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MARK SCHEME

Maximum Mark: 120

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MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

- M Method marks, awarded for a valid method applied to the problem.
- A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.
- B Mark for a correct result or statement independent of Method marks.

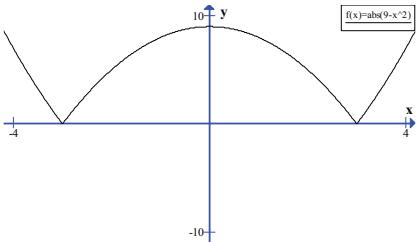
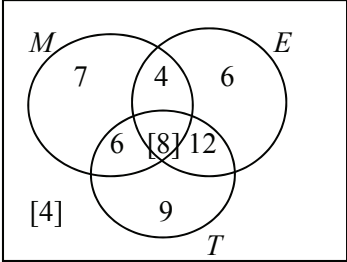
When a part of a question has two or more ‘method’ steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation ‘**dep**’ is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

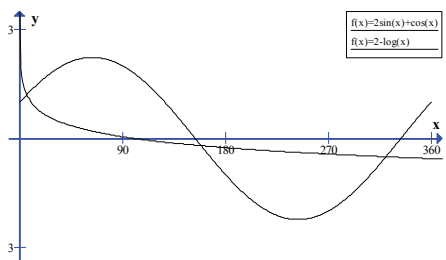
Abbreviations

awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfww	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	24 $4n$ final answer	2	B1 for each
1(a)(ii)	-11 $-2n + 1$ oe final answer	3	B1 for -11 M1 for $kn + 1$ (where $k < 0$) or $-2n + k$
1(a)(iii)	108 $3n^2$ oe final answer	3	B1 for 108 M1 for $kn^2 [+ q]$
1(a)(iv)	216 n^3 oe final answer	2	B1 for each
1(b)	337 $n^3 + 3n^2 + 2n + 1$ oe final answer	3	B1 for 337 M1 for adding <i>their</i> n th terms or 3rd differences = 6 and a cubic with numerical coefficients for the answer
2(a)	31.1	2	M1 for evidence of at least 3 correct midpoints
2(b)(i)	[7], 20, 40, 72, 100	1	
2(b)(ii)	Correct Graph	3	B1 for plotting <i>their</i> points at upper group limit (but points must be increasing vertically) B1 for 4 or 5 correct FT vertical plots (must be increasing)
2(c)(i)	32.5 to 34.5	1	FT <i>their</i> graph, dependent on increasing curve
2(c)(ii)	16.5 to 20	2	FT <i>their</i> graph, dependent on increasing curve B1 for UQ = 40.5 to 42 or LQ = 22 to 24 or M1 for <i>their</i> UQ – <i>their</i> LQ
2(c)(iii)	3 to 4	3	FT <i>their</i> graph, dependent on increasing curve M2 for <i>their</i> 55 th percentile (34 to 36) and <i>their</i> 45 th percentile (31 to 33) or M1 for <i>their</i> 45th percentile (31 to 33) or <i>their</i> 55th percentile (34 to 36) or SC3 for e.g. 32 to 35
3(a)	49.8 or 49.84 to 49.85	3	M2 for $\frac{30}{\sin 37}$ oe or M1 for $\sin 37 = \frac{30}{AC}$ oe
3(b)	39.7 or 39.8 or 39.74 to 39.81...	3	M2 for $\frac{30}{\tan 37}$ or <i>their</i> (a) $\times \cos 37$ oe or M1 for $\tan 37 = \frac{30}{BC}$ or $\cos 37 = \frac{BC}{\text{their(a)}}$ oe

