Mark Scheme (Results)

November 2024

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

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

November 2024
Question Paper Log Number P75936A
Publications Code 4MA1_2H_2411_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				
Figures in inverted commas must come from a correct method previously seen unless otherwise stated.				
Q	**Working**	**Answer**	**Mark**	**Notes**
1	$\frac{12}{7}(\times)\frac{35}{16}$ oe		3	M1 for both fractions written as improper fractions
	$\frac{12}{7}\times\frac{35}{16}=\frac{420}{112}$ oe eg $\frac{192}{112}\times\frac{245}{112}=\frac{47040}{12544}$ or $\frac{\cancel{12}^{3}}{\cancel{7}^{1}}\times\frac{\cancel{35}^{5}}{\cancel{16}^{4}}$ oe or eg $\frac{12}{\cancel{7}^{1}}\times\frac{\cancel{35}^{5}}{16}=\frac{60}{16}$ oe			M1 for multiplying the numerators and multiplying the denominators **or** cancelling the fractions fully **or** cancelling fractions partially and multiplying across
	$\frac{12}{7}\times\frac{35}{16}=\frac{420}{112}=\frac{15}{4}=3\frac{3}{4}$ oe or $\frac{12}{7}\times\frac{35}{16}=\frac{420}{112}=3\frac{84}{112}=3\frac{3}{4}$ oe $\frac{\cancel{12}^{3}}{\cancel{7}^{1}}\times\frac{\cancel{35}^{5}}{\cancel{16}^{4}}=\frac{15}{4}=3\frac{3}{4}$ oe *Working required*	shown		A1 completion to given result. dep on M2 If a student shows clearly in their working that $3\frac{3}{4}=\frac{15}{4}$ they only need to show that the LHS comes to $\frac{15}{4}$
				Total 3 marks

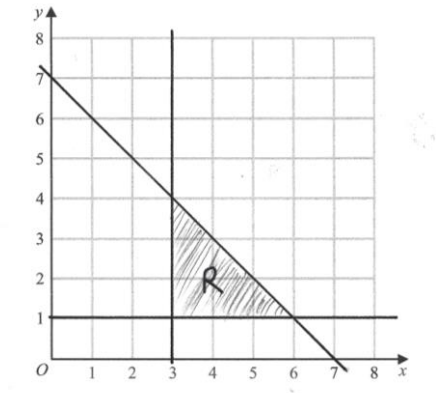
2	(a)		1.45	1	B1 allow $1.44\dot{9}$ or 1.44999(9…)
	(b)		1.35	1	B1 cao SCB1 for (a) 1.35 (b) 1.45 [score B0B1]
					Total 2 marks

3	$\cos 43 = \frac{x}{8.6}$ or $\tan 43 = \frac{8.6\sin 43}{x}$ or $\sin(90-43) = \frac{x}{8.6}$ or $\frac{x}{\sin(90-43)} = \frac{8.6}{\sin 90}$ or $(x^2 =) 8.6^2 - (8.6\sin 43)^2$ or $(x^2 =) 8.6^2 - 5.8(65...)^2$		3	M1	a correct trig statement for x or QR or a correct Pythagoras statement for x^2
	$(x =)\ 8.6\cos 43$ or $(x =) \frac{8.6\sin 43}{\tan 43}\left(= \frac{"5.8(65...)"}{\tan 43}\right)$ or $(x =) 8.6\sin(90-43)$ or $(x =) \frac{8.6\sin 47}{\sin 90}$ or $(x =) \sqrt{8.6^2 - "5.8(65...)"^2}$			M1	a fully correct calculation to find x (some students go straight to this and gain M2)
	Correct answer scores full marks (unless from obvious incorrect working)	6.3		A1	awrt 6.3 seen even if then rounded incorrectly
					Total 3 marks

