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Mark Scheme (Results)

June 2025

Pearson Edexcel International GCSE  
Mathematics A (4MA1) Paper 1HR

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Summer 2025

Log Number P75660

Publications Code 4MA1\_1HR\_2506\_MS

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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.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- 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
- awrt – answer which rounds to
- eeoo – each error or omission

- **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 shown, mark the method that leads to the answer on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.

If there is no answer on the answer line then check the working for an obvious answer.

- **Ignoring subsequent work**

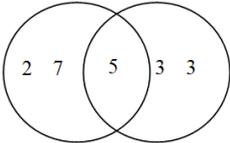
It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

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 to another.

International GCSE Maths										
Values in quotation marks must come from a correct method previously seen unless clearly stated otherwise.										
Q	Working	Answer	Mark	Notes						
1	<p>45, 90, 135, 180... <b>and</b> 70, 140, 210, 280...</p> <p><b>or</b> 2, 5, 7 <b>and</b> 3,3,5</p> <p><b>or</b></p>  <p><b>or</b> <math>\frac{45 \times 70}{5}</math> <b>or</b> 2, 3, 3, 5, 7 oe</p> <p><b>or</b></p> <table border="1" data-bbox="436 614 884 710"> <tr> <td>5</td> <td>45</td> <td>70</td> </tr> <tr> <td></td> <td>9</td> <td>14</td> </tr> </table> <p><b>or</b> 5, 9, 14 oe</p>	5	45	70		9	14		2	<p>M1 for any correct valid method eg</p> <p>for starting to list at least <b>four</b> multiples of each number</p> <p><b>or</b> 2, 5, 7 and 3, 3, 5 seen (may be in a factor tree, ignore 1)</p> <p><b>or</b> a fully correct Venn diagram</p> <p><b>or</b> 5, 9, 14 oe (could be in a table)</p>
5	45	70								
	9	14								
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	630		A1 Allow $2 \times 3^2 \times 5 \times 7$ oe eg $5 \times 9 \times 14$						
			<b>Total 2 marks</b>							

2	(i)		142.75	1	B1
	(ii)		142.85	1	B1 accept 142.8499... or 142.849
			<b>Total 2 marks</b>		

3	eg $\frac{9}{4}$ <b>and</b> $\frac{12}{7}$		3	M1 for $2\frac{1}{4}$ and $1\frac{5}{7}$ expressed as improper fractions
	eg $\frac{9}{4} \times \frac{12^3}{7}$ <b>OR</b> $\frac{9}{4} \times \frac{12}{7} = \frac{108}{28}$ oe eg $\frac{63}{28} \times \frac{48}{28} = \frac{3024}{784}$			M1 correct cancelling or multiplication of numerators and denominators without cancelling
	eg $\frac{9}{4} \times \frac{12^3}{7} = \frac{27}{7} = 3\frac{6}{7}$ <b>or</b> $\frac{9}{4} \times \frac{12}{7} = \frac{108}{28} = \frac{27}{7} = 3\frac{6}{7}$ <b>or</b> $\frac{9}{4} \times \frac{12}{7} = \frac{108}{28} = 3\frac{24}{28} = 3\frac{6}{7}$ <b>or</b> $\frac{9}{4} \times \frac{12}{7} = \frac{63}{28} \times \frac{48}{28} = \frac{3024}{784} = \frac{27}{7} = 3\frac{6}{7}$ <b>or</b> $\frac{9}{4} \times \frac{12}{7} = \frac{63}{28} \times \frac{48}{28} = \frac{3024}{784} = 3\frac{672}{784} = 3\frac{6}{7}$ <b>or</b> correct working to $\frac{27}{7}$ <b>and</b> writing $3\frac{6}{7} = \frac{27}{7}$  <i>Working required</i>	shown		A1 dep on M2, for conclusion to $3\frac{6}{7}$ from correct working – either sight of the result of the multiplication e.g. $\frac{108}{28}$ oe must be seen <b>or</b> correct cancelling prior to the multiplication to $\frac{27}{7}$  NB: use of decimals scores no marks unless as a check
				<b>Total 3 marks</b>

4 (a)		0.7	1	<p>B1 oe eg <math>\frac{7}{10}</math> oe or 70% or <math>\frac{0.7}{1}</math></p> <p>If probabilities are given as percentages then % sign must be seen</p>
(b)	<p>eg  <math>1 - (0.12 + 0.2 + 0.38) (= 0.3)</math> oe  <b>or</b> <math>1 - \text{"0.7"} (= 0.3)</math> oe  <b>or</b> <math>0.12 + 0.20 + 0.38 + 4x + x = 1</math> oe  <b>or</b> <math>\text{"0.7"} \times 350 (= 245)</math> oe  <b>or</b> <math>0.12 \times 350 (= 42)</math>  <b>or</b> <math>0.38 \times 350 (= 133)</math></p>		4	<p>M1 ft their "0.7"</p> <p>If probabilities are given as percentages then % sign must be seen</p>
	<p>eg  <math>\text{"0.3"} \div 5 (= 0.06)</math> <b>or</b> <math>\text{"0.3"} \div 5 \times 4 (= 0.24)</math> <b>or</b> 0.24  <b>or</b> <math>(x =) 0.06</math> <b>or</b> <math>(4x =) 0.24</math>  <b>or</b> <math>\text{"0.3"} \times 350 (= 105)</math> oe  <b>or</b> <math>350 - \text{"245"} (= 105)</math> oe  <b>or</b> <math>350 - \text{"42"} - 0.2 \times 350 - \text{"133"} (=105)</math> oe</p>			M1
	<p>eg  <math>\text{"0.06"} \times 350 (= 21)</math> oe  <b>or</b> <math>\text{"105"} \div 5 (= 21)</math> oe  <b>or</b> <math>\text{"0.06"} \times 4 \times 350</math> oe <b>or</b> <math>\text{"0.24"} \times 350</math></p>			M1 or for $\frac{21}{350}$ or $\frac{84}{350}$
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	84		A1 cao
				<b>Total 5 marks</b>

