Pearson

Mark Scheme (Results)

Summer 2026

Pearson Edexcel International GCSE Mathematics A (Modular)

4WM1H /01R

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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	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 $\frac{\cancel{14}^{2}}{5}\times\frac{24}{\cancel{7}^{1}}$ **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 $\frac{\cancel{14}^{2}}{5}\times\frac{24}{\cancel{7}^{1}}=\frac{48}{5}=9\frac{3}{5}$ **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) *Working required*	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	(i)		1177.5	1	B1	
	(ii)		1178.5	1	B1	accept 1178.499(..). or 1178.49̇ Award (i) B0 (ii) B1 For the correct answers given the wrong way round
						Total 2 marks

3	(a)		$4m(2h - 5)$	2	B2 (B1	for $4m(2h - 5)$ or $-4m(5 - 2h)$ for $4(2hm - 5m)$ or $m(8h - 20)$ or $2m(4h - 10)$ **or** $4m(ph - q)$ where p and q are non-zero integers **or** $(2h - 5)$ as a factor)
	(b)	eg $12x - 27 = 7x - 6$ oe **or** $4x - 9 = \frac{7}{3}x - \frac{6}{3}$ oe		3	M1	for removal of fraction **and** multiplying out LHS correctly by any multiple of 3 **or** separating fraction (RHS)
		eg $12x - 7x = -6 + 27$ **or** $5x = 21$ or $-27 + 6 = 7x - 12x$ or $-21 = -5x$ oe **or** $4x - \frac{7}{3}x = -\frac{6}{3} + 9$ oe or $\frac{5}{3}x = \frac{21}{3}$ oe			M1ft	dep on 4 terms for correctly rearranging their 4 term equation for terms in x on one side of equation and number terms on the other
		Working required	$\frac{21}{5}$		A1	dep on M1 oe eg 4.2 or $4\frac{1}{5}$
						Total 5 marks

4	$27^2 + w^2 = 63^2$ oe or $729 + w^2 = 3969$ oe or $(w^2 =)\ 63^2 - 27^2\ (= 3240)$ or $(w^2 =)\ 3669 - 729\ (= 3240)$ **OR** $\sin^{-1}\left(\frac{27(\times \sin 90)}{63}\right)(= 25.3(76...))$ **OR** $\cos^{-1}\left(\frac{27}{63}\right)(64.6(23...))$ **and** leading to $y = 64.623\ldots$ **OR** $63^2 = 27^2 + w^2 - 2 \times 27 \times w \times \cos 90$ oe		3	M1	for applying Pythagoras theorem correctly **OR** for applying sine ratio or sine rule correctly to find a missing acute angle **OR** for applying the cosine ratio to find a missing acute angle **OR** for using the cosine rule with the right angle
	$(w =)\ \sqrt{63^2 - 27^2}\ (= \sqrt{3240} = 18\sqrt{10})$ or $(w =)\ \sqrt{3969 - 729}\ (= \sqrt{3240} = 18\sqrt{10})$ **OR** $(w =)\frac{27}{\tan"25.4"}$ or $(w =)63 \times \cos"25.4"$ **OR** $(w =)27 \times \tan"64.6"$ or $(w =)63 \times \sin"64.6"$ **OR** $(w =)\frac{27 \times \sin(90 - "25.4")}{\sin("25.4")}$ or $(w =)\frac{27 \times \sin("64.6")}{\sin(90 - "64.6")}$ or $(w =)\frac{63 \times \sin("64.6")}{\sin(90)}$ **OR** $(w =)\sqrt{27^2 + 63^2 - 2 \times 27 \times 63 \times \cos"64.6"}$ or $(w =)\sqrt{27^2 + 63^2 - 2 \times 27 \times 63 \times \cos(90 - "25.4")}$			M1	for square rooting the **correct** expression **OR** for a fully correct method using their acute angle "25.3" and a correct trig ratio to find length w **OR** for a fully correct method using their acute angle "64.6" and a correct trig ratio to find length w **OR** using a fully correct sine rule using their acute to find the length *w* **OR** for a fully correct use of the cosine rule and their acute angle to find the length *w*
	Correct answer scores full marks (unless from obvious incorrect working)	56.9		A1	awrt 56.9
					Total 3 marks