4	(a)	$357 \div 0.17$ oe or $0.17N = 357$ or $\frac{17}{100} \times N = 357$ oe or $\frac{357 \times 100}{17}$ oe eg $357 \times 5.8(82\ldots)$		2	M1	a correct calculation for N or a correct equation in N (**not** $17\% \times N = 357$)
		Correct answer scores full marks (unless from obvious incorrect working)	2100		A1	cao
	(b)	$806 - 650$ (= 156) or $\frac{806}{650}(=1.24)$ oe		3	M1	
		$\frac{806-650}{650}(\times 100)(= 0.24(\times 100))$ or "1.24" $\times 100$ (= 124) or "1.24" – 1 (= 0.24)			M1	a correct calculation for the percentage increase or seeing 124 or 0.24 as either the answer or in part of the working.
		Correct answer scores full marks (unless from obvious incorrect working)	24		A1	cao (SCB1 if no marks scored for an answer of 19.3 – 19.4)
						Total 5 marks

5	$1 - (0.14 + 0.17 + 0.21)$ (= 0.48) or $0.14 + 0.17 + 0.21 + x + x = 1$ oe or 0.14×400 (= 56) or 0.17×400 (= 68) or 0.21×400 (= 84) or $(0.14 + 0.17 + 0.21) \times 400$ (= 208) oe eg 0.52×400 (= 208)		4	M1	Correct use of probabilities total 1 or correct calculation for an estimate for number of times the spinner will land on 2 or on 3 or on 5
	"0.48" ÷ 2 (= 0.24) **[could be in table]** or 400 – 56 – 68 – 84 (= 192) oe eg 400 – 208 (= 192) or 0.48×400 (= 192)			M1	A completely correct method to find the probability that the spinner will land on 4 or a completely correct method to find the number of times the spinner will land on 1 or on 4
	"0.24" × 400 oe or "192" ÷ 2			M1	a correct calculation to find the estimate required or an answer leading from 96 seen eg $\frac{96}{400}$
	Correct answer scores full marks (unless from obvious incorrect working)	96		A1	cao SCB1 for 104 if no other marks have been awarded
					Total 4 marks

6	8 × 6 (= 48) 0.5 × 8 × 6 (= 24) 15 × 8 (= 120) 15 × 6 (= 90) 15 × 10 (= 150)		3	M1	For a correct method to find the areas of 2 different faces (ie not 2 triangles) allow 8 × 6 as one area (allow with incorrect areas for this mark)
	0.5 × 8 × 6 (= 24) (× 2 (= 48)) oe 15 × 8 (= 120) 15 × 6 (= 90) 15 × 10 (= 150) (measurements with intention to add for the 2nd M mark) Surface area = "120" + "90" + "150" + "24" + "24" [allow "120" + "90" + "150" + "48" + "48"]			M1	for adding together 4 or 5 values for area (condone 48 as 1 or 2 areas) at least 3 of which are from a correct method NB: (6 + 8 + 10) × 15 (sum must be seen) is 3 faces but only award this if clearly not intended to be the volume – eg by the addition of the area of a triangular end.
	Correct answer scores full marks (unless from obvious incorrect working)	408		A1	cao SCB2 for an answer of 456 if no other marks awarded
					Total 3 marks

7	(a)(i) (ii) (iii)	 Line length 2 cm + but shaded area must be enclosed for the mark in (b) **If unlabelled, award:** $x = 3$ and $y = 3$ B1 B0 $y = 1$ and $x = 1$ B0 B1 $x = 3$ and $x = 1$ and $y = 1$ B0 B1 $x = 3$ and $y = 1$ and $y = 3$ B1 B0 $x = 3$ and $x = 1$, $y = 1$ and $y = 3$ B0 B0		3	B1 $x = 3$ drawn B1 $y = 1$ drawn B1 $x + y = 7$ drawn Allow dashed lines or solid lines for graphs of minimum length 2 squares condone lack of labels if unambiguous
	(b)			1	B1 correct region shaded – shaded in or out – labelled **R** or clear intention to be the required region (ft only for one vertical line (not $x = 0$), one horizontal line (not $y = 0$) and one line with a negative gradient eg $x = 1$, $y = 3$ and $x + y = 7$)
					Total 4 marks

8	4×145 (= 580) or 5×142 (= 710) or $\frac{145+145+145+145+x}{5} = 142$ oe		3	M1	for one correct product or for a correct equation for the weight of the last banana
	$5 \times 142 - 4 \times 145$ or "710" – "580" or $145+145+145+145+x = 5 \times 142$			M1	A fully correct method to find the weight of the 5th banana or a fully correct equation to find the missing weight with no denominator
	Correct answer scores full marks (unless from obvious incorrect working)	130		A1	
					Total 3 marks

