Pearson Edexcel

Mark Scheme (Results)

June 2025

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

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2025
Log Number P75660
Publications Code 4MA1_1HR_2506_MS

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.

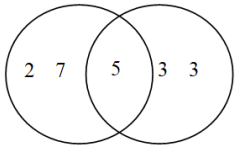
  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **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	45, 90, 135, 180... **and** 70, 140, 210, 280... **or** 2, 5, 7 **and** 3,3,5 **or**  **or** $\frac{45\times70}{5}$ **or** 2, 3, 3, 5, 7 oe **or** 5 | 45 | 70 9 | 14 **or** 5, 9, 14 oe		2	M1 for any correct valid method eg for starting to list at least **four** multiples of each number **or** 2, 5, 7 and 3, 3, 5 seen (may be in a factor tree, ignore 1) **or** a fully correct Venn diagram **or** 5, 9, 14 oe (could be in a table)
	Correct answer scores full marks (unless from obvious incorrect working)	630		A1 Allow $2 \times 3^2 \times 5 \times 7$ oe eg $5 \times 9 \times 14$
				Total 2 marks

2	(i)		142.75	1	B1
	(ii)		142.85	1	B1 accept 142.8499... or $142.84\dot{9}$
					Total 2 marks

3	eg $\frac{9}{4}$ **and** $\frac{12}{7}$		3	M1	for $2\frac{1}{4}$ and $1\frac{5}{7}$ expressed as improper fractions
	eg $\frac{9}{\cancel{4}^{1}}\times\frac{\cancel{12}^{3}}{7}$ **OR** $\frac{9}{4}\times\frac{12}{7}=\frac{108}{28}$ oe eg $\frac{63}{28}\times\frac{48}{28}=\frac{3024}{784}$			M1	correct cancelling or multiplication of numerators and denominators without cancelling
	eg $\frac{9}{\cancel{4}^{1}}\times\frac{\cancel{12}^{3}}{7}=\frac{27}{7}=3\frac{6}{7}$ **or** $\frac{9}{4}\times\frac{12}{7}=\frac{108}{28}=\frac{27}{7}=3\frac{6}{7}$ **or** $\frac{9}{4}\times\frac{12}{7}=\frac{108}{28}=3\frac{24}{28}=3\frac{6}{7}$ **or** $\frac{9}{4}\times\frac{12}{7}=\frac{63}{28}\times\frac{48}{28}=\frac{3024}{784}=\frac{27}{7}=3\frac{6}{7}$ **or** $\frac{9}{4}\times\frac{12}{7}=\frac{63}{28}\times\frac{48}{28}=\frac{3024}{784}=3\frac{672}{784}=3\frac{6}{7}$ **or** correct working to $\frac{27}{7}$ **and** writing $3\frac{6}{7}=\frac{27}{7}$ *Working required*	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 **or** correct cancelling prior to the multiplication to $\frac{27}{7}$ NB: use of decimals scores no marks unless as a check
					Total 3 marks

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

5 (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)		$\varnothing$	1	B1	
(ii)		$\notin$	1	B1	
				Total 4 marks	

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

7	$50x \div 1000$ (= $0.05x$) oe **or** $50x \times 60 \times 60$ (= $180\,000x$) oe **or** $50x \div \frac{1}{3600}$ (= $180\,000x$) oe **or** $50x \div 1000 \times 60$ (= $3x$) **or** $\frac{3600}{1000}$ or $\frac{18}{5}$ or 3.6 **or** $\frac{1000}{3600}$ 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 **or** $50x \times 3.6$ oe **or** $50x \div \frac{1000}{3600}$ oe **or** 180			M1	for a complete method including x **or** for an answer of 180
	Correct answer scores full marks (unless from obvious incorrect working)	$180x$		A1	
					Total 3 marks

8	(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 $a + b = -10$
		Correct answer scores full marks (unless from obvious incorrect working)	$(y-3)(y-7)$		A1	for correct factors
	(ii)		3, 7	1	B1	ft dep on factorising in the form $(y \pm p)(y \pm q)$
						Total 5 marks

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

<table>
<tr><td rowspan="3">10</td><td>(volume of water =) $9\times35\times28(=8820)$
or (total volume of cuboid =) $20\times35\times28(=19600)$
or (volume of space =) $(20-9)\times35\times28(=10780)$</td><td></td><td rowspan="3">3</td><td>M1</td><td>for a method to find a relevant volume for the cuboid</td></tr>
<tr><td>$\pi\times10^2\times33$ $(=3300\pi$ or $10367(.25...))$ oe</td><td></td><td>M1</td><td>(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 π</td></tr>
<tr><td>(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…))

