

REVISE

.wales

2.03 – Indices & standard form

Mark schemes for the 2.03 question pack

Spec 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.5 – Unit 2

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 51 questions in the corresponding revise.wales question pack (129 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

5.(a)	1.5×10^3		B2	If B2 not awarded, B1 for sight of 1500 OR B1 for 1.5×10^n from a denominator of 5×10^3 seen OR B1 for $a \times 10^3$ with $1 \leq a < 10$ from a denominator of 5×10^3 seen.
5.(b)	6.63×10^4		B2	B1 for $6.6(\dots) \times 10^4$. B1 for any correct value but not in standard form

9.(a)		$\frac{1}{3}$		B1	
9.(b)	4			B1	

<p>3.(a) For a method that produces 2 prime factors from the set {2, 2, 5, 5, 7} before the 2nd error.</p> <p style="text-align: center;">2, 2, 5, 5, 7</p> <p style="text-align: center;">$2^2 \times 5^2 \times 7$</p>		<p>M1</p> <p>A1</p> <p>B1</p>	<p>Allow ± '1 small square'.</p> <p>C.A.O. For sight of the five correct factors (Ignore 1s)</p> <p>F.T. 'their primes' provided at least one index form used with at least a square.</p> <p>Do not F.T. non-primes.</p> <p>Allow $(2^2)(5^2)(7)$ and $2^2.5^2.7$</p> <p>Do not allow $2^2,5^2,7$.</p> <p>Inclusion of 1 as a factor gets B0.</p>
<p>3.(b) Any reference to the index being an odd number.</p>		<p>E1</p>	<p>Do not accept 1 (should be 2²⁴ if that is what is meant)</p>

7(a) 8×10^5	B1	
7(b)(i) 30 (pieces of card)	B2	<p>If working is shown, it needs to be correct for the award of B2 Do not accept final answer of 30mm for B2</p> <p>B1 for: 3×10^{-2} written as 0.03 (metres) or 3 cm or (0.03m =) 30mm OR for a calculation that could lead to a correct response, e.g. $3 \times 10^{-2} + 0.001$ or $(3 \times 10^{-2}) + (1 \times 10^{-3})$ or $3 \times 10^{-2} \times 1000$</p> <p>(Watch for compensating errors such as $3 \times 10^{-2} = 0.003$, $0.003 \times 1000 = 30$, this is awarded B1 for intention of $3 \times 10^{-2} \times 1000$)</p>
7(b)(ii) Assumption, e.g. 'no gaps between pieces of card', 'all pieces of card completely touch', 'all pieces of card are (exactly) 1 mm thick'	E1	<p>Allow e.g. 'the thickness of each piece of card is the same', 'none of them are folded'</p>
7(c) Use of 1 tonne = 1000 kg $1000 \times 2.88 \times 10^7 + (7.2 \times 10^9)$ or $1000 \times 28\,800\,000 + 7\,200\,000\,000$ or equivalent	B1 M2	<p>For M2 any calculations used by the candidate (which may be seen in stages) need to be correct, unless replaced with a correct calculation, perhaps e.g. reverting back to correct standard form FT 'their 1000', provided a power of 10 and $\neq 1$ M1 for $(2.88 \times 10^7 \text{ (tonnes)}) + (7.2 \times 10^9)$, or $28\,800\,000 + 7\,200\,000\,000$, including no attempt to change tonnes to kg or possible place value errors in converting from standard form, this could be implied within working</p>
4 (kg per person)	A1	CAO

Second variable round.		✓	A1
9.	5.64×10^5		B2 B1 for correct answer not in standard form e.g. 564000, or 56.4×10^4 . Allow B1 for 5.64×10^5

17.	$-(\sqrt[3]{w})^5$	$-\frac{3}{5}w$	$-(\sqrt[3]{w})^3$	$\frac{1}{(\sqrt[3]{w})^3}$	$\frac{1}{(\sqrt[3]{w})^5}$	B1	
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Final Mark Scheme		
1.(a)	$18p^9$	B1
1.(b)	$\frac{g^p}{4}$	B1
1.(c)	1	R1

5.(a)	4.2×10^{-4}	B1	
5.(b)	3.6×10^8	B1	
5.(c)	4.08×10^5	B2	B1 for sight of any correct value but not in standard form. e.g. 40.8×10^4 or 408 000

15. (a) $x = 0.6424242\dots$. $100x = 64.24242\dots$ with an attempt to subtract $636/990$ or $106/165$ or equivalent	M1 A1	Or $10x$ and $1000x$, or equivalent. C.A.O. ($63.6/99$ gets M1 A0). ISW. <u>Alternative method</u> $(0.6+0.0424242\dots) = 6/10 + 42/990$ or equivalent M1 $636/990 (= 106/165)$ ISW A1
15. (b) 6	B2	B1 for $36^{\frac{1}{2}}$ or $\sqrt{36}$ or $(36/1)^{\frac{1}{2}}$ or $(1/6)^{-1}$ or $1/(1/6)$ Allow SC1 for an answer of -6 .

16. (a)	$2\sqrt{10}$	B1	
16. (b)	20	B1	
16. (c)	$100\sqrt{10}$	B1	

5.(a)	1.56×10^6	B2	Mark final answer. B1 for sight of 15.6×10^5 OR 1560000 OR equivalent correct value but not in standard form.
5.(b)	1.3×10^5	B2	Mark final answer. B1 for sight of 13×10^4 OR 130000 OR equivalent correct value but not in standard form.

<p>10(a) $\frac{6 \times 10^9}{1.5 \times 10^8}$ or equivalent</p> <p>40 or 4×10^1</p>	<p>M1</p> <p>A1</p>	<p>A calculation, using approximations, that would lead to an answer of < 50</p> <p>FT their calculation e.g. $\frac{5.9 \times 10^9}{1.5 \times 10^8}$ leads to an answer of 39.33</p>
<p>10(b)</p> <p>$63000 \times 1.5 \times 10^8$ OR $60000 \times 1.496 \times 10^8$ OR $60000 \times 1.5 \times 10^8$</p> <p>$= 9.4(5) \times 10^{12}$ (km) OR $8.9(76) \times 10^{12}$ (km) OR 9×10^{12} (km)</p>	<p>M2</p> <p>A1</p>	<p>Acceptable options for M2 and A1 Award M1 only for $63000 \times 1.496 \times 10^8$ Or M1 for 1 slip in the power of 10, but otherwise correct</p> <p>FT from M2 only If no marks awarded, SC1 for $6(.3) \times 10^{12}$ (km)</p>

14. (a)	27	B1	
14. (b)	$\frac{1}{10}$	B1	

4.	70	B3	B2 for 77 OR 80 B1 for any number between 65 and 79 inclusive, apart from 70(B3) and 77(B2) B1 for 56, 60 OR 63
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6.(a)(i)	49	B1	
6.(a)(ii)	1	B1	
6.(a)(iii)	15	B1	
6.(a)(iv)	$\frac{1}{81}$	B1	
6.(b)	(n =) 30	B2	Allow for an answer of 2^{30} . B1 for sight of $2^2 \times 2^{28}$ or $2 \times 2 \times 2^{28}$.