9	20 000 × 1.035 (= 20 700) oe or 20 000 × 0.035 (= 700) oe (NB: accept $\left(1+\frac{3.5}{100}\right)$ for 1.035 but not (1 + 3.5%))		3	M1	For finding 103.5% or 3.5% of 20 000	M2 for 20 000 × 1.035^3 [NB: $1.035^3 = 1.108717...$] **or** 20 000 × 1.035^4 (= 22 950…)
	"20 700" × 1.035 (= 21 424.5) "21 424.5"× 1.035 oe eg $20700 \times 0.035 = 724.5$ & $20700 + 724.5 = 21424.5$ $21424.5 \times 0.035 = 749.85...$ & $21424.5 + 749.85...$			M1	dep for a complete method	
	Correct answer scores full marks (unless from obvious incorrect working)	22 174		A1	Allow 22 174 - 22175 (if you see the correct answer and then 20 000 is subtracted to give 2174 - 2175 then award full marks 2174 – 2175 with no working gains 2 marks) SCB2 for $\left(2000 \times 1.035^3\right) = 2217...$ **[misread]** SCB2 for 22160 (20 000 × 1.108) SCB2 for 22180 (20 000 × 1.109) SCB1 if no marks awarded for any of these are seen (not necessarily the answer) (20 000 × 1.035^n) 20 000 × 0.965^3 (= 17 972..…..) 20 000 × 0.105 (= 2100) 20 000 × 1.105 ((= 22 100) 20 000 × 1.105^2 (= 21 424.5)	
						Total 3 marks

10	$3x+6+5x+8+7x-9=320$ oe eg $15x + 5 = 320$ Could be implied by $(320 – 5) \div 15$ oe		5	M1	a correct method to find the correct value of x for year 11 students eg an equation
	(x =) 21 or (3x =) 63 *Correct answer of 21 or 63 scores 2 marks (unless from obvious incorrect working)*			A1	For the correct value for x or 3x
	3 × "their 21" + 6 (= 69) or "their 63" + 6 (= 69) **Look for 69 by the side of the table**			M1ft	dep on M1 a correct method to find the number for year 11 Biology ft their value of x as long as only one value of x is offered and it is a clear intention to be x
	$\frac{126}{360}\times 300 (=105)$ oe eg $\frac{300}{360}(=\frac{5}{6})$ **and** $\frac{5}{6}\times 126 (=105)$ or $\frac{360}{300}=1.2$ **and** $126 \div 1.2$ (= 105) oe			M1	indep for a correct method to find the number of year 10 whose favourite is Biology $\frac{300}{360}=0.8\dot{3}$ (so allow 0.83)
		36		A1	cao dep on A1 previously scored
					Total 5 marks

11	int angle of pentagon = (3 × 180) ÷ 5 (= 108) oe **or** ext angle of pentagon = 360 ÷ 5 (= 72) oe		5	M1	allow in working but not if labelled in wrong place on diagram (unless clearly started again)
	int angle of hexagon = (4 × 180) ÷ 6 (= 120) **or** ext angle of hexagon = 360 ÷ 6 (= 60)			M1	allow in working but not if labelled in wrong place on diagram (unless clearly started again)
	360 – (“108” + “120”) (= 132) oe **or** “60” + “72” (= 132) **or** $(180-"108")+(180-"120")$ (= 132)			M1	A fully correct method to find the size of obtuse angle *AEF* but not if labelled in wrong place on diagram [Figures in inverted commas must come from correct working]
	$[180-("60"+"72")]\div 2$ oe **or** $\frac{180-"132"}{2}$ oe **or** $[180-(180-"108")-(180-"120")]\div 2$ oe			M1	A fully correct method to find the size of angle *EAF* [Figures in inverted commas must come from correct working]
	Correct answer scores full marks (unless from obvious incorrect working)	24		A1	cao
					Total 5 marks

