



Mark Scheme (Results)

Summer 2026

Pearson Edexcel International GCSE Mathematics A
4MA1/1HR

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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
- eooo – 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	eg $\frac{14}{5}$ and $\frac{24}{7}$ oe eg $\frac{98}{35}$ and $\frac{120}{35}$		3	M1 for $2\frac{4}{5}$ and $3\frac{3}{7}$ expressed as improper fractions
	eg $\frac{14^2}{5} \times \frac{24}{7^1}$ OR $\frac{336}{35}$ oe eg $\frac{11760}{1225}$			M1 correct cancelling or multiplication of numerators and denominators without cancelling NB: correct cancellation may be implied by subsequent working (eg $\frac{14}{5} \times \frac{24}{7} = \frac{2}{5} \times 24$) – the cancelled factor need not be explicitly crossed out and the resulting 1 may be omitted
	eg $\frac{14^2}{5} \times \frac{24}{7^1} = \frac{48}{5} = 9\frac{3}{5}$ or $\frac{14}{5} \times \frac{24}{7} = \frac{336}{35} = \frac{48}{5} = 9\frac{3}{5}$ or $\frac{14}{5} \times \frac{24}{7} = \frac{336}{35} = 9\frac{21}{35} = 9\frac{3}{5}$ or $\frac{98}{35} \times \frac{120}{35} = \frac{11760}{1225} = \frac{48}{5} = 9\frac{3}{5}$ or for correct working to $\frac{48}{5}$ and writing $9\frac{3}{5} = \frac{48}{5}$ (may be earlier in working) <i>Working required</i>	shown		A1 dep on M2, for conclusion to $9\frac{3}{5}$ from correct working – either sight of the result of the multiplication eg $\frac{336}{35}$ oe must be seen or correct cancelling prior to the multiplication to $\frac{48}{5}$ NB: use of decimals scores no marks unless used as a check
				Total 3 marks

2	<p>eg $2 \times 252 = 2 \times 4 \times 63$ or $2 \times 252 = 2 \times 2 \times 126$ or $2 \times 252 = 2 \times 3 \times 84$ or $4 \times 126 = 4 \times 9 \times 14$ or $9 \times 56 = 3 \times 3 \times 56$ or $9 \times 56 = 9 \times 7 \times 8$</p> <p>eg</p> <div><div>504</div><div>2252</div><div>2</div><div>2</div><div>126</div></div> <p>eg</p> <table><tr><td>2</td><td>504</td></tr><tr><td>2</td><td>252</td></tr><tr><td></td><td>126</td></tr></table>	2	504	2	252		126		3	<p>M1 for finding prime factors or factors after at least 2 stages of prime factorisation seen with 0 incorrect stages eg $2 \times 252 = 2 \times 4 \times 63$ or for finding at least 2 prime factors after at least 3 stages in prime factorisation seen with no more than 1 incorrect stage eg $4 \times 500 = 2 \times 2 \times 10 \times 50$</p> <p>Each stage gives 2 factors – may be in a factor tree or a table or listed (see LHS for examples of the amount of work needed for the award of this mark)</p>						
2	504															
2	252															
	126															
	<p>eg $2 \times 2 \times 2 \times 3 \times 3 \times 7$ oe</p> <p>eg</p> <div><div>504</div><div>2252</div><div>2</div><div>2</div><div>126</div><div>2</div><div>63</div><div>3</div><div>21</div><div>3</div><div>7</div></div> <p>eg</p> <table><tr><td>2</td><td>504</td></tr><tr><td>2</td><td>252</td></tr><tr><td>2</td><td>126</td></tr><tr><td>3</td><td>63</td></tr><tr><td>3</td><td>21</td></tr><tr><td></td><td>7</td></tr></table>	2	504	2	252	2	126	3	63	3	21		7			<p>M1 dep on M1 for prime factors 2, 2, 2, 3, 3, 7 with no others (ignore 1s)</p> <p>award this mark for</p> <div><div>$2, 4, 3, 3, 7$</div><div>$or\ 2, 2, 2, 9, 7$</div><div>$or\ 2, 2, 6, 3, 7$</div></div> <div><div>$or\ 2, 2^2, 3, 3, 7$</div><div>$or\ 2^3, 9, 7$</div><div>$or\ 2, 2, 3, 3, 14$</div></div> <div><div>$or\ 8, 3, 3, 7$</div><div>$or\ 2, 2, 2, 3^2, 7$</div><div>$or\ 2, 2, 3^2, 14$</div></div> <div><div>$or\ 2^3, 3, 3, 7$</div><div></div><div>$or\ 2, 2, 2, 3, 21$</div></div> <div><div></div><div></div><div>$or\ 2^3, 3, 21$</div></div> <p>Can be in any form, eg listed, multiplied, added May be seen in a factor tree or ladder</p>
2	504															
2	252															
2	126															
3	63															
3	21															
	7															
	Working required	$2^3 \times 3^2 \times 7$		<p>A1 dep on M2, may be in any order and allow $2^3 \cdot 3^2 \cdot 7$</p>												
				Total 3 marks												