8.(a) 0.92 written on the 'Not a Saturday' branch. Sight of $1 - 0.15 - 0.45$ OR 0.4 or 0.40 $0.4(0)$ <u>on</u> both 'car' branches AND 0.15 AND 0.45 correctly shown <u>on</u> lower branches.	B1 B1 B1	Allow this B1 if shown on working lines.
8.(b) Sight of 0.08×0.15 OR 0.08×0.4 or equivalent. $(P(\text{Sat and 'plane or car'}) =) 0.08 \times 0.15 + 0.08 \times 0.4$ or equivalent $= 0.044$ or equivalent. ISW	B1 M1 A1	FT 'their P(car)' if <1 . 0.08×0.55 implies previous B1.
<u>Alternative method</u> $(P(\text{Sat and 'plane or car'}) =) 1 - (0.92 + 0.08 \times 0.45)$ or equivalent $= 0.044$ or equivalent. ISW	M2 A1	FT 'their 0.92'. M1 for intent $P(\text{Sat and 'plane or car'}) =$ $1 - P(\text{'not Saturday'}) - P(\text{'Saturday and train'})$

10.	1×9^{100}	1×10^{60}	1×9^{93}	9×10^{96}	9×10^{99}	B1	
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7.(a)(i)	425 kg	B1	
7.(a)(ii)	21.5 s	B1	
7.(a)(iii)	83 people	B1	
7.(b)	2.38×10^{-2}	B2	B1 for sight of a correct answer but not in standard form 2.38×10^{-3} or 0.00238

angle, side, angle or two sides or equivalent.		Dependent on at least one correct angle route.
13. (a) $x = 0.2488888\dots$ $10x = 2.488888\dots$ with an attempt to subtract $224/900$ or $112/450$ or $56/225$ or equivalent e.g. $2464/9900$	M1 A1	Or $1000x$ and $100x$, or equivalent. An answer of $2.24/9$ or $22.4/90$ gains M1 only. ISW.
<u>Alternative method</u> ($0.24 + 0.00888\dots$) $24/100 + 8/900$ or equivalent $224/900$ (= $56/225$)	M1 A1	ISW
13. (b) 9	B2	B1 for $729^{\frac{1}{3}}$ or $\sqrt[3]{729}$ or $(729/1)^{\frac{1}{3}}$ or 3^2 or $(1/9)^{-1}$ or $1/(1/9)$ Allow B1 for $1/9$ or -9 .

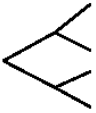
WJEC GCSE MATHEMATICS
AUTUMN 2019 MARK SCHEME

GCSE MATHEMATICS Unit 1: Higher Tier	Mark	Comments
1.(a) (Number of sides =) $\frac{360}{36}$ $= 10$	M1 A1	
1.(b) $(180 - 36) \times 10$ or equivalent $= 1440(^{\circ})$	M1 A1	F.T. 'their number of sides' if >2.
<u>Alternative method.</u> $(10 - 2) \times 180$ or equivalent $= 1440(^{\circ})$	M1 A1	F.T. 'their number of sides' if >2.
2.(a) Reflection in (the line) $x = -2$	B2	B1 for 'reflection' or 'reflected'. B1 for sight of ' $x = -2$ ' or equivalent e.g. $x + 2 = 0$ (written , not simply drawn).
2.(b) (i) Correct translation.	B2	B1 for translation '5 right'. B1 for translation '6 down'. SC1 for 2 correct vertices.
2.(b) (ii) $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$	B1	B0 for -5 (missing brackets) OR $\begin{pmatrix} -5,6 \\ 6 \end{pmatrix}$ B0 for $-\frac{5}{6}$ with or without brackets. No FT from part (b)(i).
3.(a) -5 -2 3	B2	B1 for two correct (in correct position) OR B1 for -6, -5, -2
3.(b) $6n - 1$ or equivalent	B2	B1 for sight of 6n. Mark final answer.
4.(a) 3^4	B1	
4.(b) 40·84101	B1	
4.(c) 3·6	B1	
5.(a) Correct construction of $\angle PQR = 60^{\circ}$. Correct triangle PQR drawn.	M1 A1	Correct construction arcs must be seen and angle drawn. PQ = 7 cm (± 2 mm) and triangle drawn. Allow non labelling of point P (unless position contradicted). Ignore extension of line QP if correct triangle drawn.
5.(b) Arc, <u>centre A</u> , intersecting LM at two points AND Intersecting arcs (equal radii) using the above two points as centres. Line drawn	M1 A1	[Note to markers: These arcs may be identified by the fact that they will 'cross the line LM at an acute angle'. Arcs 'crossing the line at 90° ' is evidence of an inappropriate method.]
<u>Alternative method.</u> Using the properties of a kite. Intersecting arcs whose centres are any two points on the line LM and respective radii equal in length to the distance from the points to the point A. Line drawn.	M1 A1	[Note to markers: The arcs will always intersect at a point that is a 'reflection of point A' in the line LM.]

<p>14.(a) $x = 0.4757575\dots$ $100x = 47.5757575\dots$ <u>with an attempt to subtract</u></p> <p style="text-align: center;">$471/990$ or $157/330$ ISW</p>	<p>M1</p> <p>A1</p>	<p>Or correct values $100x$ and $10x$, or equivalent. M0 for use of $x = 0.475475475\dots$</p> <p>An answer of $47.1/99$ gains M1 only.</p>
<p><u>Alternative method</u> ($0.4 + 0.07575\dots =$) $4/10 + 75/990$ or equivalent $471/990$ or equivalent ISW</p>	<p>M1</p> <p>A1</p>	
<p>14.(b) $\frac{1}{8}$</p>	<p>B1</p>	
<p>15. $9 + 4\sqrt{5}$</p> <p style="text-align: center;">(-) 2</p> <p style="text-align: center;">$7 + 4\sqrt{5}$ AND irrational</p>	<p>B2</p> <p>B2</p> <p>B1</p>	<p>If not B2, award B1 for 3 or 4 correct terms within $4 + 2\sqrt{5} + 2\sqrt{5} + 5$ or $4 + 2\sqrt{5} + 2\sqrt{5} + \sqrt{25}$ (without subsequent correct collection of terms) ($4\sqrt{5}$ is equivalent to 'two correct terms')</p> <p>B1 for (numerator of) $10\sqrt{5}$ or B1 for (denominator of) $5\sqrt{5}$ or $\sqrt{125}$ or B1 for appropriate factorisation of both numerator and denominator e.g. $\frac{\sqrt{5} \times \sqrt{100}}{\sqrt{5} \times \sqrt{25}}$ or $\frac{\sqrt{5} \times \sqrt{5} \times \sqrt{5} \times \sqrt{4}}{\sqrt{5} \times \sqrt{5} \times \sqrt{5}}$</p> <p>Mark final answer. FT for equivalent difficulty (requiring collection of terms) AND either B2 awarded AND final answer is irrational.</p>
<p>16.(a) (Area=) $\frac{1}{2} \times 1 \times [16+0+2(15+12+7)]$ or equivalent $= 42$</p>	<p>M2</p> <p>A1</p>	<p>Award M1 if only one y-value incorrect.</p> <p>F.T. from M1.</p> <p>If no marks, SC1 for an answer of 420 (from mis-reading horizontal scale).</p>
<p><u>Alternative method</u> $\frac{(16+15)}{2} + \frac{(15+12)}{2} + \frac{(12+7)}{2} + \frac{(7+0)}{2}$</p> <p style="text-align: center;">$= 42$</p>	<p>M2</p> <p>A1</p>	<p>Individual areas are: 15.5, 13.5, 9.5, 3.5.</p> <p>M1 if only one y-value incorrect or M1 for any 2 (out of 4) correctly evaluated areas (of a complete 'strip').</p> <p>(Each area of a trapezium may be seen as the sum of the area of a rectangle and a triangle.)</p> <p>F.T. from M1 (provided 4 'strips' considered).</p> <p>If no marks, SC1 for an answer of 420 (from mis-reading horizontal scale).</p>
<p>16.(b) 'Greater than' WITH valid reason e.g. trapezium rule gives an underestimate in this case and increasing the number of strips improves accuracy; less (shaded area) left out; more of the area (under curve) included; tops of strips are closer to the curve.</p>	<p>E1</p>	<p>Allow e.g. increasing the number of strips improves accuracy.</p>