12 (a)	eg $\frac{3(3x+2)-5(2x+1)}{15}(=x)$ oe eg $\frac{1-x}{15}(=x)$ or $\frac{3(3x+2)}{15}-\frac{5(2x+1)}{15}(=x)$ or $3(3x + 2) - 5(2x + 1) = x \times 5 \times 3$ oe or $\frac{3}{5}x+\frac{2}{5}-\frac{2}{3}x-\frac{1}{3}(=x)$		3	M1	Writing fractions over a common denominator or removing denominator or writing each term separately – if student has expanded/multiplied at this stage, then allow one of the 4 terms on the LHS incorrect. If the student has removed the denominator at this stage then a correct method must be shown or implied
	eg $9x+6-10x-5=15x$ oe **or** $1-x=15x$ oe eg $9x + 6 = 15x + 10x + 5$ **or** $\frac{-x+1}{15}=\frac{15x}{15}$ **or** $-\frac{16}{15}x=-\frac{1}{15}$			M1	An equation with no brackets or fractions **or** an equation with a common denominator for all terms with numerators simplified (allow one error for the 4 terms on the LHS only (they may have moved these to the RHS) across the 2 M marks and ft for simplifying)
	Working required	$\frac{1}{16}$		A1	oe 0.0625 (allow 0.062 or 0.063) dep on M1

(b)	$f^2 = \frac{a+bc}{c-d}$		4	M1	for squaring both sides in a correct equation
	eg $cf^2 - df^2 = a + bc$			M1	for multiplying by the denominator and expanding in a correct equation
	eg $cf^2 - bc = a + df^2$			M1	for isolating terms in c on one side and other terms the other in a correct equation
	Correct answer scores full marks (unless from obvious incorrect working)	$c = \frac{a+df^2}{f^2-b}$		A1	oe eg $c = \frac{-a-df^2}{b-f^2}$
					Total 7 marks

13	(a)		4, 19, 39, 50, 56, 60	1	B1	
	(b)			2	B2	**(use overlay)** Fully correct cf graph – points at ends of intervals and joined with curve or line segments. If not B2 then B1(ft from a table with only one arithmetic error that may be continued through table) for 5 or 6 of their points at ends of intervals and joined with curve or line segments OR for 5 or 6 points plotted correctly at ends of intervals not joined OR for 5 or 6 points from table plotted consistently within each interval (not at upper ends of intervals) at their correct heights and joined with smooth curve or line segments. (ignore part from 0 to first plotted point when looking at curve/line segments)
	(c)	*ft an increasing graph as student is asked to 'use your graph…'*	2.3 – 2.7	1	B1ft	Any value in range if an increasing graph is drawn (ft their graph reading across at 30 or 30.5)
	(d)	*ft an increasing graph (if reading can be taken) as student is asked to 'use your graph…'*		2	M1	For a correct method to take a reading at 3.7 kg eg 45 – 48 or a correct value for their graph (one square tolerance)
		*If a **correct** graph is drawn and answer is in the given range, then award the marks*	12, 13, 14 or 15		A1ft	Award full marks for an answer in the range if a correct cf graph is drawn and ft their increasing graph if value outside range Must be a whole number value (non-integer value gains M1 only)
						Total 6 marks

14	eg $3^{2n+3-4}\left(=3^3\times3^{1-2n}\right)$ **or** $3^{2n-1}\left(=3^3\times3^{1-2n}\right)$ **or** $\left(3^{2n+3}=\right)3^7\times3^{1-2n}$ **or** $\left(\frac{3^{2n+3}}{3^4}=\right)3^{4-2n}$ **or** $\left(3^{2n+3}=\right)3^3\times3^{5-2n}$ **or** $\frac{3^{2n}}{3^4}=3^{1-2n}$ (division by 3^3) *This is not an exhaustive list* **or** $2n+3-4$ (= ….) **or** **(**… =) $3+1-2n$ or $2n-1$ (=…) **or** (... =) $4-2n$ (no other options for this)		3	M1	For one rule of indices used to correctly combine two or more of the **given** expressions (do not need part in brackets) *(must include algebra)* **or** For one of the 4 expressions shown, providing it is clear that they apply to the LHS or to the RHS
	eg $3^{2n+3-4}=3^{3+1-2n}$ **or** $3^{2n+3}=3^{8-2n}$ **or** $3^{2n-1}=3^{4-2n}$ **or** $2n+3-4=3+1-2n$ oe eg $2n-1=4-2n$			M1	A correct single power of 3 on both sides or a correct equation in n without indices (some students may go straight to this and gain M2)
	Working required	$\frac{5}{4}$		A1	oe dep on M1
					Total 3 marks

