{100}\times\frac{1}{99}\left(=\frac{6}{9900}=\frac{1}{1650}\right)$ $+\frac{3}{100}\times\frac{2}{99}\left(=\frac{6}{9900}=\frac{1}{1650}\right)$ OR $\frac{4}{100}\times\frac{3}{99}$ $=\frac{12}{9900}\left(=\frac{1}{825}\right)$ ISW	M2 A1	M1 for sight of $\left(\frac{3}{100}\times\frac{1}{99}\right)+\left(\frac{3}{100}\times\frac{1}{99}\right)$ OR $\left(\frac{3}{100}\times\frac{1}{99}\right)+\left(\frac{1}{100}\times\frac{3}{99}\right)$ OR $2\times\frac{3}{100}\times\frac{1}{99}$ OR $\left(\frac{3}{100}\times\frac{1}{99}\right)+\left(\frac{3}{100}\times\frac{2}{99}\right)$ 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].

19. (a) $\dfrac{a}{x(x-a)}$ or $\dfrac{a}{x^2-ax}$	B2	B1 for correct numerator - not from incorrect work – use of brackets may be implied. B1 for correct denominator in a single fraction (accept equivalent) If B2, penalise -1 for incorrect subsequent work
19. (b) $x - 1 + 2x(4x + 3)$ [= 0] or $x - 1 + 8x^2 + 6x$ [= 0] or $x - 1 = -2x(4x + 3)$	M1	Clearing fraction Allow e. g. $\dfrac{x - 1 + 2x(4x + 3)}{x(4x + 3)} = 0$ Allow M1 for $x - 1 = 2x(4x + 3)$
$8x^2 + 7x - 1$ [= 0]	A1	Collecting terms and re-arranging quadratic equation Ignore presence of denominator (provided correct).
$(8x - 1)(x + 1)$ [= 0]	B2	B1 for $(8x \dots 1)(x \dots 1)$ FT their quadratic equation, provided of equivalent difficulty.
$x = \frac{1}{8}$ or $x = -1$	B1	Both answers required. Strict FT 'their derived brackets'. *Using quadratic formula FT their quadratic equation, provided of equivalent difficulty.* *$(x =)$ $\dfrac{-7 \pm \sqrt{[7^2 - 4(8)(-1)]}}{2(8)}$ M1* *For M1, allow one error, in sign or substitution, but not in formula.* *$x = \dfrac{-7 \pm \sqrt{81}}{16}$ A1* *$x = \frac{1}{8}$ or $x = -1$ (both answers required) A1* *No marks for a trial and improvement method.*

6.(a) 0·3 shown for 'Does not visit '*Erddig Gardens*'. Use of 0·7 × …… = 0·28 P(goes to '*Bersham Heritage Centre*') = 0.4 Second set of branches 0·4, 0·6, 0·4, 0·6	B1 M1 A1 A1	 Implied by sight of 0·4 (on 'top branch' of the four on the right) F.T. 'their 0·4' BUT **dependent** on M1 gained. (i.e. M0A0A0 for 0·28 and 0·72 on branches.)
6.(b) 0·7 × 0·6 = 0·42 ISW	M1 A1	F.T. 0·7 × 'their 0·6' only if 0 < 'their 0·6' < 1 0·42 gains M1A1.
7. (area) Volume Length Volume None Area	 B3	*Must use the terminology given in the question.* B3 for all 5 correct. B2 for 3 or 4 correct. B1 for 2 correct. B0 otherwise.
8.(a) $(x + 7)(x - 3)$ $(x =) -7$ AND $(x =) 3$	B2 B1	B1 for $(x \ldots 7)(x \ldots 3)$. Strict F.T. from their brackets. Allow the following. B2 for x + 7 (=0) AND x − 3 (=0) (B1) (x =) −7 AND (x =) 3 (B1) B1 for x − 7 (=0) AND x + 3 (=0) (B0) (x =) 7 AND (x =) −3 (B1) FT B1 if only (x =) −7 AND (x =) 3 seen. (B1)
8.(b) Correct method for clearing all three fractions. Accurate clearing of fractions AND expansion of brackets on lhs. 24x = 36 or equivalent. $x = \frac{36}{24}$ or equivalent	 M1 A1 A1 A1	FT until 2nd error. May be seen in stages. Allow if all over a common denominator. May be seen in stages For collection of terms. FT from 'their ax = b' ONLY if M1 gained AND no more than one previous error. If no marks, allow SC1 for sight of $\frac{2(2x-3) + 5(4x+5)}{(10)}$ or equivalent. If FT answer is a whole number then it must be shown as an integer. Allow a correct embedded answer of 1·5 or 1½ BUT penalise −1 if followed by x ≠ 1·5 or 1½. Note : An answer of 1·5 that is found without gaining M1 OR that is not embedded is zero marks.
9.(a) 40·5	B1	
9.(b) (25·5 + 25·5 =) 51	B1	
9.(c) (11·5 + 11·5=) 23	B1	

