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9260/1E

Paper 1E

Mark scheme

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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 Assessment Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from oxfordaqa.org.uk

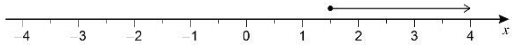
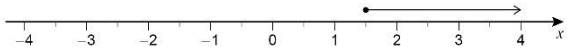
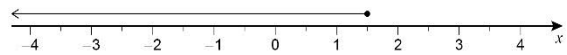
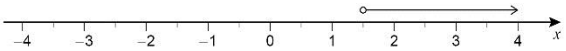
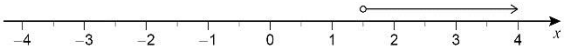
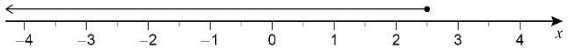
Key to mark types and abbreviations

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 $a \leq$ 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	5×10^{-3}	B1	
	Additional Guidance		
2	$1 : \frac{1}{5}$	B1	
	Additional Guidance		
3	21	B1	
	Additional Guidance		
4	$5.\dot{4}$	B1	
	Additional Guidance		

Q	Answer	Mark	Comments
5(a)	$p = 2$ and $q = 7$ or $p = 7$ and $q = 2$ or $p = 2$ and $q = 2$	B1	
	Additional Guidance		
5(b)	$p = 2$ and $q = 5$ or $p = 2$ and $q = 7$ or $p = 3$ and $q = 2$ or $p = 5$ and $q = 2$ or $p = 7$ and $q = 2$	B1	
	Additional Guidance		
	Embedded answer eg $3 \times 2 + 5 = 11$ without p and q selected		B0

Q	Answer	Mark	Comments
6(a)	Positive	B1	
	Additional Guidance		
	Ignore non-contradictory words such as ‘strong’, ‘weak’ or ‘scattered’		
6(b)	Correct straight line which passes between (20, 590) and (20, 630) and between (70, 720) and (70, 760)	B1	line must extend from 20 to 70
	Correct monthly rent for their line / curve	M1	their line / curve must be increasing allow any reading from the small vertical square that their point lies within eg if their point is in the first square above 700, allow [700, 710]
	Correct monthly rent for their line / curve × 12 correctly evaluated	A1ft	ft their increasing line / curve allow any reading from the small vertical square that their point lies within eg if their point is in the first square above 700, allow [8400, 8520]
	Additional Guidance		
	No increasing line / curve drawn		B0M0A0
	The line may go through the coordinates of the gates but no further tolerance is allowed for the first mark		
	Ignore any parts of the line outside 20 to 70		

Q	Answer	Mark	Comments
7(a)	$2x \geqslant 4 - 1$ or $2x \geqslant 3$ or $-2x \leqslant 1 - 4$ or $-2x \leqslant -3$ or $-x \leqslant -1\frac{1}{2}$	M1	oe implied by eg $x \leqslant 1\frac{1}{2}$ or $x < 1\frac{1}{2}$ or $x > 1\frac{1}{2}$ or $x = 1\frac{1}{2}$
	$x \geqslant 1\frac{1}{2}$	A1	oe implied by correct solution set on number line
		B1ft	ft their inequality with open or closed circle as appropriate
	Additional Guidance		
	Inequality line may be drawn over existing number line but intention must be clear		
	Condone a missing arrow or use of shading if the line or region extends to within 2 mm of 4 or further right		
	 with no working or with $x \geqslant 1\frac{1}{2}$ or $x = 1\frac{1}{2}$ seen		M1A1B1
	$x \leqslant 1\frac{1}{2}$ and 		M1A0B1ft
	$x \geqslant 1\frac{1}{2}$ and 		M1A0B0
	$x > 1\frac{1}{2}$ and 		M1A0B1ft
	$x \leqslant 2\frac{1}{2}$ and 		M0A0B1ft

Q	Answer	Mark	Comments
7(b)	$-8 < 2y \leqslant 4$	B1	
	Additional Guidance		

8(a)	**Alternative method 1**		
	12^2 and 10^2 seen or 144 and 100 seen or 44	M1	
	$\sqrt{12^2 - 10^2}$ or $\sqrt{144 - 100}$	M1dep	
	$\sqrt{44}$ or $2\sqrt{11}$ or 6.6…	A1	accept 7 with working
	Alternative method 2		
	$\sin^{-1}\frac{10}{12}$ or 56.4... or $\cos^{-1}\frac{10}{12}$ or 33.5...or 33.6	M1	oe
	$\tan\left(\sin^{-1}\frac{10}{12}\right) = \frac{10}{x}$ or $\cos\left(\sin^{-1}\frac{10}{12}\right) = \frac{x}{12}$ or $\tan\left(\cos^{-1}\frac{10}{12}\right) = \frac{x}{10}$ or $\sin\left(\cos^{-1}\frac{10}{12}\right) = \frac{x}{12}$	M1dep	oe
	$\sqrt{44}$ or $2\sqrt{11}$ or 6.6…	A1	accept 7 with working
	Additional Guidance		
	$\sqrt{44}$ or $2\sqrt{11}$ with incorrect simplification or conversion to decimal		M1M1depA1

