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Mark Scheme (Provisional)

Summer 2021

Pearson Edexcel International GCSE
Mathematics A (4MA1)
Paper 2H

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme.
  Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Types of mark

- M marks: method marks
- A marks: accuracy marks
- B marks: unconditional accuracy marks (independent of M marks)

Abbreviations

- cao – correct answer only
- ft – follow through
- isw – ignore subsequent working
- SC - special case
- oe – or equivalent (and appropriate)
- dep – dependent
- indep – independent
- eeoo – each error or omission

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- **No working**
  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.
- **With working**
  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.
  If a candidate misreads a number from the question. Eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review.
  If there is a choice of methods mark the one that leads to the answer on the answer line.
  If there is no answer given then mark the method that gives the lowest mark and award this mark.
  If there is no answer on the answer line then check the working for an obvious answer.
- **Ignoring subsequent work**
  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.
  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.
  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.
- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

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NOTES

Please note: [height =] 8 + 0.5 × 6 (=11)[metres] means we do not need to see 'height =' or 'metres' and if we see 8 + 0.5 × 6 we can award the method mark – and we can award the method mark if we see 11 without the working.

In the mark scheme, if we see a number written "82.5"(or "82.5") in speech marks it means the number can be a followed through value, gained from correct working but with an inaccurate result from this working. It does not mean that the student can use any value. If a student can use any previous value that has been stated, it will be made clear in the mark scheme.

When a certain degree of accuracy is requested in the question, students will normally be given the mark if they give this accuracy or better eg
Q6 asks for one decimal place which gives 10.4
The mark scheme says accept 10.4 – 10.42
Therefore full marks can be awarded for an unrounded answer such as 10.416
If in the working we saw 10.4 or 10.416 and then 10 on the answer line, we could award full marks.
If we did not see an answer in the range 10.4 – 10.42 and the answer of 10 was given then the student would not be able to gain the accuracy mark – as long as correct working was shown the response could be awarded the method marks. An answer of 10 (with no 10.4 – 10.42) with no working or incorrect working would gain no marks.
In most cases rounding instructions are for guidance only and we will accept the figure or better (more figures than specified). If we are insistent on certain rounding, this will be clearly stated in the mark scheme.

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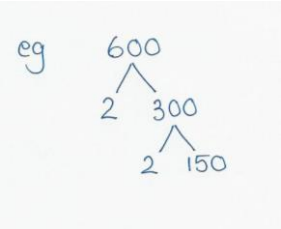
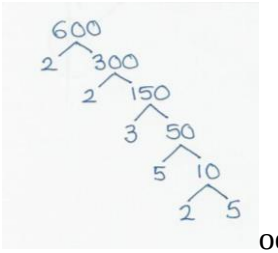
International GCSE Maths

Apart from questions 1, 2, 4b, 5, 8, 12d, 19, 21, 23 (where the mark scheme states otherwise) the correct answer, unless clearly obtained from an incorrect method, should be taken to imply a correct method.

Question	Working	Answer	Mark	Notes
1	eg $2 \times 2 \times 150$ **or** $3 \times 5 \times 40$ **or** $2 \times 3 \times 100$ **or** $5^2 \times 24$ **or**  **or** 2 | 600 2 | 300 | 150		3	M1 for at least 2 correct stages in prime factorisation which give 2 prime factors – may be in a factor tree or a table or listed eg 2, 2, 150 (see LHS for examples of the amount of work needed for the award of this mark, allow no more than one mistake ft (eg one mistake with 2 prime factors ft: $600 = 200 \times 30 = 2 \times 100 \times 5 \times 6$))
	eg $2 \times 2 \times 2 \times 3 \times 5 \times 5$  oe 2 | 600 2 | 300 2 | 150 3 | 75 5 | 25 5 | 5 | [1] oe			M1 for 2, 2, 2, 3, 5, 5 (ignore 1s) (may be a fully correct factor tree or ladder)
	Working required and note that the answer must be given as a product of powers of prime factors	$2^3 \times 3 \times 5^2$		A1 dep on M2 can be any order (allow $2^3 \,.\, 3 \,.\, 5^2$)
				Total 3 marks