5	($6x$ =) 1 – 0.45 – 0.31 (= 0.24) oe **or** 0.45 + 0.31 + $5x$ + x = 1 oe **OR** 0.45 × 400 (= 180) **or** 0.31 × 400 (= 124) **or** (0.45 + 0.31) × 400 (= 304)		4	M1 for applying the 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 =) "0.24" ÷ (5 + 1) (= 0.04) **or** ($5x$ =) "0.24" ÷ (5 + 1) × 5 (= 0.2) **OR** "0.24" × 400 (= 96) oe **or** 400 – "304" (=96) oe **or** 400 – "180" –"124" (=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 "0.2" × 400 **or** "0.04" ×5 × 400 oe **or** "96" ÷ (5 +1) × 5 oe **or** "0.04" × 400 (=16) oe **or** "96" ÷ (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 $\frac{16}{400}$
	Correct answer scores full marks (unless from obvious incorrect working)	80		A1
				Total 4 marks

6	(a)		11 13 14 16 17 18 19	1	B1	cao
	(b)		10 12 14 15 16 18 20	1	B1	cao
	(c)		12 15	1	B1	cao
						Total 3 marks

7	$\frac{1.75}{(1)} = \frac{(m)}{200}$ or (m =) 1.75 × 200 or $200 = \frac{(m)}{1.75}$ oe		2	M1	for substituting 1.75 and 200 correctly into a correct formula for density; may use any letter for the mass
	Correct answer scores full marks (unless from obvious incorrect working)	350		A1	cao
					Total 2 marks

8	$(2\times)37=(2\times)\pi\times r$ or $37=\left(\frac{1}{2}\times 2\times\right)\pi\times r$ or $37=\left(\frac{180}{360}\times 2\times\right)\pi\times r$ oe or $\pi d=37\times 2$ oe		4	M1	for substituting 37 into a correct formula for the circumference of a circle or arc length of semi-circle Allow $\pi=3.14(15...)$ or $\frac{22}{7}$
	$(r=)\frac{(2\times)37}{(2\times)\pi}(11.7(774...))$ oe			M1	for finding the radius Allow $\pi=3.14(15...)$ or $\frac{22}{7}$
	(Area=) $\frac{\pi\times"11.7"^2}{2}$ or (Area=) $\frac{\pi\times[\text{their radius}]^2}{2}$ oe			M1ft	Indep for a correct method to find the area of the semicircle using their radius where their radius is the value they clearly intend the radius to be Allow $\pi=3.14(15...)$ or $\frac{22}{7}$
	Correct answer scores full marks (unless from obvious incorrect working)	218		A1	Allow 214 – 219
					Total 4 marks

9	(a)	$(x \pm 8)(x \pm 6)$ or $(6 \pm x)(8 \pm x)$ or $x(x-6)+8(x-6)$ or $x(x+8)-6(x+8)$		2	M1	for $(x \pm 6)(x \pm 8)$ or for brackets in the from $(x+a)(x+b)$ where $ab = -48$ or $a + b = 2$
		Correct answer scores full marks (unless from obvious incorrect working)	$(x+8)(x-6)$		A1	Allow any letter for x
	(b)		–8 and 6	1	B1ft	must ft from (a) and must be 2 answer values provided $(x + a)(x + b)$ seen in either parts (a) or (b) Award B0 for –8 and 6 if no marks scored in (a)
						Total 3 marks

10	(a)		−9	1	B1	allow 2^{-9}
	(b)		−10	1	B1	allow 3^{-10}
	(c)		18	1	B1	allow 5^{18}
	(d)		0	1	B1	allow 7^{0}
						Total 4 marks

