

INTERNATIONAL GCSE MATHEMATICS

9260/2E

Extension Tier Paper 2E

Mark scheme

June 2024

Version: 1.0 Final



Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

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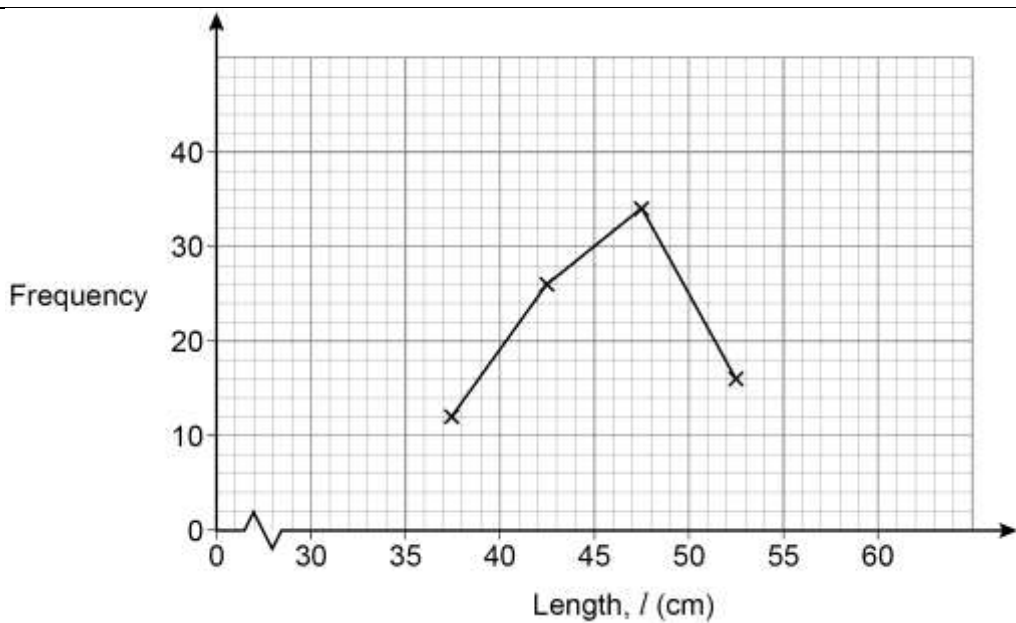
Key to mark types and abbreviations

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
[a, b)	Accept values $a \leq \text{value} < b$
3.14 ...	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Q	Answer	Mark	Comments
1	Discrete Continuous Qualitative Continuous	B4	B1 for each correct row
	Additional Guidance		
	Accept any unambiguous indication		
	Only one cross in a row – mark the cross		
	A tick and a cross in a row – mark the tick		
	Two ticks in one row is incorrect		

Q	Answer	Mark	Comments	
2(a)	$x(x - 1)$ or $(x - 1)x$ and $x^2 - x = 6$ or $6 = x^2 - x$ and $x^2 - x - 6 = 0$	B1	accept $x(x - 1) = 6$ or $(x - 1)x = 6$ or $6 = x(x - 1)$ or $6 = (x - 1)x$ and $x^2 - x - 6 = 0$	
	Additional Guidance			
	Allow $x \times (x - 1)$ for $x(x - 1)$			
	Ignore any attempt to solve $x^2 - x - 6 = 0$			

Q	Answer	Mark	Comments
2(b)	$(x - 3)(x + 2)(= 0)$ or $\frac{(- -)1 \pm \sqrt{(-1)^2 - 4(1)(-6)}}{2}$ or $x = \frac{1}{2} \pm \sqrt{\frac{25}{4}}$ or -2 and 3	M1	oe accept 1^2 for $(-1)^2$
	3	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
3	Three or four of (37.5, 12), (42.5, 26), (47.5, 34), (52.5, 16) correctly plotted or four points with correct frequencies consistently positioned at or between the class boundaries	M1	$\pm \frac{1}{2}$ small square
	(37.5, 12), (42.5, 26), (47.5, 34), (52.5, 16) correctly plotted and joined with straight lines to form a frequency polygon	A1	$\pm \frac{1}{2}$ small square
	Additional Guidance		
			M1A1
	Mark intention for straight lines		
	Points may be implied by the lines, but ignore any horizontal and/or vertical lines		
	Ignore (37.5,12) joined to (32.5, 0) or to (35, 0) and ignore (52.5, 16) joined to (55, 0) or to (57.5, 0) but any other extra line scores A0		
	Ignore extra points drawn		
	Ignore a histogram or bar chart drawn		
	Plots (35, 12), (40, 26), (45, 34), (50, 16) ie all points plotted at lower boundaries		M1A0
	Plots (35, 12), (40, 26), (45, 34), (55, 16) ie three points plotted at lower boundaries and one at upper boundary		M0