11(a)(i). $\frac{x+1+x+2}{2} \times x \quad (= 25)$	M1	Missing brackets in the expression $\frac{x(x+1+x+2)}{2}$ may be implied later from correct working.
$x^2 + x + x^2 + 2x = 50$ OR $x(2x+3) = 50$ OR $\frac{2x^2+3x}{2} = 25$ OR $x^2 + 1.5x = 25$	m1	
$2x^2 + 3x - 50 = 0$	A1	Must be convincing. If m1 awarded for $\frac{2x^2+3x}{2} = 25$, a further rearrangement, e.g. $2x^2 + 3x = 50$, must be seen before A1 is awarded.
11(a)(ii). $x = \frac{-(3) \pm \sqrt{(3)^2 - 4 \times 2 \times (-50)}}{2 \times 2}$	M1	Maybe seen in a(i). Allow one slip in substitution **<u>for M1 only</u>**, but must be correct formula.
$= \frac{-3 \pm \sqrt{409}}{4}$	A1	
$x = 4.3(059\ldots)$, $(x = -5.8(059\ldots))$	A1	CAO.
(AB=) 5.3(cm) AND (DC=) 6.3(cm)	B1	Answers must be to 1 d.p. FT 'their positive x' provided M1 awarded.
11.(b) $7^2 \times 36{\cdot}8$ OR $(7 \times \sqrt{36.8})^2$	M1	
$= 1803{\cdot}2$ (cm^2)	A1	Allow 1803 (cm^2)

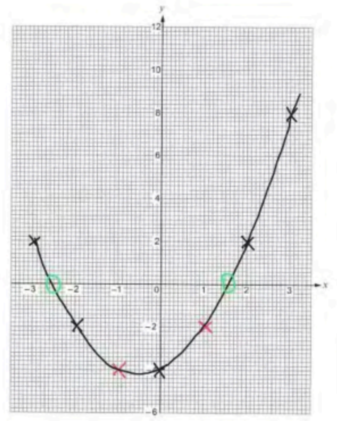
4.(a) an expression	B1	
4.(b) an equation	B1	
5. (Mid-points) 2·5, (7·5), 12·5 and 17·5. 8 × 2·5 + (0 × 7·5) + 7 × 12·5 + 5 × 17·5 (20 + 0 + 87·5 + 87·5 = 195) ÷ 20 = 9.75	B1 M1 m1 A1	Allow for sight of mid-points. F.T. 'their mid-points' including bounds, provided they fall within the classes (including lower and upper bounds and used consistently). C.A.O.
6. (x =) $\frac{360}{15}$ or $180 - \frac{(15-2) \times 180}{15}$ or equivalent = 24(°) (BR =) 8 × cos 24 or 8 × sin (90 – 24) = 7·3(0…)(cm) or 7·31(cm)	M1 A1 M2 A1	May be seen in parts. FT 'their stated value for x' (x < 90°) M1 for $\frac{BR}{8}$ = cos 24 or $\frac{BR}{8}$ = sin (90 – 24) Accept equivalent of using sin rule (as sin 90 = 1). *Alternative method to find BR* *A correct and complete method (using two trigonometric relationships and possibly Pythagoras's theorem)* *M2* *BR = 7·3(0…)(cm) or 7·31(cm)* *A1*
7. $2{\cdot}656 \times 10^6$	B2	B1 for a correct value but not in standard form. Mark final answer. B1 for sight of 2 656 000. SC1 for $2{\cdot}66 \times 10^6$ or $2{\cdot}7 \times 10^6$ or $2{\cdot}6 \times 10^6$ or $2{\cdot}65 \times 10^6$
8. Sight of 24·5 AND 15·5 OR Sight of 23·5 AND 14·5 2(24·5 + 15·5) – 2(23·5 + 14·5) or equivalent = 4(cm)	B1 M1 A1	Sight of (Greatest =) 80 OR (Least =) 76 implies B1 FT only for upper bounds of 24·4 AND 15·4 or 24·49 AND 15·49 (lower bounds must be 23·5 AND 14·5 else M0) CAO If M0, award B1 and an SC1 for sight of (Greatest =) 80 AND (Least =) 76
Alternative method. *Difference between least and greatest length for each side = 1(cm)* *4 × 1* *= 4(cm)*	*B1* *M1* *A1*	*FT only for differences of 0·9 or 0·99* *CAO*
9. Method to eliminate variable e.g. equal coefficients with appropriate addition or subtraction. First variable found, x = 4 or y = −1. Substitute to find the 2nd variable. Second variable found	M1 A1 m1 A1	*No marks for trial and improvement.* Allow 1 error in one term, not the term with equal coefficients. C.A.O. F.T. their '1st variable'. Award no marks for unsupported correct answers.