15		eg (10 000x =) 7636.36…_ (100x =) 76.36… **or (**1000x =) 763.63…_ (10x =) 7.63… **or (**100x =) 76.363…_ (x =) 0.763… oe		2	M1	For 2 recurring decimals that when subtracted give a whole number or terminating decimal with intention to subtract. (ie give 75.6 or 756 or 7560 etc) eg (10 000x =) 7636.36... and (100x =) 76.36.... **or** (1000x =) 763.63… and (10x =) 7.63… **or** (100x =) 76.363… and (x =) 0.763… with intention to subtract. (if recurring not shown then showing at least **one** of the numbers to at least 5sf) or $\frac{7}{10}+1000x(63.\dot{6}\dot{3})-10x(0.\dot{6}\dot{3})$
		eg 10 000x – 100x = 7636.36... – 76.36...= 7560 **and** $\frac{7560}{9900}=\frac{42}{55}$ **or** 1000x – 10x = 763.63... – 7.63...= 756 (990x = 756) **and** $\frac{756}{990}=\frac{42}{55}$ **or** 100x – x = 76.363... – 0.763...= 75.6 **and** $\frac{75.6}{99}=\frac{42}{55}$ (99x = 75.6) **or** $\frac{7}{10}+\frac{63}{990}=\frac{7\times99+63}{990}=\frac{42}{55}$	shown		A1	for completion to $\frac{42}{55}$ dep on M1 and must use algebra for this final mark to be awarded [allow for instance 99x = 75.6 and then $\frac{756}{990}=\frac{42}{55}$] **No algebra used gets a maximum of 1**
		Working required				**Total 2 marks**

16 (a)(i)		108	1	B1	**Accept 252**
(ii)		Correct reason	1	B1	dep on (a)(i) correct Angle at the centre(midpoint/origin/middle)is twice the angle at the circumference(side/edge/arc) oe Inscribed angle is half of the central angle oe (accept ∠ for 'angle' and 2 × or double for twice)
(b)		26	1	B1	
(c)	*ABC* = 180 – "64" or $\frac{"108"+"124"}{2}$		2	M1ft	follow through their (½(180 – "108")) in 28 + "36"= 64 ONLY FOLLOW THROUGH THEIR 108
	Correct answer scores full marks (unless from obvious incorrect working)	116		A1	cao
					Total 5 marks

17	$(\overrightarrow{HF} =)\begin{pmatrix}4\\14\end{pmatrix}+\begin{pmatrix}5\\-2\end{pmatrix}\left[=\begin{pmatrix}9\\12\end{pmatrix}\right]$ or $\begin{pmatrix}4\\14\end{pmatrix}-\begin{pmatrix}-5\\2\end{pmatrix}\left[=\begin{pmatrix}9\\12\end{pmatrix}\right]$ oe $(\overrightarrow{FH} =)\begin{pmatrix}-5\\2\end{pmatrix}+\begin{pmatrix}-4\\-14\end{pmatrix}\left[=\begin{pmatrix}-9\\-12\end{pmatrix}\right]$ or $\begin{pmatrix}-5\\2\end{pmatrix}-\begin{pmatrix}4\\14\end{pmatrix}\left[=\begin{pmatrix}-9\\-12\end{pmatrix}\right]$ oe		3	M1	a correct calculation for $\overrightarrow{HF}$ or $\overrightarrow{FH}$ (for this mark allow written as coordinates) Also allow eg 9**i** + 12**j**
	$\sqrt{"9"^2+"12"^2}$ or $\sqrt{("-9")^2+("-12")^2}$ Allow a complete method using their values for $\overrightarrow{HF}$ or $\overrightarrow{FH}$ Provided it is from $\begin{pmatrix}\pm4\\\pm14\end{pmatrix}-\begin{pmatrix}\pm5\\\pm2\end{pmatrix}$			M1indep	Allow their $\overrightarrow{HF}$ or $\overrightarrow{FH}$ provided it is from $\begin{pmatrix}\pm4\\\pm14\end{pmatrix}-\begin{pmatrix}\pm5\\\pm2\end{pmatrix}$ allowing any sign error if used $(-9)^2$ and $(-12)^2$ condone missing brackets if recovered
	Correct answer scores full marks (unless from obvious incorrect working) Watch out for a correct answer from wrong working eg –5 + 2 + 4 + 14 = 15	15		A1	from fully correct figures eg use of $\begin{pmatrix}9\\-12\end{pmatrix}$ would give the correct answer but would **not** gain this accuracy mark
					Total 3 marks