<b>5</b>	(a)(i)		2, 3, 4, 6, 8, 9, 10, 12	1	B1
	(ii)		1, 2, 4, 5, 7, 8, 10, 11	1	B1
	(b)(i)		$\emptyset$	1	B1
	(ii)		$\notin$	1	B1
					<b>Total 4 marks</b>

<b>6</b>	(a)		$-2 < x \leq 1$	2	B2 accept $1 \geq x > -2$ <b>or</b> $x > -2, x \leq 1$ if not B2 then B1 for $-2 < x$ <b>or</b> $x \leq 1$ <b>or</b> $-2 \leq x < 1$ <b>or</b> $-2 \leq x \leq 1$ <b>or</b> $-2 < x < 1$ Condone use of a variable other than $x$ but not 0
	(b)	$7a - 3a \leq 28 + 5$ <b>or</b> $4a \leq 33$ <b>or</b> $-5 - 28 \leq 3a - 7a$ <b>or</b> $-33 \leq -4a$		2	M1 for $a$ terms on one side and numbers on the other. Condone = rather than $\leq$ or any other sign for this mark.
		<i>Working required</i>	$a \leq 8.25$		A1 (dep on M1) oe eg $a \leq \frac{33}{4}$ <b>or</b> $a \leq 8\frac{1}{4}$ <b>or</b> $8.25 \geq a$ must have correct sign on answer line (sight of correct answer in working space and just 8.25 on answer line gains M1 only).
					<b>Total 4 marks</b>

7	$50x \div 1000 (= 0.05x)$ oe <b>or</b> $50x \times 60 \times 60 (= 180\,000x)$ oe <b>or</b> $50x \div \frac{1}{3600} (= 180\,000x)$ oe  <b>or</b> $50x \div 1000 \times 60 (= 3x)$ <b>or</b> $\frac{3600}{1000}$ or $\frac{18}{5}$ or 3.6 <b>or</b> $\frac{1000}{3600}$ or $\frac{5}{18}$ or 0.277(77...)		3	M1 Condone omission of $x$ for this mark
	eg $\frac{50x \times 60 \times 60}{1000}$ oe <b>or</b> $50x \times 3.6$ oe <b>or</b> $50x \div \frac{1000}{3600}$ oe <b>or</b> 180			M1 for a complete method including $x$ <b>or</b> for an answer of 180
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	180x		A1
				<b>Total 3 marks</b>

<b>8</b>	(a)		$a^{16}$	1	B1
	(b)		$c^{18}$	1	B1
	(c)(i)			2	M1 for $(y \pm 3)(y \pm 7)$ or for $(y \pm a)(y \pm b)$ with $ab = 21$ or $a + b = -10$
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$(y - 3)(y - 7)$		A1 for correct factors
	(ii)		3, 7	1	B1 ft dep on factorising in the form $(y \pm p)(y \pm q)$
					<b>Total 5 marks</b>

9	eg $\tan 24 = \frac{6.5}{QR}$ <b>or</b> $\frac{6.5}{\sin 24} = \frac{QR}{\sin(180-90-24)}$ oe <b>or</b> $\tan(180-90-24) = \frac{QR}{6.5}$ <b>or</b> $(PR =) \frac{6.5}{\sin 24} (=15.9\dots)$ <b>and</b> $6.5^2 + QR^2 = 15.9^2$		3	M1 for setting up a trig equation in $QR$ <b>or</b> for a complete method to find $PR$ <b>and</b> then setting up Pythagoras or trig equation for $QR$
	eg $(QR =) \frac{6.5}{\tan 24}$ <b>or</b> $(QR =) \frac{6.5}{\sin 24} \times \sin 66$ <b>or</b> $(QR =) 6.5 \tan 66$ [where $66 = 180 - 90 - 24$ ] <b>or</b> $(QR =) \sqrt{15.9^2 - 6.5^2}$			M1 for a complete method
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	14.6		A1 accept 14.5 – 14.61
				<b>Total 3 marks</b>

<b>10</b>	(volume of water =) $9 \times 35 \times 28 (= 8820)$ <b>or</b> (total volume of cuboid =) $20 \times 35 \times 28 (= 19600)$ <b>or</b> (volume of space =) $(20 - 9) \times 35 \times 28 (= 10780)$		3	M1 for a method to find a relevant volume for the cuboid										
	$\pi \times 10^2 \times 33 (= 3300\pi \text{ or } 10367(.25\dots))$ oe			M1 (indep) for a method to find the volume of the cylinder, accept a volume in the range 10362 to 10368.6 Allow 3.14... or $\frac{22}{7}$ for $\pi$										
	(total volume of water =) “8820” + “10367(.25...)” (= 19187(.25...)) (difference between volumes of both solids =) “19600” – “10367(.25...)” (= 9232(.74...)) (volume not filled =) “19600” – “8820” – “10367(.25...)” (=412(.74...))  <i>Working required</i>	Shown		A1 correct workings with accurate figures eg <table border="1" data-bbox="1641 624 2033 1150" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Value 1</th> <th>Value 2</th> </tr> </thead> <tbody> <tr> <td>10780</td> <td>10367(.25...) accept 10362 to 10372</td> </tr> <tr> <td>19600</td> <td>19187(.25...) accept 19182 to 19192</td> </tr> <tr> <td>8820</td> <td>9232(.74...) accept 9228 to 9238</td> </tr> <tr> <td>412(.74...) or 413 accept 408 to 418</td> <td>none needed</td> </tr> </tbody> </table>	Value 1	Value 2	10780	10367(.25...) accept 10362 to 10372	19600	19187(.25...) accept 19182 to 19192	8820	9232(.74...) accept 9228 to 9238	412(.74...) or 413 accept 408 to 418	none needed
Value 1	Value 2													
10780	10367(.25...) accept 10362 to 10372													
19600	19187(.25...) accept 19182 to 19192													
8820	9232(.74...) accept 9228 to 9238													
412(.74...) or 413 accept 408 to 418	none needed													
				<b>Total 3 marks</b>										