Q	Answer	Mark	Comments
4(a)	100	B1	may be on diagram

Q	Answer	Mark	Comments
4(b)	$\frac{20}{16}$ or 1.25 or $\frac{16}{20}$ or 0.8 or $\frac{16}{10}$ or 1.6 or $\frac{10}{16}$ or 0.625	M1	oe fraction or decimal
	12.5	A1	oe may be on diagram
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	$10 \times 20 \div 16$		M1
	$16y = 200$		M1

Q	Answer	Mark	Comments
5(a)	$\begin{pmatrix} -9 \\ 7 \end{pmatrix}$	B2	B1 $\begin{pmatrix} -9 \\ \dots \end{pmatrix}$ or $\begin{pmatrix} \dots \\ 7 \end{pmatrix}$ SC1 $\begin{pmatrix} 9 \\ -7 \end{pmatrix}$
	Additional Guidance		
	Condone + sign and/or fraction line eg $\begin{pmatrix} -9 \\ +7 \end{pmatrix}$		B2
	$\begin{pmatrix} -9x \\ 7y \end{pmatrix}$ or $\begin{pmatrix} x-9 \\ y+7 \end{pmatrix}$ or $\begin{pmatrix} 9 \text{ left} \\ 7 \text{ up} \end{pmatrix}$		B0

Q	Answer	Mark	Comments
5(b)	(×) 1.5	B1	oe fraction or mixed number
	(-8, 5)	B1	
	Additional Guidance		
	Accept 1.5 ×		1st B1

Q	Answer	Mark	Comments
6(a)	a^{10}	B2	B1 $a^9 \times a$ or $a^6 \times a^4$ or a^{6+3+1} or a^{9+1} or a^{6+4} or a^{7+3}
	Additional Guidance		
	Condone use of x in place of a		

Q	Answer	Mark	Comments
6(b)	x^{16}	B2	B1 $\left[(x^6)^3 = \right] x^{18}$ or $x^6 \times x^6 \times x^4$
	Additional Guidance		
	Condone use of a in place of x		

Q	Answer	Mark	Comments
7	8	B1	

Q	Answer	Mark	Comments
8	Alternative method 1		
	Any equation that would give the answer $x = 12$	M1	eg $5x = 2x + 36$ $5x = 60$ $2x + 36 = 60$ $12x + 36 = 180$ $9x + 72 = 180$ $7x + 36 = 120$
	$x = 12$	M1	
	Yes and M1M1 awarded and substitution into one or more expression that shows that all three angles must be equal	A1	
	Alternative method 2		
	Any equation that would give the answer $x = 12$	M1	eg $5x = 2x + 36$ $5x = 60$ $2x + 36 = 60$ $12x + 36 = 180$ $9x + 72 = 180$ $7x + 36 = 120$
	$x = 12$	M1	
	Yes and solves two different equations to show $x = 12$ for both	A1	

Alternative method 3 and Additional Guidance on the next page

8 cont	Alternative method 3		
	$5 \times 12 = 60$	M1	
	$2 \times 12 + 36 = 60$	M1	
	Yes and $5 \times 12 = 60$ and $2 \times 12 + 36 = 60$	A1	
	Additional Guidance		
	In alt 1, from $5x = 2x + 36$ or $12x + 36 = 180$ or $9x + 72 = 180$ or $7x + 36 = 120$, with $x = 12$, either of angles BAC or ACB given as 60 with Yes scores full marks		
	In alt 1, from $5x = 60$, with $x = 12$, angle ACB ($2x + 36$) given as 60 with Yes scores full marks		
	In alt 1, from $2x + 36 = 60$, with $x = 12$, angle BAC ($5x$) given as 60 with Yes scores full marks		
	Yes can be implied eg the triangle is equilateral		