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Question	Working	Answer	Mark	Notes
2	eg $\frac{18}{7}$ **and** $\frac{9}{8}$ oe		3	M1 both fractions expressed as improper fractions, no need for ÷ or × may be equivalent to those given eg $\frac{36}{14}$ or $\frac{27}{24}$ etc. A student could invert $\frac{9}{8}$ and show multiplication - as shown in the 2nd M1, this mark is then implied.
	eg $\frac{18}{7}\times\frac{8}{9}$ oe **or** oe $\frac{144}{56}\div\frac{63}{56}$			M1 **or** for both fractions expressed as equivalent fractions with denominators that are a common multiple of 7 and 8 eg $\frac{144}{56}\div\frac{63}{56}$
	eg $\frac{18}{7}\times\frac{8}{9}=\frac{144}{63}=\frac{16}{7}=2\frac{2}{7}$ **or** $\frac{18}{7}\times\frac{8}{9}=\frac{144}{63}=2\frac{18}{63}=2\frac{2}{7}$ **or** $\frac{\cancel{18}^{2}}{7}\times\frac{8}{\cancel{9}^{1}}=\frac{16}{7}=2\frac{2}{7}$ **or** $\frac{18}{7}\div\frac{9}{8}=\frac{144}{56}\div\frac{63}{56}=\frac{144}{63}=\frac{16}{7}=2\frac{2}{7}$ **or** correct working to $\frac{16}{7}$ **and** writing $2\frac{2}{7}=\frac{16}{7}$	shown		A1 Dep on M2 for conclusion to $2\frac{2}{7}$ from correct working – either sight of the result of the multiplication or division eg $\frac{144}{63}$ must be seen and then cancelled or correct cancelling prior to the multiplication to $\frac{16}{7}$ **or** writing $2\frac{2}{7}=\frac{16}{7}$ (maybe on first line of working) and correct working as far as LHS $=\frac{16}{7}$ **NB: use of decimals scores no marks**
				Total 3 marks

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Question	Working	Answer	Mark	Notes
3	180 + 149 **or** 360 − 31		2	M1
	Working not required, so correct answer scores full marks	329		A1
				Total 2 marks

Question		Working	Answer	Mark	Notes
4	(a)(i)	other seen orders of letters: a, b, d, e, i, l, n, r, z b, r, I, a, e, z, l, n, d	b, r, a, z, i, l, e, n, d	1	B1 no repeats, letters can be in any order. Condone capital letters rather than lower case letters. (no need for commas)
	(ii)		b, z	1	B1 No repeats, letters can be in any order. Condone capital letters. (no need for a comma)
	(b)		correct explanation that shows they know the meaning of intersection and empty set	1	B1 eg letter 'a' is in both sets $B \cap K = \{a\}$ Set *B* and set *K* have an element (or letter) in common. There is a letter that is in set *B* and in set *K* There is an intersection so it isn't the null set There is a letter in common (do **not** allow 'letters' or 'elements' (plural) in common) (If students mention the letter that is in common, it must be the correct one (ie a))
					Total 3 marks

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Question	Working	Answer	Mark	Notes
5	Angle *EBC* or *ECB* = (180 – 44) ÷ 2 (= 68)		5	M1 Could be seen on diagram
	Angle *GBC* = 180 – "68" (= 112) **or** Angle *GBC* = "68" + 44 (= 112) **or** Angle *BGH* = "68" (same as *EBC*) Angle *ABE* = 180 – "68" (= 112) **and** Angle *BGF* = "112" **or** Angle *ABG* = "68" **and** Angle *BGH* = "68" or Angle *FGJ* = "68" **or** Angle *BGF* = 180 – "68"(=112)			M1 for a method to as far as one step away from working out Angle *JGH* (an angle corresponding or vertically opposite to *JGH* or at the same point on a straight line with *JGH*) Could be seen on diagram. (the award of this mark also implies the previous M1)
	Working not required, so correct angle scores 3 marks (unless from obvious incorrect working)	112		A1 Could be seen in correct place on diagram
	NB: reasons must include the underlined words *Accept ∠ for angle(s) and △ for triangle* **For all angles**: They must be clearly stated as the correct angle or shown on the diagram in the correct position. (eg just seeing 68 in working without a label is not sufficient for the award of a mark for angle *EBC*)			B2 for correct answer with full reasons for their method eg isosceles triangle (or 2 equal sides, 2 equal angles) Angles in a triangle sum to 180° or angles in a triangle Angles on a straight line sum to 180° Angles on a straight line sum to 180° Exterior angle in a triangle is equal to the two opposite interior angles. Vertically opposite angles are equal. Vertically opposite angles are equal. Corresponding angles are equal. Alternate angles are equal Allied angles sum to 180° (or co-interior angles) Angles at a point (or full turn) add up to 360° (or angles at a point) (B1 for one correct reason appropriate to their method, dep on M1)
				Total 5 marks