16. Use of 7175 AND (1)·2345 or (1)23·45(÷100) 7175 × 1·2345 = (£)8858	B1 M1 A1	 Or equivalent complete method. FT for 'their 7175' provided 7170 ≤ x < 7180 and 'their 1·2345' provided 1·234 ≤ y < 1·235 Sight of (£)8857·53(75) or (£)8857·54 implies B1M1. CAO.
17.(a) General cosine <u>curve</u> with appropriate orientation and position. Correct sketch with curve passing through (0°,1), (90°,0) and (270°,0) and approximately (180°,-1) and (360°,1) AND 90(°), 180(°), 270(°), 360(°) indicated on the x-axis AND -1 and 1 indicated on the y-axis. 	M1 A1	Ignore curve shown for values x< 0° or x> 360°. Accept 180° as mid-way between 0° and 360° if unlabelled. Accept 360° as unlabelled provided the sketch does not exceed 360°.
17.(b) 46(°) AND 314(°) OR 45·6(°) AND 314·4(°) OR 45·57(29…°) AND 314·4(27…°).	B2	B1 for sight of one correct angle. Allow embedded answers. If more than two answers offered award B1 for sight of one correct angle. If no marks, awarded SC1 for truncated answers 45(°) AND 315(°) OR 45·5(°) AND 314·5(°).
18. 0·7×0·2×0·1×6 = 0·084 or equivalent	M2 A1	M1 for sight of 0·7×0·2×0·1 OR 0·014 OR 7/500 or equivalent. Fractional answer: 21/250 or equivalent. (ISW)
19. Sight of $25x^2 + 15x - 15x - 9$ $25x^2 - 19x - 9 = 0$ $x = \frac{-(-19) \pm \sqrt{(-19)^2 - 4 \times 25 \times (-9)}}{2 \times 25}$ $x = \frac{19 \pm \sqrt{1261}}{50}$ x = 1·09 with x = –0· 33 (answers to 2dp)	B1 B1 M1 A1 A1	Or equivalent. '= 0' required, but may be implied by an attempt to use the quadratic formula or if $a = 25, b = -19$, $c = -9$ used in the quadratic formula. **This substitution into the formula must be seen for M1, otherwise award M0A0A0.** FT 'their derived quadratic equation' of equivalent difficulty (a, b and c must be non-zero). Allow one slip in substitution **<u>for M1 only</u>**, but must be correct formula. Can be implied from at least one correct value of x evaluated, provided M1 awarded. CAO for their quadratic equation.

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 ≠ 21 FT 'their derived value of x'. F.T. for this A1 if x ≥ 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 = 21·4 AND x = 40·5 AND x = 70* *Then verifying:* *If x = 21·4: 5x − 17 + 2x + 9 + x + 20 = 183.2* *AND* *If x = 40·5: 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 = 21·4 OR x = 40·5 OR x = 70* *Award A1 for any one of these:* *If x = 21·4: 5x − 17 + 2x + 9 + x + 20 = 183.2* *OR* *If x = 40·5: 5x − 17 + 2x + 9 + x + 20 = 336* *OR* *If x = 70: 5x − 17 + 2x + 9 + x + 20 = 572*
5. (AB =) 13·8 × cos 41 OR 13·8 × sin 49 = 10·4(…) (cm)	M2 A1	M1 for $\cos 41 = \frac{AB}{13·8}$ OR $\sin 49 = \frac{AB}{13·8}$
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 + ……. OR ……+ 7x. Do not accept x×x×x + x×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 $100 \times 1·2^5$ or for equivalent calculations, e.g. $144 \times 1·2^3$ or 100×1·2×1·2×1·2×1·2×1·2 (may be seen in stages) B1 for a final answer of 298·5984.