11	$\sin 36 = \frac{(BD)}{15}$ oe or $\cos 36 = \frac{(AD)}{15}$ oe $\cos(90-36) = \frac{(BD)}{15}$ oe or $\sin(90-36) = \frac{(AD)}{15}$ oe $\frac{(BD)}{\sin 36} = \frac{15}{\sin 90}$ oe or $\frac{(AD)}{\sin(90-36)} = \frac{15}{\sin 90}$		4	M1	for correct trigonometric ratio used or correct use of the sine rule to find length *BD* or *AD* allow any label for length *BD* and/or *AD*
	$(BD =) 15 \times \sin 36$ (= 8.81(677…)) or $(BD =) 15 \times \cos 54$ (= 8.81(677…)) or $(BD =) \frac{15}{\sin 90} \times \sin 36$ (= 8.81(677…)) or $(AD =) 15 \times \cos 36$ (=12.1(352…)) or $(AD =) 15 \times \sin 54$ (=12.1(352…)) or $(AD =) \frac{15}{\sin 90} \times \sin(90-36)$ (=12.1(352…))			M1	for correct rearrangement to find the length *BD* or *AD* sight of 8.81(677…) or 12.1(352…) implies M2
	eg $\tan y = \frac{"8.81"}{42}$ (=0.209(92…) OR $\frac{"8.81(677...)"}{\sin y} = \frac{\sqrt{"8.81(677...)"^2 + 42^2}}{\sin 90}$ or $\frac{\sin y}{"8.81(677...)"} = \frac{\sin 90}{\sqrt{"8.81(677...)"^2 + 42^2}}$ or $\sin y = \frac{\sin 90}{\sqrt{"8.81(677...)"^2 + 42^2}} \times "8.81(677...)"$ oe or $\cos y = \frac{"42.9(15...)"^2 + "54.1(35...)"^2 - 15^2}{2 \times "42.9(15...)" \times "54.1(35...)"}$ oe			M1	for correct use of tangent ratio using length *BD* OR For finding length *AC* and/or *AD* **and** for correct use of tangent ratio or sine rule or cosine rule $(BC=) \sqrt{"8.81(677...)"^2 + 42^2}$ $\left(= \sqrt{184(1.7355...)}\right)$ = 42.9(1544..) or $(BC=) \sqrt{15^2 + "54.13(52...)"^2 - 2 \times 15 \times "54.1(352...)" \cos 36}$ = 42.9(1544..) (*AC*=) 42 + "12.1(352…)" (=54.1(352…)
	Correct answer scores full marks (unless from obvious incorrect working)	11.9		A1	Allow 11.8 – 11.9
					Total 4 marks

12	(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
		Correct answer scores full marks (unless from obvious incorrect working)	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

13	(a)	0.6 and 0.4 0.7 and 0.3 0.85 and 0.15	Correct probabilities	2	B2	for all 3 correct pairs of probabilities on the correct branches (B1 for one correct pair of probabilities on a correct branch) Allow equivalent fractions If probabilities are given as percentages then% sign must be seen 0.6 and 0.4 counts as a pair
	(b)	"0.4" × "0.3" × "0.85" oe		2	M1ft	ft (probabilities < 1) for a complete method involving one product
		Correct answer scores full marks (unless from obvious incorrect working)	0.102		A1ft	oe eg $\frac{51}{500}$ or $\frac{0.102}{1}$ or 10.2% SCB1 for an answer of 0.982 or $\frac{491}{500}$ oe or 0.6 + (0.4 × 0.7) + (0.4 × 0.3 × 0.85) or 1 – (0.4 × 0.3 × 0.15)
						Total 4 marks

14 (a)	eg $\frac{5x}{8\times x}-\frac{2(x+2)}{2\times 4x}$ **or** $\frac{5x}{8x}-\frac{2x+4}{8x}$ **or** $\frac{5x-2(x+2)}{8x}$ **or** $\frac{5x\times 4}{4\times 8x}-\frac{8(x+2)}{4\times 8x}$ **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
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{3x-4}{8x}$		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 $6x^3+21x^2...$ or $...+21x^2-12x$
	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	(M1 for 2 correct out of a maximum of 4)
	Correct answer scores full marks (unless from obvious incorrect working)	$6x^3+21x^2-12x$		A1	cao (terms may be in any order but must be simplified) ISW correct factorisation eg $3\left(2x^3+7x^2-4x\right)$ Do not ISW incorrect simplification eg $6x^3+21x^2-12x=2x^3+7x^2-4x$	
						Total 6 marks