<b>11</b>	$2500 \div 20 \times 3 (= 375)$ oe <b>or</b> $125 \times 3 (=375)$ <b>or</b> $7500 \div 20 (= 375)$ $3000 \div 20 \times 3 (= 450)$ oe <b>or</b> $150 \times 3 (= 450)$ <b>or</b> $9000 \div 20 (= 450)$		5	M1 for a method to find the interest for Bank A 2875 or 3450 implies this method mark	
	for $0.04 \times 3000$ oe (= 120) or $0.04 \times 2500$ oe (= 100) <b>or</b> $1.04 \times 3000$ oe (= 3120) or $1.04 \times 2500$ oe (= 2600)	<b>OR</b> $3000 \times 1.04^2$ (= 3244.8) <b>or</b> $2500 \times 1.04^2$ (=2704)		M1 for finding 4% <b>or</b> 104% of 3000 or 2500	<b>OR</b> M2 for $3000 \times 1.04^2$ (= 3244.8) <b>or</b> $2500 \times 1.04^2$ (=2704)
	$1.04 \times "3120"$ oe (= 3244.8) $1.04 \times "2600"$ oe (= 2704)			M1 for completing method to find the total amount for Bank B	<b>or</b> $3000 \times 1.04^3$ (= 3374.59) <b>or</b> $2500 \times 1.04^3$ (= 2812.16)
	eg "3244.8" – 3000 (= 244.8) <b>or</b> "2704" – 2500 (= 204)			M1 for a complete method to find the interest for Bank B	
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	130.2(0)		A1	
					<b>SC:</b> if none of the 2 <sup>nd</sup> or 3 <sup>rd</sup> M marks gained award SCM1 for $0.08 \times 3000$ oe <b>or</b> 240 <b>or</b> $1.08 \times 3000$ <b>or</b> 3240 <b>or</b> $0.08 \times 2500$ oe <b>or</b> 200 <b>or</b> $1.08 \times 2500$ <b>or</b> 2700 <b>or</b> $3000 \times (1 - 0.04)^2$ (= 2764.8(0)) <b>or</b> $2500 \times (1 - 0.04)^2$ (= 2304)
					accept $(1 + 0.04)$ or $\left(1 + \frac{4}{100}\right)$ as equivalent to 1.04 throughout
				<b>Total 5 marks</b>	

<b>12</b>	(a)		12, 27, 47, 65, 74, 80	1	B1
	(b)			2	M1 ft from table for at least 5 points plotted correctly at end of interval <b>or</b> ft from sensible table (ft from a table with only one arithmetic error that may be continued through table) for all 6 points plotted consistently within each interval in the <b>freq table</b> at the correct height
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	correct cf graph		A1 accept curve or line segments accept curve that is not joined at (10, 0)
	(c)			3	M1ft a line up from 46 to their graph <b>and</b> a line across to the vertical axis <b>or</b> a mark on the curve at the correct point <b>and</b> a mark on the vertical axis at the correct point <b>or</b> a reading of 57 - 59 from their cf graph <b>or</b> a value of 21 – 23 <b>or</b> a correct value for their graph must be ascending (could be a lobj)
		eg (over 46 =) $\frac{80 - "58"}{80} (\times 100) (= 0.275)$ <b>or</b> (under 46 =) $\frac{"58"}{80} (\times 100) (= 0.725 \text{ or } 72.5)$			M1ft method to find the fraction or percentage of people aged over or under 46 ft from their graph <b>or</b> a value in the range 0.26 - 0.29 or 0.71 - 0.74 or 71 (%) - 74(%)
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	28		A1ft accept 26 – 29, ft their cf graph
					<b>Total 6 marks</b>

<b>13</b>	20 (-) 12		2	M1 for both values unambiguously identified
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	8		A1
				<b>Total 2 marks</b>

<b>14</b>	eg $0.3 \times 10^{135}$ <b>or</b> $67 \times 10^{134}$ <b>or</b> $(6.7 + 0.3) \times 10^{135}$ <b>or</b> $70 \times 10^{134}$ <b>or</b> $0.7 \times 10^{136}$ <b>or</b> $7 \times 10^n$ $n \neq 135$		2	M1
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$7 \times 10^{135}$		A1
				<b>Total 2 marks</b>