13. $(4x + 3)(x - 1)$ (=0) $(x =) -\frac{3}{4}$ AND $(x =)$ 1	B2 B1	B1 for (4x ..... 3) (x ..... 1) Strict FT from their brackets provided equivalent difficulty. (Both solutions are required for this B1.) B1 if only $(x =) -\frac{3}{4}$ AND $(x =)$ 1 seen.
Alternative method (using quadratic formula) *$(x =) \frac{1 \pm \sqrt{[(-1)^2 - 4(4)(-3)]}}{2(4)}$* *$x = \frac{1 \pm \sqrt{49}}{8}$* *$x = -\frac{3}{4}$ AND 1 (or equivalent)*	*M1* *A1* *A1*	*Allow one error, in sign or substitution, but not in the formula for M1 A0 A0.*
14. *(a)* $\frac{1}{8}$	B2	B1 for 8^{-1} or $\frac{1}{2^3}$ or $(\frac{1}{2})^3$ or $\frac{1}{\sqrt{64}}$ or $\sqrt{\frac{1}{64}}$ or $\frac{1}{64^{\frac{1}{2}}}$ or $(\frac{1}{64})^{\frac{1}{2}}$
14. *(b)* $x = 0{\cdot}02222.....$ $10x = 0{\cdot}2222.....$ with an attempt to subtract $(\frac{1}{3} +) \frac{2}{90}$ OR $(\frac{1}{3} +) \frac{1}{45}$ $x = \frac{32}{90} (= \frac{16}{45})$	M1 A1 B1	Or 10x and 100x, or equivalent. Or an alternative method. Sight of $\frac{0{\cdot}2}{9}$ gains M1 only. FT 'their $\frac{2}{90}$' provided equivalent difficulty. Mark final answer. Do not ignore incorrect cancelling.
Alternative method 1 *$x = (\frac{1}{3} +) \frac{0{\cdot}2}{9}$* *$= \frac{3{\cdot}2}{9}$* *$= \frac{32}{90} (= \frac{16}{45})$*	*B1* *M1* *A1*	*Mark final answer*
Alternative method 2 *$x = 0{\cdot}35555......$* *$10x = 3{\cdot}5555.....$ with an attempt to subtract* *$x = \frac{32}{90} (= \frac{16}{45})$*	*B1* *M1* *A1*	*Or 10x and 100x, or equivalent.* *'FT 'their 0.35555…' provided equivalent difficulty'.* *Sight of $\frac{3{\cdot}2}{9}$ gains B1 M1 only* *Mark final answer*
Alternative method 3 *$x = 0{\cdot}35555......$ $(= 0{\cdot}3 + 0{\cdot}05555)$* *$= \frac{3}{10} + \frac{0{\cdot}5}{9}$ or equivalent* *$= \frac{32}{90} (= \frac{16}{45})$*	*B1* *M1* *A1*	 *Mark final answer*

11. $\frac{63{\cdot}5^2}{8.65}$ = 466(·156…) or 466·16 or 466·2	 M2 A1	If many attempts are offered without a method/answer being identified, then mark the final attempt. If M2 not gained, award M1 for correct use of values $63 \le d < 64$ AND $8{\cdot}6 < e \le 8{\cdot}7$ Mark final answer. M2 required for A1. Fractional equivalent 466(·156…) = 80645/173 Allow this A1 for an answer of 470 only from correct unambiguous working seen. If no marks gained, award SC1 for sight of 63·5 and 8·65 used within the same calculation.
12. Use of cosine rule followed by sine rule (EG =) $\sqrt{(2{\cdot}7^2 + 3{\cdot}2^2 - 2 \times 2{\cdot}7 \times 3{\cdot}2 \times \cos79(°))}$ (EG =) 3·77…. (cm) sin EFG = EG × sin 65(°) / 6·4 OR $EFG = \sin^{-1}(EG \times \sin 65(°) / 6{\cdot}4)$ F = 32(·29…..°)	S1 M2 A1 M2 A1	 M1 for (EG^2 =) $2{\cdot}7^2 + 3{\cdot}2^2 - 2 \times 2{\cdot}7 \times 3{\cdot}2 \times \cos79(°)$ or for (EG^2 =) 14·2(3…..) Accept 3·8 cm Allow √14.2(3...) if used in this form in subsequent work, provided not evaluated as a decimal (at any stage) F.T. 'their derived EG' (not 2·7, 3·2, 6·4 or spurious EG). Award M1 for sin EFG / EG = sin 65(°) / 6·4 OR EG / sin EFG = 6·4 / sin 65(°) Dependent on previous M2.
13. (Numerator) Sight of $3x(2x - 3)$ (Denominator) Sight of $(2x - 3)(2x + 3)$ $\frac{3x}{2x+3}$	B1 B2 B1	 B1 for (2x ….. 3) (2x ….. 3) Mark final answer. F.T. provided at least one previous B1 awarded AND provided simplification required.
14. *(a)* ½ × (x – 1) × (2x + 3) × sin 30° [= 6] OR ½ × (2x^2 + 3x – 2x – 3) × sin 30° [= 6] $2x^2 + x - 3$ (= 6 × 2 × 2) $2x^2 + x - 27 = 0$	B1 B1 B1	Use of 'Area = ½ ab sinC'. Correct expansion of brackets and correct collection of x terms. May be implied within equation. Must be convincing.
14. *(b)* (x =) $\frac{-1 \pm\sqrt{[(1)^2 - 4(2)(-27)]}}{2(2)}$ (x =) $\frac{-1 \pm\sqrt{217}}{4}$ (x =) –3·93 AND 3·43	M1 A1 A1	**This substitution into the formula must be seen for M1, otherwise award M0A0A0.** Allow one slip in substitution **<u>for M1 only</u>**, but must be correct formula. Can be implied from at least one correct value of x evaluated, provided M1 awarded. Both solutions required. *<u>Using trial and improvement</u>* *Award B3 for a method leading to <u>both</u> solutions, namely x = –3·93 AND x = 3·43, otherwise B0.* An unsupported answer gains zero marks.
14. *(c)* (AC =) 2·43 (cm) Length cannot be negative / must be positive.	B1 E1	F.T. 'their derived x' provided one positive and one negative solution. Accept any valid explanation, e.g. x–1>0, so x>1, x cannot be negative (as x - 1 must be > 0)
15. *(a)* $y = f(x) - 3$	B1	
15. *(b)* $y = -f(x)$	B1	
15. *(c)* $y = f(x - 10)$	B1	