4.(a)	an expression	B1	
4.(b)	an equation	B1	
5.	(Mid-points) 2·5, (7·5), 12·5 and 17·5. $8 \times 2·5 + (0 \times 7·5) + 7 \times 12·5 + 5 \times 17·5$ $(20 + 0 + 87·5 + 87·5 = 195)$ $\div 20$ $= 9.75$	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 $= 24(^{\circ})$ (BR =) $8 \times \cos 24$ or $8 \times \sin (90 - 24)$ $= 7.3(0...)(cm)$ 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). <u>Alternative method to find BR</u> 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.	2.656×10^6	B2	B1 for a correct value but not in standard form. Mark final answer. B1 for sight of 2 656 000. SC1 for 2.66×10^6 or 2.7×10^6 or 2.6×10^6 or 2.65×10^6
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 <u>OR</u> (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 <u>AND</u> (Least =) 76
	<u>Alternative method.</u> 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 <u>appropriate</u> addition or subtraction. First variable found, x = 4 or y = -1. Substitute to find the 2 nd 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 '1 st variable'. Award no marks for unsupported correct answers.

<p>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'</p>	<p>E1</p>	<p>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'.</p>
<p>10.(a)(ii) $\tan x = \frac{7.5}{4.7}$ $x = \tan^{-1}(7.5 / 4.7)$ or $\tan^{-1} 1.6$ or $\tan^{-1} 1.59(\dots)$ $= 57.9(\dots)^\circ$ or $57.8(\dots)^\circ$ or 58°</p>	<p>M1 m1 A1</p>	<p>Implies M1. C.A.O. <u>Alternative method to find x</u> A correct and complete method (using Pythagoras's theorem and a trigonometric relationship). M2 $x = 57.9(\dots)^\circ$ or $57.8(\dots)^\circ$ or 58° CAO A1</p>
<p>10.(b) $(y =) 58^\circ$ 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)'.</p>	<p>B1 E1</p>	<p><u>Strict</u> 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.</p>
<p>11. 2^{400}</p>	<p>B2</p>	<p>B1 for $(2^{100})^4$ OR sight of 2^4</p>
<p>12. (Height =) $\frac{3 \times 5533}{825}$ OR $\frac{5533}{\frac{1}{3} \times 825}$ $= 20.1(2 \text{ cm})$ ----- <i>Alternative method (finding the radius first):</i> Use $A = \pi r^2$ to evaluate r or r^2. (Height =) $\frac{3 \times 5533}{\pi \times 16.2(05\dots)^2}$ OR $\frac{5533}{\frac{1}{3} \times \pi \times 16.2(05\dots)^2}$ OR $\frac{3 \times 5533}{\pi \times 262.6(\dots)}$ OR $\frac{5533}{\frac{1}{3} \times \pi \times 262.6(\dots)}$ $= 20.1(2\dots \text{ cm})$</p>	<p>M2 A1 M2 A1</p>	<p>M1 for $5533 = 1/3 \times \text{height} \times 825$ or equivalent. Allow an answer of 20(cm) from correct working. Allow use of $\pi = 3.14, 3.142$ or $3.14(59\dots)$. When using the π button on the calculator, $r = 16.2(05\dots)$ OR $r^2 = 262.6(\dots)$. There will be no FT for any radius other than $r = 16\text{cm}$, from working seen. M1 for $5533 = 1/3 \times \text{height} \times \pi \times 16.2(05\dots)^2$ or equivalent. Allow M1 for use of $r = 16$ (cm) A1 Allow an answer of 20(cm) from correct working. Accept an answer in the range 20.10 to 20.143(cm) <u>FT base radius = 16 cm</u>: Allow an answer in the range 20.6(cm) to 20.65(cm) OR 21(cm) from correct working.</p>
<p>13.(a) $(2x + 9)(2x - 9)$</p>	<p>B2</p>	<p>B1 for $(2x \dots 9)(2x \dots 9)$</p>
<p>13.(b) $(7x - 4)(x + 2)$</p>	<p>B2</p>	<p>B1 for $(7x \dots 4)(x \dots 2)$</p>
<p>13.(c) $(x + 2)^2(x + 7)$ OR $(x + 2)(x + 2)(x + 7)$</p>	<p>B2</p>	<p>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.</p>
<p>14. $-\frac{1}{2}$ or equivalent</p>	<p>B2</p>	<p>B1 for -2 or $\frac{1}{2}$.</p>
<p>15. $2n^2 + 1$ or equivalent $= 20001$</p>	<p>B2 B1</p>	<p>B1 for sight of $2n^2$ OR for sight of consistent 2nd difference 4. B1 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 20001 gains all 3 marks. If no marks, award SC1 for an unsupported answer of 20000.</p>