Q	Answer	Mark	Comments
9	Alternative method 1: Changes to improper fractions		
	$\left(2\frac{3}{4}=\right) \frac{11}{4}$ and $\left(1\frac{5}{12}=\right) \frac{17}{12}$	M1	
	$\left(\frac{11}{4}=\right) \frac{33}{12}$ or $\left(\frac{11}{4}=\right) \frac{132}{48}$ and $\left(\frac{17}{12}=\right) \frac{68}{48}$	M1dep	with M1 awarded oe with a common denominator eg $\frac{66}{24}$ and $\frac{34}{24}$
	$\frac{33}{12} + \frac{17}{12} = \frac{50}{12}$ and $\frac{50}{12} = 4\frac{2}{12} = 4\frac{1}{6}$ or $\frac{33}{12} + \frac{17}{12} = \frac{50}{12}$ and $(4\frac{1}{6} =) 4\frac{2}{12} = \frac{50}{12}$	A1	oe demonstration that both sides of the equation are equal eg $\frac{66}{24} + \frac{34}{24} = \frac{100}{24}$ and $\frac{100}{24} = \frac{25}{6} = 4\frac{1}{6}$ must have M1M1 awarded

Alternative method 2 and Additional Guidance on the next page

Q	Answer	Mark	Comments
9 cont	Alternative method 2: Deals with fraction parts and then adds the integers		
	$(2)\frac{9}{12}$ or $(2)\frac{36}{48}$ and $(1)\frac{20}{48}$	M1	oe with a common denominator eg $(2)\frac{18}{24}$ and $(1)\frac{10}{24}$
	$(2)\frac{9}{12} + (1)\frac{5}{12} = (3)\frac{14}{12}$	M1dep	with M1 awarded oe with a common denominator eg $(2)\frac{18}{24} + (1)\frac{10}{24} = (3)\frac{28}{24}$
	$\frac{14}{12} = 1\frac{2}{12} = 1\frac{1}{6}$ and $2 + 1 + 1\frac{1}{6} = 4\frac{1}{6}$	A1	oe demonstration that both sides of the equation are equal must have M1M1 awarded
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Accept working with both sides to show they come to a common value eg right side changed to $\frac{25}{6}$ and left side worked out to be $\frac{25}{6}$		M1M1A1
	Accept eg $\frac{3 \times 11}{12}$ for $\frac{33}{12}$ unless contradicted		
	Accept eg $4 + \frac{2}{12}$ for $4\frac{2}{12}$ and vice versa		
	Accept eg $\frac{9+5}{12}$ for $\frac{9}{12} + \frac{5}{12}$ and vice versa		

Q	Answer	Mark	Comments
10	180 – 165 or 15 or $180(n - 2) = 165n$	M1	oe equation
	24	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	24 seen embedded eg $180(24 - 2)$ without answer 24		M1A0

Q	Answer	Mark	Comments
11(a)	Alternative method 1: Cross multiplies first		
	$4(5x + 2)$ or $20x + 8$ or $3(7 - 2x)$ or $21 - 6x$ or equation with multiplication by a multiple of 12	M1	accept embedded eg $\frac{20x+8}{12}$ eg $8(5x + 2) = 6(7 - 2x)$
	$20x + 8 = 21 - 6x$	M1dep	oe equation with brackets expanded and fractions removed eg $40x + 16 = 42 - 12x$
	$20x + 6x = 21 - 8$ or $26x = 13$	M1	collects terms for their equation with brackets expanded, unknowns on one side and numbers on the other their equation must have two terms in x and two constant terms
	0.5 or $\frac{1}{2}$	A1	oe fraction eg $\frac{13}{26}$

Alternative method 2 and Additional Guidance on the next page

Q	Answer	Mark	Comments
11(a) cont	Alternative method 2: Splits the given equation into four fractions		
	$\frac{5x}{3} + \frac{2}{3} = \frac{7}{4} - \frac{2x}{4}$	M1	oe equation with four fractions
	$\frac{5x}{3} + \frac{2x}{4} = \frac{7}{4} - \frac{2}{3}$ or $\frac{26x}{12} = \frac{13}{12}$	M1	collects terms for their equation, unknowns on one side and numbers on the other their equation must have two terms in x and two constant terms
	$20x + 6x = 21 - 8$ or $26x = 13$	M1dep	oe equation with fractions eliminated or oe equation of the form $ax = b$ dep on M2
	0.5 or $\frac{1}{2}$	A1	oe fraction eg $\frac{13}{26}$
	Additional Guidance		
	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
11(b)	$5x(3x - 2)$ or $\frac{2x^2}{3x^2 - 2x}$ or $\frac{2x^2}{x(3x - 2)}$ or $\frac{10x}{15x - 10}$ or $\frac{10x}{5(3x - 2)}$	M1	
	$\frac{2x}{3x - 2}$	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	$\frac{2x}{3x - 2}$ followed by incorrect further work		M1A0