18	$y = -2x(+9)$ or gradient of line = –2		4	M1	a rearrangement with the correct *x* term or stating that the gradient of given line is –2
	Gradient of perpendicular = $\frac{1}{2}$ oe eg $\frac{-1}{-2}$			M1ft	For a statement that the gradient of the perpendicular line is $\frac{1}{2}$ or implication by equation of line with gradient $\frac{1}{2}$ (if a student goes straight to this stage then M2 is awarded) **This mark can also be awarded for the perpendicular gradient of what they indicate the gradient of the original line to be**
	eg $11 = "\frac{1}{2}" \times 8 + c$ or $y - 11 = "\frac{1}{2}"(x - 8)$ oe or $c = 7$			M1dep	dep on previous M1 being awarded; a correct method to find the equation of the perpendicular line by using their gradient of the perpendicular line and (8, 11)
	Correct answer scores full marks (unless from obvious incorrect working)	$y = \frac{1}{2}x + 7$		A1oe	a correct equation for the line in the form $y = mx + c$ (as requested) If no other marks awarded then award SCB1 for $y = -\frac{1}{2}x + 15$
					Total 4 marks

19	(i)		(0, 4)	1	B1
	(ii)		(5, 12)	1	B1
	(iii)		(5, –3)	1	B1
					Total 3 marks

20	$(10x + 21)(x - 1)$ or $\frac{-11 \pm \sqrt{(11)^2 - 4 \times 10 \times -21}}{2 \times 10}$ $10\left[\left(x + \frac{11}{20}\right)^2 - \frac{121}{400}\right] - 21 (= 0)$ oe		3	M1	A correct method to solve the quadratic; correct factors or correct substitution into the formula or can be simplified as far as $\frac{-11 \pm \sqrt{121 + 840}}{20}$ or correctly completing the square. $(10)(x + 2.1)(x - 1)$ is not a correct factorisation – it is working backwards from calculator answers.
	$(x =) 1, (x =) -2.1$			A1	dep on M1 for correct critical values
	Working required	$-2.1 < x < 1$		A1	dep on M1 oe eg $x > -2.1$ (and) $x < 1$ (do not penalise 'or') or $\frac{-21}{10} < x < 1$ etc including the open interval (–2.1, 1) or]–2.1, 1[
					Total 3 marks

21	$5x + 3x + 2 = 26$ oe		4	M1	a correct equation for x
	$x = 3$ *Correct value of x scores M1A1 (unless from obvious incorrect working)*			A1	
	7 × "3" oe eg "15" + "6" (where "15" is 5 × "3" and "6" is 2 × "3")			M1ft	use of **their positive value** for x in $7x$ (ie use of correct regions from Venn diagram for the set required) **[their value** is their value given for x which must be clearly assigned as x]
	Correct answer scores full marks (unless from obvious incorrect working)	21		A1	cao
					Total 4 marks