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Question	Working	Answer	Mark	Notes	
6	19.35 ÷ (4 + 5) (= 2.15)		4	M1	M2 for $\frac{5}{9}\times 19.35 (=10.75)$
	"2.15" × 5 (= 10.75)			M1	
	$\frac{12-"10.75"}{12}\times 100$ oe **or** $100-\frac{10.75\times 100}{12}$ oe			M1	
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	10.4		A1 accept 10.4 – 10.42 SCB1 for $\frac{5}{9}\times 12 (=6.66...)$oe	
					Total 4 marks

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Question	Working	Answer	Mark	Notes
7	$\sin 42 = \frac{6.5}{x}$ **or** $\frac{x}{\sin 90} = \frac{6.5}{\sin 42}$ or $\cos 48 = \frac{6.5}{x}$ [where 48 = 180 – 90 – 42]		3	M1 **or** use of tan to find the horizontal side **and** then a correct first step in Pythagoras' theorem ie [base =] $\frac{6.5}{\tan 42} (= 7.21...)$ and [x^2 =] 6.5^2 + "7.21…"^{2}
	[x =] $\frac{6.5}{\sin 42}$ **or** $\frac{6.5 \sin 90}{\sin 42}$ **or** [x =] $\frac{6.5}{\cos 48}$ [where 48 = 180 – 90 – 42]			M1 **or** complete method using Pythagoras [x =] $\sqrt{6.5^2 + "7.21..."^2}$ (If students give this statement with nothing before it they gain M2)
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	9.7		A1 accept 9.7 – 9.72
				Total 3 marks

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Question	Working		Answer	Mark	Notes
8	eg $10a + 4c = 20$ $+ \ 2a - 4c = 7$ eg $[\, c = \frac{10 - 5a}{2} \,]$ oe $2a - 4\left(\frac{10 - 5a}{2}\right) = 7$ oe	eg $10a + 4c = 20$ $- \ 10a - 20c = 35$ eg $[\, a = \frac{7 + 4c}{2} \,]$ oe $5\left(\frac{7 + 4c}{2}\right) + 2c = 10$ oe		3	M1 multiplication of one or both equation(s) with correct operation selected (allow one arithmetic error) (if + or – is not shown then assume it is the operation that at least 2 of the 3 terms have been calculated for) **or** correct rearrangement of one equation with substitution into second
	eg $5 \times$ "2.25" $+ 2c = 10$ **or** $2 \times$ "2.25" $- 4c = 7$	eg $5a + 2 \times$ "−0.625" $= 10$ **or** $2a - 4 \times$ "−0.625" $= 7$			M1 (dep on previous M1 but not on a correct first value) correct method to find second unknown – this could be a correct substitution into one of the equations given or calculated or starting again with the same style of working as for the first method mark
	Working required		$a = 2.25$ $c = -0.625$		A1 oe eg $a = \frac{9}{4}$, $c = -\frac{5}{8}$ for both solutions dependent on first M1
					Total 3 marks

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Question		Working	Answer	Mark	Notes
9	(i)	$(x \pm 6)(x \pm 4)$		2	M1 or $(x + a)(x + b)$ where $ab = -24$ **or** $a + b = 2$
		Working not required, so correct answer scores full marks	$(x + 6)(x - 4)$		A1
	(ii)	*Answer must come from the factors in (i) as the questions says 'Hence solve…'*	$-6, 4$	1	B1ft **Must** follow through from their factors in (i), so even if the answers 4 and –6 are given the mark can only be awarded if it follows from the factorisation in (i) (dep on 2 factors)
					Total 3 marks
					NB: Some students may show the whole of their working in the space for (i) or (ii). Please award the marks for (i) and (ii) so long as there is no ambiguity.