3	(a)		e^{10}	1	B1
	(b)		g^3	1	B1
					Total 2 marks

4	(i)		1177.5	1	B1
	(ii)		1178.5	1	B1 accept 1178.499(...) or 1178.49
					Award (i) B0 (ii) B1 for the correct answers given the wrong way round
					Total 2 marks

5	$(6x =) 1 - 0.45 - 0.31 (= 0.24)$ oe or $0.45 + 0.31 + 5x + x = 1$ oe OR $0.45 \times 400 (= 180)$ or $0.31 \times 400 (= 124)$ or $(0.45 + 0.31) \times 400 (= 304)$		4	M1	for showing a clear understanding that the total of probabilities is 1 OR for finding the number of blue counters or green counters or blue & green counters If probabilities are given as percentages then % sign must be seen
	$(x =) \text{“}0.24\text{”} \div (5 + 1) (= 0.04)$ or $(5x =) \text{“}0.24\text{”} \div (5 + 1) \times 5 (= 0.2)$ OR $\text{“}0.24\text{”} \times 400 (= 96)$ oe or $400 - \text{“}304\text{”} (= 96)$ or $400 - \text{“}180\text{”} - \text{“}124\text{”} (= 96)$			M1	for method to find the value of x or $5x$ OR method to find the total number of red and yellow counters
	eg $\text{“}0.2\text{”} \times 400$ or $\text{“}0.04\text{”} \times 5 \times 400$ oe or $\text{“}96\text{”} \div (5 + 1) \times 5$ oe or $\text{“}0.04\text{”} \times 400 (= 16)$ oe or $\text{“}96\text{”} \div (5 + 1) (= 16)$ oe OR for an answer of $\frac{80}{400}$ or 16 or $\frac{16}{400}$			M1	for a complete method to find the number of red counters or a method to find the number of yellow counters OR for an answer of $\frac{80}{400}$ or 16 or $\frac{16}{400}$
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	80		A1	
					Total 4 marks

6	$5 \times 8 (= 40)$ or $24 \times [\text{their height B}]$ or $24 \div 8 (= 3)$ or $8 \div 24 \left(= \frac{1}{3} \text{ oe} \right)$ or $3 : 1 \text{ oe}$ or $1 : 3 \text{ oe}$ or eg $\frac{24}{8} = \frac{x}{5}$ or $\frac{24}{x} = \frac{8}{5} \text{ oe}$ or $(24 \div 8)^2 (= 9)$ or $(8 \div 24)^2 \left(= \frac{1}{9} \text{ oe} \right)$ or $9 : 1 \text{ oe}$ or $1 : 9 \text{ oe}$		3	M1 for a method to find the area of A or the area of B where [their height B] is clearly identified on the diagram or in the working or the linear scale factor, may be seen in an equation or for setting up an equation using the base and the height of A and B or finding the area scale factor, may be seen in an equation
	eg $5 \times 8 (= 40)$ and $24 \div 8 (= 3)$ or $3 : 1 \text{ oe}$ or $5 \times 8 (= 40)$ and $8 \div 24 \left(= \frac{1}{3} \text{ oe} \right)$ or $1 : 3 \text{ oe}$ or $5 \times "3" (= 15) \text{ oe}$ eg $24 \div \frac{8}{5} (= 15)$ or $5 \times 8 (= 40)$ and $(24 \div 8)^2 (= 9)$ or $9 : 1 \text{ oe}$ or $5 \times 8 (= 40)$ and $(8 \div 24)^2 \left(= \frac{1}{9} \text{ oe} \right)$ or $1 : 9 \text{ oe}$			M1 for a method to find the area of A and the linear scale factor or the height of B or finding the area of A and the area scale factor
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	360		A1 cao
				Total 3 marks

7	(a)		open circle at $x = 1$ and a line with an arrow to the left	1	B1 allow a line without an arrow if it reaches to at least -3 , with an arrow it can be any length
	(b)		$-1, 0, 1, 2, 3$	2	<p>B2 for $-1, 0, 1, 2, 3$, accept in any order, do not allow repeats</p> <p>(B1 for $-1 \leq y < 4$, may be seen as two separate inequalities eg $-1 \leq y$ and $y < 4$</p> <p>or</p> <p>4 correct values and no incorrect values, ignore repeats (eg $-1, 0, 1, 2$ or $-1, 1, 2, 3$)</p> <p>or</p> <p>for 6 values with no more than one incorrect value, ignore repeats (eg $-1, 0, 1, 2, 3, 4$ or $-2, -1, 0, 1, 2, 3$))</p>

(c)	$\text{eg } -5w > -10 - 8$ or $-5w > -18$ or $8 + 10 > 5w$ or $18 > 5w$ or $\frac{8}{5} - \frac{5w}{5} > \frac{-10}{5}$ oe eg $1.6 - w > -2$		2	M1 for correctly isolating the algebraic term or for dividing the inequality by 5 or w and 3.6 oe with the incorrect sign or for an answer of 3.6 oe allow any sign instead of $>$
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$w < 3.6$		A1 oe eg $3.6 > w$ or $w < \frac{18}{5}$ or $\frac{18}{5} > w$ oe Must have correct inequality symbol on answer line NB sight of correct answer in working space and just ($w =$) 3.6 oe on answer line gains M1 only
				Total 5 marks

8			2	M1 for $(x \pm 4)(x \pm 8)$ or for $(x + a)(x + b)$ with $ab = 32$ or $a + b = -12$
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$(x - 4)(x - 8)$		A1 for correct factors oe eg $(-x + 8)(-x + 4)$
				Total 2 marks

9	eg $11 \times 77 (= 847)$ or $8 \times 75.2 (= 601.6)$ oe		3	M1 for method to find the total weight of the 11 sheep or the 8 sheep
	“847” – “601.6” (= 245.4)			M1 for method to find the total weight of the 3 sheep
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	81.8		A1 oe eg $81\frac{4}{5}, \frac{409}{5}$
				Total 3 marks

10	200 000 $\times$ 0.014 (= 2800) oe or 200 000 $\times$ 1.014 (= 202 800) oe		3	M1 for finding 1.4% or 101.4% of 200 000	M2 for 200 000 $\times$ 1.014 ³ oe or 200 000 $\times$ 1.014 ⁴ (= 211 437...) oe
	eg 200 000 $\times$ 1.014 ³ oe or “202 800” $\times$ 1.014 $\times$ 1.014 oe or “202 800” $\times$ 1.014 (=205 639.2) oe and “205 639.2” $\times$ 1.014 oe			M1 (dep) for a complete method	
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	208 518		A1 awrt 208 518 If no other mark awarded, award SCB1 for 200 000 $\times$ 0.042 (= 8400) oe or 200 000 $\times$ 1.042 (= 208 400) oe or 200 000 $\times$ 1.014 ² (= 205 639.2) oe or 200 000 $\times$ 0.986 (= 197 200) oe or 200 000 $\times$ 0.958 (= 191 600) oe or 200 000 $\times$ 0.986 ³ (= 191 717...) oe	
				Total 3 marks	

11	eg $3 \times 11 \times x = 264$ or $(x =) 264 \div (3 \times 11) (= 8)$ or $x = 8$ or $3 \times 11 (= 33)$		4	M1 for setting up a correct equation using the dimensions and volume or for method to find the value of x or for finding the area of the front face, may be seen embedded in attempted surface area calculations or expressions
	eg at least two of $3 \times 11 (= 33)$ or $3 \times \text{“8”} (= 24)$ or $\text{“8”} \times 11 (= 88)$ OR eg $2 \times (3 \times 11 + 3 \times x + 11 \times x)$ $(= 66 + 28x)$			M1 for method to find the area of at least 2 different faces, may be seen embedded in attempted surface area calculations OR for an expression for the total surface area in terms of x Allow use of “their 8” as long as clearly stated
	eg $2 \times (3 \times 11 + 3 \times \text{“8”} + \text{“8”} \times 11)$ or $2 \times \text{“33”} + 2 \times \text{“24”} + 2 \times \text{“88”}$ or $\text{“33”} + \text{“24”} + \text{“88”} (= 145)$ OR $66 + 28 \times \text{“8”}$ OR eg $4 \times \text{“33”} + 2 \times \text{“88”} (= 308)$ or $4 \times \text{“33”} + 2 \times \text{“24”} (= 180)$ or $4 \times \text{“88”} + 2 \times \text{“33”} (= 418)$ or $4 \times \text{“88”} + 2 \times \text{“24”} (= 400)$ or $4 \times \text{“24”} + 2 \times \text{“88”} (= 272)$ or $4 \times \text{“24”} + 2 \times \text{“33”} (= 162)$			M1 for an addition using the area of at least 3 different faces OR for substituting into the expression for total surface area OR for $4 \times$ area of one face + $2 \times$ area of another face Allow use of “their 8” as long as clearly stated
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	290		A1 cao
				Total 4 marks

12	<p>eg $\begin{array}{r} 4x + 4y = 5 \\ \underline{2x + 4y = 2} \\ 2x = 3 \end{array}$</p> <p>eg $\begin{array}{r} 4x + 4y = 5 \\ \underline{4x + 8y = 4} \\ -4y = 1 \end{array}$</p> <p>eg $\begin{array}{r} x + 2y = 1 \\ \underline{x + y = 1.25} \\ y = -0.25 \end{array}$</p> <p>or eg $4(1 - 2y) + 4y = 5$</p>		3	<p>M1 for a correct method to eliminate x or y – multiplying or dividing one or both equations so the coefficient of x and y is the same in both (condone one arithmetic error in multiplication or division), with the intention to subtract all 3 terms to eliminate one variable (intention to subtract is clearly showing a minus sign or subtracting 2 or 3 out of 3 terms)</p> <p>or writing x or y in terms of the other variable and correctly substituting into the other (condone missing brackets)</p> <p>NB the mark is for the method and not for the result of the method. However, if the correct result of the method is seen, the mark can be awarded.</p>
	<p>eg $“1.5” + 2y = 1$ or $4 \times “1.5” + 4y = 5$</p> <p>or $x + 2 \times “-0.25” = 1$ or $4x + 4 \times “-0.25” = 5$</p>			<p>M1 (dep) for correct substitution to find second variable using their value from a correct method to find the first variable</p> <p>or for repeating above method to find the second variable</p>
	<i>Working required</i>	$\begin{array}{l} x = 1.5 \\ y = -0.25 \end{array}$		A1 oe, dep on M1
				Total 3 marks

13	(a)	eg $4y = 10x (+ 5)$ oe eg $y = 2.5x (+ 1.25)$ or $-10x (-5) = -4y$ oe		2	M1 for $4y = 10x (+ 5)$ oe or an answer of $2.5x$ oe or an answer of -2.5 oe
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	2.5		A1 oe eg $\frac{5}{2}, \frac{10}{4}, \frac{-5}{-2}, \frac{-10}{-4}$
	(b)		(0, 1.25)	1	B1 oe eg $\left(0, \frac{5}{4}\right)$
					Total 3 marks

14	(a)	USE OVERLAY (NB a histogram / bar chart type graph scores 0 marks unless a CF diagram is drawn over their histogram / bar chart) (Ignore any part of the graph before (10, 19))		2	M1 for at least 5 points plotted correctly at end of interval or for all 6 points plotted consistently within each interval from the cumulative frequency table at the correct height
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	correct cf graph		A1 for fully correct plotting with points joined accept curve or line segments accept curve that is not joined at (0, 0)
	(b)		21 – 23	1	B1 accept answer in the range 21 – 23 or ft an ascending graph
	(c)		29 or 30 or 31	1	B1 accept integer value of 29 or 30 or 31 or ft an ascending graph for an integer value
					Total 4 marks

15	eg $(5 - 2) \times 180 (= 540)$ or $(10 - 2) \times 180 (= 1440)$ or $(10 - 2) \times 180 \div 10 (= 144)$ or $360 \div 10 (= 36)$		3	M1 for a method to find the sum of the interior angles for a pentagon or a decagon or the size of an interior angle of a regular decagon or the size of an exterior angle of a regular decagon Angles may be seen on the diagram
	eg “540” – $(80 + 75 + 109 + 180 + “36”)$ or “540” – $(80 + 75 + 109 + 360 - “144”)$ or $80 + 75 + 109 + 180 + “36” + x = “540”$			M1 for a method to the missing angle in the pentagon or for forming an equation in x
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	60		A1
				Total 3 marks

16 (a)	eg $\frac{5 \times x}{8 \times x} - \frac{2(x+2)}{2 \times 4x}$ or $\frac{5x}{8x} - \frac{2x+4}{8x}$ or $\frac{5x-2(x+2)}{8x}$ or $\frac{4 \times 5x}{4 \times 8x} - \frac{8(x+2)}{8 \times 4x}$ or $\frac{20x}{32x} - \frac{8x+16}{32x}$ or $\frac{20x-8(x+2)}{32x}$ oe		3	M1 for two correct fractions with a common denominator or a single correct fraction condone M1 for $\frac{5x-2x+4}{8x}$ or $\frac{3x+4}{8x}$ or $\frac{20x-8x+16}{32x}$ or $\frac{12x+16}{32x}$
	eg $\frac{5x-2x-4}{8x}$ or $\frac{20x-8x-16}{32x}$ or $\frac{12x-16}{32x}$ oe			M1 for a correct single fraction with bracket expanded
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$\frac{3x-4}{8x}$		A1 oe but must be in simplest form eg $\frac{-4+3x}{8x}$ ISW correct separating into 2 fractions eg $\frac{3x-4}{8x} = \frac{3}{8} - \frac{1}{2x}$ Do not ISW incorrect simplification eg $\frac{3x-4}{8x} = -\frac{1}{8}$ is M2A0

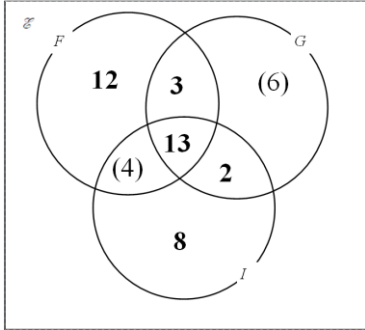
(b)	eg $3x(2x-1) = 6x^2 - 3x$ or $3x(x+4) = 3x^2 + 12x$ or $(2x-1)(x+4) = 2x^2 + 8x - x - 4 (= 2x^2 + 7x - 4)$		3	M1 for sight of $6x^2 - 3x$ or $3x^2 + 12x$ or $2x^2 + 8x - x - 4$ or $2x^2 + 7x - 4$ or for an expansion with only one error	M2 for 3 (out of a maximum of 4) of $6x^3 + 24x^2 - 3x^2 - 12x$ this can be implied by $6x^3 + 21x^2 \dots$ or $\dots + 21x^2 - 12x$ (M1 for 2 correct out of a maximum of 4)
	eg $[(6x^2 - 3x)(x+4) =] 6x^3 + 24x^2 - 3x^2 - 12x$ or $[(3x^2 + 12x)(2x-1) =] 6x^3 - 3x^2 + 24x^2 - 12x$ or $[3x(2x^2 + 8x - x - 4) =] 6x^3 + 24x^2 - 3x^2 - 12x$ or $[3x(2x^2 + 7x - 4) =] 6x^3 + 21x^2 - 12x$			M1 ft dep on M1 and a quadratic expression Allow one further error	
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$6x^3 + 21x^2 - 12x$		A1 cao (terms may be in any order but must be simplified) ISW correct factorisation eg $3(2x^3 + 7x^2 - 4x)$ Do not ISW incorrect simplification eg $6x^3 + 21x^2 - 12x = 2x^3 + 7x^2 - 4x$	
				Total 6 marks	

17	(a)		$3x^2 + 10x - 8$	2	B2 for correct differentiation (B1 for 2 of $3x^2$, $10x$, -8 correct)
	(b)	eg $(3x - 2)(x + 4) (= 0)$ $(x =) \frac{-10 \pm \sqrt{10^2 - (4 \times 3 \times -8)}}{2 \times 3}$		3	M1 ft 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 or completing the square allow one sign error and some simplification, allow as far as eg $\frac{-10 \pm \sqrt{100 + 96}}{6}$ oe)
					M1 (dep on M1) for -4 or $\frac{2}{3}$ oe eg 0.66(6...) or 0.67
		<i>Working required</i>	$(-4, 48)$		A1 (dep on first M1) for both correct coordinates
					Total 5 marks

18	eg $\frac{2}{8} \times \frac{1}{7} \left(= \frac{2}{56} = \frac{1}{28} \right)$ oe eg $\frac{1}{8} \times \frac{1}{7} \times 2 \left(= \frac{2}{56} = \frac{1}{28} \right)$ or $\frac{3}{8} \times \frac{2}{7} \left(= \frac{6}{56} = \frac{3}{28} \right)$ oe $\frac{1}{8} \times \frac{1}{7} \times 6 \left(= \frac{6}{56} = \frac{3}{28} \right)$		3	M1 for the correct product for $1 \rightarrow 4$ or $2 \rightarrow 5$, allow eg $\frac{1}{4} \times \frac{1}{7} \left(= \frac{1}{28} \right)$ oe or $\frac{3}{4} \times \frac{1}{7} \left(= \frac{3}{28} \right)$ oe allow multiples of these products for this mark only
	eg $\frac{2}{8} \times \frac{1}{7} + \frac{3}{8} \times \frac{2}{7}$ oe eg $\frac{1}{8} \times \frac{1}{7} \times 2 + \frac{1}{8} \times \frac{1}{7} \times 6$ OR $\frac{2}{8} \times \frac{1}{7} + \frac{3}{8} \times \frac{2}{7} \left(+ \frac{2}{8} \times \frac{2}{7} = \frac{12}{56} = \frac{3}{14} = 0.21(4...) = 21.(4...) \% \right)$			M1 for the addition of two correct probabilities for $1 \rightarrow 4$, $2 \rightarrow 5$ where the second card is 3 more OR addition of 3 correct probabilities for $1 \rightarrow 4$, $2 \rightarrow 5$, $1 \rightarrow 5$ scores M2A0, second card is 3 or more
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$\frac{8}{56}$		A1 oe eg $\frac{1}{7}$ or any equivalent fraction or correct decimal or percentage rounded or truncated to at least 2 sf eg 0.14(2...) or 14(.2...) % SCB1 for an answer of $\frac{8}{64}$ oe or $\frac{12}{64}$ oe eg $\frac{1}{8}$, 0.125, 12.5% or $\frac{3}{16}$, 0.1875, 18.75% (eg with replacement) – must be supported with working eg $\frac{2}{8} \times \frac{1}{8} + \frac{3}{8} \times \frac{2}{8} \left(+ \frac{2}{8} \times \frac{2}{8} \right)$
				Total 3 marks

19	eg $PQR = 170 \div 2 (= 85)$ or reflex $POR = 360 - 170 (= 190)$		5	M1 for method to find PQR or reflex POR Angles to be identified either by notation or correctly positioned on the diagram
	eg $PSR = 180 - "85" (= 95)$ or $PSR = "190" \div 2 (= 95)$			M1 for method to find PSR Angles to be identified either by notation or correctly positioned on the diagram
	<i>Correct answer scores 3 marks (unless from obvious incorrect working)</i>	42		A1
				B2 (dep on M2) for two correct reasons for their method, eg <u>Angle</u> at the <u>centre</u> is <u>2</u> $\times$ (double) angle at <u>circumference</u> <u>Opposite angles</u> of a <u>cyclic quadrilateral</u> sum to 180° <u>Angles</u> in a <u>quadrilateral</u> add up to 360 or <u>Angles</u> around a <u>point</u> add up to 360° <u>Angle</u> at the <u>centre</u> is <u>2</u> $\times$ (double) angle at <u>circumference</u> <u>Angles</u> in a <u>quadrilateral</u> add up to 360 If not B2, then award B1 (dep on at least M1) for one correct reason for their method
				Total 5 marks

20	eg $y = kt^2$ or $40 = k \times 4^2$	or $t = c\sqrt[3]{x}$ or $12 = c \times \sqrt[3]{8}$		5	M1 for setting up a proportionality equation or first step to find the value of a constant of proportionality Allow any letter or the same letter for the constants of proportionality
	eg $k = \frac{40}{4^2}$ or $k = 2.5$ oe	or $c = \frac{12}{\sqrt[3]{8}}$ or $c = 6$			M1 for a method to find the value of a constant of proportionality, allow this for M2 if proportionality equation not seen
	eg $k = \frac{40}{4^2}$ or $k = 2.5$ oe and $c = \frac{12}{\sqrt[3]{8}}$ or $c = 6$				M1 for a method to find the value of both constants of proportionality, allow this for M3 if proportionality equations not seen
	eg $t = "6" \times \sqrt[3]{27} (=18)$ or $y = "2.5" ("6" \sqrt[3]{x})^2$				M1 for method to find t when $x = 27$ or for writing y in terms of x
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	810			A1
					Total 5 marks

21 (a)	eg $F \cap G \cap I' = 16 - x$ and $F' \cap G \cap I = 15 - x$ or $F \cap G \cap I' = 24 - 6 - 15 (= 3)$ and $F' \cap G \cap I = 24 - 6 - 16 (= 2)$ oe		3	<p>M1 for correct expressions or calculations for the unknown intersections May be seen on the diagram or in the workings but must be linked to correct section</p> <p>Allow for sight of the expressions $x + 4 + 16 - x + 15 - x (= 35 - x)$ or $x + 6 + 16 - x + 15 - x (= 37 - x)$</p>
	eg $x + 6 + 16 - x + 15 - x = 24$ oe eg $37 - x = 24$ or $(x =) 24 - (6 + "3" + "2")$ or $(x =) 16 + 15 + 6 - 24$			<p>M1 for setting up a correct equation using the total for German or for a correct calculation for x</p>
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	13		<p>A1 could be shown on diagram</p> 
(b)	eg "12" + "13" + 6 + 4 + "3" + "2" + "8" (= 48) or $60 - ("12" + "13" + 6 + 4 + "3" + "2" + "8")$		2	<p>M1ft for a method to find total studying at least one of French or German or Italian or none of French or German or Italian (ft their values in (a) from a complete Venn diagram and total of all 7 values must be less than 60)</p>
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	12		<p>A1ft for 12 or ft their values in (a) from a complete Venn diagram and total of all 7 values must be less than 60</p>
Total 5 marks				

22	eg $\frac{(AC)}{\sin(180-62-47)} = \frac{13}{\sin 62}$ or $\frac{(AB)}{\sin 47} = \frac{13}{\sin 62}$	eg $BX = 13 \sin 47 (= 9.50(7...))$ or $BX = \sqrt{13^2 - (13 \cos 47)^2} (= 9.50(7...))$ or $XC = 13 \cos 47 (= 8.86(5...))$ or $XC = \sqrt{13^2 - (13 \sin 47)^2} (= 8.86(5...))$ (some students are using $13 \sin 47$ or $13 \cos 47$ as the length of AB or AC – this approach gains 0 marks)	4	M1 for setting up a trig equation for AC or AB OR for finding the length BX where BX is the perpendicular height of triangle ABC or the length XC , must be clearly identified or used correctly to gain this mark. Check the diagram for values
	eg $(AC =) \frac{13 \sin(180-62-47)}{\sin 62} (= 13.9...)$ or $(AB =) \frac{13 \sin 47}{\sin 62} (= 10.7(6...))$	eg $AX = "9.507..." \div \tan 62 (= 5.05(5...))$ and $XC = 13 \cos 47 (= 8.86(5...))$		M1 for a complete method for AC or AB OR for finding both the length of AX and the length of XC , must be clearly identified or used correctly to gain this mark.
	eg $\frac{1}{2} \times "13.9..." \times 13 \times \sin 47$ or $\frac{1}{2} \times ("5.05(5...)" + "8.86(5...)") \times 13 \times \sin 47$ or $\frac{1}{2} \times "10.7(6...)" \times 13 \times \sin(180-62-47)$ or $\frac{1}{2} \times ("5.05(5...)" + "8.86(5...)") \times "9.50(7...)"$			M1 for method to find the area of the triangle
	Correct answer scores full marks (unless from obvious incorrect working)		66.2	A1 accept 65.7 – 66.4
				Total 4 marks

23	(a)		0	1	B1
	(b)	eg $(f(0.5)) = \frac{1}{0.5} (= 2)$ oe or $(gf(0.5)) = 4\left(\frac{1}{0.5}\right)^2 - 8\left(\frac{1}{0.5}\right) + 15$ or $(gf(x)) = 4\left(\frac{1}{x}\right)^2 - 8\left(\frac{1}{x}\right) + 15\left(= \frac{4}{x^2} - \frac{8}{x} + 15\right)$		2	M1 for finding $f(0.5)$ or $gf(0.5)$ or $gf(x)$
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	15		A1

(c)	eg $x = 4(y^2 - 2y) + \dots$ or $x = 4(y^2 - 2y + \dots)$ oe	eg $x - 11 = 4y^2 - 8y + 4$ oe or eg $x - 15 = 4y^2 - 8y$ oe or eg $x = 4(y^2 - 2y + 1) + 11$ oe		4	M1 for correctly taking out a factor of 4 or for a correct start to the method in rearranging NB: for each method, allow x and y to be used the other way around
	eg $x = 4[(y-1)^2 - 1^2] + \dots$ or $x = 4[(y-1)^2 - 1^2 + \dots]$ or $x = 4(y-1)^2 - 4 + \dots$ oe	eg $\frac{x-11}{4} = y^2 - 2y + 1$ oe or $\frac{x-15}{4} + 1 = y^2 - 2y + 1$ oe or $\frac{x-15}{4} = y^2 - 2y$ oe or $x = 4(y-1)^2 + 11$ oe			M1 for correctly completing the square or correctly isolating $y^2 - 2y + 1$ or $y^2 - 2y$ or for $x = 4(y-1)^2 + 11$ oe Award of this mark implies the previous mark
	eg $(y-1)^2 = \frac{x-11}{4}$ oe	eg $(y-1)^2 = \frac{x-11}{4}$ oe or eg $(y-1)^2 = \frac{x-15}{4} + 1$ oe			M1 for reaching $(y-1)^2 = \frac{x-11}{4}$ oe or an answer of $1 \pm \sqrt{\frac{x-11}{4}}$ or $1 - \sqrt{\frac{x-11}{4}}$
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>		$1 + \sqrt{\frac{x-11}{4}}$		A1 must be in terms of x , oe eg $1 + \sqrt{\frac{x-15}{4}} + 1$ or $\frac{\sqrt{x-11} + 2}{2}$ or $1 + \frac{\sqrt{x-11}}{2}$ Do not ISW incorrect simplification eg $1 + \sqrt{\frac{x-11}{4}} = 1 + \sqrt{\frac{x}{4}} - \sqrt{\frac{11}{4}}$ is M3A0
					Total 7 marks

24	eg $\frac{6-1}{7-3} \left(= \frac{5}{4} = 1.25 \right)$ oe or $(1 = 3k + b \text{ and } 6 = 7k + b \text{ leading to})$ $(k =) \frac{5}{4} (= 1.25)$		4	M1 for a method to find the gradient of the radius
	eg $-1 \div \frac{5}{4} \left(= -\frac{4}{5} = -0.8 \right)$ oe			M1ft for a method to find the gradient of the tangent ft their gradient of radius
	eg $6 = -\frac{4}{5} \times 7 + c$ or $c = \frac{58}{5} (= 11.6)$ or $y - 6 = -\frac{4}{5}(x - 7)$ or $y = -\frac{4}{5}x + \frac{58}{5}$			M1ft (dep on previous M1) for substitution of (7, 6) and their gradient of the tangent into $y = mx + c$ or $y - y_1 = m(x - x_1)$ ft their gradient of tangent
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$4x + 5y - 58 = 0$		A1 oe eg $4x + 5y = 58$ etc but must be integer coefficients accept $a = 4, b = 5, c = -58$
				Total 4 marks