Q	Answer	Mark	Comments
12	$208 \div (4 + 9)$ or $208 \div 13$ or 16	M1	oe
	their 16×4 or 64 or their 16×9 or 144 or their 16×5 or 80	M1dep	
	their $144 - \text{their } 64 + 30$ or their $144 - x = \text{their } 64 - 30$ or $144 - x = 34$ or their $80 + 30$ or their $80 - y = -30$	M1dep	oe any letter
	110	A1	SC2 50
	Additional Guidance		
	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	SC2 is from Mia having \$30 more than Lee		

Q	Answer	Mark	Comments
13(a)	9	B1	

Q	Answer	Mark	Comments
13(b)	24 and 36 with no others	B2	B1 24 and 36 with one or two others or 24 with up to one other or 36 with up to one other

Q	Answer	Mark	Comments
14	Alternative method 1		
	$10x^2 + 30x$	M1	may be implied eg $7x^2 + 8x^2 + 22x$
	$2x^2 + 8x$ or $-2x^2 - 8x$	M1	may be implied eg $7x^2 + 8x^2 + 22x$
	$a = 15$ and $b = 22$	A1ft	ft M1M0 or M0M1 with at most 1 error
	Alternative method 2		
	$7x^2 + 10x^2 - 2x^2 = ax^2$ or $15x^2 = ax^2$ or $10 - 2 + 7 = a$	M1	equate x^2 terms or coefficients implied by $a = 15$
	$30x - 8x = bx$ or $22x = bx$ or $30 - 8 = b$	M1	equate x terms or coefficients implied by $b = 22$
	$a = 15$ and $b = 22$	A1ft	ft M1M0 or M0M1 with at most 1 error
	Additional Guidance		
	Allow recovery of missing brackets, eg $7x^2 + 10x^2 + 30x - 2x^2 + 8x = 15x^2 + 22x$ $a = 15$ and $b = 22$		M1M1A1
	$15x^2 + 22x$ in working implies the method marks		M1M1A0
	$a = 15x^2$ and $b = 22x$ implies the method marks		M1M1A0
	$7x^2 + 10x^2 + 30x - 2x^2 + 8x = 15x^2 + 38x$ $a = 15$ and $b = 38$ (one error)		M1M0A1ft
	$30x + 8x = bx$ or $b = 38$ and $a = 15$		M1M0A1ft
	$7x^2 + 10x^2 + 2x^2 = ax^2$ or $a = 19$ and $b = 22$		M0M1A1ft

Q	Answer	Mark	Comments
15(a)	$(8 =) 2^3$ or $(10^{11} =) (2 \times 5)^{11}$ or $(10^{11} =) 2^{11} \times 5^{11}$ or $2^{14} \text{ or } 5^{11}$	M1	
	$2^{14} \times 5^{11}$	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
15(b)	(HCF $\Rightarrow$) $p \times q$ or (91 $\Rightarrow$) 7×13 or $3 \times 7 \times 13^2$ or 3549 or $7^2 \times 13$ or 637 or $3 \times 13 \times 7^2$ or 1911 or $13^2 \times 7$ or 1183 or ($p \Rightarrow$) 7 and ($q \Rightarrow$) 13 or ($p \Rightarrow$) 13 and ($q \Rightarrow$) 7	M1	oe eg $91 = p \times q$
	($x \Rightarrow$) 3549 and ($y \Rightarrow$) 637 or ($x \Rightarrow$) 1911 and ($y \Rightarrow$) 1183	A1	accept in index form SC1 ($x \Rightarrow$) 24843 and ($y \Rightarrow$) 91 or ($x \Rightarrow$) 273 and ($y \Rightarrow$) 8281
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Special case is using ($p \Rightarrow$) 1 and ($q \Rightarrow$) 91 or vice versa and may be given in index form eg ($x \Rightarrow$) $3 \times 1 \times 19^2$ and ($y \Rightarrow$) $1^2 \times 91$		