15 (a)	$(3m\pm5)(3m\pm5)$ or $(3m\pm5)^2$ **or** $(3m)^2-(5)^2$		2	M1	Allow for using a different letter to *m* eg $(3x\pm5)(3x\pm5)$
	Correct answer scores full marks (unless from obvious incorrect working)	$(3m+5)(3m-5)$		A1	Allow for using a different letter to *m* eg $(3x+5)(3x-5)$
(b)	$y^{\frac{3}{4}}$ or $y^{\frac{2}{5}}$ or $\frac{1}{y^{\frac{1}{2}}}$ or $y^{-\frac{1}{2}}$		3	M1	For a correct conversion to index form on one of the terms
	eg $y^{\frac{3}{4}+\frac{2}{5}}\left(\times y^{-\frac{1}{2}}\right)$ or $y^{\frac{23}{20}}\left(\times y^{-\frac{1}{2}}\right)$ or $\frac{y^{\frac{3}{4}+\frac{2}{5}}}{y^{\frac{1}{2}}}$ oe or $y^{\frac{3}{4}-\frac{1}{2}}\left(\times y^{\frac{2}{5}}\right)$ or $y^{\frac{1}{4}}\left(\times y^{\frac{2}{5}}\right)$ oe or $\left(y^{\frac{3}{4}}\right)\times y^{\frac{2}{5}-\frac{1}{2}}$ or $\left(y^{\frac{3}{4}}\times\right)y^{-\frac{1}{10}}$ oe OR eg $y^{\frac{3}{4}+\frac{2}{5}-\frac{1}{2}}$ or $y^{\frac{23}{20}-\frac{1}{2}}$ or $y^{\frac{1}{4}+\frac{2}{5}}$ or $y^{\frac{3}{4}-\frac{1}{10}}$ oe OR $(n=)\frac{3}{4}+\frac{2}{5}-\frac{1}{2}$ oe or $(n=)\frac{23}{20}-\frac{1}{2}$ or $(n=)\frac{1}{4}+\frac{2}{5}$ or $(n=)\frac{3}{4}-\frac{1}{10}$ oe OR eg $\frac{3}{4}-\frac{1}{2}$ followed by $\frac{1}{4}+\frac{2}{5}$ oe			M1	For a correct multiplication or division rule seen between two terms provided third term remains unchanged and all conversions to index form are correct. OR For a correct application of index rules to all three terms, with all three parts correctly converted to index form. OR For the correct fractional sum to find the correct expression for the value of *n* seen for all three terms following correct conversion to index form for all three terms. OR For the correct overall fractional sum seen in two stages after correct conversion to index form for all terms.
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{13}{20}$		A1	oe eg 0.65 Allow $y^{\frac{13}{20}}$ or $y^{0.65}$
					Total 5 marks

16 (a)	eg $3(x+1)$ or $3x+3$ oe **or** $(2x+5)(x+6)$ or $2x^2+12x+5x+30$ or $2x^2+17x+30$ oe **or** $3(x+4)$ or $3x+12$ oe **or** $(2x+5)(x+9)$ or $2x^2+18x+5x+45$ or $2x^2+23x+45$ oe **or** $(x+1)(x+9)$ or $x^2+x+9x+9$ or $x^2+10x+9$ oe **or** $(x+4)(x+6)$ or $x^2+4x+6x+24$ or $x^2+10x+24$ oe		3	M1	For a correct expression for the area of one section of the compound shape
	eg $2x^2+12x+5x+30+3x+3=169$ oe or $2x^2+17x+30+3x+3=169$ oe **or** $2x^2+18x+5x+45-3x-12=169$ oe or $2x^2+23x+45-3x-12=169$ oe **or** $x^2+x+9x+9+x^2+4x+6x+24=169$ oe or $x^2+10x+9+x^2+10x+24=169$ oe			M1	For the addition of two correct pairs of areas or the correct subtraction of a smaller from the larger with brackets expanded (allow one error in expansion only) and set equal to 169. Must see fully correct expression set equal to 169, or recovered in next line of working. eg $2x^2+12x+5x+30+3x+3$ (So) $2x^2+20x+33=169$
	Working required	$x^2+10x-68=0$		A1	dep on M2 and fully correct working reaching either $2x^2+20x+33=169$ or $2x^2+20x+33-169=0$ or $2x^2+20x-136=0$ oe before stating the given answer of $x^2+10x-68=0$ **Allow if part (a) is done in part (b) (if it is not done in (a))**

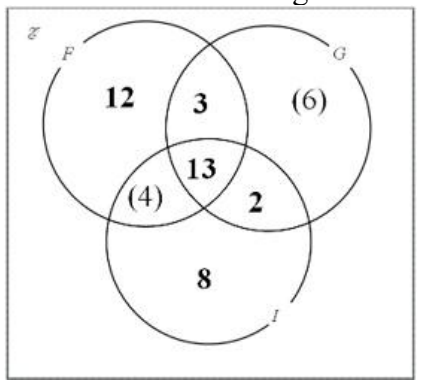
(b)	$\frac{-10 \pm \sqrt{10^2 - (4 \times 1 \times -68)}}{2(\times 1)}$ OR $(x+5)^2 - (5)^2 - 68 (= 0)$ oe		3	M1	for correctly substituting into the quadratic formula or can be simplified as far as $\frac{-10 \pm \sqrt{372}}{2}$ (allow + in place of ± in the formula) condone **one** sign error condone omission of brackets allow partial correct evaluation OR completing the square	M2 for allowing one sign error and some simplification – allow as far as $\frac{-10 \pm \sqrt{100 + 272}}{2}$ or $\frac{-10 \pm \sqrt{100 - -272}}{2}$ or $\frac{-10 \pm \sqrt{372}}{2}$
	$\frac{-10 \pm \sqrt{372}}{2}$ oe or $\frac{-10 \pm \sqrt{100 + 272}}{2}$ or $-5 \pm \frac{\sqrt{372}}{2}$ oe OR $(x+5)^2 = 93$ or better			M1	dep on M1 If the first M1 is awarded and an answer of 4.64 seen award this M mark (allow + in place of ± in the formula)	
	Working required	4.64		A1	dep on M1 awrt 4.64 If candidate writes -14.6 and 4.64 on the answer line award A0 **Allow if part (b) is done in part (a) (if it is not done in (b))**	
						Total 6 marks

17	$\pi\times(5x)^2\times\frac{120}{360}$ oe or $\pi\times25x^2\times\frac{1}{3}$ oe or $\pi\times(3x)^2\times\frac{120}{360}$ oe or $\pi\times9x^2\times\frac{1}{3}$ oe		4	M1	For finding the correct area of one sector Condone missing brackets if recovered. Do not award this mark if $\frac{1}{3}\pi5x^2-\frac{1}{3}\pi3x^2=\frac{2\pi x^2}{3}$ follows. Allow $\frac{120}{360}=0.333(33...)$ Allow $\pi=3.14(15...)$ or $\frac{22}{7}$
	$\pi\times25x^2\times\frac{1}{3}-\pi\times9x^2\times\frac{1}{3}=300\pi$ oe or $26.1(79...)x^2-9.42(47...)x^2=300\pi$ oe $25x^2\pi-\times9x^2\pi=900\pi$ oe or $25x^2\times\frac{1}{3}-9x^2\times\frac{1}{3}=300$ oe or $16x^2\times\frac{1}{3}=300$ oe			M1	for a **correct** equation for the shaded area Brackets must be removed Allow $300\pi=942(.47...)$ **Use alternative mark scheme if 300 is used instead of 300 π**
	$(x=)\sqrt{\frac{300}{\frac{25}{3}-\frac{9}{3}}}\left(=\sqrt{\frac{300}{\frac{16}{3}}}=\sqrt{\frac{225}{4}}\right)$ $(x=)\sqrt{\frac{300\times3}{16}}\left(=\sqrt{\frac{900}{16}}=\sqrt{\frac{225}{4}}\right)$			M1	for a fully correct method for finding x
	Working required	7.5		A1	oe eg $\frac{15}{2}$ dep on M2 if decimals used allow awrt 7.5
					Total 4 marks

17 **MISREAD** **Using** 300	$\pi\times(5x)^2\times\frac{120}{360}$ oe or $\pi\times25x^2\times\frac{1}{3}$ oe or $\pi\times(3x)^2\times\frac{120}{360}$ oe or $\pi\times9x^2\times\frac{1}{3}$ oe		4	M1	Condone missing brackets if recovered. do not award for $\frac{1}{3}\pi5x^2-\frac{1}{3}\pi3x^2=\frac{2\pi x^2}{3}$ Allow $\frac{120}{360}=0.333(33...)$ Allow $\pi=3.14(15...)$ or $\frac{22}{7}$
	$\pi\times25x^2\times\frac{1}{3}-\pi\times9x^2\times\frac{1}{3}=300$ $25x^2\pi\times\frac{1}{3}-3x^2\pi=300$ oe or $\frac{25x^2\pi}{3}-3x^2\pi=300$ or $16x^2\pi\times\frac{1}{3}=300$ oe			M1	for a **correct** equation for the shaded area Brackets must be removed
	$(x=)\sqrt{\frac{300}{\frac{25}{3}\pi-\frac{9}{3}\pi}}\left(=\sqrt{\frac{300}{\frac{16\pi}{3}}}=\sqrt{\frac{225}{4\pi}}\right)$ oe $(x=)\sqrt{\frac{300\times3}{16\pi}}\left(=\sqrt{\frac{900}{16\pi}}=\sqrt{\frac{225}{4\pi}}=4.23(14..)\right)$			M1	for a fully complete method to find x
	Working required			A0	
					Total 4 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
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{8}{56}$		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** eg $\frac{3}{16}$, 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	(i)		F	1	B1 Allow f
	(ii)		B	1	B1 Allow b
					Total 2 marks

20 (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	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 Allow for sight of the expressions $x + 4 + 16 - x + 15 - x$ $(= 35 - x)$ or $x + 6 + 16 - x + 15 - x$ $(= 37 - x)$
	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			M1	for setting up a correct equation using the total for German **or** for a correct calculation for x
	Correct answer scores full marks (unless from obvious incorrect working)	13		A1	could be shown on diagram 
(b)	eg "12" + "13" + 6 + 4 + "3" + "2" + "8" (= 48) **or** 60 – ("12" + "13" + 6 + 4 + "3" + "2" + "8")		2	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)
	Correct answer scores full marks (unless from obvious incorrect working)	12		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
					Total 5 marks

21	eg $\frac{(AC)}{\sin(180-62-47)}=\frac{13}{\sin 62}$ **or** $\frac{(AB)}{\sin 47}=\frac{13}{\sin 62}$	eg $BX=13\sin 47\left(=9.50(7...)\right)$ or $BX=\sqrt{13^2-\left(13\cos 47\right)^2}\left(=9.50(7...)\right)$ **or** $XC=13\cos 47\left(=8.86(5...)\right)$ $XC=\sqrt{13^2-\left(13\sin 47\right)^2}\left(=8.86(5...)\right)$ (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 $\left(AC=\right)\frac{13\sin(180-62-47)}{\sin 62}(=13.9...)$ **or** $\left(AB=\right)\frac{13\sin 47}{\sin 62}(=10.7(6...))$	eg $AX="9.507..."\div\tan 62\left(=5.05(5...)\right)$ **and** $XC=13\cos 47\left(=8.86(5...)\right)$			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 $\frac{1}{2}\times"13.9..."\times13\times\sin 47$ **or** $\frac{1}{2}\times\left("5.05(5...)"+"8.86(5...)"\right)\times13\times\sin 47$ **or** $\frac{1}{2}\times"10.7(6...)"\times13\times\sin(180-62-47)$ **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

22	$4(x\pm1)^2$ .... or $4[(x\pm1)^2....]$ **or** $(2x\pm2)^2$... or $4(x^2\pm2x+1)$.... or $4(x^2\pm2x+1....)$ **or** $4(x+b)^2-c$		3	M1	for a start to completing the square or for an embedded or implied completion of the square or equivalent forms or $a = 4$ embedded in an incorrect final answer in the form $4(x+d)^2-e$ (must be these signs) where d and e are positive
	$4\left[(x+1)^2-(1)^2\right]$.... or $4\left[(x+1)^2-1\right]$.... or $4\left[(x+1)^2-(1)^2....\right]$ or $4\left[(x+1)^2-1....\right]$ **or** $(2x+2)^2-4...$ oe or $4(x+1)(x+1)-4...$ or $(2x+2)^2-13$ **or** $4(x+1)^2-\frac{64}{16}...$ or $4(x+1)^2-4...$			M1	for correctly completing the square but terms do not need to be simplified and -9 may or may not be present or for a correct balancing step after embedded completion of the square **NB: Please refer to ALT mark scheme for comparison of coefficients method**
	Correct answer scores full marks (unless from obvious incorrect working)	$4(x+1)^2-13$		A1	Accept $-13+4(x+1)^2$ (if student continues to solve a quadratic equation, ISW) **SCB2** for $4(x-1)^2-13$
					Total 3 marks

22 ALT	$ax^2 + 2abx + ab^2 - c$		3	M1	for multiplying out $a(x+b)^2 - c$ **or** $a = 4$ embedded in an incorrect final answer in the form $4(x+d)^2 - e$ (must be these signs)
	$2ab = 8$ **or** $ab^2 - c = -9$			M1	for equating coefficients
	Correct answer scores full marks (unless from obvious incorrect working)	$4(x+1)^2 - 13$		A1	Accept $-13 + 4(x+1)^2$ (if student continues to solve a quadratic equation, ISW)
					Total 3 marks

23	(i)	10 ÷ 5 (= 2) or 45 ÷ 15 (= 3) or 24 ÷ 20 (= 1.2 oe) OR 100 squares = 10 (adults) or 25 squares = 2.5 (adults) or 1 square = 0.1 (adults) or 1 cm square = 2.5 (adults) OR 3.5 × 10 oe or 350 × 0.1 oe **and** 0.5 × 10 oe or 50 × 0.1 oe		2	M1	For using (frequency density =) frequency ÷ class width OR for using histogram bar area to determine frequency OR for calculating area by counting squares on the histogram Can be implied by a height of a correct block drawn on the histogram for $25 < t \leq 40$ at height of 6 cm or $40 < t \leq 60$ at a height of 2.4 cm Or correct frequency density value marked on the frequency density axis of the histogram
		Correct answer scores full marks (unless from obvious incorrect working)	35 and 5		A1	
	(ii)		$25 < t \leq 40$ at height of 6 cm $40 < t \leq 60$ at a height of 2.4 cm	2	B2 (B1	for 2 correct blocks for 1 correct block)
						Total 4 marks

24	$\sqrt{(n--3)^2+(n+4-7)^2}=\sqrt{68}$ oe or $(n--3)^2+(n+4-7)^2=68$ or $\sqrt{(-3-n)^2+(7-(n+4))^2}=\sqrt{68}$ or $(-3-n)^2+(7-(n+4))^2=68$ or $\sqrt{(-3-n)^2+(3-n))^2}=\sqrt{68}$ oe or $(-3-n)^2+(3-n)^2=68$ or $\sqrt{(n+3)^2+(n-3)^2}=\sqrt{68}$ oe or $(n+3)^2+(n-3)^2=68$ oe		6	M1	for a **correct** equation for the distance between the two points
	$n^2+6n+9+n^2-6n+9=68$ oe or $n^2+9+n^2+9=68$ oe or $2n^2+18=68$ or $2n^2=50$ or $n^2=25$ or $n=\pm5$ or $n=5$ or $n=-5$			M1	for a **correct** equation with the brackets removed **Award first two method marks if coordinates (5, 9) are seen. May be labelled on a diagram at point Q**
	$(m=)\dfrac{"5"+4-7}{"5"--3}\left(=\dfrac{2}{8}=\dfrac{1}{4}\right)$ oe OR $"5"+4="5"m+k$ $-\quad 7 \quad = -3m+k$ $"5"+4-7 = "5"m-(-3m)$ leading to $m=\dfrac{"5"+4-7}{"5"-(-3)}\left(=\dfrac{1}{4}\right)$			M1	dep on previous M1 for finding the gradient of the line *PQ* OR For setting up two simultaneous equations for the line PQ and all correct steps leading to calculating the gradient, may see different letter to *m* being used, may be seen as the coefficient of *x* in their equation.
	$m_{QR}\times\left[\dfrac{1}{4}\right]=-1$ oe or $\dfrac{-1}{\left[\dfrac{1}{4}\right]}$ oe or -4			M1ft	Indep For clearly finding the negative reciprocal of their gradient for *PQ*
	$"5"+4="-4"("5")+c$ or $c=29$ or [their *n*] + 4 = [their gradient for *QR*][their *n*] + c or $y-("5"+4)="-4"(x-"5")$ or *y* - [their *n* + 4] = [their gradient for QR](*x* - [their *n*]) or $y=-4x+29$ or $y+4x=29$			M1ft	dep on previous M1 for substituting their coordinates for point Q and their gradient for *QR,* following through using their value of *n*, provided $n>0$
	Working required	$4x+y-29=0$		A1	dep on M2 oe eg $-4x-y+29=0$

				Total 6 marks

25	$\sqrt{15^2+36^2}\left(=\sqrt{1521}=39\right)$ oe		5	M1	for finding *HD* or *CI* or *JB* or *GE*
	$\sqrt{89^2-"39"^2}\left(=\sqrt{6400}=80\right)$ oe			M1	for finding *GH* or *BC* or *ED* or *JI*
	eg $"39"\times\tan 30\left(=13\sqrt{3}=22.5(166...)\right)$ or $"39"\times\frac{1}{\sqrt{3}}$ oe or $\sin 30\times\frac{"39"}{\sin(180-30-90)}$			M1	for finding *FG* using the tangent ratio or fully correct alternative method to find length *FG*
	eg $\tan(HDF)=\frac{"80"+"22.5(166...)"}{"39"}$ (=2.62(863…)) or $\sin HDF=\frac{("80"+"22.5(166...)")}{\sqrt{"102(.5166...)"^2+"39"^2}}(\times\sin 90)$ (=0.934(65…)) or $\cos HDF=\frac{"109(.6843...)"^2+"39"^2-"102(.5166...)"^2}{2\times"109(.6843...)"\times"39"}$ (=0.355(58…))			M1	for finding correct ratio for angle *HDF* using the tangent ratio or fully correct alternative method [*FH* = "80" + "22.5(166…)" (=102(.5166…)] [*FD* = $\sqrt{"102(.5166...)"^2+"39"^2}\left(=109(.6843...)\right)$]
	Working required	69.2		A1	awrt 69.2 dep on M2
					Total 5 marks

26	eg two terms from $(27^x =)\left(3^3\right)^x$ or 3^{3x} **OR** $(9^{4-n} =)\left(3^2\right)^{4-n}$ or 3^{8-2n} or $\left(\frac{1}{9^{4-n}} = 9^{-4+n} =\right)\left(3^{-2}\right)^{-4+n}$ or 3^{-8+2n} **OR** $\left(\frac{6^x}{2^x} =\right)3^x$ or $(6^x =)2^x \times 3^x$ **OR** $\left(\frac{27^x}{3^x} =\right)9^x$		3	M1	for correctly changing the base of at least two terms
	eg $\frac{(3^3)^x \times 3^{n+6}}{(3^2)^{4-n}} = 3^x$ **or** $\frac{3^{3x} \times 3^{n+6}}{3^{8-2n}} = \left(\frac{2^x}{2^x} \times\right)3^x$ **or** $3x + n + 6 - (8 - 2n) = x$ oe			M1	for correctly writing the left hand side and right side with all indices written with the same base **or** for a correct equation in terms of x and n with no indices
	Working required	$1-\frac{3}{2}n$		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
					Total 3 marks

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