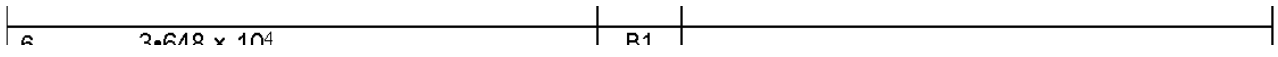
<p>7.(a) Correct framework</p>  <p>Suitable labelling on both 1st pair of branches AND on both of at least one pair of 2nd set of branches. e.g. 'Car', 'No car', 'Before 8', 'After 8'. OR Titles of 'Car' and 'Before 8' with branch endings of 'Yes' and 'No'.</p> <p>Correct probabilities on first pair of branches 0·7 AND 0·3 (for 'Car', 'No car') OR 0·4 AND 0·6 (for 'Before 8', 'After 8')</p> <p>Correct probabilities on second two sets of branches 0·4 AND 0·6 correctly placed (following 0·7 and 0·3) OR 0·7 AND 0·3 correctly placed (following 0·4 and 0·6)</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p>	<p>Accept any unambiguous wording.</p> <p>Must be consistent with their labelling. Allow this B1 if no headings given, <u>unless</u> contradicted by, or inconsistent with, further labelling.</p> <p>Allow this B1 if no headings given, <u>unless</u> contradicted by, or inconsistent with, further labelling.</p> <p>Allow this B1 if only shown on one set of branches. Provided not contradicted on the other set of branches.</p>
<p>7.(b) $0·7 \times 0·4$ or equivalent. $= 0·28$ or equivalent.</p>	<p>M1</p> <p>A1</p>	<p>No FT. M1A0 for a final answer of 0·28%. Mark final answer.</p>
<p>8.(a) $PA = 12(\text{cm})$ AND correct theorem given, e.g. 'tangents from an external point are equal in length'.</p>	<p>E1</p>	<p>Must use the words '<u>tangents</u>' AND '<u>equal (identical/same)</u>'. Do not accept e.g. 'PA = PB'. (E0) Accept alternative correct answers.</p>
<p>8.(b) $\hat{PAO} = 90(^{\circ})$ AND correct theorem given, e.g. 'the tangent at any point on a circle is perpendicular to the radius at that point'.</p>	<p>E1</p>	<p>Must use the words '<u>tangent</u>' AND '<u>radius (diameter)</u>'. Allow e.g. 'radius and tangent meet at 90'. (E1) Do not accept e.g. 'PA and OA meet at 90'. (E0)</p>
<p>8.(c) (Area PAOB =) $2 \times \frac{12 \times 4}{2}$ or equivalent. $= 48 (\text{cm}^2)$</p>	<p>M1</p> <p>A1</p>	<p>OR FT '<u>their PA</u>' $\times 4 + \frac{12 \times 4}{2}$ M0 for 48×2 or $12 \times 4 \times 2 (= 96)$ An unsupported final answer of 48 gains both marks. If no marks gained allow SC1 for sight of $24(\text{cm}^2)$ OR a correct evaluation of ('their PA' $\times 4) / 2$.</p>
<p>9.(a) $y = 2·5x + 3$</p>	<p>B1</p>	
<p>9.(b) $y = 3x - 5$</p>	<p>B1</p>	
<p>9.(c) Line D</p>	<p>B1</p>	
<p>10.(a) $t \propto 1/g$ OR $t = k/g$ $36 = k/25$ OR $k = 900$ $t = 900/g$</p>	<p>B1</p> <p>M1</p> <p>A1</p>	<p>Allow $t \propto k/g$ FT from $y \propto 1/x^n$ with $n \neq 1, n > 0$ No FT from direct proportion M1 implies B1. May be seen explicitly in part (b). Do not allow $t \propto 900/g$ for the A mark</p>
<p>10.(b) $(900/20 =)$ 45 (days)</p>	<p>B1</p>	<p>FT 'their formula' only if non-linear.</p>
<p>10.(c) Sight of 900/40 22 (goats)</p>	<p>M1</p> <p>A1</p>	<p>FT 'their formula' only if non-linear and of equivalent difficulty M1 A0 for an answer of 22·5 or 23 For A1, FT for equivalent difficulty i.e. need to round down an answer with a decimal part of 0.5 or over. Allow use of trial and improvement for M1, provided 22 or 23 seen. A0 for incorrect working e.g. $90/4$ given as 22.2, leading to 22.</p>
<p>11. (a) $(\sqrt[3]{m})^2$</p>	<p>B1</p>	
<p>11. (b) $p^{\frac{1}{3}}$</p>	<p>B1</p>	

<p>13. $(4x + 3)(x - 1)$ ($=0$)</p> <p>$(x =) -\frac{3}{4}$ AND $(x =) 1$</p>	<p>B2</p> <p>B1</p>	<p>B1 for $(4x \dots 3) (x \dots 1)$</p> <p>Strict FT from their brackets provided equivalent difficulty. (Both solutions are required for this B1.)</p> <p>B1 if only $(x =) -\frac{3}{4}$ AND $(x =) 1$ seen.</p>
<p><u>Alternative method (using quadratic formula)</u></p> <p>$(x =) \frac{1 \pm \sqrt{(-1)^2 - 4(4)(-3)}}{2(4)}$</p> <p>$x = \frac{1 \pm \sqrt{49}}{8}$</p> <p>$x = -\frac{3}{4}$ AND 1 (or equivalent)</p>	<p>M1</p> <p>A1</p> <p>A1</p>	<p>Allow one error, in sign or substitution, but not in the formula for M1 A0 A0.</p>
<p>14. (a) $\frac{1}{8}$</p>	<p>B2</p>	<p>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 $(\frac{1}{64})^{\frac{1}{2}}$</p>
<p>14. (b) $x = 0.02222\dots$ $10x = 0.2222\dots$ with an attempt to subtract</p> <p>$(\frac{1}{3} +) \frac{2}{90}$ OR $(\frac{1}{3} +) \frac{1}{15}$</p> <p>$x = \frac{32}{90} (= \frac{16}{45})$</p>	<p>M1</p> <p>A1</p> <p>B1</p>	<p>Or $10x$ and $100x$, or equivalent. Or an alternative method.</p> <p>Sight of $\frac{0.2}{9}$ gains M1 only.</p> <p>FT 'their $\frac{2}{90}$' provided equivalent difficulty. Mark final answer. Do not ignore incorrect cancelling.</p>
<p><u>Alternative method 1</u></p> <p>$x = (\frac{1}{3} +) \frac{0.2}{9}$</p> <p>$= \frac{3.2}{9}$</p> <p>$= \frac{32}{90} (= \frac{16}{45})$</p>	<p>B1</p> <p>M1</p> <p>A1</p>	<p>Mark final answer</p>
<p><u>Alternative method 2</u></p> <p>$x = 0.35555\dots$ $10x = 3.5555\dots$ with an attempt to subtract</p> <p>$x = \frac{32}{90} (= \frac{16}{45})$</p>	<p>B1</p> <p>M1</p> <p>A1</p>	<p>Or $10x$ and $100x$, or equivalent. 'FT 'their 0.35555...' provided equivalent difficulty'.</p> <p>Sight of $\frac{3.2}{9}$ gains B1 M1 only Mark final answer</p>
<p><u>Alternative method 3</u></p> <p>$x = 0.35555\dots (= 0.3 + 0.05555)$</p> <p>$= \frac{3}{10} + \frac{0.5}{9}$ or equivalent</p> <p>$= \frac{32}{90} (= \frac{16}{45})$</p>	<p>B1</p> <p>M1</p> <p>A1</p>	<p>Mark final answer</p>

<p>11.</p> $\frac{63 \cdot 5^2}{8 \cdot 65}$ <p>= 466(·156...) or 466·16 or 466·2</p>	<p>M2</p> <p>A1</p>	<p>If many attempts are offered without a method/answer being identified, then mark the final attempt.</p> <p>If M2 not gained, award M1 for correct use of values $63 \leq d < 64$ AND $8 \cdot 6 < e \leq 8 \cdot 7$</p> <p>Mark final answer. M2 required for A1.</p> <p>Fractional equivalent $466(\cdot 156 \dots) = 80645/173$</p> <p>Allow this A1 for an answer of 470 only from correct unambiguous working seen.</p> <p>If no marks gained, award SC1 for sight of 63·5 and 8·65 used within the same calculation.</p>
<p>12. Use of cosine rule followed by sine rule</p> <p>(EG =) $\sqrt{2 \cdot 7^2 + 3 \cdot 2^2 - 2 \times 2 \cdot 7 \times 3 \cdot 2 \times \cos 79^\circ}$</p> <p>(EG =) 3·77.... (cm)</p> <p>$\sin EFG = EG \times \sin 65^\circ / 6 \cdot 4$ OR $EFG = \sin^{-1}(EG \times \sin 65^\circ / 6 \cdot 4)$</p> <p>F = 32(·29.....°)</p>	<p>S1</p> <p>M2</p> <p>A1</p> <p>M2</p> <p>A1</p>	<p>M1 for (EG² =) $2 \cdot 7^2 + 3 \cdot 2^2 - 2 \times 2 \cdot 7 \times 3 \cdot 2 \times \cos 79^\circ$ or for (EG² =) 14·2(3.....)</p> <p>Accept 3·8 cm</p> <p>Allow $\sqrt{14 \cdot 2(3 \dots)}$ if used in this form in subsequent work, provided not evaluated as a decimal (at any stage)</p> <p>F.T. 'their derived EG' (not 2·7, 3·2, 6·4 or spurious EG).</p> <p>Award M1 for $\sin EFG / EG = \sin 65^\circ / 6 \cdot 4$ OR $EG / \sin EFG = 6 \cdot 4 / \sin 65^\circ$</p> <p>Dependent on previous M2.</p>
<p>13. (Numerator) Sight of $3x(2x - 3)$ (Denominator) Sight of $(2x - 3)(2x + 3)$</p> $\frac{3x}{2x + 3}$	<p>B1</p> <p>B2</p> <p>B1</p>	<p>B1 for $(2x \dots 3)(2x \dots 3)$</p> <p>Mark final answer.</p> <p>F.T. provided at least one previous B1 awarded AND provided simplification required.</p>
<p>14. (a) $\frac{1}{2} \times (x - 1) \times (2x + 3) \times \sin 30^\circ [= 6]$ OR $\frac{1}{2} \times (2x^2 + 3x - 2x - 3) \times \sin 30^\circ [= 6]$</p> <p>$2x^2 + x - 3 (= 6 \times 2 \times 2)$</p> <p>$2x^2 + x - 27 = 0$</p>	<p>B1</p> <p>B1</p> <p>B1</p>	<p>Use of 'Area = $\frac{1}{2} ab \sin C$'.</p> <p>Correct expansion of brackets and correct collection of x terms. May be implied within equation.</p> <p>Must be convincing.</p>
<p>14. (b) $(x =) \frac{-1 \pm \sqrt{[1]^2 - 4(2)(-27)}}{2(2)}$</p> <p>$(x =) \frac{-1 \pm \sqrt{217}}{4}$</p> <p>(x =) -3·93 AND 3·43</p>	<p>M1</p> <p>A1</p> <p>A1</p>	<p>This substitution into the formula must be seen for M1, otherwise award M0A0A0.</p> <p>Allow one slip in substitution for M1 only, but must be correct formula.</p> <p>Can be implied from at least one correct value of x evaluated, provided M1 awarded.</p> <p>Both solutions required.</p> <p><u>Using trial and improvement</u> Award B3 for a method leading to <u>both</u> solutions, namely $x = -3 \cdot 93$ AND $x = 3 \cdot 43$, otherwise B0.</p> <p>An unsupported answer gains zero marks.</p>
<p>14. (c) (AC =) 2·43 (cm)</p> <p>Length cannot be negative / must be positive.</p>	<p>B1</p> <p>E1</p>	<p>F.T. 'their derived x' provided one positive and one negative solution.</p> <p>Accept any valid explanation, e.g. $x - 1 > 0$, so $x > 1$, x cannot be negative (as $x - 1$ must be > 0)</p>
<p>15. (a) $y = f(x) - 3$</p>	<p>B1</p>	
<p>15. (b) $y = -f(x)$</p>	<p>B1</p>	
<p>15. (c) $y = f(x - 10)$</p>	<p>B1</p>	

<p>15.</p> $\pi \times 3^2 \times h + \frac{2}{3} \times \pi \times 3^3 = 63\pi \quad \text{or equivalent}$ <p>Allow $\frac{\frac{4}{3} \times \pi \times 3^3}{2}$ for $\frac{2}{3} \times \pi \times 3^3$.</p> $9\pi h = 63\pi - 18\pi \quad \text{or } h = \frac{63\pi - 18\pi}{9\pi}$ <p>or equivalent e.g. $\frac{45\pi}{9\pi} = 5 \text{ (cm)}$</p> <p>(Total height =) 8 (cm)</p>	<p>M2 (Using 'h' as height of cylinder) M1 for summing 2 terms and equating to 63π, with 1 term being correct</p> <p>M1 may be implied by a subtraction or seen in stages e.g. $9\pi h = 27\pi$ from $63\pi - 36\pi$ or $9\pi h = 36\pi$ from $63\pi - 27\pi$ or $9\pi h = 57\pi$ from $63\pi - 6\pi$ (using incorrect evaluations for volume of hemisphere)</p> <p>Allow the use of $\pi = 3 \cdot 14$.</p> <p>m1 Isolating the term in h. FT from M1 or M2.</p> <p>A1 C.A.O.</p> <p>B1 FT 'their 5' + 3 provided M1m1 or M2m1 awarded</p> <p>If no marks, award SC1 for 18π for the volume of the hemisphere (but NOT from a calculation for surface area) OR SC2 for 45π for the volume of the cylinder.</p>
<p><u>Alternative method</u></p> $\pi \times 3^2 \times (H - 3) + \frac{2}{3} \times \pi \times 3^3 = 63\pi \quad \text{or equivalent}$ <p>Allow $\frac{\frac{4}{3} \times \pi \times 3^3}{2}$ for $\frac{2}{3} \times \pi \times 3^3$.</p> $9\pi(H - 3) = 63\pi - 18\pi$ <p>or equivalent e.g. $9\pi H = 63\pi - 18\pi + 27\pi$</p> $(H =) \frac{63\pi - 18\pi + 27\pi}{9\pi} \quad \text{or equivalent e.g. } \frac{72\pi}{9\pi}$ <p>(Height of object =) 8 (cm)</p>	<p>M2 (Using 'H' as total height of object) M1 for summing 2 terms and equating to 63π, with 1 term being correct. M1 may be implied by a subtraction or seen in stages.</p> <p>Allow the use of $\pi = 3 \cdot 14$.</p> <p>m1 Isolating the term in (H - 3). FT from M1 or M2.</p> <p>A1 FT from M1m1 or M2m1.</p> <p>A1 C.A.O.</p> <p>If no marks, award SC1 for 18π for the volume of the hemisphere (but NOT from a calculation for surface area) OR SC2 for 45π for the volume of the cylinder OR SC2 for an appropriate volume of 72π.</p>
<p>16. (a) $3\sqrt{2}$</p>	<p>B1</p>
<p>16. (b) 2</p>	<p>B1</p>
<p>16. (c) $9\sqrt{3}$</p>	<p>B1</p>

<p>17. 218° and 322° with no other values</p>	<p>B2</p>	<p>B1 for either angle. Check diagram. Ignore extra (correct or incorrect) values outside the required range. Penalise -1 for each extra value within range (beyond 2 attempts). If no marks, SC1 for accurate evaluations from consistent use of $180+n$ AND $360-n$ (with n acute). Method must be seen for this mark.</p>
<p>18. (a) $\frac{1}{7} \times \frac{3}{6} \times \frac{2}{5}$ or equivalent $8/210 (= 4/105)$</p>	<p>M1 A1</p>	<p>Penalise once only throughout for a repeated error in calculating the denominator (of 210) ISW</p>
<p>18. (b) $1 - P(3, 3, 3)$ $1 - \frac{1}{7} \times \frac{3}{6} \times \frac{2}{5}$ $\frac{186}{210} (= \frac{93}{105} = \frac{62}{70} = \frac{31}{35})$</p>	<p>M1 M1 A1</p>	<p>ISW If no other marks, award SC1 for an answer of $\frac{279}{343}$ (from working 'with replacement') OR SC1 for sight of $\frac{1}{7} \times \frac{3}{6} \times \frac{2}{5}$</p>
<p><u>Alternative method</u> $(P(\text{total}10)+P(\text{total}11)+P(\text{total}12)+P(\text{total}13)+P(\text{total}14)=)$ $P(3,3,4) \times 3 + P(3,3,5) \times 3 + P(3,4,5) \times 6$ $+ P(3,5,5) \times 3 + P(4,5,5) \times 3$ $= \frac{1}{7} \times \frac{3}{6} \times \frac{1}{5} \times 3 + \frac{1}{7} \times \frac{3}{6} \times \frac{2}{5} \times 3 + \frac{1}{7} \times \frac{1}{6} \times \frac{2}{5} \times 6 + \frac{1}{7} \times \frac{2}{6} \times \frac{1}{5} \times 3 + \frac{1}{7} \times \frac{2}{6} \times \frac{1}{5} \times 3$ $\frac{186}{210} (= \frac{93}{105} = \frac{62}{70} = \frac{31}{35})$</p>	<p>M1 M1 A1</p>	<p><i>M0 if orderings are not considered</i> ISW If no marks awarded, award SC1 for the correct method for calculating any individual total, e.g. $P(\text{total } 10) = \frac{1}{7} \times \frac{3}{6} \times \frac{1}{5} \times 3$ or equivalent For information only: $P(10) = \frac{36}{210} (= \frac{6}{35})$ $P(11) = \frac{72}{210} (= \frac{12}{35})$ $P(12) = \frac{48}{210} (= \frac{8}{35})$ $P(13) = \frac{24}{210} (= \frac{4}{35})$ $P(14) = \frac{6}{210} (= \frac{1}{35})$ OR award SC1 for a calculation leading to an answer of $\frac{54}{210}$ (from adding probabilities without accounting for different ordering) OR award SC1 for an answer of $\frac{279}{343}$ (from working 'with replacement').</p>



7. (a)		$7.2 \times 10^6 \text{ cm}^3$	B1	
7. (b)	6		B1	

<p>2(a) Whale indicated or implied on bearing 010° from Aberporth and 280° from Aberystwyth.</p> <p>Region in the sea inside a circle, centred at the whale, of correct (4cm) radius $\pm 2\text{mm}$</p>	<p>B2</p> <p>B2</p>	<p>Accept indication from one bearing line drawn with the second bearing shown on this line, including one line terminating at the correct intersection point</p> <p>B1 for either of the bearings correctly shown or unambiguously indicated, e.g. by an unambiguous mark on the correct bearing</p> <p>FT 'their position of the whale' For B2 the region must be entirely within the sea or on FT indicated as a region within the sea Allow intention of circle provided it lies completely within the tolerance given by the overlay B1 for (intention of a) circle, radius out of tolerance but within $\pm 4\text{ mm}$, centred at the whale including any region on the land</p>
<p>2(b) $20 \times 12 \times 2.5 \div 100$</p> <p style="text-align: center;">6 (m)</p>	<p>M2</p> <p>A1</p>	<p>M1 for any 3 of these 4 terms correct in a calculation which may be shown in stages</p> <p>CAO Answer given within the statement takes precedence Sight of 600 is awarded M1 and also SC1 provided not from incorrect working</p>
<p>2(c)(i) $\frac{13}{20} (\times 100)$ or $\frac{12.5}{20} (\times 100)$ or $\frac{12.8}{19} (\times 100)$ or $\frac{12}{20} (\times 100)$ or $\frac{12}{19} (\times 100)$ or $\frac{12.8}{20} (\times 100)$ or $\frac{13}{19} (\times 100)$ or equivalent</p> <p>OR</p> <p>A trial and improvement method, considering percentages or decimals of 19 or 20 with a correct calculation shown between (60% of 19) $0.6 \times 19 (= 11.4)$ and (70% of 20) $0.7 \times 20 (= 14)$ inclusive</p> <p>An answer in the inclusive range 60(%) to 70(%)</p>	<p>B1</p> <p>B1</p>	<p>Allow:</p> <ul style="list-style-type: none"> • fraction written as division, e.g. $13 \div 20$ • inclusion of consistent change of place value • a similar suitable fraction, e.g. $12/18$ <p>Only award if B1 previously awarded, however allow B2 for an unsupported answer in this range.</p> <p>If no marks, award SC1 for any of the following answers:</p> <ul style="list-style-type: none"> • 50(%) from $\frac{10}{20} (\times 100)$ or equivalent • 52(%) to 53(%) from $\frac{10}{19} (\times 100)$ or equivalent

<p>2(c)(ii) $(19 - 0.1 \times 19) \times 1000\ 000\ 000$ or $(19 - 0.1 \times 19) \times (1) \times 10^9$ or $0.9 \times 19 \times 1000\ 000\ 000$ or $1.9 \times 10^{10} \times 9 \times 10^{-1}$</p> <p style="text-align: right;">or equivalent</p> <p style="text-align: right;">1.71×10^{10}</p>	<p>M2</p> <p>A2</p>	<p>Must have engaged with at least one stage of interpretation of the size of 'billion' in figures</p> <p>M1 for any one of the following:</p> <ul style="list-style-type: none"> • for sight of digits 171 irrespective of place value • $19 - 0.1 \times 19$ • 19 billion $- 0.1 \times 19$ billion • $(19 - 0.1 \times 19) \times 1000$ million • 0.9×19 • 1.9×10^{10} (19 billion in standard form) • 1.9×10^9 only if clearly calculated from 10% of 19 billion <p>A1 for any of the following:</p> <ul style="list-style-type: none"> • 17 100 000 000 • 1.71×10^4 million • equivalent correct value not given correctly in standard form, e.g. 17.1×10^9 • an answer of 1.7×10^{10} <p>OR A1 for FT from M1 or M2</p> <ul style="list-style-type: none"> • 'their number' given correctly in standard form provided it is $> 1.71 \times 10^6$ (including for the number in the last bullet point listed for M1) <p>A0 for 17.1 billion or 17 100 million (M1 A0)</p> <p>Treat use of an estimate of 19 as a MR-1 from an accuracy mark, e.g. use of 20 gives an answer of 1.8×10^{10}, award (M2 A2 MR-1) 3 marks</p>
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7.(a) $5(0) \times 10^6$	B2	Mark final answer. Award B1 for one of the following: <ul style="list-style-type: none">• sight of 0.5×10^7• sight of 5 000 000• equivalent correct value but not in standard form.• sight of 30 000 AND 0.006• 5×10^n ($n \geq 3$, but not 6), following one place value error in one of the given numbers.
7.(b) $4.795(0) \times 10^4$	B2	Mark final answer. B1 for one of the following: <ul style="list-style-type: none">• sight of $479.5(0) \times 10^2$• $4.8(0) \times 10^4$• sight of 47 950• equivalent correct value but not in standard form.• sight of 47800 AND 150• 'their 47 950' is written correctly in standard form, following one place value error in one of the given numbers or in the addition of 47800 AND 150.