Q	Answer	Mark	Comments	
16(a)	Ticks male with reference to medians	B2	eg ticks male and [30.5, 31.5] and [32.5, 33.5] eg ticks male and states male median is greater B1 (female =) [30.5, 31.5] or (male =) [32.5, 33.5] or horizontal line from cf 40 to both graphs implied by marks on the graphs or the horizontal axis	
	Additional Guidance			
	55 – 22 = 33		B0	
	Condone an unambiguous alternative for 'median' for B2 eg middle, medium			
	Male may be implied eg 33 > 31 so the males are older		B1	

Q	Answer	Mark	Comments
16(b)	4	B2	B1 76

Q	Answer	Mark	Comments
17(a)	1550	B1	

Q	Answer	Mark	Comments
17(b)	31.5 or 32.5 or 19.65 or 19.75	M1	oe eg $32 - 0.5$ or $32 + 0.5$ or $19.7 - 0.05$ or $19.7 + 0.05$ accept $32.\dot{4}9$ for 32.5 throughout accept $19.7\dot{4}9$ for 19.75 throughout
	their 32.5 – their 19.65	M1	$32 < \text{their } 32.5 \leq 33$ $19.6 \leq \text{their } 19.65 < 19.7$ M1M1 is implied by $32 - 19.7 + 0.5 + 0.05$
	12.85 from using 32.5 and 19.65	A1	accept $12.8\dot{4}9$ for 12.85
	Additional Guidance		
	Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	32.45 – 19.65		M1M1A0
	31.5 – 19.75		M1M0A0
	32.4 – 19.69		M0M1A0
	$32 - 19.7 = 12.3$		M0M0A0
	12.85 with no method		M0M0A0

Q	Answer	Mark	Comments
18	1.025 seen	M1	oe fraction or decimal eg $1 + \frac{2.5}{100}$ or $\frac{41}{40}$ implied by [292 680, 292 690] or [285 540, 285 550] or [278 570, 278 580]
	$300\,000 \div 1.025^4$ or [271 700, 271 790]	M1dep	oe eg $300\,000 \div 1.025 \div 1.025 \div 1.025 \div 1.025$
	271 800	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	For year on year calculations, accept [292 680, 292 690] for year 1, [285 540, 285 550] for year 2, and [278 570, 278 580] for year 3, followed by an answer of 271 800		M1M1A1
	Do not accept 102.5% or $1+2.5\%$ for 1.025		

Q	Answer	Mark	Comments
19(a)	$0.05\dot{5}\dot{4}$	B1	

Q	Answer	Mark	Comments
19(b)	Alternative method 1: Multiplies by powers of 10		
	$10x = 2.33\ldots$ or $100x = 23.33\ldots$	M1	oe multiplication by powers of 10 any or no letter
	$9x = 2.1$ with $10x = 2.33\ldots$ seen or $99x = 23.1$ with $100x = 23.33\ldots$ seen or $90x = 21$ with $100x = 23.33\ldots$ and $10x = 2.33\ldots$ seen	M1dep	oe subtraction to eliminate recurring decimals oe if x implied $\frac{2.1}{9}$ with $2.33\ldots$ seen $\frac{23.1}{99}$ with $23.33\ldots$ seen $\frac{21}{90}$ with $23.33\ldots$ and $2.33\ldots$ seen
	$\frac{2.1}{9} = \frac{7}{30}$ or $\frac{23.1}{99} = \frac{7}{30}$ or $\frac{21}{90} = \frac{7}{30}$	A1	oe from multiplication by powers of 10 working for M2 must be shown

Alternative method 2 and Additional Guidance on the next page

Q	Answer	Mark	Comments
19(b) cont	Alternative method 2: Splits decimal into 2 parts		
	$(0.0\dot{3} =) \frac{1}{30}$ or $10x = 0.33\ldots$ or $100x = 3.33\ldots$	M1	oe fraction or any two equations that can be subtracted. any letter for equation
	$\frac{2}{10} + \frac{1}{30}$	M1dep	oe fractions
	$\frac{7}{30}$	A1	working for M2 must be shown
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Use of x may be implied eg $100 \times 0.233\ldots = 2.33\ldots$ $99 \times 0.233\ldots = 23.1$		M1M1
	Allow recovery of incorrect notation for recurring decimals eg $10x = 2.3$ and $100x = 23.3$ followed by $90x = 21$ eg $10x = 2.333$ and $100x = 23.333$ with no further correct work		M1M1 M0M0