22	$(y-2)^2+y^2+y=3$	$x^2+(x+2)^2+x+2=3$		5	M1	substitution of linear equation into quadratic – allow one sign error in substituted expression
	$2y^2-3y+1[=0]$ oe (any form with 3 terms)	$2x^2+5x+3[=0]$ oe (any form with 3 terms)			M1	Dep on M1 simplified to a 3 term quadratic with 2 or 3 of 3 terms correct
	$(2y-1)(y-1)$ [= 0] $\frac{-(-3)\pm\sqrt{(-3)^2-4\times2\times1}}{2\times2}$ $2[(y-\frac{3}{4})^2-\frac{9}{16}]+1=0$ oe (leading to y values of $\frac{1}{2}$ and 1) (allow x used for y here)	$(2x+3)(x+1)$ [= 0] $\frac{-5\pm\sqrt{5^2-4\times2\times3}}{2\times2}$ $2[(x+\frac{5}{4})^2-\frac{25}{16}]+3=0$ oe (leading to x values of $-\frac{3}{2}$ and -1) (allow y used for x)			M1ft	dep on M1 for solving *their* 3 term quadratic equation using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error and some simplification – allow as far as $\frac{3\pm\sqrt{9-8}}{4}$ or $\frac{-5\pm\sqrt{25-24}}{4}$) or if completing the square then as far as shown on LHS OR the correct values for x OR the correct values for y
	eg $(x=)\text{"}\frac{1}{2}\text{"}-2$ oe $\text{"}1\text{"}-2$ oe	$(y=)\text{"}-\frac{3}{2}\text{"}+2$ oe, $\text{"}-1\text{"}+2$ oe			M1	dep on previous M1 for correct method to find both other values or **a correct pair of values**
	Working required		$x=-\frac{3}{2}, y=\frac{1}{2}$ $x=-1,\ y=1$		A1	oe dep on M2 for all 4 values
						Total 5 marks

23	$16x^2-36=(4x-6)(4x+6)$ $[=4(2x+3)(2x-3)]$ oe or $16x^2-36=(8x-12)(2x+3)$ $[=4(2x+3)(2x-3)]$ oe		4	M1indep	
	$2x^2+7x+6=(2x+3)(x+2)$ **and** $x^2-5x-14=(x-7)(x+2)$ [We will make an exception of $2x^2+7x+6=(4x+6)(0.5x+1)$ as this then cancels with $(4x + 6)$]			M1indep	[NB: the two fractions when divided and cancelled give an answer of $4(2x – 3)$ or $2(4x – 6)$ or $8x – 12$ (any one of these gain 2 marks)] M2 for any fraction with completely simplified non-linear numerator and non-linear denominator that will cancel to –19
	$4(2x-3)-(7+8x)(=n)$ [allow invisible brackets ie $8x – 12 – 7 + 8x$] or an expression that clearly shows the numerator is – 19 times the denominator eg $\frac{-38x-57}{2x+3}(=n)$			M1	a linear expression that should give the correct value for n (this mark implies previous M marks as not all factorising is necessary)
	Working required	–19		A1	dep on M2
					Total 4 marks

24	67 + 51 (= 118) or angle split into 67 and 51		6	M1	A diagram showing 118 or use of 118 in further calculations
	$AC^2 = 8.4^2 + 9.2^2 - 2\times 8.4\times 9.2\times \cos"118"(= 227.(7615))$ (227 – 228)			M1	a correct method to find length AC^2
	$AC = \sqrt{8.4^2 + 9.2^2 - 2\times 8.4\times 9.2\times \cos"118"}(= 15.(09...))$ (15 – 15.1)			M1	a correct method to find length AC
	$\frac{\sin ACB}{8.4} = \frac{\sin"118"}{"15.09..."}$ or $\frac{\sin BAC}{9.2} = \frac{\sin"118"}{"15.09..."}$ or $\cos ACB = \frac{9.2^2 + "15.09"^2 - 8.4^2}{2\times 9.2\times "15.09"}$ or $\cos BAC = \frac{8.4^2 + "15.09"^2 - 9.2^2}{2\times 8.4\times "15.09"}$			M1	dep on previous method marks a correct statement of the sine rule or the cosine rule to find angle ACB or angle BAC [numbers in inverted commas must come from correct working]
	$(ACB =)\sin^{-1}\left(\frac{8.4\sin"118"}{"15.09..."}\right)$ or $\cos^{-1}\left(\frac{9.2^2 + "15.09"^2 - 8.4^2}{2\times 9.2\times "15.09"}\right)(= 29.(43...))$ (29 – 30) $(BAC =)\sin^{-1}\left(\frac{9.2\sin"118"}{"15.09..."}\right)$ or $\cos^{-1}\left(\frac{8.4^2 + "15.09"^2 - 9.2^2}{2\times 8.4\times "15.09"}\right)(= 32.(56...))$ (32 – 33)			M1	a completely correct statement for angle ACB or angle BAC [numbers in inverted commas must come from correct a correct method]
	Correct answer scores full marks (unless from obvious incorrect working) **Look for angles and lengths on their diagram**	280		A1	allow 279 – 280 a correct answer from a scale drawing gains full marks but if answer is slightly inaccurate gains 0 marks
					Total 6 marks