Q	Answer	Mark	Comments
8(b)	**Alternative method 1**		
	$\sin 52 = \frac{10}{y}$ or $\cos 38 = \frac{10}{y}$	M1	
	$\frac{10}{\sin 52}$ or $\frac{10}{\cos 38}$	M1dep	
	[12.69, 12.7]	A1	accept 13 with working
	Alternative method 2		
	$\frac{y}{\sin 90} = \frac{10}{\sin 52}$	M1	
	$\frac{10}{\sin 52} \times \sin 90$	M1dep	
	[12.69, 12.7]	A1	accept 13 with working
	Alternative method 3		
	$\left(\frac{10}{\tan 52}\right)^2 + 10^2$ or $(10 \times \tan 38)^2 + 10^2$	M1	oe eg $\left(\frac{10 \times \sin 38}{\sin 52}\right)^2 + 10^2$
	$\sqrt{\left(\frac{10}{\tan 52}\right)^2 + 10^2}$ $\sqrt{(10 \times \tan 38)^2 + 10^2}$	M1dep	oe eg $\sqrt{\left(\frac{10 \times \sin 38}{\sin 52}\right)^2 + 10^2}$
	[12.69, 12.7]	A1	accept 13 with working
	Additional Guidance		

Q	Answer	Mark	Comments
9	**Alternative method 1**		
	360 – 248 or 112	M1	
	180 – 43 or 137	M1	
	their 112 + their 137 + 49 + 49 + x = 360 or 360 – their 112 – their 137 – 49 or 62	M1dep	oe dep on M2
	13	A1	
	Alternative method 2		
	180 – 2(49 + x) or 82 – 2x	M1	oe correct expression for angle C
	43 + 248 + x + 180 – 2(49 + x) = 360	M1dep	oe correct equation
	x – 2x = 360 – 43 – 248 – 180 + 2 × 49	M1dep	oe collecting terms
	13	A1	
	Alternative method 3		
	360 – 43 – 248 – x or 69 – x	M1	oe correct expression for angle C
	69 – x + 2(49 + x) = 180	M1dep	oe correct equation eg $\frac{180-(69-x)}{2} - x = 49$
	–x + 2x = 180 – 69 – 2 × 49	M1dep	oe collecting terms eg $\frac{x}{2} - x = 49 - \frac{111}{2}$ or $\frac{x}{2} = 6.5$
	13	A1	
	Additional Guidance		
	Award marks for angles on the diagram even if not used in working		
	Beware the assumption that angle at centre is twice angle at C 360 – 248 = 112, angle C = 112 ÷ 2 = 56 x = (180 – 56) ÷ 2 – 49 = 13		M1M0 M0A0

Q	Answer	Mark	Comments
10(a)	(x =) 3 (x =) 7	B1	both answers required
	Additional Guidance		
	(3, 0) and (7, 0)		B0
	(x – 3)(x – 7)		B0
	(x – 3) and (x – 7)		B0
	3, 7 and 21		B0
10(b)	**Alternative method 1**		
	(their 3 + their 7) ÷ 2 or (x =) 5 or $5^2 - 10 \times 5 + 21$ or (y =) –4	M1	
	(5, –4)	A1ft	ft their two roots from (a)
	Alternative method 2		
	$(x - 5)^2 - 25 + 21$ or $2x - 10 = 0$ or (x =) 5	M1	
	(5, –4)	A1	
	Additional Guidance		
	If exactly two roots are given in (a), allow correct or ft answer in (b) eg (a) –3 and –7 (b) (–5, 96)		M1A1ft

Q	Answer	Mark	Comments
11	36	B1	$2^2 \times 3^2$ is B0
	Additional Guidance		
	$2^2 \times 3^2 = 36$ (assume 36 is their answer)		B1
	Both $2^2 \times 3^2$ and 36 as a choice on the answer line		B0
12	(C has) 6 (faces) or (T has) 5 (faces)	B1	seen or used
	330 ÷ (their 6 + their 5) × their 6 or 330 ÷ 11 × 6 or 30 × 6	M1	oe
	180	A1	
	Additional Guidance		
	Answer 180 with no incorrect working		B1M1A1
	6 and 4 seen, answer 198		B1M1A0
	6 and 3 seen, answer 220		B1M1A0
	8 and 4 seen, answer 220		B0M1A0
	6 and 5 seen, answer 150		B1M0A0
	6 and 4 seen, answer 132		B1M0A0
	6 and 3 seen, answer 110		B1M0A0
	8 and 4 seen, answer 110		B0M0A0