Q	Answer	Mark	Comments
20(a)	$10n - 6 - n^2$	B3	oe expression B2 two correct terms B1 one correct term eg $-10n + 6 - n^2$ – 6 must not only be part of a list
	Additional Guidance		
	Condone $10x - 6 - x^2$		B3
	Condone unsimplified algebra eg $10(n - 1) + 4$ eg $-6 - 1n^2 + 10 \times n$		B2 B3
	Do not accept a combination of letters eg $10n - 6 - x^2$		B2

Q	Answer	Mark	Comments
20(b)	Alternative method 1		
	$2(3n + 5)^2$ or $2(3n + 5)(3n + 5)$	B2	B1 $2(9n^2 + 30n + 25)$ or $(an + b)(cn + d)$ where $ac = 18$ and $bd = 50$ or $(an + b)(cn + d)$ where $ac = 18$ and $ad + bc = 60$ or $2(an + b)(cn + d)$ where $ac = 9$ and $bd = 25$ or $2(an + b)(cn + d)$ where $ac = 9$ and $ad + bc = 30$
	Alternative method 2		
	$(18n^2 + 60n + 50) \div 2 = 9n^2 + 30n + 25$ and $(3n + 5)^2$ or $(3n + 5)(3n + 5)$	B2	B1 $(18n^2 + 60n + 50) \div 2 = 9n^2 + 30n + 25$ or $(3n + 5)^2$ or $(3n + 5)(3n + 5)$
	Additional Guidance		
	For B2 do not ignore further work eg $2(3n + 5)^2 (= 0)$ followed by $n = -\frac{5}{3}$		B1
	$(6n + 10)(3n + 5)$		B1
	Condone multiplication signs for B2 or B1 eg $2 \times (3n + 5) \times (3n + 5)$		B2
	Condone missing final bracket eg $(9n + 3)(2n + 6$		B1

Q	Answer	Mark	Comments
21	$x = 4$ and $y = 1$ drawn as solid lines and $y = x$ drawn as a dashed line and correct region identified	B3	B2 $x = 4$ and $y = 1$ drawn as solid lines and $y = x$ drawn as a dashed line and correct region not identified or $x = 4$ and $y = 1$ and $y = x$ drawn with each line either solid or dashed and correct region identified B1 $x = 4$ drawn and no other vertical lines or $y = 1$ drawn and no other horizontal lines or $y = x$ drawn each line either solid or dashed
			Additional Guidance
			Allow any unambiguous identification of region eg labelled R or shaded in or shaded out
			For B3 or B2 lines must enclose the required region For B1 allow any line length
			Mark intention for straight lines

Q	Answer	Mark	Comments
22(a)	2.5	B1	oe eg $\frac{10}{4}$

Q	Answer	Mark	Comments
22(b)	Alternative method 1: Using t is total time		
	$\frac{1}{2} \times (16 + t) \times 10$ or two of $\frac{1}{2} \times 4 \times 10$ or 20 or 16×10 or 160 or $\frac{1}{2} \times (t - 20) \times 10$ or $5(t - 20)$	M1	oe area expressions working may be seen on diagram throughout implied by 180 or 35
	$\frac{1}{2} \times 4 \times 10 + 16 \times 10 + \frac{1}{2} \times (t - 20) \times 10 = 215$	M1dep	oe equation eg $\frac{1}{2} \times (16 + t) \times 10 = 215$
	27	A1	
	Alternative method 2: Calculating the time travelled beyond 20 seconds		
	$\frac{1}{2} \times (16 + 20 + x) \times 10$ or two of $\frac{1}{2} \times 4 \times 10$ or 20 or 16×10 or 160 or $\frac{1}{2} \times x \times 10$ or $5x$	M1	oe area expressions working may be seen on diagram throughout implied by 180 or 35
	$\frac{1}{2} \times x \times 10 + 16 \times 10 + \frac{1}{2} \times 4 \times 10 = 215$ or $2 \times (215 - 16 \times 10 - \frac{1}{2} \times 4 \times 10) \div 10$ or $2 \times 35 \div 10$ or 7	M1dep	oe equation eg $\frac{1}{2} \times x \times 10 = 35$ oe expression for the time travelled after 20 seconds
	27	A1	