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Question	Working	Answer	Mark	Notes
10	$11.2^2 - 7.4^2$ (= 70.68) or $[x =]\cos^{-1}\left(\frac{7.4}{11.2}\right)(= 48.64...)$ or $[y =]\sin^{-1}\left(\frac{7.4}{11.2}\right)(= 41.35...)$ or $\sin^{-1}\left(\frac{7.4\sin 90}{11.2}\right)$		5	M1 A correct first stage to finding the perpendicular height of the triangular cross section
	eg $\sqrt{11.2^2 - 7.4^2}$ (= 8.407...) **or** $[h =]\sin"48.64..."\times 11.2$ **or** $\tan"48.64..."\times 7.4(= 8.407...)$ **or** $[h =]\cos"41.35..."\times 11.2$ **or** $\frac{7.4}{\tan"41.35..."}$ (=8.407…)			M1 oe eg $h = \frac{11.2\sin"48.64..."}{\sin 90}$
	eg 7.4 × "8.407" ÷ 2 (= 31.10....) **or** 7.4 × "8.407" × 15 (= 933.19...)			M1 for method to find area of cross section **or** volume of cuboid
	eg "31.10" × 15 (= 466.59...) **or** "933.19" ÷ 2 (= 466.59...)			M1 complete method to find volume of the prism
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	467		A1 accept 466 – 467 SCB2 (if M0 awarded) for $0.5 \times 7.4 \times \sqrt{11.2^2 + 7.4^2} \times 15$ (= 745) **or** SCB1 (if M0 awarded) for $7.4 \times \sqrt{11.2^2 + 7.4^2} \times 15$ (= 1490) or $0.5 \times 7.4 \times \sqrt{11.2^2 + 7.4^2}$ (=49.6…) or 0.5 × 7.4 × 11.2 × 15 (= 621.6) or 622
				Total 5 marks

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Question	Working	Answer	Mark	Notes		
11(a)	eg 100 + 24 (=124 [%]) **or** 1 + 0.24 (= 1.24) **or** $\frac{180000}{124}(=1451.6...)$		3	M1		
	eg 180 000 ÷ 1.24 180 000 ÷ 124 × 100 or 180 000 × 100 ÷ 124 oe			M1	for a complete method	
	Working not required, so correct answer scores full marks (unless from obvious incorrect working) *NB: this question is one where students could misread the number of zeros(eg one too many or one too few) in the question, up to M2 could be awarded if a correct method is seen with this misread*	145 000		A1	accept 145 000 − 145 200 (if a correct answer is seen in working and then rounded incorrectly, award full marks) (if no marks awarded, SCB1 for 223 200 or 223 000)	
(b)	for 0.018 × 120 000 oe **or** 2160 **or** 1.018 × 120 000 oe **or** 122 160		3	M1	For finding 1.8% or 101.8% of the value	**OR** M2 for 120 000 × 1.018^3 **or** 120 000 × 1.018^4 **or** 128 876.09
	1.018 × "122 160" (= 124 358.88) oe **and** 1.018 × "124 358.88" (= 126 597.34) oe			M1	for completing the method	(M1 for 120 000 × 1.018^2 **or** 124 358.88)
	Working not required, so correct answer scores full marks (unless from obvious incorrect working) *NB: this question is one where students could misread the number of zeros in 120 000 (eg one too many or one too few) in the question, up to M2 could be awarded if a correct method is seen with this misread*	127 000		A1	or 126 597 – 126 600 (if a correct answer is seen in working and then rounded incorrectly, award full marks) **SC:** if no other marks gained award M1 for 1.054 × 120 000 oe **or** 126 480 **or** 6 480 (accept (1 + 0.018) as equivalent to 1.018 throughout)	
						Total 6 marks