2. (a) –4 –2	B2	B1 for each
2. (b) At least 5 correct plots and no incorrect plot. A smooth <u>curve</u> drawn through their plots. 	P1 C1	FT 'their (–1,–4)' and 'their (1,–2)' Allow ± '½ a small square'. FT 'their 7 plots' OR a curve through the 5 given points **AND** (−1,–4) and (1,–2). Allow the intention to pass through their plots (within 1 small square, either horizontally <u>or</u> vertically of the point).
2.(c) –2·6 AND 1·6	B1	<u>Strict</u> FT 'their curve' only if exactly two points of intersection with the x-axis. Answers must be written to one decimal place. Allow ± 'up to but not including 1 small square'.

10. $5n - 7 > n + 26$ or equivalent. **B2**

Award B2 for $5n - 7 > n + 19 + 7$.
Award B1 for one of the following:

- Sight of $5n - 7$
- Sight of $n + 26$
- Sight of $n + 19 + 7$

(Least number of apples Twm picked =) 9 **B2**

An answer must be given following work from an inequality.
Award B2 for n = 9.
FT for B2 or B1, from 'their <u>inequality</u>', if of equivalent difficulty (must be at least 3 terms, with at least 2 'n' terms and a constant).

Possible scenarios:

1st B2	2nd B2	
Inequality used	B2 awarded for:	B1 awarded for:
$5n - 7 > n + 26$ B2 awarded	9	Sight of: • $4n > 33$ • $n > \frac{33}{4}$ or equiv • 8(·25) One slip in solving the inequality, but final answer rounded correctly
$5n - 7 > n + 19$ B1 awarded	7	Sight of: • $4n > 26$ • $n > \frac{26}{4}$ or equiv • 6(·5) One slip in solving the inequality, but final answer rounded correctly
$5n > n + 26$ B1 awarded		
$5n - 7 < n + 26$ B1 awarded		Sight of: • $4n < 33$ • $n < \frac{33}{4}$ or equiv

<u>Unsupported answers or no inequality shown</u>
If B0 B0, award SC1 for an unsupported answer of 9 without showing any working or no inequality shown.

<u>Use of equations</u>
If an equation is used throughout, a possible first B1 (see bullet points) and then B0 is awarded.

If B1 for an equation is awarded (see bullet points), a second B2 or B1 could be awarded if there is evidence that the equation has then been turned to an inequality (e.g. $n > 8·25$, so answer is 9).

If an inequality is shown and then equation used, B2 B2 is possible.

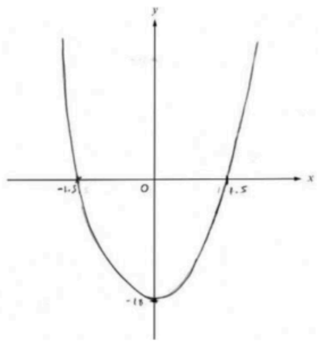
or 830 (cm²) or 264π (cm²)		Unsupported correct answer is awarded full marks.
12. $x = \frac{-(-7)\pm\sqrt{(-7)^2-4\times(59)\times(-13)}}{2\times(59)}$	M1	**This substitution into the formula must be seen for M1, otherwise award M0A0A0.** Allow one slip in substitution **<u>for M1 only</u>**, but must be correct formula.
$= \frac{7\pm\sqrt{3117}}{118}$	A1	Can be implied from the two correct, unrounded values of x, provided M1 awarded.
x = 0·53, x = –0·41	A1	CAO Both solutions required. Award SC3 for both roots correctly rounded using the trial and improvement method used correctly.