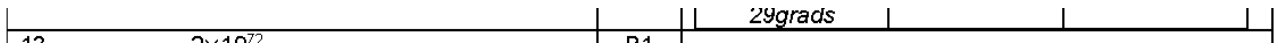
<p>15.(a) $x = 0.6545454\dots$ and $100x = 65.45454\dots$ <u>with</u> an attempt to subtract</p> <p>$648/990$ (= $324/495 = 108/165 = 36/55$ or equivalent)</p>	<p>M1</p> <p>A1</p>	<p><u>Complete</u> method. Or $10x$ and $1000x$, or equivalent. Or a <u>complete</u> alternative method. x and $10\,000x$ gives an answer of $65448 / 99990$.</p> <p>An answer of $64.8/99$ gains M1 only. ISW</p>
<p>15.(a) <u>Alternative method</u> $0.6 + 0.0545454\dots = 6/10 + 54/990$ or equivalent</p> <p>$648/990$ (= $36/55$ or equivalent)</p>	<p>M1</p> <p>A1</p>	<p>An answer of $64.8/99$ gains M1 only. ISW</p>
<p>15.(b) $1/9$</p>	<p>B2</p>	<p>B1 for 9^{-1} or $1/3^2$ or $(1/3)^2$ or $1^{\beta}\sqrt{729}$ or $1/729^{1/3}$ or $(1/729)^{1/3}$ or ${}^3\sqrt{(1/729)}$ Mark final answer.</p>

17. $\sqrt{20} = 2\sqrt{5}$ $(\sqrt{5})^3 = 5\sqrt{5}$ $(\frac{2\sqrt{5} + 5\sqrt{5} + 11\sqrt{5}}{3} =)$ $6\sqrt{5}$	B1 B1 B1	FT provided B1 already awarded AND provided all terms are of the form $a\sqrt{5}$ (and the answer is $b\sqrt{5}$ where b is an integer). $18\sqrt{5}$ (with no contradictory working) implies B2. $6\sqrt{5}$ (with no contradictory working) implies B3.
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Length			
9.(a)	7.6×10^{-3}	B1	
9.(b)	6×10^6	B1	
9.(c)	2.8×10^4	B2	Mark final answer. Award B1 for one of the following: <ul style="list-style-type: none">• sight of 28×10^3• sight of 28 000• equivalent correct value but not in standard form• sight of 23 000 AND 5000• 'their 28000' is written correctly in standard form, following one place value error in one of the numbers from work seen.

<p>3(a) (Difference 60 million – 41 000 000 =) 19 000 000 or 19 million</p> <p>(Underspend) $\frac{19\,000\,000}{60\,000\,000} (\times 100)$ or equivalent</p> <p style="text-align: right;">31.67(%)</p>	<p>B1</p> <p>M1</p> <p>A1</p>	<p>May be implied in further working Allow 19 m(ii)</p> <p>FT 'their 60 million – 41 000 000' including if a place value error made</p> <p>CAO (must be 2 d.p.)</p> <p>Answer space takes precedence</p>
<p>3(a) <u>Alternative method</u> (Underspend)</p> <p>(100 -) $\frac{41\,000\,000}{60\,000\,000} (\times 100)$ or equivalent</p> <p style="text-align: right;">31.67(%)</p>	<p>M1</p> <p>A2</p>	<p>Allow place value error</p> <p>CAO (must be 2 d.p.)</p> <p>Answer space takes precedence</p> <p>A1 for 31.6(6...%), 31.7(%), 32(%) or 68.33(%)</p>
<p>3(b) 4×10^6</p>	<p>B1</p>	

<p>3(c) (Change to \$) 350×1.25 (\$)$437.5(0)$</p> <p>(Only \$10 and \$50 notes available so he can buy) (\$)$430$</p> <p>(Fewest number of notes making up \$430) 8 \$50 (notes) and 3 \$10 (notes)</p> <p>(Cost in £ to buy \$430 is) $430 \div 1.25$ or $350 - 7.5(0) \div 1.25 (= 350 - 6)$ (£)344</p>	<p>M1 A1</p> <p>A1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p><i>Do not penalise slips in giving incorrect use of £ for \$</i></p> <p>FT 'their (\$)$437.5(0)$' (provided not a multiple of 10) rounded down to nearest multiple of 10 Accept stated or implied as (\$)$7.50$ can't be converted ($\\$430$) implies previous M1 A1, provided not from incorrect working</p> <p>FT 'their \$$430$' provided it is a multiple of 10 (and provided M1 previously awarded) Must be fewest number of notes, that may be listed Sight of correct number of notes with no incorrect working implies previous A1, unless contradicted</p> <p>FT 'their whole number multiple of \$$10$' $\div 1.25$ Ignore attempt at any further calculation if $430 \div 1.25$ seen</p> <p>Must be $<(\pounds)350$ and depends on M1 M1 previously awarded Mark final answer</p> <p>If final M0 A0, then award SC1 for (£) 6 (left) or similar on FT, provided not from incorrect or inappropriate working</p>
<p>3(c) <u>Alternative method</u> $\pounds40 = \\$50$ and $\pounds8 = \\$10$ 8 \$50 notes, 3 \$10 notes</p> <p>(Cost to buy £350 is) $8 \times 40 + 3 \times 8$ (£)344</p>	<p>M1 A3</p> <p>M1 A1</p>	<p>A2 for 8 \$50 notes <i>and sight of $350 - 8 \times 40$ or equivalent</i></p> <p>OR</p> <p>A1 for 8 \$50 notes</p>
<p>Organisation and communication</p> <p>Writing</p>	<p>OC1</p> <p>W1</p>	<p>For OC1, candidates will be expected to:</p> <ul style="list-style-type: none"> • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanations and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means <p>For W1, candidates will be expected to:</p> <ul style="list-style-type: none"> • 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.



16. (a)(i)	16	B1	
16. (a)(ii)	$\frac{1}{100}$	B1	
16. (b)	$100x = 7.141414\dots$ and $10000x = 714.1414\dots$ with an attempt to subtract on both sides $\frac{707}{9900}$	M1 A1	Or x and $100x$, or equivalent. Or a <u>complete</u> alternative method. The multiplied decimals must be correct. An answer of $\frac{7.07}{99}$ gains M1 only. ISW
16. (b)	<u>Alternative method</u> $0.07 + 0.00141414\dots = \frac{7}{100} + \frac{14}{9900}$ or equivalent $\frac{707}{9900}$	M1 A1	ISW
16. (c)	$\frac{3\sqrt{5}}{2}$	B2	B1 for one of the following: <ul style="list-style-type: none"> • a numerator of $3\sqrt{5}$ • $\frac{\sqrt{45}}{\sqrt{4}}$ or $\frac{\sqrt{9} \times \sqrt{5}}{\sqrt{4}}$ i.e. for one step of simplification of surds (but not for $\sqrt{\frac{45}{4}}$) • sight of $1 \cdot 5\sqrt{5}$ (from $\sqrt{2 \cdot 25 \sqrt{5}}$).
16. (d)	An appropriate irrational number within the required range	B1	e.g. 2π , $\pi + 3$, $\sqrt{40}$, $3\sqrt{5}$, $8 - \sqrt{2}$. Ignore additional irrational numbers within range. B0 for multiple answers, unless all are irrational numbers within the required range.