Working required</td><td>Shown</td><td>A1</td><td>correct workings with accurate figures
eg
<table><tr><td>Value 1</td><td>Value 2</td></tr><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></table></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">Total 3 marks</td></tr>
</table>

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

12	(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 **or** 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 **freq table** at the correct height
		Correct answer scores full marks (unless from obvious incorrect working)	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 **and** a line across to the vertical axis **or** a mark on the curve at the correct point **and** a mark on the vertical axis at the correct point **or** a reading of 57 - 59 from their cf graph **or** a value of 21 – 23 **or** a correct value for their graph must be ascending (could be a lobf)
		eg (over 46 =) $\frac{80-"58"}{80}(\times 100)(=0.275)$ **or** (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 **or** a value in the range 0.26 - 0.29 or 0.71 - 0.74 or 71 (%) - 74(%)
		Correct answer scores full marks (unless from obvious incorrect working)	28		A1ft	accept 26 – 29, ft their cf graph
						Total 6 marks

13	20 (−) 12		2	M1	for both values unambiguously identified
	Correct answer scores full marks (unless from obvious incorrect working)	8		A1	
					Total 2 marks

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

15 (a)	eg $12\times\frac{5a+8}{3}-12\times\frac{2a+5}{4}=12\times23$ **or** eg $4(5a+8)-3(2a+5)=12\times23(=276)$ **or** eg $\frac{4(5a+8)}{12}-\frac{3(2a+5)}{12}(=23)$ **or** eg $\frac{4(5a+8)-3(2a+5)}{12}(=23)$		4	M1	for clear intention to multiply all terms by 12 or a multiple of 12 **or** to express LHS as two fractions over 12 or a multiple of 12 **or** as a single fraction with a denominator of 12 or a multiple of 12 (If expanded numerator, allow one sign error **or** one numerical error but not both) Accept $\frac{20a+32}{12}-\frac{6a+15}{12}(=23)$ or $\frac{20a+32}{12}-\frac{6a+15}{12}(=23)$ or $\frac{20a+32-6a+15}{12}(=23)$
	eg $20a+32-6a-15=12\times23(=276)$ oe **or** $14a+17=276$			M1	ft for expanding brackets and multiplying both sides by denominator with no more than one error in total leading to a linear equation Accept a linear equation leading to 14a – 17 = 276 oe **or** 14a + 47 = 276 oe **or** 26*a* + 17 = 276 This mark implies the previous M mark if not already awarded
	eg $20a-6a=276-32+15$ oe or $14a=259$			M1	ft dep on previous M1 for correctly rearranging terms in *a* on one side and number terms on the other side
	Working required	18.5		A1	oe dep on M2 eg $\frac{259}{14}$ **or** $\frac{37}{2}$

(b)	eg $\frac{3}{\sqrt{y}}\left(=\frac{3\sqrt{y}}{y}\right)$ **or** $\frac{3}{y^{0.5}}$ **or** $\frac{3}{y^{\frac{1}{2}}}$ **or** $\left(\frac{y^{0.5}}{3}\right)^{-1}$ **or** $\left(\frac{y^{\frac{1}{2}}}{3}\right)^{-1}$ 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 $\left(\frac{a}{b}\right)^{-1}=\left(\frac{b}{a}\right)$
	Correct answer scores full marks (unless from obvious incorrect working)	$3y^{-0.5}$		A1	oe eg $3y^{-\frac{1}{2}}$, accept $c = 3$ and $n = -0.5$ oe
					Total 6 marks

16	(10000x =) 6121.21..._ eg (100x=) 61.21... (1000x =) 612.12..._ **or** (10x=) 6.12... (100x =) 61.212..._ **or** (x=) 0.612...		2	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) eg (1000x =) 612.12... and (10x =) 6.12.... **or** (100 000x =) 61 212.12.… and (1000x =) 612.… **or** (100x =) 61.212.… and (x =) 0.612.… with intention to subtract x is not required to award this mark (if recurring dots not shown in **both** numbers then showing at least **one** of the numbers to at least 5sf) or $\frac{6}{10}+1000x(12.12)-10x(0.12)$
	eg 10000x − 100x = 6121.21… − 61.21…=6060 (9900x = 6060) **and** $\frac{6060}{9900}=\frac{101}{165}$ **or** 1000x – 10x = 612.12... – 6.12... = 606 (990x = 606) **and** $\frac{606}{990}=\frac{101}{165}$ **or** 100x – x = 61.212... – 0.612... 60.6 **(**99x = 60.6) **and** $\frac{60.6}{99}=\frac{101}{165}$ oe **OR** 0.6 +… and (1000x –100x = 990x = 12) **and** $0.6+\frac{12}{990}=\frac{0.6\times990+12}{990}=\frac{101}{165}$ oe	shown		A1 for completion to $\frac{101}{165}$ dep on M1 and must use algebra for this final mark to be awarded [allow for instance 99x = 60.6 and then $\frac{606}{990}=\frac{101}{165}$] **No algebra used gets a maximum of 1 mark**
	Working required			**Total 2 marks**

17	eg $4n$, $4n + 4$, $4n + 8$ **or** $4n$, $4(n + 1)$, $4(n + 2)$ **or** $4n - 4$, $4n$, $4n + 4$ **or** $4(n - 1)$, $4n$, $4(n + 1)$		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 $(4n + 8)^2 - (4n)^2$ $(= 16n^2 + 64n + 64 - 16n^2)$ **or** $(4(n + 2))^2 - (4n)^2$ $(= 16n^2 + 64n + 64 - 16n^2)$ **or** $(4n + 4)^2 - (4n - 4)^2$ $(=16n^2 + 32n + 16 - 16n^2 + 32n - 16)$ **or** $(4(n + 1))^2 - (4(n - 1))^2$ $(= 16n^2 + 32n + 16 - 16n^2 + 32n - 16)$			M1	for squaring the largest and smallest multiple of 4 and subtracting (no need to expand or simplify for this mark)
	eg $(4n + 8)^2 - (4n)^2 = 16n^2 + 64n + 64 - 16n^2 = 64n + 64$ **or** $(4n + 8)^2 - (4n)^2 = (4n + 8 + 4n)(4n + 8 - 4n) = 8(8n + 8) = 64n + 64$ **or** $(4(n + 2))^2 - (4n)^2 = 16n^2 + 64n + 64 - 16n^2 = 64n + 64$ **or** $(4(n + 2))^2 - (4n)^2 = (4(n + 2) + 4n)(4(n + 2) - 4n) = 8(8n + 8) = 64n + 64$ **or** $(4n + 4)^2 - (4n - 4)^2 = 16n^2 + 32n + 16 - 16n^2 + 32n - 16 = 64n$ **or** $(4n + 4)^2 - (4n - 4)^2 = (4n + 4 + 4n - 4)(4n + 4 - 4n + 4) = 8n \times 8 = 64n$ **or** $(4(n + 1))^2 - (4(n - 1))^2 = 16n^2 + 32n + 16 - 16n^2 + 32n - 16 = 64n$ **or** $(4(n + 1))^2 - (4(n - 1))^2 = (4(n + 1) + 4(n - 4))(4(n + 1) - 4(n - 4)) = 8n \times 8 = 64n$	correctly shown		A1	dep on M2, for use of algebra to show correct conclusion
	Working required				**Total 3 marks**

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 $\propto$ for method marks
	Correct answer scores full marks (unless from obvious incorrect working)	$F = \frac{48}{r^3}$		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)
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{1}{4}$		A1	oe
					Total 5 marks

19	$\frac{2}{9}\times\frac{1}{8}\left(=\frac{2}{72}\right)$ oe **or** $\frac{1}{9}\times\frac{2}{8}\left(=\frac{2}{72}\right)$ oe **or** $\frac{2}{9}\times\frac{3}{8}\left(=\frac{6}{72}\right)$ oe **or** $\frac{3}{9}\times\frac{2}{8}\left(=\frac{6}{72}\right)$ oe **or** $\frac{2}{9}\times\frac{5}{8}\left(=\frac{10}{72}\right)$ oe **or** $\frac{5}{9}\times\frac{2}{8}\left(=\frac{10}{72}\right)$ oe or ${}^{9}C_{2}$ or $\frac{9!}{2!7!}$ or $\frac{9\times8}{2}$ or 36 **or** 1 + 2 + 6 (= 9)		3	M1	for finding one correct product or for the correct number of total outcomes or for the correct number of outcomes when the sum < 5 NB if using decimals allow 2 decimal places truncated or rounded
	$3\times"\frac{2}{72}"+2\times"\frac{6}{72}"$ oe **or** $"\frac{2}{72}"+"\frac{6}{72}"+"\frac{10}{72}"$ oe or ${}^{9}C_{2}$ or $\frac{9!}{2!7!}$ or $\frac{9\times8}{2}$ or 36 **and** 1 + 2 + 6 (= 9)			M1	for a complete **correct** method or for the correct number of total outcomes **and** for the correct number of outcomes when the sum < 5
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{18}{72}$		A1	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
	SEE NEXT PAGE FOR ALT METHOD				**Total 3 marks**

19 ALT	$\frac{2}{9}\times\frac{1}{8}\left(=\frac{2}{72}\right)$ oe **or** $\frac{1}{9}\times\frac{2}{8}\left(=\frac{2}{72}\right)$ **or** $\frac{1}{9}\times\frac{1}{8}\left(=\frac{1}{72}\right)$ oe **or** $\frac{2}{9}\times\frac{2}{8}\left(=\frac{4}{72}\right)$ **or** $\frac{3}{9}\times\frac{1}{8}\left(=\frac{3}{72}\right)$ oe **or** $\frac{1}{9}\times\frac{3}{8}\left(=\frac{3}{72}\right)$ oe **or** $\frac{2}{9}\times\frac{3}{8}\left(=\frac{6}{72}\right)$ oe **or** $\frac{3}{9}\times\frac{2}{8}\left(=\frac{6}{72}\right)$ oe **or** $\frac{1}{9}\times\frac{6}{8}\left(=\frac{6}{72}\right)$ oe **or** $\frac{6}{9}\times\frac{1}{8}\left(=\frac{6}{72}\right)$ oe **or** $\frac{3}{9}\times\frac{6}{8}\left(=\frac{18}{72}\right)$ oe **or** $\frac{6}{9}\times\frac{3}{8}\left(=\frac{18}{72}\right)$ oe **or** $\frac{1}{9}\times\frac{8}{8}\left(=\frac{8}{72}\right)$ oe **or** $\frac{8}{9}\times\frac{1}{8}\left(=\frac{8}{72}\right)$ **or** $\frac{2}{9}\times\frac{8}{8}\left(=\frac{16}{72}\right)$ oe **or** $\frac{8}{9}\times\frac{2}{8}\left(=\frac{16}{72}\right)$ oe		3	M1 for finding one correct product NB if using decimals allow 2 decimal places truncated or rounded
	$1-\left(2\times"\frac{1}{72}"+7\times"\frac{2}{72}"+4\times"\frac{3}{72}"+2\times"\frac{4}{72}"+3\times"\frac{6}{72}"\right)$ **or** $1-\left("\frac{6}{72}"+"\frac{6}{72}"+"\frac{18}{72}"+"\frac{8}{72}"+"\frac{16}{72}"\right)$ **or** $1-\frac{54}{72}$ oe			M1 for a complete **correct** method
	Correct answer scores full marks (unless from obvious incorrect working) 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)	$\frac{18}{72}$		A1 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
				Total 3 marks

20	eg $(AC^2 =)18^2 - 7^2 (= 275)$ **or** $(AC =)\sqrt{18^2 - 7^2} (= \sqrt{275}$ or $5\sqrt{11}$ or $16.5(831...))$ **or** $(FB^2 =)9^2 + 7^2 (= 130)$ **or** $(FB =)\sqrt{9^2 + 7^2} (= \sqrt{130}$ or $11.4(017...))$ **or** $(GC^2 =)18^2 - 9^2 (= 243)$ **or** $(GC =)\sqrt{18^2 - 9^2} (= \sqrt{243}$ or $9\sqrt{3}$ or $15.5(884...))$ **or** $18^2 = (BC)^2 + 7^2 + 9^2$ oe		3	M1	for method to find AC^2 **or** AC **or** FB^2 **or** FB **or** GC^2 **or** GC **or** 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 $\angle FCA = \sin^{-1}\left(\frac{7}{18}\right) (= 22.88...)$ **and** $AC = \frac{7}{\tan"22.88..."}$
	eg $"275" - 9^2 (= 194)$ **or** $"16.5..."^2 - 9^2 (= 194)$ **or** $18^2 - "130" (= 194)$ **or** $18^2 - "11.4..."^2 (= 194)$ $"243" - 7^2 (= 194)$ **or** $"15.5..."^2 - 7^2 (= 194)$ **or** $18^2 - 7^2 - 9^2 (= 194)$ **or** $\angle FCB = \sin^{-1}\left(\frac{"11.4"}{18}\right) (= 39.3(036...))$ **and** $\cos"39.3" = \frac{(BC)}{18}$ or $\tan"39.3" = \frac{"11.4"}{(BC)}$ oe			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
	Correct answer scores full marks (unless from obvious incorrect working)	13.9		A1	accept 13.8 to 14
					Total 3 marks

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

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 **three** 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** $(x=)\frac{12\pm\sqrt{(-12)^2-4\times5\times(-32)}}{2\times5}$ **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** $\frac{6\pm\sqrt{(-6)^2-4\times5\times(-155)}}{2\times5}$ **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 **their** 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 $2\times4+y=3$ **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 **their** 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
	Working required if the correct answers come from incorrectly using $y = 2x – 3$ oe award M4A0.		$x=-\frac{8}{5}$, $y=\frac{31}{5}$, $x=4$, $y=-5$		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					**Total 5 marks**

23	eg $(y + 3)(x + 2) = 4x(3y – 5)$ **or** $\frac{3y-5}{x+2}=\frac{y+3}{4x}$ **or** $\frac{x+2}{3y-5}=\frac{4x}{y+3}$ **or** $\frac{3y-5}{y+3}=\frac{x+2}{4x}$ **or** $\frac{4x}{x+2}=\frac{y+3}{3y-5}$		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 **or** for removing the fractions **and** expanding the brackets, allow one error in one term we can **ft** $4x(y+3)=(x+2)(3y-5)$ oe for the 2nd , 3rd and 4th method marks
	eg $20x + 3x + 6 = 12xy – xy – 2y$ oe **or** $23x + 6 = 11xy – 2y$ 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 $23x + 6 = y(11x – 2)$ **or** $20x + 3x + 6 = y(12x – x – 2)$			M1ft	dep on 2nd M mark for factorising, for y, an equation in the form $ax+b=cxy+dy$ (may not be simplified) the factorisation must be correct
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{23x+6}{11x-2}$		A1	oe
					Total 5 marks

24	eg $(d =)\ (3y - 4) - (2x + 5)\ (= 3y - 2x - 9)$ **or** $(2x+5)+d=3y-4$ oe **or** $(d =)\ (4x - 2) - (3y - 4)\ (= 4x - 3y + 2)$ **or** $(3y-4)+d=(4x-2)$ **or** $(2d =)\ (4x - 2) - (2x + 5)\ (= 2x - 7)$ **or** $(2x+5)+2d=(4x-2)$ 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 $216=\frac{9}{2}\left[2\left(2x+5\right)+(9-1)d\right]$ **or** $216=\frac{9}{2}\left[2(2x+5)+(9-1)"(3y-2x-9)"\right]$ **or** $216=\frac{9}{2}\left[2(2x+5)+(9-1)"(4x-3y+2)"\right]$ **or** $216=\frac{9}{2}\left[2(2x+5)+(9-1)"(x-3.5)"\right]$ **or** $216=\frac{9}{2}\left[2(2("d+3.5")+5)+8d\right]$				M1 for a correct equation for the sum of 9 terms in x and d **or** in terms of x and y **or** 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 **and** $12y-6x=55$ oe **or** $6x-6y=-11$ oe **and** $18x-12y=11$ oe **or** $2x-2d=7$ oe **and** $8d+4x=38$ **oe** eg $d=x-3.5$ oe **and** $48=12x-18$ oe **or** $x=d+3.5$ oe **and** $48=12d+24$ oe **or** $d=4.75-0.5x$ oe **and** $3x-2=14.5$ oe				M2 **left hand column** 2 correct equations in terms of x and y in the form $px + qy = r$ oe **or** 2 correct equations in terms of x and d in the form $px + qd = r$ oe **right hand column** 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 $py + q = r$ **or** 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 $pd + q = r$ **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>**
	one equation must be from the differences and one equation must be from the sum of the terms				
	Working required	$x=\frac{11}{2}$ $y=\frac{22}{3}$			A2 (dep on M2) oe (allow 7.3(33…)) (A1 for $x=\frac{11}{2}$ **or** $y=\frac{22}{3}$)
					Total 6 marks

25	eg $\frac{40}{360}\pi r^2 - \frac{1}{2}r^2 \sin 40 (= 28)$ oe **or** $\frac{40}{360}\pi r^2 = 28 + \frac{1}{2}r^2 \sin 40$ oe		6	M1	for a correct expression for the area of the shaded region Allow 3.14… or $\frac{22}{7}$ for π sin 40 = 0.64…
	(radius ^{2} =) 992 – 1024 (radius =) 31.8(096…)	31.8		A1	Allow answers in the range 31.5 – 32.0
	eg $\left(BC^2 =\right) 2\times"31.8"^2 - 2\times"31.8"^2 \cos 40 (= 473.4...)$ **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 **their clearly identified radius** eg *r* = …. or seen on diagram NB $\frac{180-40}{2} = 70$ sin 20 = 0.34… sin 70 = 0.93… or 0.94
	eg $\left(BC =\right)\sqrt{2\times"31.8"^2 - 2\times"31.8"^2 \cos 40} (= 21.7...)$ **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… 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*
	Correct answer scores full marks (unless from obvious incorrect working)	49.4		A1	accept 48.9 – 49.7
					Total 6 marks

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