Q	Answer	Mark	Comments
23	210 and 330	B2	B1 210 and 330 with one or two incorrect values or 210 or 330 with up to one incorrect value
	Additional Guidance		
	Ignore any correct values outside the range for B1 only		
	Condone coordinates eg (210, -0.5) and (330, -0.5)		B2
	Accept embedded eg $\sin 210 (= -0.5)$		
	May be seen on diagram		

Q	Answer	Mark	Comments
24(a)	Opposite angles of a cyclic quadrilateral (add up to 180)	B1	oe eg A and C face each other in the four-sided shape with corners on the circle, (and are supplementary)
	Additional Guidance		
	Allow abbreviations eg opp angles of cyclic quad (add to 180)		B1
	Ignore irrelevant statements alongside a correct statement eg A and C are opposite angles in a cyclic quadrilateral and all angles add up to 360		B1
	Do not ignore relevant incorrect statements alongside a correct statement eg Opposite angles in a cyclic quadrilateral are equal But condone Opposite angles in a cyclic quadrilateral equal(s) 180		B0 B1

Q	Answer	Mark	Comments
24(b)	Alternate segment (theorem)	B1	oe eg Angle between tangent and chord equals angle at circumference in other segment
	Additional Guidance		
	Allow abbreviations eg alt segment		B1
	Ignore irrelevant statements alongside a correct statement		B1
	Do not ignore relevant incorrect statements alongside a correct statement		B0

Q	Answer	Mark	Comments
24(c)	Valid method to eliminate a variable	M1	eg $10w + 3 \times 2w = 180$ or $16w = 180$ or $5 \times x + 3x = 180$ or $8x = 180$
	$w = 11.25$	A1	oe eg $\frac{45}{4}$
	$x = 22.5$	A1	oe eg $\frac{45}{2}$

Q	Answer	Mark	Comments
25(a)	Tangent drawn at A	B1	

Q	Answer	Mark	Comments
25(b)	(1, -2)	B1	accept $([0.9, 1.1], -2)$

Q	Answer	Mark	Comments
26	$\frac{180-x}{360} \times \pi \times r^2$	M1	oe
	$\frac{x}{360} \times \pi \times (2r)^2$	M1	oe
	$\frac{180-x}{360} \times \pi r^2 = \frac{x}{360} \times \pi (2r)^2$ or $180 - x = 4x$	M1dep	oe correct equation dep on M2
	36	A1	
	Additional Guidance		
	Missing brackets must be recovered eg1 $\frac{180-x}{360} \times \pi r^2 = \frac{x}{360} \times \pi 2r^2$ $180 - x = 4x$ (and could score A1) eg2 $\frac{180-x}{360} \times \pi r^2 = \frac{x}{360} \times \pi 2r^2$ $180 - x = 2x$		M1 M1M1 M1 MOM0

Q	Answer	Mark	Comments
27	Alternative method 1: Probability of one coffee and one tea		
	$(C, T) \frac{6}{10} \text{ and } \frac{4}{9}$ or $(T, C) \frac{4}{10} \text{ and } \frac{6}{9}$	M1	oe may be seen on a tree diagram
	$P(CT) \frac{6}{10} \times \frac{4}{9} \text{ or } \frac{24}{90}$ or $P(TC) \frac{4}{10} \times \frac{6}{9} \text{ or } \frac{24}{90}$	M1dep	oe eg $\frac{4}{15}$ may be seen on a tree diagram
	$\frac{6}{10} \times \frac{4}{9} + \frac{4}{10} \times \frac{6}{9}$ or $\frac{24}{90} + \frac{24}{90}$	M1dep	oe
	$\frac{48}{90} \text{ or } 0.53... \text{ or } 53.(...) \%$	A1	oe fraction eg $\frac{8}{15}$