Q	Answer	Mark	Comments
13	**Alternative method 1**		
	(Perimeter of square =) $4 \times d$ or $4d$ or (Perimeter of square =) $2r \times 4$ or $8r$	M1	expression for perimeter using any letter to represent the side of the square or half the side of the square
	$\pi d \div 4d$ or $2\pi r \div 8r$ or 0.78(5…) or 0.79 or 78(.5…)% or 79%	M1dep	oe must be using perimeters not areas
	Correct expressions for perimeter and circumference and 78(.5…)% or 79% or Correct expressions for perimeter and circumference and 0.78(5…) or 0.79 and 0.8	A1	
	Alternative method 2		
	Perimeter of square eg (side of square =) 10 (so perimeter =) 4×10 or 40	M1	correctly evaluates perimeter of square using a chosen value for the side of the square
	Circumference of circle ÷ perimeter of square eg $\pi \times 10 \div 40$ or 0.78(5…) or 0.79 or 78(.5…)% or 79%	M1dep	oe must be using a consistent chosen value must be using perimeters not areas
	Correct values for perimeter and circumference and 78(.5…)% or 79% or Correct values for perimeter and circumference and 0.78(5…) or 0.79 and 0.8	A1	

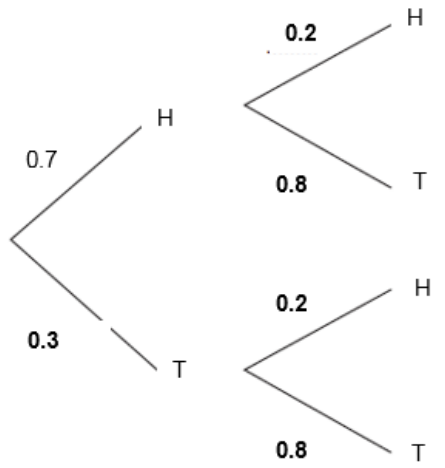
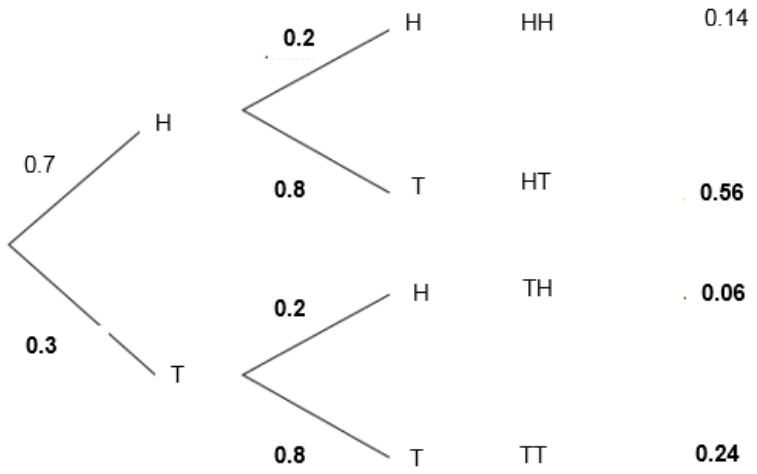
Alternative methods and Additional Guidance continued on the next page

Q	Answer	Mark	Comments
13 cont	**Alternative method 3**		
	(Perimeter of square =) $4 \times d$ or $4d$ or (Perimeter of square =) $2r \times 4$ or $8r$	M1	expression for perimeter using any letter to represent the side of the square or half the side of the square
	$0.8 \times 4d$ or $3.2d$ or $0.8 \times 8r$ or $6.4r$	M1dep	oe
	$4d$ and $3.2d$ and $3.1(4\ldots)d$ or $8r$ and $6.4r$ and $6.2(8\ldots)r$ or $6.3r$	A1	
	Alternative method 4		
	Perimeter of square eg (side of square =) 10 (so perimeter =) 4×10 or 40	M1	correctly evaluates perimeter of square using a chosen value for the side of the square
	80% of perimeter of square eg $0.8 \times 4 \times 10$ or 32	M1dep	oe
	Correct values for perimeter, 80% of perimeter and circumference eg 40 and 32 and 31.(4…)	A1	
	Additional Guidance		
	Premature rounding resulting in eg 78.75% will lose the last mark		
	Using area for both shapes		M0M0A0
	Condone missing % signs throughout		

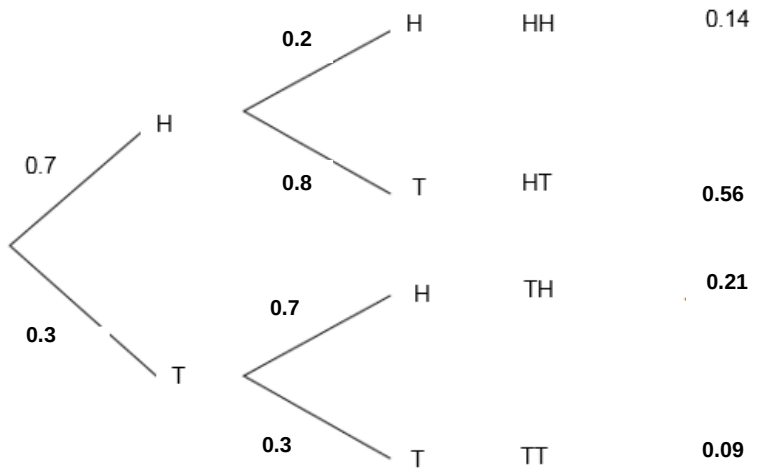
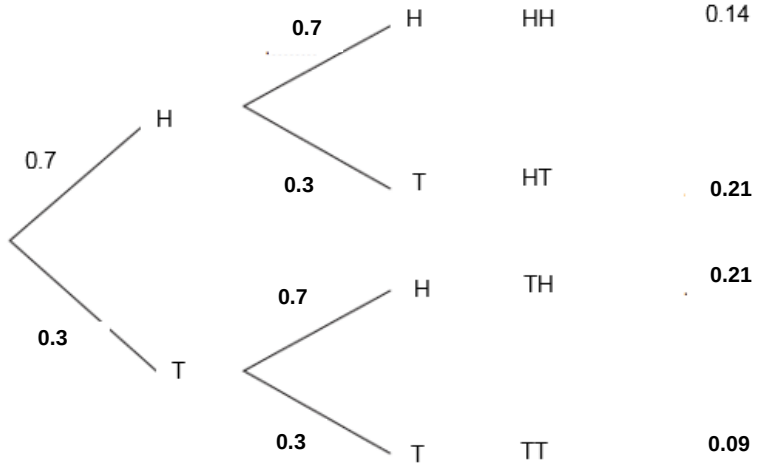
Q	Answer	Mark	Comments
14(a)	47.5 minutes	B1	
	Additional Guidance		

14(b)	A time in the range (48, 48.5) and a time in the range (2, 2.5) and the correct sum of their times in the range [50.5, 51)	B2	B1 a time in the range (48, 48.5) and a time in the range (2, 2.5) with an incorrect or no evaluation but that would give an answer in the range [50.5, 51) or a time in the range (48, 48.5) and a time in the range (2, 2.5) and the correct sum of their times but **not** in the range [50.5, 51) or three correct times in the wrong order
	Additional Guidance		
	Accept times in minutes and seconds		
	48.4 and 2.3 and 50.7 (= 51)		B2
	48.499 and 2.499 and 50.998 (= 51)		B2
	48m 29s and 2m 29s and 50m 58s (= 51)		B2
	48.4 and 2.3 and 51 (incorrect evaluation but answer would be in range)		B1
	48.4 and 2.3 (no evaluation but answer would be in range)		B1
	48.2 and 2.1 and 50.3 (correct evaluation but answer not in range)		B1
	48.2 and 2.1 and 51 (incorrect evaluation and answer would not be in range)		B0
	48.2 and 2.1 (no evaluation and answer would not be in range)		B0
	48.5 and 2.5 and 51		B0
	48 and 2.5 and 50.5		B0
	48.5 and 2 and 50.5		B0

Q	Answer	Mark	Comments
15	$\frac{3}{14}$	B1	
	Additional Guidance		
16	0.6y or 1.25y or three values in the ratio 0.6 : 1 : 1.25	M1	oe eg $\frac{3}{5}y$ or $\frac{5}{4}y$ or 60, 100, 125 or 12, 20, 25
	0.6y + y + 1.25y = 39.33 or 2.85y = 39.33	M1dep	oe $\frac{39.33}{(0.6 + 1 + 1.25)}$ oe scores M2
	13.8	A1	oe
	Additional Guidance		
	$\frac{39.33}{(60 + 100 + 125)} \times 100$ or 0.138×100		M2
	$\frac{39.33}{(12 + 20 + 25)} \times 20$ or 0.69×20		M2

Q	Answer	Mark	Comments
17	P(H) for second coin = 0.14 ÷ 0.7 or 0.2	M1	0.2 on top branch of second coin
	Each pair of branches totals 1	M1	
		A1	
	P(HT) 0.56 and P(TH) 0.06 and P(TT) 0.24	A1ft	ft their values but probabilities must be $0 < p < 1$ must have scored at least M1
	Additional Guidance		
			M1M1A1A1

Additional Guidance continued on the next page

Q	Answer	Mark	Comments
17 cont		M1M1A0A1ft	
		M0M1A0A1ft	

Q	Answer	Mark	Comments
18(a)	$\frac{11+1}{4}$ or 3rd is LQ or 9th is UQ or LQ = a or UQ = 18 or 18 – a = 5	M1	may be implied by a and 18 (and 15) indicated in the list condone 11 ÷ 4 = 2.75 → 3rd is LQ or 11 ÷ 4 × 3 = 8.25 → 9th is UQ
	13	A1	
	Additional Guidance		
	18 – 13 = 5 with no answer or answer 5		M1A0
	$\frac{3}{4}$ of 24 = 18 so 18 is UQ		M0A0
	Accept other valid methods for calculating quartiles eg the following method includes the median in both halves of the data set: UQ = 17.5 or LQ = 12.5 or $\frac{a+14}{2}=12.5$, answer 11		M1A1

Q	Answer	Mark	Comments
18(b)	(M =) 15 and (A =) 12 and Mateo or correct box plot drawn for Mateo and states Mateo's median is larger	B2	B1 (M =) 15 and (A =) 12
	Additional Guidance		
	Correct box plot needs min at 10, median at 15, max at 24 but allow LQ to be [11, 13] and UQ to be [17, 18]		
	Condone referring to other point values eg min, LQ, UQ, max alongside the median		
	As well as referring to median also mentions range or IQR in this part		B1 max
	Assume 'average' refers to median unless mean is calculated and used ie mean = 170 ÷ 11 = 15.(…)		B0
18(c)	(A's IQR =) 8 and Mateo or (A's range =)19 and (M's range =)14 and Mateo or correct box plot drawn for Mateo and states Mateo's box or box plot is narrower oe	B2	B1 (A's IQR =) 8 or (A's range =)19 and (M's range =)14 SC1 available (if no other marks awarded in either part) for both medians, A's IQR or both ranges correctly stated in either part or by the graph or correct box plot drawn
	Additional Guidance		
	Correct box plot needs min at 10, median at 15, max at 24 but allow LQ to be [11, 13] and UQ to be [17, 18]		
	Accept lower for narrower because in this set of values there is no ambiguity as all point values are higher		
	As well as referring to range or IQR also mentions median values in this part		B1 max
19	17.5	B1	
	Additional Guidance		

Q	Answer	Mark	Comments
20	**Alternative method 1**		
	80(n – 30) or 80n – 2400	M1	oe eg (n – 30) × 80
	$\frac{18n}{2}$ or 9n	M1	oe eg $\frac{n}{2}$ × 18
	10 × 35 + 20 × 55 or 350 + 1100 or 1450	M1	
	80(n – 30) + 9n + their 1450 = 5814 or 80(n – 30) + 9n = 4364	M1dep	oe dep on M1M1M1
	89n = 6764 or 6764 ÷ 89	M1dep	oe 6764 can be 5814 + 2400 – their 1450
	76	A1	
	Alternative method 2 – works out the number of $80 tickets		
	80x and $\frac{18(30+x)}{2}$ or 270 + 9x	M1	oe
	10 × 35 + 20 × 55 or 350 + 1100 or 1450	M1	
	their 1450 + 80x + 270 + 9x = 5814	M1dep	oe dep on M1M1
	89x = 4094 or 4094 ÷ 89 or 46	M1dep	oe 4094 can be 5814 – their 1450 – 270
	their 46 + 30	M1dep	
	76	A1	

Alternative methods and Additional Guidance continued on the next page

Q	Answer	Mark	Comments
20 cont	**Alternative method 3 –** assumes half the passengers in each section choose their seats		
	80(n – 30) or 80n – 2400	M1	oe eg (n – 30) × 80
	$\frac{18(n-30)}{2}$ or 9n – 270	M1	oe eg $\frac{n}{2}$ × 18 – 270
	10 × 35 + 20 × 55 + 30 ÷ 2 × 18 or 350 + 1100 + 270 or 1720	M1	
	80(n – 30) + 9n – 270 + their 1720 = 5814 or 80(n – 30) + 9n = 4364	M1dep	oe dep on M1M1M1
	89n = 6764 or 6764 ÷ 89	M1dep	oe 6764 can be 5814 + 2400 + 270 – their 1720
	76	A1	
	Alternative method 4 – works out the number of \$80 tickets, assuming half the passengers in each section choose their seats		
	$\frac{80x}{2}$ and $\frac{98x}{2}$	M1	oe
	10 × 35 + 20 × 55 + 30 ÷ 2 × 18 or 350 + 1100 + 270 or 1720	M1	
	their 1720 + $\frac{80x}{2}$ + $\frac{98x}{2}$ = 5814	M1dep	oe dep on M1M1
	89x = 4094 or 4094 ÷ 89 or 46	M1dep	oe 4094 can be 5814 – their 1720
	their 46 + 30	M1dep	
	76	A1	

Additional Guidance continued on the next page

Q	Answer	Mark	Comments

	Additional Guidance	
20 cont	Answer of 76	6 marks
	The independent method marks may be awarded for embedded values or expressions	
	For M marks allow unsimplified algebraic expressions eg $\frac{18n}{2}$ for $9n$	
	When setting up their equation allow for previous numerical or algebraic errors seen in working, eg $(n - 30) \times 80 = 80n - 240$ $\frac{n}{2} \times 18$ followed by $80n - 240 + 9n + 1450 = 5814$ but $80n - 240 + 9n + 1450 = 5814$ without seeing $(n - 30) \times 80$	M1M1M1M1 M0M1M1M0
	Use the scheme that awards the student the most marks	

Q	Answer	Mark	Comments
21(a)	$(2x – 1)(x + 3)$ or $(1 – 2x)(–x – 3)$	B2	B1 $(2x + a)(x + b)$ where $ab = –3$ or $a + 2b = 5$ or $2(x – \frac{1}{2})(x + 3)$
	Additional Guidance		
	Ignore any attempt to solve in part (a)		
	Factorisation must be seen in this part		
	$(2x – 1) \times (x + 3)$		B2
	$(2x + 1)(x – 3)$		B1
	$(2x – 1)(2x + 3)$		B0
	$(x – 1)(x + 3)$		B0
21(b)	$\frac{1}{2}$ and $–3$	B1ft	ft their answer to (a) in the form $(2x + a)(x + b)$
	Additional Guidance		
	Factorisation seen in this part does not gain any credit in part (a)		
	Solutions must be seen in this part		
	Solutions seen but factorisation given as answer		B0
	$(2x + 1)(x – 3)$ in part (a) with $–\frac{1}{2}$ and 3 in part (b)		B1ft

Q	Answer	Mark	Comments
22	$2(b-a)-5=1$ or $2b-2a=6$ or $b-a=3$	M1	oe $\begin{pmatrix} 2(b-a) & -5 \\ 2a & -5b \end{pmatrix} = \begin{pmatrix} 1 \\ 9 \end{pmatrix}$ oe with neither correct equation scores M0M1
	$2a-5b=9$	M1	
	Correctly eliminates one variable	M1dep	eg $2b-5b-5=10$ dep on M1M1
	$b=-5$	A1	
	$a=-8$	A1	
	Additional Guidance		
	$a=-8$ and $b=-5$		5 marks
	One correct value with no other work worth any credit		Zero
	Missing brackets around $b-a$ must be recovered		

23(a)	$5\sqrt{5}$ and $20\sqrt{5}$ and $-15\sqrt{5}$	B2	B1 $5\sqrt{5}$ or $20\sqrt{5}$
	Additional Guidance		
	$-15\sqrt{5}$ alone		B0

Q	Answer	Mark	Comments
23(b)	$\frac{(13+\sqrt{7})(5+\sqrt{7})}{(5-\sqrt{7})(5+\sqrt{7})}$	M1	may be implied by the second mark
	$65+5\sqrt{7}+13\sqrt{7}+7$ or $65+18\sqrt{7}+7$ or $72+5\sqrt{7}+13\sqrt{7}$ or $72+18\sqrt{7}$ and $25\left(+5\sqrt{7}-5\sqrt{7}\right)-7$ or $18\left(+5\sqrt{7}-5\sqrt{7}\right)$	M1dep	
	$65+5\sqrt{7}+13\sqrt{7}+7$ and $25\left(+5\sqrt{7}-5\sqrt{7}\right)-7$ and $4+\sqrt{7}$ or $b=4$	A1	must show all four terms of numerator
	Additional Guidance		
	Further working eg $4+\sqrt{7}=4\sqrt{7}$		A0
	Multiplying across to reach $4+\sqrt{7}$ or $b=4$		M0M0A0
24(a)	*OCA* = 42 or *ACB* = 90 or *COA* = 96 or *COB* = 84 or *OBC* = 48 or 90 – 42 or (180 – 84) ÷ 2	M1	may be on diagram eg *ACB* marked with the symbol for a right angle
	48	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
24(b)	**Alternative method 1**		
	BVW = *VZW*	M1	allow q for *VZW*
	BV = *BW and BVW* = 45 or *BVW* = *BWV* or $BVW = \frac{180-90}{2}$	M1	may be seen first
	Full working to prove q = 45 with both correct reasons	A1	isosceles triangle **and** alternate segment
	Alternative method 2		
	BWV = *VZW*	M1	allow q for *VZW*
	BV = *BW and BWV* = 45 or *BVW* = *BWV* or $BWV = \frac{180-90}{2}$	M1	may be seen first
	Full working to prove q = 45 with both correct reasons	A1	isosceles triangle **and** alternate segment
	Alternative method 3		
	BVW = *VZW* and *BWV* = *VZW*	M1	allow q for *VZW*
	90 + 2q = 180 and q = 45 or $q = \frac{180-90}{2}$	M1dep	must be using triangle *BVW*
	Full working to prove q = 45 with both correct reasons	A1	alternate segment (twice) **and** angle sum of a triangle with *B* a right angle

Alternative method and Additional Guidance continued on the next page

Q	Answer	Mark	Comments
24(b) cont	**Alternative method 4**		
	$VOW = 2 \times VZW$ (where O is the centre)	M1	oe allow q for VZW
	$VOW = 90$ and $VZW = \frac{90}{2}$ or $VOW = 90$ and $90 = 2q$ and $q = 45$	M1dep	allow q for VZW
	Full working to prove $q = 45$ with both correct reasons	A1	angle at circumference is twice the angle at the centre **and** V and W are midpoints of the sides of the square
	Additional Guidance		
	Methods involving joining other points on the diagram should be marked in the same way as Alt 4		
	Beware $q = \frac{180-90}{2}$ coming from assuming $WVZ = 90$		
	The method needs to be shown for all marks so angles only marked on the diagram do not score		
	The method needs to be shown for each angle so stating eg $BVW = 45$ and $BWV = 45$ is insufficient for the second mark of Alt 1		

Q	Answer	Mark	Comments
25(a)	**Alternative method 1**		
	$\frac{3(x+4)-7}{2(x+4)}$	M1	oe
	$3x + 12 - 7 = 2x + 8$ or $3x + 5 = 2x + 8$ or $3x - 2x = 8 - 5$	M1dep	correct equation rearranged to remove fraction
	3	A1	
	Alternative method 2		
	$\frac{3c-7}{2c} = 1$ and $3c - 7 = 2c$ or $c = 7$	M1	oe any letter must rearrange g(c) = 1 to remove fraction
	$x + 4 = 7$	M1dep	
	3	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
25(b)	**Alternative method 1** Using $y = \frac{3x-7}{2x}$		
	$2xy = 3x - 7$	M1	oe
	$2xy - 3x = -7$	M1dep	oe
	$x(2y-3) = -7$ or $x = \frac{-7}{2y-3}$	M1dep	oe
	$\frac{-7}{2x-3}$ or $\frac{7}{3-2x}$	A1	
	Alternative method 2 Interchanging x and y		
	$2xy = 3y - 7$	M1	oe
	$2xy - 3y = -7$	M1dep	oe
	$y(2x-3) = -7$	M1dep	oe
	$\frac{-7}{2x-3}$ or $\frac{7}{3-2x}$	A1	
	Alternative method 3		
	$y = \frac{3}{2} - \frac{7}{2x}$	M1	oe
	$y - \frac{3}{2} = -\frac{7}{2x}$	M1dep	oe
	$2x = \frac{-7}{y-\frac{3}{2}}$ or $x = \frac{-7}{2y-3}$	M1dep	oe
	$\frac{-7}{2x-3}$ or $\frac{7}{3-2x}$	A1	$\frac{-3.5}{x-1.5}$ is M3A0
	Additional Guidance		
	Allow eg $y = \frac{7}{3-2x}$		M1M1M1A1

Q	Answer	Mark	Comments
26	$\sqrt{10.24}$ or 3.2 or $\frac{16}{5}$ or $\frac{1}{\sqrt{10.24}}$ or 0.3125 or $\frac{5}{16}$	M1	oe implied by 32.768 or $\frac{1}{32.768}$ oe
	(their 3.2)^3 × 250 or 250 ÷ (their 0.3125)^3	M1dep	oe
	8192	A1	
	Additional Guidance		

27(a)	**Alternative method 1**		
	Second difference is 2	M1	implied by n^2
	Subtracts n^2 values from original sequence	M1dep	implied by 80 100 120 140
	$n^2 + 20n + 60$	A1	oe allow $a = 1$ $b = 20$ $c = 60$
	Alternative method 2		
	Any three of $a + b + c = 81$ $4a + 2b + c = 104$ $9a + 3b + c = 129$ $16a + 4b + c = 156$	M1	using $an^2 + bn + c$
	Any 2 equations in 2 unknowns eg $3a + b = 23$ $5a + b = 25$ $7a + b = 27$	M1dep	correctly eliminates the same letter using two different pairs of equations
	$n^2 + 20n + 60$	A1	oe allow $a = 1$ $b = 20$ $c = 60$

Alternative methods and Additional Guidance continued on the next page

Q	Answer	Mark	Comments
27(a) cont	**Alternative method 3**		
	Second difference is 2 or $a = 1$	M1	using $an^2 + bn + c$
	$3a + b = 23$ and substitutes their a	M1dep	oe eg $b = 20$
	$n^2 + 20n + 60$	A1	oe allow $a = 1$ $b = 20$ $c = 60$
	Alternative method 4		
	$a + b + c = 81$ $3a + b = 23$	M1	
	$a = 1$ and substitutes into another equation	M1dep	
	$n^2 + 20n + 60$	A1	oe allow $a = 1$ $b = 20$ $c = 60$
	Additional Guidance		
	Sequence (60) 81 104 129 156 1st differences (21) 23 25 27 2nd differences 2 2 2		

Q	Answer	Mark	Comments
27(b)	$n^2 - 55n + 750 < 0$ or $(n - 30)(n - 25)$ or $\frac{-(-55) \pm \sqrt{(-55)^2 - 4 \times 1 \times 750}}{2 \times 1}$ or $\frac{55}{2} \pm \sqrt{\left(\frac{55}{2}\right)^2 - 750}$	M1	oe
	$25 < n < 30$ or $n = 25$ and $n = 30$	M1dep	oe
	4 with working that is not from trial and improvement	A1	allow 26, 27, 28, 29 listed with full method shown
	Additional Guidance		
	$n = 25$ and $n = 30$		M1M1dep
	$n = 25$ and $n = 30$ from substitution into the nth term		Zero
	Answer 4 from trial and improvement		Zero

Q	Answer	Mark	Comments
28	$x^2 + 5x - x - 5$ or $x^2 + 4x - 5$	M1	
	$2x + 5 - 1$ or $2x + 4$	M1	ft their expansion providing their expansion is a 3 or 4 term quadratic
	-2	A1	must have scored M1M1
	Additional Guidance		
	Correct solution followed by further work eg to find the equation of the tangent		A0
	Answer given as $(-3, -2)$		A0
	Solving $2x + 4 = 0$ to give -2		A0
	$x^2 + 5x - x - 5 = x^2 - 4x - 5$ $2x - 4$		M1 M0
	$x^2 - 4x - 5$ $2x - 4$		M0 M1

Q	Answer	Mark	Comments
29	**Alternative method 1**		
	$\frac{1}{2} \times w \times 3w \times \sin 150$	M1	
	$\frac{1}{2} \times w^2 \times 3 \times \frac{1}{2} = 4.32$ or $w^2 = 5.76$ or $w = 2.4$	M1dep	oe
	$AC^2 = (\text{their } 2.4)^2 + (3 \times \text{their } 2.4)^2 - 2 \times \text{their } 2.4 \times 3 \times \text{their } 2.4 \times \cos 150$ or $(\text{their } 2.4)^2 (10 + 3\sqrt{3})$ or 87.52… or 87.53	M1dep	oe
	$\sqrt{\text{their } 87.52...}$	M1dep	
	[9.35, 9.36] or 9.4	A1	
	Alternative method 2		
	$\frac{1}{2} \times w \times 3w \times \sin 150$	M1	
	$\frac{1}{2} \times w^2 \times 3 \times \frac{1}{2} = 4.32$ or $w = 2.4$	M1dep	oe
	$AX = 3 \times \text{their } 2.4 \times \sin 30$ or 3.6 and $BX = 3 \times \text{their } 2.4 \times \cos 30$ or $\frac{18\sqrt{3}}{5}$ or 6.23… or 6.24 and $AC^2 = (\text{their } 3.6)^2 + (\text{their } \frac{18\sqrt{3}}{5} + \text{their } 2.4)^2$ or 87.52… or 87.53	M1dep	drops a perpendicular from A to meet CB extended at X oe eg $AX = 3 \times \text{their } 2.4 \times \sin 30$ or 3.6 and $BX = \frac{\text{their } 3.6}{\tan 30}$ or $\frac{18\sqrt{3}}{5}$ and $AC^2 = (\text{their } 3.6)^2 + (\text{their } \frac{18\sqrt{3}}{5} + \text{their } 2.4)^2$
	$\sqrt{\text{their } 87.52...}$	M1dep	
	[9.35, 9.36] or 9.4	A1	
	Additional Guidance		
	If using Alt 2 may see $XC = 8.635…$ used		