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Question		orking	Answer	Mark	Notes	
12	(a)			2	M1	for at least 4 points plotted correctly at end of interval **or** for all points plotted consistently within each interval of the associated frequency table (eg at 2.5, 7.5, 12.5, 17.5, 22.5, 27.5 or 0, 5, 10, 15, 20, 25) at the correct height
		(NB: a 'bar chart' type graph scores zero marks)	correct cf graph		A1	All points plotted correctly at end of interval (tolerance 1 small square) and joined with a curve or line segments accept curve that is not joined at (0, 0).
	(b)	If answer is in the given range, then award the mark – unless from obvious incorrect working	10.5 to 12	1	B1ft	accept answer in range 10.5 – 12 or ft *their* cumulative frequency graph (must be an ascending graph) (allow 1 small square tolerance)
	(c)	NB: readings are 5.5 – 7 and 15.5- 17 (but for this M1 these do not have to be correct if correct working is shown – eg lines or marks indicating use of CF 20 (or 20.25)and CF 60 (or 60.75) with an indication on the Distance axis at the correct points (or they can just show the correct readings))		2	M1ft	For correct use of LQ and UQ, ft from a cum freq graph provided method is shown – eg a line horizontally to the graph from readings of CF 20 and CF 60 to meet the graph and then a vertical line to the Distance axis(even if wrongly read scale) **or** clear marks on the graph and Distance axis that correspond to the correct readings **or** correct values from the Distance axis
		If answer is in the given range, then award the marks – unless from obvious incorrect working	8.5 to 11.5		A1ft	Accept a single value in range 8.5 to 11.5 or ft from their cumulative frequency graph provided method is shown
	(d)	**not in context**: office *B* workers have a higher median than office *A* workers oe **in context**: office *B* workers [tend to] travel further oe		2	B1	ft comparison of medians e.g. Office *B* workers travel further [but if they have a wrong median then correct comparison of this with the 15 km] (Must compare to median in (b))
		not in context: the IQR for office *A* workers is bigger than the IQR for office *B* workers oe **in context**: The distances for the office *A* workers are more spread out/more varied oe			B1	ft comparison of IQR eg Office *A* distances are more spread (must compare to IQR in (c)) **NB: To award both marks at least one comparison must be in context**
						Total 7 marks

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Question		Working	Answer	Mark	Notes
13	(a)		0.3		B1 oe first race branch correct
			0.6, 0.4, 0.6	2	B1 oe second race branches correct
	(b)	0.7 × "0.6" (= 0.42) oe **or** "0.3" × "0.4" (= 0.12) oe **or** 0.7 × 0.4 (= 0.28) oe **or** "0.3" × "0.6" (= 0.18) oe			M1 ft their tree diagram dep on probabilities being less than 1
		"0.42" + "0.12" oe **or** 1 – "0.28" – "0.18"oe			M1 ft complete method to find probability that Emilie wins exactly one of the races
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	0.54	3	A1 oe, eg $\frac{27}{50}$ ft from their tree diagram on M marks only
	(c)	0.7 × 0.4 × (1 – 0.6) (= 0.112) oe **or** "0.54" × 0.3 (= 0.162) oe **or** $0.7\times"0.6"\times0.3+"0.3"\times"0.4"\times0.3(=0.162)$			M1 ft
		eg "0.112" + "0.162"			M1 ft For a fully correct method
		Working not required, so correct answer scores full marks (unless from obvious incorrect working) *NB: allow decimals, fractions or percentages with % as oe for probability*	0.274	3	A1 oe, eg $\frac{137}{500}$ ft from (a) and (b) on M marks only
					Total 8 marks

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Question	Working	Answer	Mark	Notes
14		$\frac{4y^5}{3x^2}$	3	B3 Accept $\frac{4}{3}x^{-2}y^5$ or $\frac{4x^{-2}y^5}{3}$ or $1.\dot{3}x^{-2}y^5$ oe NB: Must see 4 and 3 and not $16^{\frac{1}{2}}$ or $9^{\frac{1}{2}}$ or $16^{-\frac{1}{2}}$ or $9^{-\frac{1}{2}}$ (allow use of 1.3[33..])
				If not B3 then B2 for 2 of: correct fraction ($\frac{4}{3}$ *or* $1.\dot{3}$)(allow use of 1.3[33..]) **or** *x* term correct **(** x^2 on denominator or x^{-2} on numerator) **or** *y* term correct $(y^5$ on numerator or y^{-5} on denominator)
				If not B2 then **B1** for 1 of : correct fraction **or** *x* term correct **or** *y* term correct **or** for one of applying negative power to at least 3 out of 4 of 9, x^4, 16, y^{10} **or** applying square root to at least 3 out of 4 of 9, x^4, 16, y^{10} eg at least 3 of the 4 parts of $\frac{16y^{10}}{9x^4}$ **or** $\frac{16x^{-4}}{9y^{-10}}$ **or** $\frac{\frac{1}{9}x^{-4}}{\frac{1}{16}y^{-10}}$ **or** $\frac{3x^2}{4y^5}$ oe
				Total 3 marks