14. Lines $y = \frac{1}{2}x + 1$, $y + x = 0$ and $x = 3$ all correct.	B2	B1 for any 2 correct lines. If $y = 3$ and any other vertical or horizontal line shown e.g. y = ± 3 or x = -3, do not award a mark unless $x = 3$ is selected for the region or clearly labelled.
Correct region identified.	B1	Strict FT provided B1 awarded. Accept indication by 'shading out'.

1.(a)	$7 + 5x - 10 = 3x + 8$ or equivalent.	B1	FT until 2nd error. 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 $3{\cdot}5(55\ldots)$ or $3{\cdot}6$. 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 $\pm 2f = \pm 13 \pm h$. Unsupported $f = \frac{\pm 13 \pm h}{\pm 2}$ 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: • $f = (13 - h) \div 2$ 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 $5(3x + -7y)$.

3.(a)(i) m^7	B1	
3.(a)(ii) m^{10}	B1	
3.(b) $7n - 3$	B2	Mark final answer. B1 for sight of $7n$. Allow notation of $n7$ or $7 \times n$ or $n \times 7$ for $7n$. Allow N for n, but penalise –1 for use of a different letter.

7, 8 and 9	B2	Award B2 for all three integers and no extras. Award B1 for one of the following indicated as a final answer: • 7, 8, 9 and only **<u>one</u>** other incorrect value • for two correct with no incorrect value • 7 to 9 • 7, 7·5, 8, 8·5, 9 • sight of 6.5 < n < 9.5 or equivalent • 14,16,18 • 14,15,16,17,18. Allow B2 for correct embedded answers of 7, 8 and 9 (e.g. sight of only 2 × 7 = 14, 2 × 8 = 16, 2 × 9 = 18 with no other calculations) BUT only B1 if contradicted on answer line (e.g. 14, 16, 18 for the example above).

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.

13.(a) (Area of triangle =) $\frac{1}{2} \times 4x \times (2x - 1)$ $\frac{8x^2 - 4x}{2} = \frac{3}{4}$ or equivalent $16x^2 - 8x - 3 = 0$	M1 m1 A1	Allow award of M1 if brackets omitted. Accept equivalent e.g. using area of rectangle = 1·5. Expanding brackets and equating. Clearing fractions and equating to zero. Must be convincing.
13.(b)(i) $(4x - 3)(4x + 1)$ $[= 0]$ $x = \frac{3}{4}$ AND $x = -\frac{1}{4}$	M2 A1	Solution may be seen in part (a). If seen in both, the work in the answer space for part (b)(i) takes precedence. M1 for $(4x \ldots 3)(4x \ldots 1)$ M1 for two brackets which multiply to give $16x^2 - 8x + k$ or $16x^2 + mx - 3$. Strict FT from M1 *<u>Using quadratic formula</u>* $(x =) \frac{-(-8) \pm \sqrt{(-8)^2 - 4(16)(-3)}}{2(16)}$ *M1* *For M1, allow one error, in sign or substitution, but not in formula.* $x = \frac{8 \pm \sqrt{256}}{32}$ *A1* $x = \frac{3}{4}$ *or* $x = -\frac{1}{4}$ *(both answers required)* *A1* Do not allow a trial and improvement method.
13.(b)(ii) (*BC* = 2 × $\frac{3}{4}$ – 1 =) 0·5 (m) AND a valid statement e.g. length cannot be negative; length must be positive.	E1	Solution may be seen in part (a) or (b)(i). If seen in both, the work in the answer space for part (b)(ii) takes precedence. FT 'their x' provided an equivalent decision is required i.e. one value of x is greater than $\frac{1}{2}$ and the other is less than $\frac{1}{2}$.

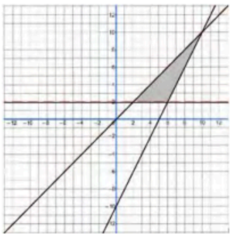
14.(a)(i) 2·5	B1	
14.(a)(ii) At least 6 correct plots and no incorrect plot. A smooth curve drawn through their plots.	P1 C1	FT 'their (0·5, 2·5)'. Allow '±½ a small square'. FT 'their 7 plots' OR a curve through the 6 given plots and through (0·5, 2·5). Allow for the intention to pass through their plots (± 1 small square horizontal OR vertical). The curve should NOT intercept the y-axis.
14.(b) Two correct readings from their graph.	B2	For reference, x = 0·4 AND 2·6 to 1d.p. B1 for one correct reading. Strict FT 'their graph'. If more than two points of intersection, award B1 for one correct answer, B2 for a complete set of answers. If no marks, award SC1 for drawing the line y = 3.