<p><b>15</b> (a)</p>	<p>eg <math>12 \times \frac{5a+8}{3} - 12 \times \frac{2a+5}{4} = 12 \times 23</math> <b>or</b>  eg <math>4(5a+8) - 3(2a+5) = 12 \times 23 (= 276)</math> <b>or</b>  eg <math>\frac{4(5a+8)}{12} - \frac{3(2a+5)}{12} (= 23)</math> <b>or</b>  eg <math>\frac{4(5a+8) - 3(2a+5)}{12} (= 23)</math></p>	<p>4</p>	<p>M1 for clear intention to multiply all terms by 12 or a multiple of 12  <b>or</b>  to express LHS as two fractions over 12 or a multiple of 12  <b>or</b> as a single fraction with a denominator of 12 or a multiple of 12</p> <p>(If expanded numerator, allow one sign error <b>or</b> one numerical error but not both)</p> <p>Accept</p> $\frac{20a+32}{12} - \frac{6a+15}{12} (= 23) \text{ or } \frac{20a+32-6a+15}{12} (= 23) \text{ or}$ $\frac{20a+32-6a+15}{12} (= 23)$
	<p>eg <math>20a+32-6a-15 = 12 \times 23 (= 276)</math> oe  <b>or</b> <math>14a+17 = 276</math></p>		<p>M1 ft for expanding brackets and multiplying both sides by denominator with no more than one error in total leading to a linear equation</p> <p>Accept a linear equation leading to</p> $14a - 17 = 276 \text{ oe } \text{or } 14a + 47 = 276 \text{ oe } \text{or}$ $26a + 17 = 276$ <p>This mark implies the previous M mark if not already awarded</p>
	<p>eg <math>20a-6a = 276-32+15</math> oe  <b>or</b> <math>14a = 259</math></p>		<p>M1 ft dep on previous M1 for correctly rearranging terms in <math>a</math> on one side and number terms on the other side</p>
	<p><i>Working required</i></p>	<p>18.5</p>	<p>A1 oe dep on M2 eg <math>\frac{259}{14}</math> <b>or</b> <math>\frac{37}{2}</math></p>

(b)	eg $\frac{3}{\sqrt{y}} \left( = \frac{3\sqrt{y}}{y} \right)$ <b>or</b> $\frac{3}{y^{0.5}}$ <b>or</b> $\frac{3}{y^{\frac{1}{2}}}$ <b>or</b> $\left( \frac{y^{0.5}}{3} \right)^{-1}$ <b>or</b> $\left( \frac{y^{\frac{1}{2}}}{3} \right)^{-1}$ oe		2	M1 for a correct first step by applying one of the following index rules $\sqrt{x} = x^{\frac{1}{2}} = x^{0.5}$ or $\left( \frac{a}{b} \right)^{-1} = \left( \frac{b}{a} \right)$
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$3y^{-0.5}$		A1 oe eg $3y^{-\frac{1}{2}}$ , accept $c = 3$ and $n = -0.5$ oe
				<b>Total 6 marks</b>

<p><b>16</b></p>	<p>(10000x =) 6121.21..._</p> <p>eg <math>\frac{(100x=) 61.21...}{\quad}</math></p> <p>(1000x =) 612.12..._</p> <p><b>or</b> <math>\frac{(10x=) 6.12...}{\quad}</math></p> <p>(100x =) 61.212..._</p> <p><b>or</b> <math>\frac{(x=) 0.612...}{\quad}</math></p>		2	<p>M1 for 2 recurring decimals that when subtracted give a whole number or terminating decimal with <u>intention to subtract</u>. (ie give 60.6 or 606 or 6060 etc)</p> <p>eg (1000x =) 612.12... and (10x =) 6.12....</p> <p><b>or</b> (100 000x =) 61 212.12.... and (1000x =) 612....</p> <p><b>or</b> (100x =) 61.212.... and (x =) 0.612....</p> <p>with intention to subtract</p> <p>x is not required to award this mark (if recurring dots not shown in <b>both</b> numbers then showing at least <b>one</b> of the numbers to at least 5sf)</p> <p>or <math>\frac{6}{10} + 1000x(12.12) - 10x(0.12)</math></p>
	<p>eg <math>10000x - 100x = 6121.21... - 61.21... = 6060</math> (9900x = 6060)</p> <p><b>and</b> <math>\frac{6060}{9900} = \frac{101}{165}</math> <b>or</b></p> <p><math>1000x - 10x = 612.12... - 6.12... = 606</math> (990x = 606)</p> <p><b>and</b> <math>\frac{606}{990} = \frac{101}{165}</math> <b>or</b></p> <p><math>100x - x = 61.212... - 0.612... = 60.6</math> (99x = 60.6)</p> <p><b>and</b> <math>\frac{60.6}{99} = \frac{101}{165}</math> oe</p> <p><b>OR</b></p> <p>0.6 + ... and (1000x - 100x = 990x = 12)</p> <p><b>and</b> <math>0.6 + \frac{12}{990} = \frac{0.6 \times 990 + 12}{990} = \frac{101}{165}</math> oe</p>	shown		<p>A1 for completion to <math>\frac{101}{165}</math> dep on M1 and must use algebra for this final mark to be awarded</p> <p>[allow for instance <math>99x = 60.6</math> and then <math>\frac{606}{990} = \frac{101}{165}</math>]</p> <p><b>No algebra used gets a maximum of 1 mark</b></p>
	Working required			<b>Total 2 marks</b>

17	eg $4n, 4n + 4, 4n + 8$ <b>or</b> $4n, 4(n + 1), 4(n + 2)$ <b>or</b> $4n - 4, 4n, 4n + 4$ <b>or</b> $4(n - 1), 4n, 4(n + 1)$		3	M1 for correct expressions for 3 consecutive multiples of 4 (any letter can be used) may just see the first and third multiple for this mark
	eg $(4n + 8)^2 - (4n)^2 (= 16n^2 + 64n + 64 - 16n^2)$ <b>or</b> $(4(n + 2))^2 - (4n)^2 (= 16n^2 + 64n + 64 - 16n^2)$ <b>or</b> $(4n + 4)^2 - (4n - 4)^2 (= 16n^2 + 32n + 16 - 16n^2 + 32n - 16)$ <b>or</b> $(4(n + 1))^2 - (4(n - 1))^2 (= 16n^2 + 32n + 16 - 16n^2 + 32n - 16)$			M1 for squaring the largest and smallest multiple of 4 and subtracting (no need to expand or simplify for this mark)
	eg $(4n + 8)^2 - (4n)^2 = 16n^2 + 64n + 64 - 16n^2 = 64n + 64$ <b>or</b> $(4n + 8)^2 - (4n)^2 = (4n + 8 + 4n)(4n + 8 - 4n) = 8(8n + 8) = 64n + 64$ <b>or</b> $(4(n + 2))^2 - (4n)^2 = 16n^2 + 64n + 64 - 16n^2 = 64n + 64$ <b>or</b> $(4(n + 2))^2 - (4n)^2 = (4(n + 2) + 4n)(4(n + 2) - 4n) = 8(8n + 8) = 64n + 64$ <b>or</b> $(4n + 4)^2 - (4n - 4)^2 = 16n^2 + 32n + 16 - 16n^2 + 32n - 16 = 64n$ <b>or</b> $(4n + 4)^2 - (4n - 4)^2 = (4n + 4 + 4n - 4)(4n + 4 - 4n + 4) = 8n \times 8 = 64n$ <b>or</b> $(4(n + 1))^2 - (4(n - 1))^2 = 16n^2 + 32n + 16 - 16n^2 + 32n - 16 = 64n$ <b>or</b> $(4(n + 1))^2 - (4(n - 1))^2 = (4(n + 1) + 4(n - 4))(4(n + 1) - 4(n - 4)) = 8n \times 8 = 64n$	correctly shown		A1 dep on M2, for use of algebra to show correct conclusion
	<i>Working required</i>			<b>Total 3 marks</b>

18	(a)	$F = \frac{k}{r^3}$ or $Fr^3 = k$ or $kF = \frac{1}{r^3}$		3	M1	oe $k$ can be any letter (must be a letter and not 1)
		$6 = \frac{k}{2^3}$ oe or $k = 48$ or $6k = \frac{1}{2^3}$ oe or $k = \frac{1}{48}$			M1	For substitution of $F$ and $r$ into a correct formula, implies the first M1 if you see this stage Condone use of $\infty$ for method marks
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$F = \frac{48}{r^3}$		A1	oe with $F$ the subject eg $F = 48 \times \frac{1}{r^3}$ or $F = 48 \times r^{-3}$ Award 3 marks if answer is $F = \frac{k}{r^3}$ and $k = 48$ clearly given in the body of the script  M2A0 for $Fr^3 = 48$ or $r = \sqrt[3]{\frac{48}{F}}$ or $r^3 = \frac{48}{F}$
	(b)	$(r^3 =) \frac{"48"}{3072}$ oe eg $\frac{1}{64}$ or (0.01(5625)) rounded or truncated		2	M1ft	allow use of their "48" as long as M2 gained in (a)
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$\frac{1}{4}$		A1	oe
					<b>Total 5 marks</b>	

<p><b>19</b></p>	$\frac{2}{9} \times \frac{1}{8} \left( = \frac{2}{72} \right) \text{ oe or } \frac{1}{9} \times \frac{2}{8} \left( = \frac{2}{72} \right) \text{ oe or } \frac{2}{9} \times \frac{3}{8} \left( = \frac{6}{72} \right) \text{ oe or } \frac{3}{9} \times \frac{2}{8} \left( = \frac{6}{72} \right) \text{ oe or}$ $\frac{2}{9} \times \frac{5}{8} \left( = \frac{10}{72} \right) \text{ oe or } \frac{5}{9} \times \frac{2}{8} \left( = \frac{10}{72} \right) \text{ oe}$ <p>or</p> ${}^9C_2 \text{ or } \frac{9!}{2!7!} \text{ or } \frac{9 \times 8}{2} \text{ or } 36 \text{ or } 1 + 2 + 6 (= 9)$		3	<p>M1 for finding one correct product</p> <p>or</p> <p>for the correct number of total outcomes or for the correct number of outcomes when the sum &lt; 5 NB if using decimals allow 2 decimal places truncated or rounded</p>
	$3 \times \frac{2}{72} + 2 \times \frac{6}{72} \text{ oe or}$ $\frac{2}{72} + \frac{6}{72} + \frac{10}{72} \text{ oe}$ <p>or</p> ${}^9C_2 \text{ or } \frac{9!}{2!7!} \text{ or } \frac{9 \times 8}{2} \text{ or } 36 \text{ and } 1 + 2 + 6 (= 9)$			<p>M1 for a complete <b>correct</b> method</p> <p>or</p> <p>for the correct number of total outcomes <b>and</b> for the correct number of outcomes when the sum &lt; 5</p>
	<p><i>Correct answer scores full marks (unless from obvious incorrect working)</i></p>	$\frac{18}{72}$		<p>A1 oe eg <math>\frac{9}{36}</math> or 0.25 or 25%</p> <p>SCB1 for <math>\frac{21}{81}</math> oe eg <math>\frac{7}{27}</math> or 0.259(25...) or 25.9(25...) % truncated or rounded</p>
<p><b>SEE NEXT PAGE FOR ALT METHOD</b></p>				<p><b>Total 3 marks</b></p>

<b>19 ALT</b>	$\frac{2}{9} \times \frac{1}{8} \left( = \frac{2}{72} \right) \text{ oe or } \frac{1}{9} \times \frac{2}{8} \left( = \frac{2}{72} \right) \text{ or } \frac{1}{9} \times \frac{1}{8} \left( = \frac{1}{72} \right) \text{ oe or } \frac{2}{9} \times \frac{2}{8} \left( = \frac{4}{72} \right) \text{ or}$ $\frac{3}{9} \times \frac{1}{8} \left( = \frac{3}{72} \right) \text{ oe or } \frac{1}{9} \times \frac{3}{8} \left( = \frac{3}{72} \right) \text{ oe or } \frac{2}{9} \times \frac{3}{8} \left( = \frac{6}{72} \right) \text{ oe or } \frac{3}{9} \times \frac{2}{8} \left( = \frac{6}{72} \right) \text{ oe or}$ $\frac{1}{9} \times \frac{6}{8} \left( = \frac{6}{72} \right) \text{ oe or } \frac{6}{9} \times \frac{1}{8} \left( = \frac{6}{72} \right) \text{ oe or } \frac{3}{9} \times \frac{6}{8} \left( = \frac{18}{72} \right) \text{ oe or } \frac{6}{9} \times \frac{3}{8} \left( = \frac{18}{72} \right) \text{ oe or}$ $\frac{1}{9} \times \frac{8}{8} \left( = \frac{8}{72} \right) \text{ oe or } \frac{8}{9} \times \frac{1}{8} \left( = \frac{8}{72} \right) \text{ or } \frac{2}{9} \times \frac{8}{8} \left( = \frac{16}{72} \right) \text{ oe or } \frac{8}{9} \times \frac{2}{8} \left( = \frac{16}{72} \right) \text{ oe}$		3	<b>M1</b> for finding one correct product  NB if using decimals allow 2 decimal places truncated or rounded
	$1 - \left( 2 \times \frac{1}{72} + 7 \times \frac{2}{72} + 4 \times \frac{3}{72} + 2 \times \frac{4}{72} + 3 \times \frac{6}{72} \right) \text{ or}$ $1 - \left( \frac{6}{72} + \frac{6}{72} + \frac{18}{72} + \frac{8}{72} + \frac{16}{72} \right) \text{ or } 1 - \frac{54}{72} \text{ oe}$			<b>M1</b> for a complete <b>correct</b> method
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i> Do not allow $\frac{6}{9} \times \frac{3}{8} = \frac{18}{72}$ or $\frac{3}{9} \times \frac{6}{8} = \frac{18}{72}$ as this an incorrect method (M1M0A0)	$\frac{18}{72}$		<b>A1</b> oe eg $\frac{9}{36}$ or 0.25 or 25%  SCB1 for $\frac{21}{81}$ oe eg $\frac{7}{27}$ or 0.259(25...) or 25.9(25...) % truncated or rounded
				<b>Total 3 marks</b>

20	eg $(AC^2 \Rightarrow) 18^2 - 7^2 (= 275)$ <b>or</b> $(AC \Rightarrow) \sqrt{18^2 - 7^2} (= \sqrt{275} \text{ or } 5\sqrt{11} \text{ or } 16.5(831\dots))$ <b>or</b> $(FB^2 \Rightarrow) 9^2 + 7^2 (= 130)$ <b>or</b> $(FB \Rightarrow) \sqrt{9^2 + 7^2} (= \sqrt{130} \text{ or } 11.4(017\dots))$ <b>or</b> $(GC^2 \Rightarrow) 18^2 - 9^2 (= 243)$ <b>or</b> $(GC \Rightarrow) \sqrt{18^2 - 9^2} (= \sqrt{243} \text{ or } 9\sqrt{3} \text{ or } 15.5(884\dots))$ <b>or</b> $18^2 = (BC)^2 + 7^2 + 9^2$ <b>oe</b>		3	M1 for method to find $AC^2$ <b>or</b> $AC$ <b>or</b> $FB^2$ <b>or</b> $FB$ <b>or</b> $GC^2$ <b>or</b> $GC$ <b>or</b> for a correct equation using $BC^2$ and 18 and 7 and 9  other longer ways to find $AC$ , $FB$ , $GC$ may be used but must be a complete method eg $\angle FCA = \sin^{-1}\left(\frac{7}{18}\right) (= 22.88\dots)$ <b>and</b> $AC = \frac{7}{\tan 22.88\dots}$
	eg $"275" - 9^2 (= 194)$ <b>or</b> $"16.5\dots" - 9^2 (= 194)$ <b>or</b> $18^2 - "130" (= 194)$ <b>or</b> $18^2 - "11.4\dots" (= 194)$ $"243" - 7^2 (= 194)$ <b>or</b> $"15.5\dots" - 7^2 (= 194)$ <b>or</b> $18^2 - 7^2 - 9^2 (= 194)$ <b>or</b> $\angle FCB = \sin^{-1}\left(\frac{"11.4"}{18}\right) (= 39.3(036\dots))$ <b>and</b> $\cos 39.3 = \frac{(BC)}{18}$ <b>or</b> $\tan 39.3 = \frac{"11.4"}{(BC)}$ <b>oe</b>			M1 for complete method to find $BC^2$  other longer ways to find $BC$ may be used but must be a complete method, leading to a trig equation in $BC$
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	13.9		A1 accept 13.8 to 14
				<b>Total 3 marks</b>

<b>21</b>	(a)		$(-2, 9)$	1	B1
	(b)		$a = 3$	2	B1
			$b = -11$		B1
					<b>Total 3 marks</b>

22	$x^2 + (-2x+3)^2 = 41$	$\left(\frac{-y+3}{2}\right)^2 + y^2 = 41$		5	M1 substitution of $y = \pm 2x \pm 3$ (or $x = \frac{\pm y \pm 3}{2}$ ) into $x^2 + y^2 = 41$ to obtain an equation in $x$ only (or $y$ only)
	eg $5x^2 - 12x - 32 (= 0)$ oe or $5x^2 - 12x = 32$	eg $5y^2 - 6y - 155 (= 0)$ or $5y^2 - 6y = 155$			M1 ft dep on previous M1 for multiplying out and collecting terms, forming a <b>three</b> term quadratic in any form of $ax^2 + bx + c (= 0)$ where at least 2 coefficients ( $a$ or $b$ or $c$ ) are correct
	$(5x + 8)(x - 4) (= 0)$ or $(x =) \frac{12 \pm \sqrt{(-12)^2 - 4 \times 5 \times (-32)}}{2 \times 5}$ or $5 \left[ \left(x - \frac{6}{5}\right)^2 - \left(\frac{6}{5}\right)^2 \right] - 32 (= 0)$ (should give $(x =) -\frac{8}{5}, 4$ )	eg $(5y - 31)(y + 5) (= 0)$ or $\frac{6 \pm \sqrt{(-6)^2 - 4 \times 5 \times (-155)}}{2 \times 5}$ or $5 \left[ \left(y - \frac{3}{5}\right)^2 - \left(\frac{3}{5}\right)^2 \right] - 155 (= 0)$ (should give $(y =) \frac{31}{5}, -5$ )			M1 ft dep on M1 method to solve <b>their</b> 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{12 \pm \sqrt{144 + 640}}{10}$ or $\frac{6 \pm \sqrt{36 + 3100}}{10}$ or if factorising allow brackets which expanded give 2 out of 3 terms correct) or correct values for $x$ or correct values for $y$
	eg $2 \times 4 + y = 3$ and $2 \times -\frac{8}{5} + y = 3$	eg $2x + \frac{31}{5} = 3$ and $2x - 5 = 3$			M1 ft dep on previous M1 for substituting <b>their</b> 2 found values of $x$ or $y$ into one of the two given equations or their rearranged equation used in the substitution or for one correct pair of values
	<i>Working required if the correct answers come from incorrectly using <math>y = 2x - 3</math> oe award M4A0.</i>		$x = -\frac{8}{5}, y = \frac{31}{5},$ $x = 4, y = -5$		A1 oe dep on M2 for all 4 values (allow coordinates)
	If they find the values of $y$ but think they are the values of $x$ then the maximum mark is 3				<b>Total 5 marks</b>

23	eg $(y + 3)(x + 2) = 4x(3y - 5)$ <b>or</b> $\frac{3y-5}{x+2} = \frac{y+3}{4x}$ <b>or</b> $\frac{x+2}{3y-5} = \frac{4x}{y+3}$ <b>or</b> $\frac{3y-5}{y+3} = \frac{x+2}{4x}$ <b>or</b> $\frac{4x}{x+2} = \frac{y+3}{3y-5}$		5	M1 for correct use of intersecting chords theorem to form an equation
	eg $xy + 2y + 3x + 6 = 12xy - 20x$ oe			M1 for expanding the brackets <b>or</b> for removing the fractions <b>and</b> expanding the brackets, allow one error in one term we can <b>ft</b> $4x(y + 3) = (x + 2)(3y - 5)$ oe for the 2 <sup>nd</sup> , 3 <sup>rd</sup> and 4 <sup>th</sup> method marks
	eg $20x + 3x + 6 = 12xy - xy - 2y$ oe <b>or</b> $23x + 6 = 11xy - 2y$ oe			M1ft dep on previous M1 for correctly collecting all the y terms on one side and non-y terms on the other side
	eg $23x + 6 = y(11x - 2)$ <b>or</b> $20x + 3x + 6 = y(12x - x - 2)$			M1ft dep on 2 <sup>nd</sup> M mark for factorising, for y, an equation in the form $ax + b = cxy + dy$ (may not be simplified) the factorisation must be correct
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$\frac{23x+6}{11x-2}$		A1 oe
				<b>Total 5 marks</b>

24	eg $(d =) (3y - 4) - (2x + 5) (= 3y - 2x - 9)$ <b>or</b> $(2x + 5) + d = 3y - 4$ oe <b>or</b> $(d =) (4x - 2) - (3y - 4) (= 4x - 3y + 2)$ <b>or</b> $(3y - 4) + d = (4x - 2)$ <b>or</b> $(2d =) (4x - 2) - (2x + 5) (= 2x - 7)$ <b>or</b> $(2x + 5) + 2d = (4x - 2)$ oe		6	M1 for a correct expression or equation using the common difference, may be in terms of $d$ for this mark we will allow an expression for $-d$ or $-2d$
	eg $216 = \frac{9}{2} [2(2x + 5) + (9 - 1)d]$ <b>or</b> $216 = \frac{9}{2} [2(2x + 5) + (9 - 1)(3y - 2x - 9)]$ <b>or</b> $216 = \frac{9}{2} [2(2x + 5) + (9 - 1)(4x - 3y + 2)]$ <b>or</b> $216 = \frac{9}{2} [2(2x + 5) + (9 - 1)(x - 3.5)]$ <b>or</b> $216 = \frac{9}{2} [2(2(d + 3.5) + 5) + 8d]$			M1 for a correct equation for the sum of 9 terms in $x$ and $d$ <b>or</b> in terms of $x$ and $y$ <b>or</b> in terms of $x$ or in terms of $d$  for “ $3y - 2x - 9$ ” we will allow $(3y - 4) - (2x + 5)$ or for using their incorrect simplification from $(3y - 4) - (2x + 5)$ shown  for “ $4x - 3y + 2$ ” we will allow $(4x - 2) - (3y - 4)$ or for using their incorrect simplification from $(4x - 2) - (3y - 4)$ shown  similarly for their “ $x - 3.5$ ” and their “ $d + 3.5$ ”
	eg $6x - 6y = -11$ oe <b>and</b> $12y - 6x = 55$ oe <b>or</b> $6x - 6y = -11$ oe <b>and</b> $18x - 12y = 11$ oe <b>or</b> $2x - 2d = 7$ oe <b>and</b> $8d + 4x = 38$ oe	eg $d = x - 3.5$ oe <b>and</b> $48 = 12x - 18$ oe <b>or</b> $x = d + 3.5$ oe <b>and</b> $48 = 12d + 24$ oe <b>or</b> $d = 4.75 - 0.5x$ oe <b>and</b> $3x - 2 = 14.5$ oe		M2 <b>left hand column</b> 2 correct equations in terms of $x$ and $y$ in the form $px + qy = r$ oe <b>or</b> 2 correct equations in terms of $x$ and $d$ in the form $px + qd = r$ oe  <b>right hand column</b> 2 correct equations in terms of $x$ and $y$ where one is substituted into the other to get a correct equation in the form $px + q = r$ or $py + q = r$ <b>or</b> 2 correct equations in terms of $x$ and $d$ where one is substituted into the other to get a correct equation in the form $px + q = r$ or $pd + q = r$  <b>If not M2 then M1 for one correct equation in any of the required forms from <u>the left hand or right hand column</u></b>
	one equation must be from the differences and one equation must be from the sum of the terms			
	<i>Working required</i>	$x = \frac{11}{2} \quad y = \frac{22}{3}$		A2 (dep on M2) oe (allow 7.3(33...)) (A1 for $x = \frac{11}{2}$ <b>or</b> $y = \frac{22}{3}$ )
<b>Total 6 marks</b>				

25	eg $\frac{40}{360} \pi r^2 - \frac{1}{2} r^2 \sin 40 (= 28) \text{ oe or}$ $\frac{40}{360} \pi r^2 = 28 + \frac{1}{2} r^2 \sin 40 \text{ oe}$		6	M1 for a correct expression for the area of the shaded region  Allow 3.14... or $\frac{22}{7}$ for $\pi$ $\sin 40 = 0.64...$
	(radius <sup>2</sup> =) 992 – 1024 (radius =) 31.8(096...)	31.8		A1 Allow answers in the range 31.5 – 32.0
	eg $(BC^2 =) 2 \times "31.8" ^2 - 2 \times "31.8" ^2 \cos 40 (= 473.4...)$ or $\frac{0.5BC}{"31.8"} = \sin 20$ or $\frac{BC}{\sin 40} = \frac{"31.8"}{\sin(70)}$			M1 for a correct first step to find $BC$ using <b>their clearly identified radius</b> eg $r = \dots$ or seen on diagram NB $\frac{180 - 40}{2} = 70$ $\sin 20 = 0.34...$ $\sin 70 = 0.93... \text{ or } 0.94$
	eg $(BC =) \sqrt{2 \times "31.8" ^2 - 2 \times "31.8" ^2 \cos 40} (= 21.7...)$ or $(BC =) 2 \times "31.8" \sin 20 (= 21.7...)$ or $BC = \frac{"31.8" \sin 40}{\sin(70)} (= 21.7...)$			M1 dep on previous M1 for a complete method to find $BC$  $\cos 40 = 0.76... \text{ or } 0.77$
	eg $\frac{130}{360} \times 2 \times \pi \times "21.7"$			M1 dep on previous M1 for a complete method to find the length of arc $BD$
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	49.4		A1 accept 48.9 – 49.7
				<b>Total 6 marks</b>

26	eg $\sqrt[3]{1.728}(=1.2)$ oe <b>or</b> (length <b>R</b> : <b>S</b> =) 1 : 1.2 oe eg 5 : 6 <b>or</b> (length <b>R</b> : <b>S</b> : <b>T</b> =) 1 : 1.2 : 6 oe eg 5 : 6 : 30 <b>or</b> (volume <b>S</b> : <b>T</b> = ) 1.728 : 216 <b>or</b> 216 ÷ 1.728 (= 125)		4	M1 for method to find the scale factor between the heights of <b>R</b> and <b>S</b> <b>or</b> for a correct ratio for the lengths <b>R</b> : <b>S</b> <b>or</b> for a correct ratio for the lengths <b>R</b> : <b>S</b> : <b>T</b> <b>or</b> for a correct ratio or scale factor for the volumes <b>S</b> : <b>T</b>
	eg $6 \div "1.2" (= 5)$ <b>or</b> $\sqrt[3]{\frac{216}{1.728}} (= 5)$ (length <b>S</b> : <b>T</b> =) 1 : 5 or $\sqrt[3]{1.728} : \sqrt[3]{216}$ (area <b>S</b> : <b>T</b> =) "1.2" <sup>2</sup> : 6 <sup>2</sup> oe <b>or</b> (area <b>S</b> : <b>T</b> =) 6 <sup>2</sup> : 30 <sup>2</sup> oe <b>or</b> (area <b>R</b> : <b>S</b> : <b>T</b> =) 1 : "1.2" <sup>2</sup> : 6 <sup>2</sup> oe <b>or</b> (area <b>R</b> : <b>S</b> : <b>T</b> =) 5 <sup>2</sup> : 6 <sup>2</sup> : 30 <sup>2</sup> oe			M1 for method to find the scale factor between the heights of <b>S</b> and <b>T</b> <b>or</b> for a correct ratio of the heights of <b>S</b> and <b>T</b> in the form 1 : <i>n</i> <b>or</b> for a correct method to find the ratio for the areas <b>S</b> : <b>T</b> fit their ratio of lengths <b>or</b> for a correct method to find the ratio for the areas <b>R</b> : <b>S</b> : <b>T</b> fit their ratio of lengths (maybe seen as the two separate ratios of <b>R</b> : <b>S</b> and <b>R</b> : <b>T</b> )
	eg "5" <sup>2</sup> <b>or</b> (area <b>S</b> : <b>T</b> =) 1 <sup>2</sup> : "5" <sup>2</sup> <b>or</b> (area <b>S</b> : <b>T</b> =) 1 : 25 <b>or</b> $(k =) \frac{36}{1.44}$ oe			M1 for squaring the scale factor of the heights of <b>S</b> and <b>T</b> <b>or</b> for a correct ratio in the form 1 : <i>n</i> for the areas <b>S</b> : <b>T</b> fit their ratio of areas, may be implied by their final answer <b>or</b> for a correct calculation using the area ratio of <b>S</b> : <b>T</b> to find the value of <i>k</i>
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	25		A1 cao
				<b>Total 4 marks</b>