Alternative method 2 and Additional Guidance on the next page

Q	Answer	Mark	Comments
27 cont	Alternative method 2: Probability of both coffee or both tea		
	$(C, C) \frac{6}{10} \text{ and } \frac{5}{9}$ or $(T, T) \frac{4}{10} \text{ and } \frac{3}{9}$	M1	oe may be seen on a tree diagram
	$P(CC) \frac{6}{10} \times \frac{5}{9} \text{ or } \frac{30}{90}$ or $P(TT) \frac{4}{10} \times \frac{3}{9} \text{ or } \frac{12}{90}$	M1dep	oe, but only accept an equivalent for $\frac{30}{90}$ if $\frac{6}{10}$ and $\frac{5}{9}$ seen may be seen on a tree diagram
	$1 - \frac{6}{10} \times \frac{5}{9} - \frac{4}{10} \times \frac{3}{9}$ or $1 - \frac{30}{90} - \frac{12}{90}$	M1dep	oe with both from correct method
	$\frac{48}{90} \text{ or } 0.53... \text{ or } 53.(...) \%$	A1	oe fraction eg $\frac{8}{15}$
	Additional Guidance		
	Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Ignore incorrect simplification or conversion after correct probability seen		
	$\frac{24}{45}$		M3A1
	Accept decimals rounded or truncated to at least 2 decimal places		

Q	Answer	Mark	Comments
28	Alternative method 1: Calculates FC and AC to use $\tan$ in triangle ACF		
	$\frac{FC}{13} = \tan 16$ or $(FC =) 13 \times \tan 16$ or 3.7...	M1	oe equation or expression for FC
	$\sqrt{13^2 + 13^2}$ or $\frac{13}{\sin 45}$ or $\frac{13}{\cos 45}$ or $\sqrt{338}$ or $13\sqrt{2}$ or 18.3(8...) or 18.4	M1	oe expression for AC
	$\tan x = \frac{\text{their } 3.7...}{\text{their } 18.3(8...)}$ or $\tan^{-1} \frac{\text{their } 3.7...}{\text{their } 18.3(8...)}$	M1dep	oe equation or expression for angle CAF dep on M2 any letter
	[11.4, 11.5]	A1	

Alternative methods 2 and 3 and Additional Guidance on the next pages

Q	Answer	Mark	Comments
28 cont	Alternative method 2: Calculates FC and AF to use sin in triangle ACF		
	$\frac{FC}{13} = \tan 16$ or $(FC =) 13 \times \tan 16$ or 3.7...	M1	oe equation or expression for FC
	$(\frac{13}{BF} = \cos 16$ or $\frac{13}{\cos 16}$ or 13.5... and) $\sqrt{13.5...^2 + 13^2}$ or $\sqrt{351.(...)}$ or 18.7(5...) or 18.8	M1	oe expression for AF
	$\sin x = \frac{\text{their } 3.7...}{\text{their } 18.7(5...)}$ or $\sin^{-1} \frac{\text{their } 3.7...}{\text{their } 18.7(5...)}$	M1dep	oe equation or expression for angle CAF dep on M2 any letter
	[11.4, 11.5]	A1	

Alternative method 3 and Additional Guidance on the next page

Q	Answer	Mark	Comments
28 cont	Alternative method 3: Calculates AC and AF to use cos in triangle ACF		
	$\sqrt{13^2 + 13^2}$ or $\frac{13}{\sin 45}$ or $\frac{13}{\cos 45}$ or $\sqrt{338}$ or $13\sqrt{2}$ or 18.3(8...) or 18.4	M1	oe expression for AC
	$(\frac{13}{BF} = \cos 16 \text{ or } \frac{13}{\cos 16} \text{ or } 13.5...$ and) $\sqrt{13.5...^2 + 13^2}$ or $\sqrt{351.(...)}$ or 18.7(5...) or 18.8	M1	oe expression for AF
	$\cos x = \frac{\text{their } 18.4...}{\text{their } 18.7(5...)}$ or $\cos^{-1} \frac{\text{their } 18.4...}{\text{their } 18.7(5...)}$	M1dep	oe equation or expression for angle CAF dep on M2 any letter
	[11.4, 11.5]	A1	
	Additional Guidance		
	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Working may be seen on diagram		
	Accept decimals rounded or truncated to at least 1 decimal place		
	Accept 13 replaced with a letter for all marks		

Q	Answer	Mark	Comments
29	$\begin{pmatrix} 15 & 0 \\ 0 & 15 \end{pmatrix}$ or $\begin{pmatrix} r+6 & 2r+6t \\ 3-3 & 6-3t \end{pmatrix}$ or $r+6=15$ or $r=9$ or $2r+6t=0$ or $6-3t=15$ or $t=-3$	M1	oe must be a 2×2 matrix
	Any two of $r+6=15$ or $r=9$ or $2r+6t=0$ or $6-3t=15$ or $t=-3$	M1dep	oe
	$r=9$ and $t=-3$	A1	
	Additional Guidance		
	Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Ignore incorrect elements if not used		