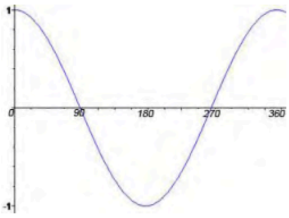
10. Sight of $12x + 4y = 180$ or equivalent AND $26x + 7y = 360$ or equivalent	B2	x and y terms need to be collected for B2. If B2 not awarded, award B1 for one of the following: • $12x + 4y = 180$ or equivalent • $13x + 5x + 8x + 7y = 360$ • $26x + 7y = 360$ or equivalent
Method to eliminate one variable e.g. equal coefficients **AND** appropriate intention to add or subtract or use a method of substitution.	M1	FT 'their equations', provided of equivalent difficulty. Allow one error in one term (not the term with equal coefficients).
First variable found x = 9(°) or y = 18(°)	A1	CAO (for their equations).
Substitute to find the 2nd variable.	m1	FT substitution of their '1st variable' if M1 gained.
Second variable found.	A1	No marks for 'trial and improvement'. No marks for an unsupported answer.
	5	

11. Correct equation e.g. $\frac{50x + 10 - 21x + 9}{(15)} = \frac{9 \times 3 \times 5}{(15)}$ $(29x + 19 = 135)$ $29x = 116$ $x = 4$	B2 B1 B1	FT until 2nd error. Award B1 for one of the following: • 1 error in one term • Sight of $5(10x + 2)$ AND $-3(7x - 3)$ or equivalent • Sight of $50x + 10 - 21x + 9$. Subsequent work may show use of common denominator in order to award the B2. Mark final answer. Award the final B0 for $\frac{116}{29}$ If FT leads to a whole number answer, it must be shown as a whole number. Otherwise, accept a fraction. Allow B2B1B1 for a correct embedded answer BUT only B2B1B0 if contradicted by $x \neq 4$ or equivalent. Note 1: $\frac{50x + 10 - 21x - 9}{(15)} = \frac{135}{(15)}$ B1 (one error –9) $29x = 134$ B1 $x = \frac{134}{29}$ B1 Note 2: $\frac{50x + 10 - 21x + 9}{(15)} = \frac{9}{(15)}$ B1 (one error = 9) $29x = -10$ B1 $x = \frac{-10}{29}$ B1 Note 3: $\frac{50x + 10 - 21x - 9}{(15)} = \frac{9}{(15)}$ B0 B0 B0 (2 errors –9 & 9) Award B2B1B1 for unsupported answer of 4, or for an answer which has come from a non-algebraic method.

12. $x \leq 2$ or equivalent $y \leq 3$ or equivalent $y \geq -x+1$ or equivalent	 B1 B1 B2	Accept in any order. Accept '<'. Accept '<'. Accept '>'. B1 for one of the following: • $y = -x+1$ or $y < -x+1$ or $y \leq -x+1$ • $y \geq kx+1$ or $y > kx+1$ (with $k \neq -1$ and either $k < 0$ or $k = 1$) • $y \geq -x+c$ or $y > -x+c$ (with $c \neq 1$)

Unit 1: Higher Tier	Mark	Comments
4. Sight of $7(x+8)$ or equivalent **AND** Sight of $3(x+1)$ or equivalent.	B1	Check diagram for answers Brackets must be seen unless implied in later correct working.
$7(x+8)+3(x+1)=89$ or equivalent.	B1	FT 'their expressions' provided of equivalent difficulty. Equating the sum of their two area expressions to 89.
$7x+56+3x+3=89$	B1	Correct expansion in an equation.
$10x=30$	B1	FT only from $ax \pm b \pm cx \pm d = k$, provided working with area.
$x=3$	B1	FT from any equation of the form $fx = g$. Answer must be > –1 on FT. Accept an answer rounded, truncated or as an improper fraction (if not whole number) on FT. Mark final answer. If the first B0 or B1 awarded, then award an additional SC2 for $x=3$ clearly identified as a final answer if no correct equation shown. Award full marks if $x=3$ given and correct equation shown. If an incorrect equation shown and correct answer on FT given (with or without workings shown), award the final B0B1B1 marks.
4. Alternative method *Sight of $7(x+8+3)$ or equivalent* ***AND*** *Sight of $3(7-1-x)$ or equivalent.*	*B1*	*Check diagram for answers.* *Brackets must be seen unless implied in later correct working.*
$7(x+8+3)-3(7-1-x)=89$ or equivalent.	*B1*	*FT 'their expressions' provided of equivalent difficulty.* *Equating the difference of their two area expressions to 89.*
$7x+77-18+3x=89$	*B1*	*Correct expansion in an equation.*
$10x=30$	*B1*	*FT only from $ax \pm b \pm cx \pm d = k$, provided working with area.*
$x=3$	*B1*	*FT from any equation of the form $fx = g$.* *Answer must be > –1 on FT.* *Accept an answer rounded, truncated or as an improper fraction (if not whole number) on FT.* *Mark final answer.* *If the first B0 or B1 awarded, then award an additional SC2 for $x=3$ clearly identified as a final answer if no correct equation shown.* *Award full marks if $x=3$ given and correct equation shown.* *If an incorrect equation shown and correct answer on FT given (with or without workings shown), award the final B0B1B1 marks.*