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Question	Working	Answer	Mark	Notes
15 (a)		8.5, 5, 4, 5	2	B2 all 4 correct (allow eg 5.0 for 5) (B1 for 2 or 3 correct)
(b)				M1 ft their table dep on B1 scored in (a) for 5 or 6 points plotted correctly (tolerance 1 small square)
		fully correct graph	2	A1 A fully correct graph – correct points plotted correctly (within tolerance of 1 small square) and intention to join with a smooth curve (be generous if intention is clearly a smooth curve through all points)
				NB: If a student has nothing in the table for part (a) but draws a fully correct graph in part (b) award the marks in part (a)
				Total 4 marks

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Question	Working	Answer	Mark	Notes
16 (a)	$A = \frac{k}{r^2}$		3	M1 oe k can be any letter (must be a letter and not 1)
	$5 = \frac{k}{0.3^2}$ oe **or** k = 0.45 oe			M1 implies first M1 if you see this stage
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$A = \frac{0.45}{r^2}$		A1 oe with A as the subject eg $A = \frac{9}{20r^2}$ (allow $A = \frac{k}{r^2}$ where k = 0.45 oe) (SC if M0 scored then award B2 for $A \propto \frac{0.45}{r^2}$ oe)
(b)	$[A =] \frac{"0.45"}{(7.5A)^2}$ oe **or** $\frac{"0.45"}{56.25A^2}$ **or** $\frac{9}{20(7.5A)^2}$ oe		3	M1 ft from (a) dep on M2 in (a) ($[A =] \frac{"0.45"}{7.5A^2}$ is zero marks unless recovered later)
	$A^3 = \frac{"0.45"}{56.25}$ ($A^3 = \frac{1}{125}$ or 0.008 oe) or $125\,A^3 = 1$ oe			M1 ft their 0.45 dep on M2 in (a) Must include A^3
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	0.2		A1 oe
				Total 6 marks

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Question	Working	Answer	Mark	Notes
17	eg $\frac{4-(-1)}{6-4}$ $(=\frac{5}{2}=2.5)$		4	M1 for a method to find the gradient of **L**
	eg $\frac{-1}{"2.5"}$ $(=-\frac{2}{5}=-0.4)$ or $\frac{-1}{\textit{their}\ \text{gradient}}$ oe			M1 ft for a method to find the gradient of **M** if *their* gradient of **L** clearly stated (even if no method shown for gradient of **L**)
	$y =$ "-0.4"$x + 8$ oe eg $y-8=-\frac{2}{5}(x-0)$ **or** $(8 \div 2) \times 5$ $(= 20)$ oe **or** $8 \div$ ('*their gradient of* **M**')			M1 dep on previous M1 for substitution of (0, 8) into equation for a line **or** use of $(8 \div 2) \times 5$ $(= 20)$ (maybe on diagram) NB: 20 gains M3 if clearly intended as x coordinate (stated or on a diagram)
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	(20, 0)		A1
				Total 4 marks

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Question	Working	Answer	Mark	Notes
18	[*ADC* =] 180 – 98 (= 82)		6	M1 may be seen on diagram
	$[AC^2 =]8^2 + 7.5^2 - 2\times 8\times 7.5\times\cos(98)\,(=136.95...)$			M1 correct equation for *AC* or AC^2
	$[AC =]\sqrt{"136.95"}$ **or** $\sqrt{64+56.25+16.7....}(=11.7...)$ oe			M1 complete method to find *AC* showing correct order of operations
	eg $[[AD =]\frac{"11.7"\sin 35}{\sin"82"}(=6.77..)$ **or** $[DC =]\frac{"11.7"\times\sin"63"}{\sin"82"}$ (=10.5..)oe (where **"82" = 180 – 98** , "63" = 180 – "82" – 35)			M1 correct calculation for *AD* **or** *DC* dep on 1st M1 and 2nd M1
	eg $[AD =]\frac{"11.7"\sin 35}{\sin"82"}$ **and** $[DC =]\frac{"11.7"\sin"63"}{\sin"82"}$ oe **or** $[AD =]\frac{"11.7"\sin 35}{\sin"82"}$ **and** $[DC =]\sqrt{"11.7"^2+"6.77"^2-2\times"11.7"\times"6.77"\times\cos"63"}$ $[DC =]\frac{"11.7"\sin"63"}{\sin"82"}$ **and** $[AD =]\sqrt{"11.7"^2+"10.5"^2-2\times"11.7"\times"10.5"\times\cos 35}$ Where "63" = 180 – "82" – 35			M1 correct calculations for *AD* **and** *DC* (*AD* = 6.77... *DC* = 10.5...) dep on 1st M1 and 2nd M1
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	32.8		A1 accept 32.7 – 32.9
				Total 6 marks

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Question	Working		Answer	Mark	Notes	
19	$x^2+(3-2x)^2=18$	$\left(\frac{3-y}{2}\right)^2+y^2=18$		5	M1	substitution of linear equation into quadratic
	$5x^2-12x-9[=0]$ oe	$5y^2-6y-63[=0]$ oe			M1	simplified to a correct 3 term quadratic
	$(5x+3)(x-3)\ [=0]$ $\frac{-(-12)\pm\sqrt{(-12)^2-4\times5\times(-9)}}{2\times5}$ $5[(x-\frac{12}{10})^2-\frac{144}{100}]-9=0$ oe	$(5y-21)(y+3)\ [=0]$ $\frac{-(-6)\pm\sqrt{(-6)^2-4\times5\times(-63)}}{2\times5}$ $5[(y-\frac{6}{10})^2-\frac{36}{100}]-63=0$ oe			M1ft	dep on M1 for solving *their* 3 term quadratic equation using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error and some simplification – allow as far as $\frac{12\pm\sqrt{144+180}}{10}$ or $\frac{6\pm\sqrt{36+1260}}{10}$)(if completing the square allow as far as shown)
			$x=-0.6$ **and** $x=3$ **OR** $y=4.2$ **and** $y=-3$		A1	oe dep on M2 for both x-values **OR** both y-values
	Working must be shown		$x=-0.6$, $y=4.2$ $x=3$, $y=-3$		A1	oe dep on M2 (must be clearly shown as correct pairs), accept answers given as coordinates
						Total 5 marks

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Question	Working	Answer	Mark	Notes
20	eg $\sqrt{\frac{36}{25}}\left(=\frac{6}{5}\right)$ **or** $\sqrt{\frac{25}{36}}\left(=\frac{5}{6}\right)$ **or** $\sqrt{36}:\sqrt{25}\ (6:5)$ **or** $\sqrt{25}:\sqrt{36}\ (5:6)$ **or** $\frac{(\sqrt{25})^3}{(\sqrt{36})^3}=\left(\frac{125}{216}\right)$ oe **or** $\frac{36^3}{25^3}=\frac{(\text{vol of large})^2}{300^2}$ **or** $\frac{36}{25}=\frac{(\text{vol of large})^{\frac{2}{3}}}{300^{\frac{2}{3}}}$ oe		3	M1 for a correct scale factor for length – may be given as a fraction or ratio **or** a correct scale factor for volume given as a fraction or ratio **or** a correct equation for the volume of each large block
	eg $300\times\left("\frac{6}{5}"\right)^3$ **or** $300\div\left("\frac{5}{6}"\right)^3$ oe **or** $\sqrt{\frac{300^2\times36^3}{25^3}}$ **or** $\left(\frac{36\times300^{\frac{2}{3}}}{25}\right)^{\frac{3}{2}}$ oe			M1 for a complete method to find the volume of a large block
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	518.4		A1 allow 518
				Total 3 marks