Unit 1: Higher Tier	Mark	Comments
1.(c) $4\frac{1}{2}$ or 4.5 or $\frac{9}{2}$	B3	<p>Mark final answer. Award B2 for an unsimplified evaluation as a single fraction or mixed number e.g.</p> <ul style="list-style-type: none"> • $4\frac{7}{14}$ • $3\frac{21}{14}$ • $\frac{63}{14}$ • $\frac{441}{98}$ or equivalent • $4 + \frac{1}{2}$. <p>FT for one of the following:</p> <ul style="list-style-type: none"> • adding 'their improper fractions' (which incorporate the entire numbers) provided fractions have a common denominator (one numerator must be correct) and answer given in a (proper or improper) simplified form • 3 + 'their fractions' evaluated correctly and in a simplified form, provided fractions have a common denominator (one numerator must be correct) • 'their 3' + 1.5 (or equivalent) in a simplified form • $3 + \frac{1}{2}$ (or equivalent in its simplified form) evaluated provided $\frac{1}{2}$ has come from two fractions with a common denominator (e.g. $\frac{10}{14} + \frac{11}{14} = \frac{21}{14} = 1\frac{7}{14} + 3 = 3\frac{1}{2}$). <p>Award B1 for sight of two fractions with a common denominator (allow an error in one numerator) e.g.</p> <ul style="list-style-type: none"> • (1) $\frac{10}{14} + (2) \frac{11}{14}$ • $\frac{24}{14} + \frac{39}{14}$ • $\frac{168}{98} + \frac{273}{98}$ or equivalent. <p>An unsupported answer of $4\frac{1}{2}$ or 4.5 or $\frac{9}{2}$ is awarded B3.</p>

7.(a)	5.7×10^{-3}	B1	
7.(b)	4×10^6	B2	Mark final answer. Award B1 for one of the following: <ul style="list-style-type: none">• sight of 4 000 000• equivalent correct value but not in standard form e.g. 0.4×10^7.

Unit 2: Higher Tier	Mark	Comments
9. $\frac{a+b}{2} = b - a$ $a + b = 2(b - a)$ $a + b = 2b - 2a \quad \text{or} \quad a + 2a = 2b - b \quad (= 3a = b)$	B1 B1 B1	Award B0 for $a + b \div 2 = b - a$ unless brackets are implied in later correct workings. May be implied by correct further work (e.g. $a + b = 2b - 2a$). Award final B1 only from convincing work. If no marks, award SC1 for one of the following: <ul style="list-style-type: none"> • $a + b \div 2 = b - a$ • $\frac{a+b}{2} = a - b$ • sight of $\frac{a+b}{2}$ AND $b - a$ • showing the result is true (mean = range) for a pair of values a and b (where $3a = b$) e.g. stating that $a = 3$ and $b = 9$ and that $(9 + 3) \div 2 = 6$ and $9 - 3 = 6$.
9. <u>Alternative method:</u> Assuming $b = 3a$ (Mean =) $\frac{a + 3a}{2}$ $= 2a$ $\text{Range} = 3a - a = 2a$	M1 A1 B1	Working must be shown. Working must be shown.

Unit 2: Higher Tier	Mark	Comments
11. 2^{398}	B1	Mark final answer. Allow (n=) 398.

15. (a) (i)	$2\sqrt{5}$	B1	
15. (a) (ii)	$6\sqrt{2}$	B1	
15. (b)	a^4	B1	

<p>14. $(\frac{3}{4} + \frac{1}{8}) \frac{7}{8}$ or 0.875 or equivalent</p>	<p>B3</p>	<p>If not B3:</p> <ul style="list-style-type: none"> • B2 for $\frac{1}{8}$ or 0.125 • B2 for sight of $\frac{3}{4}$ AND 8^{-1} or $\frac{1}{2^3}$ or $(\frac{1}{2})^3$ or $\frac{1}{\sqrt[4]{4096}}$ or $\sqrt[4]{\frac{1}{4096}}$ or $\frac{1}{4096^{\frac{1}{4}}}$ or $(\frac{1}{4096})^{\frac{1}{4}}$ • B1 for sight of $\frac{3}{4}$ OR 8^{-1} or $\frac{1}{2^3}$ or $(\frac{1}{2})^3$ or $\frac{1}{\sqrt[4]{4096}}$ or $\sqrt[4]{\frac{1}{4096}}$ or $\frac{1}{4096^{\frac{1}{4}}}$ or $(\frac{1}{4096})^{\frac{1}{4}}$ <p>Note: $\frac{1}{\frac{3}{8}}$ is insufficient for $\frac{3}{4}$.</p>
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17

96

R1

5. Marking codes

- 'M' marks are awarded for any correct method applied to appropriate working, even though a numerical error may be involved. Once earned they cannot be lost.
- 'm' marks are dependant method marks. They are only given if the relevant previous 'M' mark has been earned.
- 'A' marks are given for a numerically correct stage, for a correct result or for an answer lying within a specified range. They are only given if the relevant M/m mark has been earned either explicitly or by inference from the correct answer.
- 'B' marks are independent of method and are usually awarded for an accurate result or statement.
- 'S' marks are awarded for strategy
- 'E' marks are awarded for explanation
- 'U' marks are awarded for units
- 'P' marks are awarded for plotting points
- 'C' marks are awarded for drawing curves

UNIT 1: NON-CALCULATOR, HIGHER TIER

GCSE Mathematics Unit 1 · Higher Tier	Mark	Comments
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7. (a)	1.23×10^{-1}	4	
		B2	B1 for a correct value not in standard form. e.g. 12.3×10^{-2}
(b)	5×10^{-4}	B2	B1 for a correct value not in standard form. e.g. 0.5×10^{-3}
		4	

12. (a) $16a^{12}$	$\frac{1}{2}$ B1	
(b) $\pm\sqrt{h^2 - a^2}$	B1 2	

Unit 1: Higher Tier		
13. (a) $x = 0.47878\dots$ and $100x = 47.878\dots$ with an attempt to subtract.	M1	Or $10x$ and $1000x$ with an attempt to subtract, or equivalent.
$474 / 990 \text{ ISW.}$	A1	An answer of $\frac{47.4}{99}$ gains M1 only.
(b) $16 - 4\sqrt{3} - 4\sqrt{3} + 3$ $= 19 - 8\sqrt{3}$ $a = 19$ AND $b = -8$	B1 B1 B1	F.T. for addition of at least two irrational numbers. C.A.O.
(c) $\frac{1}{9}$	B2 7	B1 for 9^{-1} or $\frac{1}{3^2}$ or $\frac{1}{\sqrt[3]{729}}$

<p>16.(a) (i) Indicates sequence as 'Miss', 'Miss', 'Hit'. $0.7 \times 0.7 \times 0.3$ $= 0.147$</p> <p>(ii) Indicates three possible situations HMM or MHM or MMH 0.441 Less than a 50% chance.</p> <p>(b) Indicates that the first ball selected is returned to the box before the second ball is selected OR the two attempts are independent.</p>	<p style="text-align: center;">4</p> <p>S1 M1 A1</p> <p>M1 A1 A1</p> <p>B1</p> <p style="text-align: center;">7</p>	<p>May be indicated by $0.3 \times 0.7 \times 0.7 \times 3$ or equivalent. F.T. 'their 0.147' $\times 3$ F.T. 'their 0.441'</p>
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