13. Correct region identified. 	B3	Accept indication by ‘shading out’. B2 for two lines drawn correctly OR three lines drawn correctly with no region or an incorrect region identified. B1 for one line drawn correctly. If there are more than three lines drawn, only award B2 or B1 if the correct lines are <u>clearly identified</u>. If $y = 2$ shown and any other vertical or horizontal line shown e.g. $x = \pm 2$ or $y = -2$, unless $y = 2$ is selected for the region or clearly labelled, do not consider this as a correct line. *Minimum length of a line must be 2 cm.* *For a line to be considered correct, it must be so for the entirety of its drawn length.*

		answer of 0·8827(16…).
16.(a) Cosine <u>curve</u> with appropriate orientation and position AND passing through (0°,1), (90°,0) and (270°,0) and approximately (180°,-1) and (360°,1) AND 90(°), 180(°), 270(°), 360(°) indicated on the x-axis AND -1 and 1 indicated on the y-axis. 	B2	Ignore curve shown for values x< 0° or x> 360°. Accept 180° as mid-way between 0° and 360° if unlabelled. Accept 360° as unlabelled provided the sketch does not exceed 360°. B1 for: • General cosine <u>curve</u> with appropriate orientation and appropriate position (ignore missing or incorrect labelling) **OR** • A continuous graph passing through (0°,1), (90°,0) and (270°,0) and approximately (180°,-1) and (360°,1) AND 90(°),-270(°), indicated on the x-axis AND -1 and 1 indicated on the y-axis. Accept 180° as mid-way between 0° and 360° if unlabelled. Accept 360° as unlabelled provided the sketch does not exceed 360°.
16.(b) 60(°) AND 300(°)	B2	<u>Ignore any angle outside of the range 0° < x < 360°.</u> Note B2 for 60(°) AND 300(°) and no other angle within the range 0° < x < 360°. Allow embedded answers. If not B2, award B1 for either of the following: • 60(°) **AND** 300(°) and one incorrect angle within the range 0° < x < 360° • 60(°) **OR** 300(°) and up to one incorrect angle within the range 0° < x < 360° If B2 or B1 awarded, penalise -1 for <u>each</u> further incorrect answer.

	Radians	Gradians
60°	π/3 or 1·047…	66·666…
300°	358·952…	293·333…

		approximation.
19. $6x^2 + 19x + 1 = 0$	B2	'= 0' required, but may be implied by an attempt to use the quadratic formula or if $a = 6, b = 19, c = 1$ used in the quadratic formula. Award B1 for sight of $7x^2 + 21x(+1)$ AND $x^2 + 2x$
$x = \frac{-(19) \pm \sqrt{(19)^2 - 4 \times 6 \times 1}}{2 \times 6}$	M1	**This substitution into the formula must be seen for M1, otherwise award M0A0A0.** FT 'their derived quadratic equation equated to zero' provided of equivalent difficulty (a, b and c must be non-zero). No FT from $7x^2 + 21x + 1 = 0$. Allow one slip in substitution **for M1 only**, but must be correct formula. This can be awarded as a single attempt which may be seen anywhere in the solution for solving their quadratic equation equated to zero.
$x = \frac{-19 \pm \sqrt{337}}{12}$	A1	Can be implied from at least one correct value of x evaluated (not necessarily rounded to 2dp), provided M1 awarded.
x = –0·05 with x = –3·11 (answers to 2dp)	A1	CAO for their quadratic equation.

9. (a) $45x + 23y = 89520$ or $23y + 45x = 89520$	B1	May be seen in part (b) as long as not contradicted by an incorrect equation in part (a). Award B1 if 89 520 or $45x + 23y$ seen in the table in (a), but $45x + 23y = 89520$ seen in (b).
9.(b) Method to eliminate one variable e.g. equal coefficients AND an appropriate intention to subtract or add (whichever is appropriate) or use a method of substitution.	 M1	No marks for 'trial and improvement'. No marks for unsupported answers. Answer lines take precedence. FT 'their equation' from (a) if of equivalent difficulty (e.g. both the coefficients of x and y are ≠ 0 and ≠ 1). Allow one error in one term (not the term with equal coefficients).
First variable found (The number of seated tickets sold, x =) 1560 or (The number of standing tickets sold, y =) 840	A1	CAO
Second variable found.	A1	FT substitution of their '1st variable' evaluated correctly, provided M1 gained. If **both** correct answers are seen in working space, but contradicted on answer lines, award M1A1A0. Treat reversed answers as a slip (M1A1A1).

End of solutions