25	(a)	eg $3\mathbf{a} + 2\mathbf{a} + 2\mathbf{b} + \frac{3}{2}(2\mathbf{a} + 2\mathbf{b})$ oe eg $3\mathbf{a} + 2\mathbf{a} + 2\mathbf{b} + 3\mathbf{a} + 3\mathbf{b}$		2	M1 for a correct method to find $\overrightarrow{OD}$
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	8a+5b		A1 cao
	(b)	eg $\overrightarrow{OP} = \lambda(8\mathbf{a} + 5\mathbf{b})$ oe or $\overrightarrow{OP} = 4\mathbf{b} + \mu(-4\mathbf{b} + 3\mathbf{a} + 2\mathbf{a} + 2\mathbf{b})$ or $\overrightarrow{OP} = 4\mathbf{b} + \mu(5\mathbf{a} - 2\mathbf{b})$ oe or $\overrightarrow{OP} = 3\mathbf{a} + 2\mathbf{a} + 2\mathbf{b} + x(-2\mathbf{a} - 2\mathbf{b} - 3\mathbf{a} + 4\mathbf{b})$ or $\overrightarrow{OP} = 5\mathbf{a} + 2\mathbf{b} + x(2\mathbf{b} - 5\mathbf{a})$ oe OR eg $\overrightarrow{PD} = r(8\mathbf{a} + 5\mathbf{b})$ oe or $\overrightarrow{PD} = s(-4\mathbf{b} + 3\mathbf{a} + 2\mathbf{a} + 2\mathbf{b}) + \frac{3}{2}(2\mathbf{a} + 2\mathbf{b})$ or $\overrightarrow{PD} = s(5\mathbf{a} - 2\mathbf{b}) + 3\mathbf{a} + 3\mathbf{b}$ oe		4	M1 ft, for an expression for $\overrightarrow{OP}$ OR $\overrightarrow{PD}$ ft an answer in the form $m\mathbf{a} + n\mathbf{b}$ from (a)
		eg 2 of eg $\overrightarrow{OP} = \lambda(8\mathbf{a} + 5\mathbf{b})$ oe or $\overrightarrow{OP} = 4\mathbf{b} + \mu(-4\mathbf{b} + 3\mathbf{a} + 2\mathbf{a} + 2\mathbf{b})$ or $\overrightarrow{OP} = 4\mathbf{b} + \mu(5\mathbf{a} - 2\mathbf{b})$ oe or $\overrightarrow{OP} = 3\mathbf{a} + 2\mathbf{a} + 2\mathbf{b} + x(-2\mathbf{a} - 2\mathbf{b} - 3\mathbf{a} + 4\mathbf{b})$ or $\overrightarrow{OP} = 5\mathbf{a} + 2\mathbf{b} + x(2\mathbf{b} - 5\mathbf{a})$ oe OR eg $\overrightarrow{PD} = r(8\mathbf{a} + 5\mathbf{b})$ oe or $\overrightarrow{PD} = s(-4\mathbf{b} + 3\mathbf{a} + 2\mathbf{a} + 2\mathbf{b}) + \frac{3}{2}(2\mathbf{a} + 2\mathbf{b})$ or $\overrightarrow{PD} = s(5\mathbf{a} - 2\mathbf{b}) + 3\mathbf{a} + 3\mathbf{b}$ oe			M1 ft, for 2 different expressions for $\overrightarrow{OP}$ OR $\overrightarrow{PD}$ ft an answer in the form $m\mathbf{a} + n\mathbf{b}$ from (a)
		eg $8\lambda = 5\mu$ and $5\lambda = 4 - 2\mu$ oe or $8\lambda = 5 - 5x$ and $5\lambda = 2 + 2x$ oe OR $8r = 5s + 3$ and $5r = -2s + 3$ oe			M1 ft, dep on M2, for comparing coefficients for a and b ft an answer in the form $m\mathbf{a} + n\mathbf{b}$ from (a)
		<i>Working required</i>	20:21		A1 dep on M2, oe
					Total 6 marks

26	<p>eg two terms from $(27^x =)(3^3)^x$ or 3^{3x}</p> <p>OR $(9^{4-n} =)(3^2)^{4-n}$ or 3^{8-2n} or $\left(\frac{1}{9^{4-n}} = 9^{-4+n} =\right)(3^{-2})^{-4+n}$ or 3^{-8+2n}</p> <p>OR $\left(\frac{6^x}{2^x} =\right)3^x$ or $(6^x =)3^x \times 2^x$</p> <p>OR $\left(\frac{27^x}{3^x} =\right)9^x$</p>		3	<p>M1 for correctly changing the base of at least two terms</p>
	<p>eg $\frac{(3^3)^x \times 3^{n+6}}{(3^2)^{4-n}} = 3^x$ or $\frac{3^{3x} \times 3^{n+6}}{3^{8-2n}} = \left(\frac{2^x}{2^x} \times\right) 3^x$</p> <p>or eg $3x + n + 6 - (8 - 2n) = x$ oe</p>			<p>M1 for correctly writing the left hand side and right side with all indices written with the same base</p> <p>or for a correct equation in terms of x and n with no indices</p>
	<i>Working required</i>	$1 - \frac{3}{2}n$		<p>A1 (dep on M1) oe eg $1 - 1.5n$, $\frac{2-3n}{2}$, $\frac{3n-2}{-2}$ Do not ISW incorrect simplification eg $\frac{2-3n}{2} = -3n$ is M2A0</p>
				Total 3 marks