25	eg $\tan 30 = \frac{x}{0.5AB}$ **or** $\tan 60 = \frac{0.5AB}{x}$ oe **or** $0.5AB = \frac{x}{\tan 30}$ **or** $0.5AB = x\tan 60$ oe **or** $\frac{1}{2}AB = \sqrt{3}x$		5	M1 (off spec but a student who knows without calc that height of triangle = 3*x*: $\tan 60 = \frac{3x}{0.5AB}$ or $\sin 60 = \frac{3x}{BC}$)
	eg (*AB* =) $2x\tan 60$ **or** $\frac{2x}{\tan 30}$ **or** $2\sqrt{3}x$ **or** $3.46..x$ oe **OR** area small⌴ $\left(\frac{1}{6}\textit{shape}\right) = \frac{1}{2}\times x\tan 60\times x$ **or** $\frac{1}{2}\times\sqrt{3}x\times x$ **or** $\frac{\sqrt{3}}{2}x^2$			M1 Expression for side of triangle (*AB* or *BC* or *AC*) **OR** the area of one or more of the six triangles
	eg $6\times\frac{1}{2}\times x\tan 60\times x$ **or** $\frac{1}{2}\times(2x\tan 60)^2\times\sin 60$ **or** $\frac{1}{2}\left(\frac{2x}{\tan 30}\right)^2\sin 60$ **or** $\frac{1}{2}\times 2\sqrt{3}x\times\sqrt{\left(2\sqrt{3}x\right)^2-\left(\sqrt{3}x\right)^2}$ **or** $0.5\times 2\sqrt{3}x\times 3x$ **or** $3\sqrt{3}x^2$ **or** $5.19...x^2$			M1 a correct expression for the area of triangle *ABC*
	$6\times\frac{\sqrt{3}}{2}x^2-\pi x^2$ **or** $3\sqrt{3}x^2-\pi x^2$ **or** "5.19..." $x^2-\pi x^2$ **or** $6\times\frac{1}{2}\times\tan 60\times x^2-\pi x^2$ **or** $\frac{1}{2}\left(\frac{2x}{\tan 30}\right)^2\sin 60-\pi x^2$ oe			M1 a correct expression for the area of the shaded parts of the diagram or a correct equation for the shaded parts of the diagram
	Correct answer scores full marks (unless from obvious incorrect working) **Look for values written on the diagram**	2.05		A1 2.05 – 2.06
	SEE NEXT PAGE FOR USING A VALUE FOR RADIUS		**Total 5 marks**	

25	eg $\tan 30 = \frac{100}{0.5AB}$ **or** $\tan 60 = \frac{0.5AB}{100}$ oe **or** $0.5AB = \frac{100}{\tan 30}$ **or** $0.5AB = 100\tan 60$ oe **or** $\frac{1}{2}AB = \sqrt{3}\times 100$		5	M1 eg using radius = **100** **ANY VALUE CAN BE USED CONSISTENTLY FOR AWARD OF MARKS**
	eg (AB =) $200\tan 60$ **or** $\frac{200}{\tan 30}$ **or** $200\sqrt{3}\,x$ or $346\ldots x$) or area small triangle$\left(\frac{1}{6}\,shape\right)$ = $\frac{1}{2}\times$"173..."$\times 100$ (= 8660…)			M1 Expression for side of triangle or the area of one or more of the six triangles
	eg $\frac{1}{2}\times 200\sqrt{3}\times 200\sqrt{3}\times\sin 60 (= 51961.52...)$ or or $6\times\frac{1}{2}\times$"173..."$\times 100$ $(= 6\times$"8660..."$= 51961.52...)$			M1 a correct expression for the area of the triangle
	eg "51961.52"$-\pi\times 100^2 = 100^2\,n$			M1 a correct equation for the area of the shaded parts of the diagram.
	Correct answer scores full marks (unless from obvious incorrect working)	2.05		A1 2.05 – 2.06
	SEE PREVIOUS PAGE FOR USING *x* FOR RADIUS			**Total 5 marks**

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom