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9260/1E

Paper 1E Extension Tier

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 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 $\leqslant$ 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	56°	B1	

Q	Answer	Mark	Comments
2	$\begin{pmatrix}3\\0\end{pmatrix}$	B1	

Q	Answer	Mark	Comments
3	10^{15}	B1	

Q	Answer	Mark	Comments
4	2	B1	

Q	Answer	Mark	Comments
5	**Alternative method 1**		
	$\frac{\pi \times 9^2}{2}$ or $\frac{81\pi}{2}$ or [127.17, 127.3] or 127	M1	oe eg 40.5π
	9×18 – their [127.17, 127.3] or $162 - 40.5\pi$ or [34.7, 34.83] or 35	M1dep	oe eg $2 \times \left(9 \times 9 - \frac{\pi \times 9^2}{4}\right)$
	$0.2 \times 9 \times 18$ or 32.4	M1	oe
	[34.7, 34.83] or 35 and 32.4	A1	SC1 162 seen
	Alternative method 2		
	$\frac{\pi \times 9^2}{2}$ or $\frac{81\pi}{2}$ or [127.17, 127.3] or 127	M1	oe eg 40.5π
	9×18 – their [127.17, 127.3] or $162 - 40.5\pi$ or [34.7, 34.83] or 35	M1dep	oe eg $(18 \times 18 - \pi \times 9^2) \div 2$
	$\frac{\text{their [34.7, 34.83]}}{9 \times 18}$ or [0.214, 0.21605]	M1dep	oe accept 0.21 with working
	[21.4, 21.605]	A1	oe eg [0.214, 0.21605] and 0.2 accept 21 with working SC1 162 seen

Alternative method 3 and Additional Guidance are on the next page

5 cont	**Alternative method 3**		
	$\frac{\pi \times 9^2}{2}$ or $\frac{81\pi}{2}$ or [127.17, 127.3] or 127	M1	oe eg 40.5π
	$\frac{\text{their [127.17, 127.3]}}{9 \times 18}$ or [0.784, 0.786] or [78.4, 78.6]	M1dep	oe accept 0.79 with working accept 79 with working
	1 – their [0.784, 0.786] or [0.214, 0.21605] or 100 – their [78.4, 78.6] or 1 – 0.2 or 100 – 20	M1dep	oe accept 0.21 with working accept 100 – 79 with working
	[21.4, 21.605]	A1	oe eg [0.214, 0.21605] and 0.2 accept 21 with working SC1 162 seen
	Additional Guidance		
	Beware [21.4, 21.605] from using diameter 9		Zero

Q	Answer	Mark	Comments
6(a)	0.3 or $\frac{3}{10}$ or 30%	B1	condone %30
	Additional Guidance		
	3 : 7 or 3 : 10		B0

Q	Answer	Mark	Comments
6(b)	No and a valid reason	B1	eg not enough trials
	Additional Guidance		
	Ignore non-contradictory comments eg about bias alongside a correct reason		
	No not enough data		B1
	No need more spins		B1
	No need a larger sample / 10 is a small sample		B1
	No it was **only** spun 10 times		B1
	No it shows the relative frequency not the probability		B0
	No probabilities don't stay the same / are about luck		B0
	No it's biased		B0
	No it's an estimate		B0

Q	Answer	Mark	Comments
6(c)	Cannot tell	B1	

Q	Answer	Mark	Comments
7(a)	$(y - 7)(y + 7)$ or $-(7 - y)(y + 7)$	B1	brackets in either order oe factorisation eg $(7 - y)(-7 - y)$ or $(7 + y)(y - 7)$ any letter
	Additional Guidance		
	Condone missing closing bracket eg $(y - 7)(y + 7$		B1
	Allow use of multiplication sign eg $(y - 7) \times (y + 7)$		B1
	Ignore any attempt to solve		

Q	Answer	Mark	Comments
7(b)	$2p$	B2	B1 $2^2 \times p$ and $2 \times 3 \times p^2$ or $2 \times 2 \times p$ and $2 \times 3 \times p \times p$ or $2p(2 + 3p)$ or answer p or HCF evaluated for their valid value of p
	Additional Guidance		
	$2 \times p$ or $p \times 2$		B2
	States a prime number, p, **greater than 2** and then gives the HCF for $4p$ and $6p^2$ eg $p = 3$ Answer 6		B1
	Their valid value of p may be implied eg $4p = 12$ and $6p^2 = 54$ Answer 6 (implies $p = 3$)		B1
	Prime factors may be seen in a repeated factor division for B1		

Q	Answer	Mark	Comments
8(a)	**Alternative method 1**		
	(13 – 3) × (2.6 – 1.2) ÷ 2 or (13 – 3) × 1.4 ÷ 2 or 10 × (2.6 – 1.2) ÷ 2 or 10 × 1.4 ÷ 2	M1	oe calculation shown eg 0.5 × 1.4 × 10 × sin 90
	(13 – 3) × (2.6 – 1.2) ÷ 2 + 1.2 × 13 = 22.6 or (13 – 3) × 1.4 ÷ 2 + 1.2 × 13 = 22.6 or 10 × (2.6 – 1.2) ÷ 2 + 1.2 × 13 = 22.6 or 10 × 1.4 ÷ 2 + 1.2 × 13 = 22.6	A1	oe calculation shown may be shown in stages eg 10 × 1.4 ÷ 2 = 7 and 7 + 1.2 × 13 = 22.6 SC1 7 + 15.6 = 22.6 with no method for 7 shown or 7 + 1.2 × 13 = 22.6 with no method for 7 shown
	Alternative method 2		
	0.5 × (1.2 + 2.6) × (13 – 3) or 0.5 × 3.8 × (13 – 3) or 0.5 × (1.2 + 2.6) × 10 or 0.5 × 3.8 × 10	M1	oe calculation shown
	0.5 × (1.2 + 2.6) × (13 – 3) + 1.2 × 3 = 22.6 or 0.5 × 3.8 × (13 – 3) + 1.2 × 3 = 22.6 or 0.5 × (1.2 + 2.6) × 10 + 1.2 × 3 = 22.6 or 0.5 × 3.8 × 10 + 1.2 × 3 = 22.6	A1	oe calculation shown may be shown in stages eg 0.5 × 3.8 × 10 = 19 and 19 + 1.2 × 3 = 22.6 SC1 19 + 3.6 = 22.6 with no method for 19 shown or 19 + 1.2 × 3 = 22.6 with no method for 19 shown

Q	Answer	Mark	Comments	
8(b)	22.6×9 or 203.4	M1	must use the given cross-section	
	203 400	A1	SC1 140 400 or 0.2034	
	Additional Guidance			
	SC1 for the volume in litres of the top cuboid part of the pool or multiplying the correct volume by 0.001			

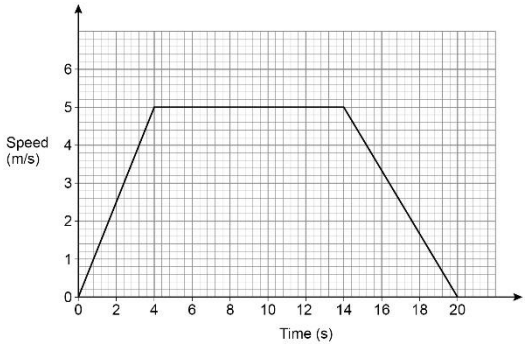
Q	Answer	Mark	Comments	
9	$\frac{2(3x+1)}{4}$ $\left(\text{and } \frac{x}{4}\right)$	M1	oe common denominator eg $\frac{4(3x+1)}{8}$ and $\frac{2x}{8}$	
	$\frac{6x+2}{4}$ $\left(\text{and } \frac{x}{4}\right)$	M1dep	oe brackets expanded eg $\frac{12x+4}{8}$ and $\frac{2x}{8}$ or $\frac{14x+4}{8}$	
	$\frac{7x+2}{4}$	A1		
	Additional Guidance			
	$\frac{7x+2}{4}$ followed by further work eg $\frac{7x}{4}+\frac{1}{2}$ or $\frac{3.5x+1}{2}$ or $\frac{1.75x+0.5}{1}$			M1M1A0

Q	Answer	Mark	Comments
10	**Alternative method 1**		
	$1 + \frac{2}{100}$ or 1.02 seen	M1	oe implied by 1.104… implied by 2800 + 2800 × 0.02 or 2856
	$2800 \times (1.02)^5$ or 3091.426…	M1dep	oe eg 2800 × 1.104…
	3091.42 or 3091.43 or 3091.4 or 3091	A1	
	Alternative method 2		
	$1 + \frac{2}{100}$ or 1.02 seen	M1	oe implied by 2800 + 2800 × 0.02 or 2856
	2800 × 1.02 or 2856 and their 2856 × 1.02 or 2913.12 and their 2913.12 × 1.02 or 2971.38(24) and their 2971.38(24) × 1.02 or [3030.8, 3030.81005] and their [3030.8, 3030.81005] × 1.02 or [3091.41, 3091.43]	M1dep	oe must be exactly 5 years
	3091.42 or 3091.43 or 3091.4 or 3091	A1	
	Additional Guidance		
	1 + 2% only		M0
	3091 from an incorrect value eg 3091.21 followed by 3091		A0

Q	Answer	Mark	Comments
11	$2\pi r = 15$ or $\pi d = 15$ or $(d =) \frac{15}{\pi}$ or $(d =)$ [4.77, 4.8] or $(r =) \frac{15}{2\pi}$	M1	oe eg $12\pi r = 90$
	[2.38, 2.39] or 2.4	A1	

Q	Answer	Mark	Comments
12	$5w^{10}$	B2	B1 $\frac{15w^{10}}{3}$ or $\frac{15w^{16}}{3w^6}$ or $\frac{5w^{16}}{w^6}$ or $\frac{15w^{14}}{3w^4}$ or $\frac{5w^{14}}{w^4}$ or $\frac{15w^{12}}{3w^2}$ or $\frac{5w^{12}}{w^2}$
	Additional Guidance		
	Allow unnecessary multiplication signs in a B1 response eg $\frac{15\times w^{16}}{3\times w^6}$		
	$5 \times w^{10}$ or $5.w^{10}$ is B1 unless correct answer also seen		
	B2 response followed by further incorrect work		B1
	B1 response followed by further incorrect work		B1
	Allow division sign for fraction eg $15w^{16} \div 3w^6$		B1
	Allow simplified equivalent expressions eg $\frac{5w^{11}}{w}$		B1

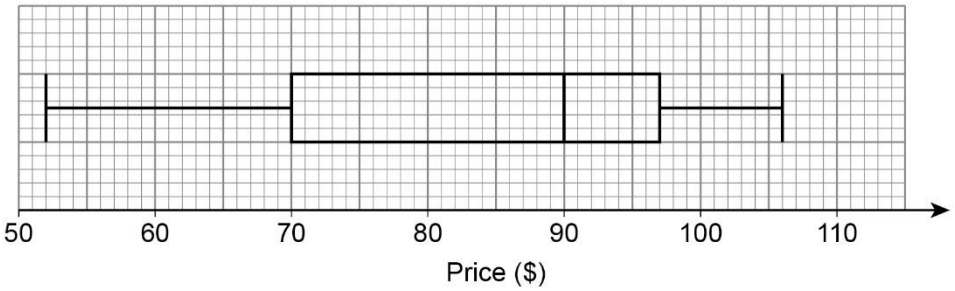
Q	Answer	Mark	Comments
13	$3850 \div (2 + 5)$ or 550	M1	oe
	their 550×2 or 1100 or their 550×5 or 2750	M1dep	1100 is implied by 1400 2750 is implied by 2800
	their $550 \times 2 + 300$ or 1400 and $3850 + 300 + 50$ or 4200 or their $550 \times 2 + 300$ or 1400 and their $550 \times 5 + 50$ or 2800 or $\frac{1400}{4200}$ or 1400 : 2800 or 1 : 2	M1dep	oe eg their $550 \times 2 + 300$ or 1400 and their $550 \times 2 + 300 +$ their $550 \times 5 + 50$ or 4200
	$\frac{1}{3}$	A1	
	Additional Guidance		
	$\frac{1}{3}$ must be their final answer to award the A mark		
	$3850 \div 7 = 550$ and $3850 \div 5 = 770$ is choice unless 550 is chosen		

Q	Answer	Mark	Comments
14	Straight line from (0, 0) to (4, 5)	B1	
	Horizontal line from (4, 5) to (14, 5)	B1ft	horizontal line ft their first section for 10 seconds or horizontal line ft their first section ending at (14, 5)
	Straight line from (14, 5) to (20, 0)	B1ft	line with negative gradient to x-axis ft their previous section for 6 seconds or line with negative gradient to x-axis ft their previous section ending at (20, 0)
	Additional Guidance		
	Mark intention for straight lines		
	For second mark, first section may be missing		
	For third mark, second section may be missing		
			B1B1B1

Q	Answer	Mark	Comments
15	**Alternative method 1**		
	(3rd term =) $6 + x$ or (1st term =) $\frac{3-x}{2}$	M1	oe eg $6 + x = y$ or $2a + x = 3$ where a is the first term
	$2(6 + x) + x = 45$ or $3x + 12 = 45$	M1dep	oe
	11	A1	implied by 3rd term of 17
	–4	A1ft	ft (3 – their 11) ÷ 2 with at least M1 awarded
	Alternative method 2		
	(3rd term =) $6 + x$ or (1st term =) $\frac{3-x}{2}$	M1	oe eg $6 + x = y$ or $2a + x = 3$ where a is the first term
	$6 + x = y$ and $2y + x = 45$ and $3y = 51$ or $3x + 12 = 45$	M1dep	oe where y is the third term
	$(x =)$ 11 or $(y =)$ 17	A1	where y is the third term
	–4	A1ft	ft (3 – their 11) ÷ 2 with at least M1 awarded
	Alternative method 3		
	(3rd term =) $6 + x$ or (3rd term =) $\frac{45-x}{2}$ or (1st term =) $\frac{3-x}{2}$	M1	oe eg $6 + x = y$ or $2y + x = 45$ where y is the third term or $2a + x = 3$ where a is the first term
	$6 + x = \frac{45-x}{2}$ or $12 + 2x = 45 - x$ or $3x = 33$	M1dep	oe
	$(x =)$ 11	A1	implied by 3rd term of 17
	–4	A1ft	ft (3 – their 11) ÷ 2 with at least M1 awarded

Alternative method 4 and Additional Guidance are on the next page

15 cont	**Alternative method 4**		
	$2a + x = 3$ where a is the first term	M1	oe eg (1st term =) $\frac{3-x}{2}$
	$2a + x = 3$ and $2[2(2a + x) + x] + x = 45$ or $8a + 7x = 45$ and $3x = 33$ or $8a - 14a = 24$	M1dep	oe
	$(x =)$ 11 or $(a =) -\frac{24}{6}$	A1	
	–4	A1ft	ft (3 – their 11) ÷ 2 with at least M1 awarded
	Additional Guidance		
	$2a + x = 3$ or $2a + x$ without seeing a as the first term is insufficient to score		
	Condone $6 + x = 45$		M1
	$6 + x = 45$ $x = 39$ Answer –18		M1 M0A0 A1ft
	If their answer follows through (3 – their 11) ÷ 2 then the correct expression for the first term is implied		M1M0A0A1ft
	Answer 11		M1M1A1

Q	Answer	Mark	Comments
16	Box drawn with lower quartile line drawn at 70 and median line drawn at 90	B1	must be the first two vertical lines of a box with three vertical lines
	(Maximum value) 106	B1	may be drawn
	(Upper quartile) 97	B1	may be drawn
	Fully correct box plot including minimum at 52	B1ft	ft max one error with only B2 awarded correct structure needed
	Additional Guidance		
			
	Mark intention eg any height and allow horizontal line through centre		
	Allow ends of whiskers to be vertical lines of any length, dots, crosses or missing		
	$\pm\frac{1}{2}$ small square tolerance		

Q	Answer	Mark	Comments
17(a)	**Alternative method 1**		
	(Angle at centre =) $\frac{360}{8}$ or 45	M1	accept (half angle at centre =) $\frac{360}{16}$ or (half angle at centre =) 22.5
	$\tan\left(\frac{\text{their } 45}{2}\right) = \frac{0.5}{h}$	M1dep	oe eg tan 22.5 = $\frac{0.5}{h}$
	(h =) $\frac{0.5}{\tan 22.5}$ = 1.207	A1	
	Alternative method 2		
	(Internal angle =) $180 - \frac{360}{8}$ or 135	M1	accept (half internal angle =) 67.5
	$\tan\left(\frac{\text{their } 135}{2}\right) = \frac{h}{0.5}$	M1dep	oe eg tan 67.5 = $\frac{h}{0.5}$
	(h =) 0.5 × tan 67.5 = 1.207	A1	
	Alternative method 3		
	(Angle at centre =) $\frac{360}{8}$ or 45 or (internal angle =) $180 - \frac{360}{8}$ or 135	M1	accept (half angle at centre =) $\frac{360}{16}$ or (half angle at centre =) 22.5 or (half internal angle =) 67.5
	$\frac{h}{\sin\left(\frac{\text{their } 135}{2}\right)} = \frac{0.5}{\sin\left(\frac{\text{their } 45}{2}\right)}$	M1dep	oe eg $\frac{h}{\sin 67.5} = \frac{0.5}{\sin 22.5}$
	(h =) $\frac{0.5 \times \sin 67.5}{\sin 22.5}$ = 1.207	A1	

Alternative method 4 and Additional Guidance are on the next page

17(a) cont	**Alternative method 4**		
	$2a^2 = 1$ or $\sqrt{\left(\frac{1}{2}\right)}$ or $\frac{1}{\sqrt{2}}$ or $\frac{\sqrt{2}}{2}$	M1	oe equation or exact value
	$(h =)\ 0.5 + \frac{1}{\sqrt{2}}$ or $(h =)\ \frac{1+\sqrt{2}}{2}$	M1dep	oe eg $(h =)\ \left(2 \times \frac{1}{\sqrt{2}} + 1\right) \div 2$
	$(h =)\ 0.5 + \frac{1}{\sqrt{2}} = 1.207$	A1	oe eg 0.5 + 0.707 = 1.207 with M1 seen
	Additional Guidance		
	Award M1 even if not subsequently used		
	Working back from the given answer needs to be convincing for full marks		

Q	Answer	Mark	Comments
17(b)	**Alternative method 1** uses one white octagon to four grey quarter-squares		
	(Area of one octagon =) $8 \times \frac{1}{2} \times \frac{1+\sqrt{2}}{2}$ or $2+2\sqrt{2}$ or $8 \times \frac{1}{2} \times 1.207$ or [4.82, 4.83] or $8 \times \frac{1}{2} \times h$ or $4h$	M1	oe splits octagon into 8 isosceles triangles
	their [4.82, 4.83] : 1 or their $4h$: 1	M1dep	oe eg 1 : $\frac{1}{\text{their [4.82, 4.83]}}$
	1 : [0.207, 0.21] or 1 : $\frac{\sqrt{2}-1}{2}$	A1	oe eg 1 : $\frac{1}{2+2\sqrt{2}}$
	Alternative method 2 uses 16 white octagons to 16 grey squares		
	(Area of one octagon =) $8 \times \frac{1}{2} \times \frac{1+\sqrt{2}}{2}$ or $2+2\sqrt{2}$ or $8 \times \frac{1}{2} \times 1.207$ or [4.82, 4.83] or $8 \times \frac{1}{2} \times h$ or $4h$	M1	oe splits octagon into 8 isosceles triangles
	(White =) 16 × their [4.82, 4.83] or [77.12, 77.3] or $32+32\sqrt{2}$ or 16 × their $4h$ or $64h$ **and** (Grey =) 16	M1dep	oe implied by 16 × their [4.82, 4.83] : 16 or [77.12, 77.3] : 16 or $32+32\sqrt{2}$: 16 or $64h$: 16
	1 : [0.207, 0.21] or 1 : $\frac{\sqrt{2}-1}{2}$	A1	oe eg 1 : $\frac{1}{2+2\sqrt{2}}$

Alternative methods 3 and 4 and Additional Guidance are on the next two pages

17(b) cont	**Alternative method 3** uses whole area and 16 grey squares		
	(Area of pattern =) $\left(4+4\sqrt{2}\right)^2$ or $48+32\sqrt{2}$ or $(8 \times 1.207)^2$ or [93.12, 93.3] or $(8 \times h)^2$ or $64h^2$	M1	oe
	(Area of pattern =) $\left(4+4\sqrt{2}\right)^2$ or $48+32\sqrt{2}$ or $(8 \times 1.207)^2$ or [93.12, 93.3] or $(8 \times h)^2$ or $64h^2$ **and** (White =) their [93.12, 93.3] – 16 or [77.12, 77.3] or $32+32\sqrt{2}$ or their $64h^2 - 16$	M1dep	oe implied by their [93.12, 93.3] – 16 : 16 or [77.12, 77.3] : 16 or $32+32\sqrt{2}$: 16 or $64h^2 - 16 : 16$ or $4h^2 - 1 : 1$
	1 : [0.207, 0.21] or $1 : \frac{\sqrt{2}-1}{2}$	A1	oe eg $1 : \frac{1}{2+2\sqrt{2}}$

Alternative method 4 and Additional Guidance are on the next page

17(b) cont	**Alternative method 4** uses whole area and 16 white octagons		
	(Area of pattern =) $\left(4+4\sqrt{2}\right)^2$ or $48+32\sqrt{2}$ or $(8 \times 1.207)^2$ or [93.12, 93.3] or $(8 \times h)^2$ or $64h^2$ or (Area of one octagon =) $8 \times \frac{1}{2} \times \frac{1+\sqrt{2}}{2}$ or $2+2\sqrt{2}$ or $8 \times \frac{1}{2} \times 1.207$ or [4.82, 4.83] or $8 \times \frac{1}{2} \times h$ or $4h$	M1	oe
	(Area of pattern =) $\left(4+4\sqrt{2}\right)^2$ or $48+32\sqrt{2}$ or $(8 \times 1.207)^2$ or [93.12, 93.3] or $(8 \times h)^2$ or $64h^2$ **and** (White =) 16 × their [4.82, 4.83] or [77.12, 77.3] or $32+32\sqrt{2}$ or 16 × their $4h$ or $64h$	M1dep	oe implied by their [77.12, 77.3] : their [93.12, 93.3] – their [77.12, 77.3] or [77.12, 77.3] : 16 or $32+32\sqrt{2}$: 16 or $64h : 64h^2 - 64h$ or $1 : h-1$
	1 : [0.207, 0.21] or $1 : \frac{\sqrt{2}-1}{2}$	A1	oe eg $1 : \frac{1}{2+2\sqrt{2}}$
	Additional Guidance		
	May use any values such that side of octagon : height of triangle = $\sqrt{2}$: 1		

Q	Answer	Mark	Comments
18(a)	$0.7665 \times 734 \times \sqrt{\frac{435}{50}}$	M1	oe
	1659.(...)	A1	
	Additional Guidance		
	Ignore rounding once correct answer seen		

Q	Answer	Mark	Comments
18(b)	$1250 = 0.7665 \times 682 \times \sqrt{\frac{m}{50}}$ or $\left(\frac{c}{0.7665 \times d}\right)^2 \times 50$	M1	oe eg $1250 = 522.753 \times \sqrt{\frac{m}{50}}$ implied by [2.39, 2.4]
	$\left(\frac{1250}{0.7665 \times 682}\right)^2 \times 50$	M1dep	oe
	[285.6, 286]	A1	

Q	Answer	Mark	Comments
19	$2n$	B1	

Q	Answer	Mark	Comments
20	decay of 15%	B1	

Q	Answer	Mark	Comments
21(a)	$\frac{1}{2} \times 12 \times 46 \times \sin 60$ or $276 \sin 60$	M1	oe eg $23 \times 6\sqrt{3}$
	$239(.0\ldots)$ or $138\sqrt{3}$	A1	accept 240 with method seen
	Additional Guidance		
	Using *C* is an acceptable equivalent method eg $\frac{1}{2} \times 41.33 \times 46 \times 0.25\ldots$	M1	

Q	Answer	Mark	Comments
21(b)	$12^2 + 46^2 - 2 \times 12 \times 46 \times \cos 60$ or $144 + 2116 - 1104 \cos 60$ or $144 + 2116 - 552$ or 1708	M1	oe eg $\cos 60 = \frac{12^2 + 46^2 - a^2}{2 \times 12 \times 46}$ or $(46 - 12 \cos 60)^2 + (12 \sin 60)^2$ or $40^2 + \left(6\sqrt{3}\right)^2$
	$\sqrt{12^2 + 46^2 - 2 \times 12 \times 46 \times \cos 60}$ or $\sqrt{\text{their } 1708}$	M1dep	oe
	$41(.3\ldots)$ or $2\sqrt{427}$ or $\sqrt{1708}$	A1	may be on diagram

Q	Answer	Mark	Comments
22	8.15 or 8.25	B1	implied by 48.9 or 49.5
	their 8.15×6 or 48.9 and their 8.25×6 or 49.5	M1	implied by (their 8.25 – their 8.15) × 6 $8.1 <$ their $8.15 < 8.2$ $8.2 <$ their $8.25 < 8.3$
	8.15 and 8.25 and 0.6	A1	
	Additional Guidance		
	49.5 – 48.9		B1M1A0
	8.15 and 8.24 48.9 and 49.44		B1 M1A0
	Accept $8.24\dot{9}$ for 8.25 and $0.5\dot{9}$ for 0.6		

Q	Answer	Mark	Comments
23	$180° < x < 270°$	B1	

Q	Answer	Mark	Comments
24	**Alternative method 1 RHS**		
	$B = D = 90$ or AC is common	M1	may be shown on diagram eg accept double notch marking on AC
	$B = D = 90$ and AC is common (and $AD = AB$)	M1dep	may be shown on diagram
	ABC and ADC are congruent RHS with appropriate facts and all reasons shown	A1	eg RHS and $B = 90$, $D = 90$, angle in a semicircle and AC is common and $AD = AB$ (given)
	Alternative method 2 SSS		
	AC is common or $BC = DC$	M1	may be shown on diagram eg accept double notch marking on AC
	AC is common and $BC = DC$ (and $AD = AB$)	M1dep	may be shown on diagram
	ABC and ADC are congruent SSS with appropriate facts and all reasons shown	A1	eg SSS and AC is common and $AD = AB$ (given) and $BC = DC$, Pythagoras' theorem

Alternative methods 3 and 4 and Additional Guidance are on the next two pages

24 cont	**Alternative method 3 SAS**		
	$B = D = 90$ or $BAC = DAC$ or AC is common or $BCA = DCA$ or $BC = DC$	M1	may be shown on diagram eg accept double notch marking on AC
	($AD = AB$) and $BAC = DAC$ and AC is common or AC is common and $BCA = DCA$ and $BC = DC$ or $BC = DC$ and $B = D = 90$ (and $AD = AB$)	M1dep	may be shown on diagram
	ABC and ADC are congruent SAS with appropriate facts and all reasons shown	A1	eg SAS and $AC = AC$ and $BAC = DAC$, symmetry and $AD = AB$ (given)

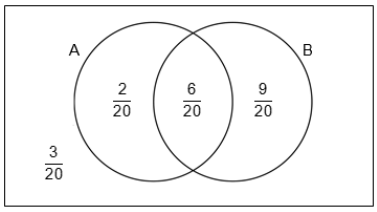
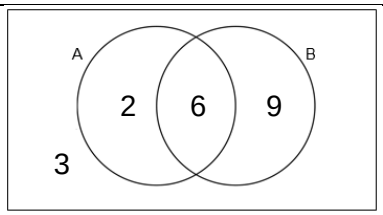
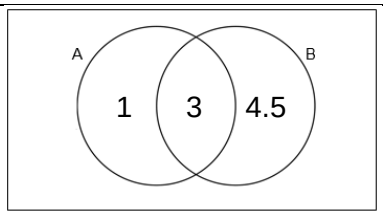
Alternative method 4 and Additional Guidance are on the next page

24 cont	**Alternative method 4 ASA**		
	$B = D = 90$ or $BAC = DAC$ or AC is common or $BCA = DCA$ or $BC = DC$	M1	may be shown on diagram eg accept double notch marking on AC
	$B = D = 90$ (and $AD = AB$) and $BAC = DAC$ or $BAC = DAC$ and AC is common and $BCA = DCA$ or $B = D = 90$ and $BC = DC$ and $BCA = DCA$	M1dep	may be shown on diagram
	ABC and ADC are congruent ASA with appropriate facts and all reasons shown	A1	eg ASA and $B = D = 90$, angle in a semicircle and $BAC = DAC$, same cosine and $AD = AB$ (given)
	Additional Guidance		
	Use the scheme that favours the student		
	Accept angle subtended by diameter for angle in a semicircle		
	Do not accept eg opposite angle from diameter / angle facing diameter		
	Accept HL for RHS		
	Using SSA		A0

Q	Answer	Mark	Comments
25(a)	$\begin{pmatrix} 6 & 2 \\ -8 & 4 \end{pmatrix}\begin{pmatrix} 2 & -1 \\ 4 & 3 \end{pmatrix}$	M1	
	$\begin{pmatrix} 20 & 0 \\ 0 & 20 \end{pmatrix}$	A1	
	$\begin{pmatrix} 20 & 0 \\ 0 & 20 \end{pmatrix} = 20\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ or $\begin{pmatrix} 20 & 0 \\ 0 & 20 \end{pmatrix}$ and $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ and $k = 20$	A1	oe eg $\begin{pmatrix} 20 & 0 \\ 0 & 20 \end{pmatrix} = 20\mathbf{I}$ and $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = \mathbf{I}$ must see $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$
	Additional Guidance		
	Condone missing brackets		
	$\begin{pmatrix} 20 & 0 \\ 0 & 20 \end{pmatrix}$ with no further working		M1A1

Q	Answer	Mark	Comments
25(b)	Enlargement centre O scale factor k or scale factor their k or scale factor 20	B2ft	B1 enlargement scale factor k or enlargement scale factor their k or enlargement scale factor 20 or enlargement centre O ft their k from (a) if used
	Additional Guidance		
	Accept enlarge for enlargement		
	Accept O or origin or (0, 0) but **not** 0, 0 for centre O		
	Accept sf or factor for scale factor		
	Combined transformation eg enlarged centre O and moved up		B0

Q	Answer	Mark	Comments
26	$a = 20$	B1	
	$a \times b^{(3-1)} = 8.192$ or their $20 \times b^2 = 8.192$ or $b^2 = 8.192 \div$ their 20 or $b^2 = 0.4096$ or $b = \sqrt{0.4096}$	M1	oe
	$b = 0.64$	A1	oe eg $\frac{16}{25}$

Q	Answer	Mark	Comments
27	$\frac{2}{5} \times \frac{3}{4}$ or $\frac{6}{20}$	M1	oe may be seen correctly placed on diagram
	$\frac{2}{5}$ – their $\frac{6}{20}$ or $\frac{2}{20}$ or $\frac{3}{4}$ – their $\frac{6}{20}$ or $\frac{9}{20}$	M1dep	oe may be seen correctly placed on diagram
	1 – their $\frac{2}{20} - \frac{3}{4}$ or $1 - \frac{2}{5}$ – their $\frac{9}{20}$ or 1 – their $\frac{6}{20}$ – their $\frac{2}{20}$ – their $\frac{9}{20}$ or $(P(A \cup B)' =) \frac{3}{20}$	M1dep	oe may be seen correctly placed on diagram
		A1	oe fraction, decimal or percentage SC2 four values in correct ratio in the diagram but not as probabilities SC1 three values in correct ratio in A U B in the diagram but not as probabilities
	Additional Guidance		
			SC2
			SC1
	Probabilities seen without method must be > 0 and < 1		

Q	Answer	Mark	Comments
28	$150x + 125$ or $-150x - 125$	M1	
	$4x^2 + 10x + 10x + 25$ or $4x^2 + 20x + 25$	M1	
	$8x^3 + 20x^2 + 20x^2 + 50x + 20x^2 + 50x + 50x + 125$ or $8x^3 + 40x^2 + 50x + 20x^2 + 100x + 125$ or $8x^3 + 60x^2 + 150x + 125$	M1dep	dep on 2nd M
	$8x^3 + 60x^2$ or $4x^2(2x + 15)$	A1	
	Additional Guidance		
	Allow recovery of brackets eg $8x^3 + 60x^2 + 150x + 125 - 150x + 125 = 8x^3 + 60x^2$		M3A1

Q	Answer	Mark	Comments
29	4 : 5	B2	oe ratio B1 $\sqrt{\frac{96}{150}}$ or $\sqrt{0.64}$ or $\sqrt{96} : \sqrt{150}$ or $\sqrt{16} : \sqrt{25}$ or $\frac{4}{5}$ or 0.8 or $\sqrt{\frac{150}{96}}$ or $\sqrt{1.5625}$ or $\sqrt{150} : \sqrt{96}$ or $\sqrt{25} : \sqrt{16}$ or $\frac{5}{4}$ or 1.25 or 5 : 4 oe
	Additional Guidance		
	12 : 15		B2

Q	Answer	Mark	Comments
30	**Alternative method 1**		
	$3y = 2x - 5$	M1	allow f(x) for y
	$3y + 5 = 2x$	M1dep	allow f(x) for y
	$\frac{3x+5}{2}$	A1	oe eg $\frac{-3x-5}{-2}$
	Alternative method 2		
	$x = \frac{2y-5}{3}$ or $3x = 2y - 5$	M1	condone f(x) for y
	$3x + 5 = 2y$	M1dep	condone f(x) for y
	$\frac{3x+5}{2}$	A1	oe eg $\frac{-3x-5}{-2}$
	Additional Guidance		
	Condone $y = \frac{3x+5}{2}$ or f(x) = $\frac{3x+5}{2}$		M2A1

Q	Answer	Mark	Comments
31	$3(x-2)^2\ldots$ or $(x-2)^2\ldots$	M1	
	$3[(x-2)^2-4]+5$ or $3(x-2)^2-12+5$ or $3(x-2)^2-7$	M1dep	oe correct expression eg $3[(x-2)^2-4+\frac{5}{3}]$
	$(2, -7)$ with M2 awarded	A1	
	Additional Guidance		
	Answer from any other method eg differentiation		M0

Q	Answer	Mark	Comments
32	**Alternative method 1 Working with 0.18… and 0.5…**		
	$10x = 1.8(8\ldots)$ or $100x = 18.8(8\ldots)$ or $10y = 5.5(5\ldots)$ or $100y = 55.5(5\ldots)$ or $\frac{5}{9}$	M1	oe multiplication by a power of 10 any letters
	$100x - 10x = 18.8(8\ldots) - 1.8(8\ldots)$ or $90x = 17$ with $100x = 18.8(8\ldots)$ and $10x = 1.8(8\ldots)$ seen	M1dep	oe subtraction to eliminate recurring digits for both decimals eg $1000x - 10x = 188.8(8\ldots) - 1.8(8\ldots)$ or $990x = 187$ with $1000x = 188.8(8\ldots)$ and $10x = 1.8(8\ldots)$ seen or $10x - x = 1.8(8\ldots) - 0.18(8\ldots)$ or $9x = 1.7$ with $10x = 1.8(8\ldots)$ seen
	$\frac{17}{90}$ and $\frac{5}{9}$ or $\frac{17}{90} \times \frac{9}{5}$	M1dep	oe fractions working for M2 must be shown
	$\frac{17}{50}$	A1	working for M3 must be shown

Alternative method 2 and Additional Guidance are on the next page

32 cont	**Alternative method 2 Working with 0.08… and 0.5…**		
	$10x = 0.8(8\ldots)$ or $100x = 8.8(8\ldots)$ or $10y = 5.5(5\ldots)$ or $100y = 55.5(5\ldots)$ or $\frac{5}{9}$	M1	oe multiplication by a power of 10 any letters
	$100x - x = 8.8(8\ldots) - 0.08(8\ldots)$ or $99x = 8.8$ with $100x = 8.8(8\ldots)$ seen	M1dep	oe subtraction to eliminate recurring digits for both decimals eg $1000x - 10x = 88.8(8\ldots) - 0.8(8\ldots)$ or $990x = 88$ with $1000x = 88.8(8\ldots)$ and $10x = 0.8(8\ldots)$ seen
	$\frac{8.8}{99} + \frac{1}{10} = \frac{17}{90}$ and $\frac{5}{9}$ or $\frac{8.8}{99} + \frac{1}{10} = \frac{17}{90}$ and $\frac{17}{90} \times \frac{9}{5}$	M1dep	oe fractions working for M2 must be shown
	$\frac{17}{50}$	A1	working for M3 must be shown
	Additional Guidance		
	Use of x may be implied eg $10 \times 0.18(8\ldots) = 1.8(8\ldots)$ $9 \times 0.18(8\ldots) = 1.7$		M1 M1

Q	Answer	Mark	Comments	
33	$4x - 11$	M1		
	$4 \times 3 - 11$ or (gradient =) 1	M1dep		
	-7 = their $1 \times 3 + c$ or $c = -10$ or $y = x - 10$	M1dep	oe	
	18	A1		
	Additional Guidance			
	Answer 18 with no evidence of incorrect method			M3A1
	$-7 = 4x - 11$ leading to gradient 1			M1M0