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Question	Working	Answer	Mark	Notes
21	$\left[\frac{dy}{dx} =\right] 2\times kx - 16x^{-2}$ **or** $2kx - \frac{16}{x^2}$ oe		5	M2 for both terms differentiated correctly (M1) for one term differentiated correctly
	"$2kx - 16x^{-2}$" $= 0$ oe			M1 ft dep on M1
	eg $\frac{8}{27}k = 8$ or $\frac{4}{3}k = 36$ or $k = 27$ oe			M1 (not ft) for substituting $x = \frac{2}{3}$ into their correct equation for k and getting as far as one step from the value of k or the correct value of k
	Working must be seen	36		A1 dep on M4
				Total 5 marks

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Qu	Working	Answer	Mark	Notes
22	[g(x) =] $2(x-3)^2-5$		4	B2 for $a = 2$, $b = 3$ and $c = 5$ correct (stated or shown) (B1 for one of $a = 2$, $b = 3$ and $c = 5$ correct)
	stretch y direction scale factor 2 oe [ft their a] **or** translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ (ft correct use of their b and c) oe			M1 **Stretch** and a correct description of the stretch **or translation** and a correct description of the translation NB: must include the word translation (or translate) and stretch
		Correct transformations in correct order		A1 Stretch y direction scale factor 2 **followed by** translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ oe eg translation $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$, stretch SF2 in y direction followed by translation $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$
				Total 4 marks
22 Alt	[g(x) =] $2(x-3)^2-5$		4	B2 for $a = 2$, $b = 3$ and $c = 5$ correct (stated or shown) (B1 for one of $a = 2$, $b = 3$ and $c = 5$ correct)
	translation $\begin{pmatrix} 3 \\ -2.5 \end{pmatrix}$ (ft correct use of their b and $0.5c$) oe **or** stretch y direction scale factor 2 (ft their a)			M1 A correct description of the stretch **or** the translation
		Correct transformations in correct order		A1 Translation $\begin{pmatrix} 3 \\ -2.5 \end{pmatrix}$ oe **followed by** stretch y direction scale factor 2
				Total 4 marks

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23	eg $\dfrac{\left(\dfrac{N+3}{2}\right)}{N}\left(=\dfrac{N+3}{2N}\right)$	eg where b = number of black pens $\dfrac{b}{2b-3}$ **or** $\dfrac{b}{N}$ **and** $N = 2b-3 (\text{or } b = \dfrac{N+3}{2})$	eg where r = number of red pens $\dfrac{r+3}{2r+3}$ **or** $\dfrac{r+3}{N}$ **and** $N = 2r+3 (\text{or } r = \dfrac{N-3}{2})$		5	M1	for making a correct start by finding the probability of the first pen being black for their method. If in 2 variables, one must also be defined in terms of the other. (any letter may be used for the variable)
	eg $\dfrac{N+3}{2N} \times \dfrac{N-3}{2(N-1)} = \dfrac{9}{35}$	eg $\dfrac{b}{2b-3} \times \dfrac{b-3}{2b-4} = \dfrac{9}{35}$ **or** $\dfrac{b}{N} \times \dfrac{b-3}{N-1} = \dfrac{9}{35}$	eg $\dfrac{r+3}{2r+3} \times \dfrac{r}{2r+2} = \dfrac{9}{35}$ **or** $\dfrac{r+3}{N} \times \dfrac{r}{N-1} = \dfrac{9}{35}$ **and** $N = 2r+3$			M1	oe dep on previous M1 for a correct equation for black, red – must be in one variable or if 2 variables, one must be defined in terms of other.
	eg $35(N + 3)(N – 3) = 9(2N(2N – 2))$ **or** $35(N^2 – 9) = 9(4N^2 – 4N)$	eg $35(b^2 – 3b) = 9(4b^2 – 14b + 12)$	eg $35(r^2 + 3r) = 9(4r^2 + 10r + 6)$			M1	dep on previous marks for a correct equation in one variable with no algebraic fractions – brackets may or may not be expanded
	eg $N^2 – 36N + 315 (= 0)$	eg $b^2 – 21b + 108 (= 0)$	eg $r^2 – 15r + 54 (= 0)$			M1	For correctly rearranging their equation to a 3 term quadratic
	Working must be seen				21, 15	A1	cao dep on M4
							Total 5 marks

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