Question	Answer	Marks	Partial Marks
3(c)	21.7 or 21.8 or 21.67 to 21.81	3	M2 for $\frac{30}{\tan 26} - \text{their}(b)$ or $\frac{(\text{their}(a)) \times \sin(180 - (180 - 37) - 26)}{\sin 26}$ oe or M1 for $\frac{30}{\tan 26}$ or $\frac{\text{their}(a)}{\sin 26} = \frac{CD}{\sin(180 - (180 - 37) - 26)}$ oe
3(d)	325 or 326 or 327 or 325[.0] to 327.2	2	M1 for $\frac{1}{2} \times \text{their}(c) \times 30$ oe
4(a)	Correct triangle (2, 1) (3, 1) (2, 4)	2	B1 for translation $\begin{pmatrix} k \\ -4 \end{pmatrix}$ or $\begin{pmatrix} 0 \\ k \end{pmatrix}$
4(b)	Correct triangle (-5, 2) (-5, 3) (-8, 2)	2	B1 for correct rotation, incorrect centre or for rotation 90° clockwise, correct centre
4(c)	Rotation [Centre] (0, 0) 90° clockwise oe	2	B1 for each
4(d)	Correct triangle (-5, -2) (-5, -3) (-8, -2)	3	B1 for $y = -x$ soi M1 for correct shape, incorrect location
4(e)	Reflection x -axis oe	2	B1 for each
5(a)	[Angle between] tangent [and] radius / diameter [=90] oe	1	
5(b)(i)	134	2	M1 for $360 - 90 - 90 - 46$ oe
5(b)(ii)	23	2	M1 for $(180 - \text{their}(i)) \div 2$ oe
5(b)(iii)	67	2	FT $(\text{their}(i)) \div 2$ M1 for $(\text{their}(i)) \div 2$ oe
5(b)(iv)	113	2	FT $180 - \text{their}(iii)$ or $(360 - \text{their}(i)) \div 2$ M1 for $180 - \text{their}(iii)$ or $(360 - \text{their}(i)) \div 2$ oe
5(c)	44	3	M2 for $180 - 67 - 23 - 23 - 23$ oe or $360 - 226 - 67 - 23$ oe or B1 for angle $OBC = 23$ or 226 seen

Question	Answer	Marks	Partial Marks
6(a)	8	3	<p>M1 for $y = \frac{k}{x^2}$ oe</p> <p>A1 for $k = 128$</p> <p>OR</p> <p>M2 for $32 \div \left(\frac{4}{2}\right)^2$ oe</p> <p>or M1 for $\frac{y}{32} = \frac{4^2}{\frac{1}{2^2}}$ oe</p>
6(b)	$[\pm] \frac{1}{2}$ oe	2	M1 for $x^2 = \frac{\text{their } k}{512}$ oe or $2 \times \sqrt{\frac{32}{512}}$ oe
6(c)	$[x = \pm] \sqrt{\frac{128}{y}}$ oe final answer	3	<p>M1 for multiplication by x^2</p> <p>M1 for division by y or for square root</p>
7(a)	Correct Graph 	4	<p>B1 for maximum point on or close to y-axis</p> <p>B1 for correct shape between <i>their</i> -3 and 3</p> <p>B1 for mod graph</p>
7(b)	$[x =] \pm 4, \pm \sqrt{2}$ or ± 1.41 or $\pm 1.414...$	2	B1 for any 2 correct answers
7(c)	$k > 9$ $k = 0$	2	B1 for each
8(a)	Correct values inside circles 	3	<p>B2 for 4 or 5 regions correct</p> <p>B1 for 2 or 3 regions correct</p>
8(b)(i)	17	1	FT <i>their</i> diagram
8(b)(ii)	11	1	FT <i>their</i> diagram

Question	Answer	Marks	Partial Marks
8(c)	$\frac{4}{56}$ oe	2	FT <i>their 4</i> M1 for $\frac{\text{their 4}}{k}$ ($k > \text{their 4}$) or $\frac{p}{56}$ ($p < 56$)
8(d)	$\frac{1190}{3080}$ oe	2	M1 for $\frac{35}{56} \times \frac{34}{55}$
8(e)	$\frac{6}{25}$ oe	2	FT <i>their 6</i> M1 for $\frac{\text{their 6}}{k}$ ($k > \text{their 6}$) or $\frac{p}{25}$ ($p < 25$)
8(f)	$\frac{12}{870}$ oe	3	M2 for $\frac{\text{their 4}}{30} \times \frac{(\text{their 4})-1}{29}$ ($\text{their 4} < 30$) or M1 for $\frac{a}{30} \times \frac{a-1}{29}$ ($\text{their } a < 30$)
9(a)	$[\cos x =] \frac{8^2 + 6^2 - 2^2}{2 \times 6 \times 8}$ oe	M2	M1 for $12^2 = 8^2 + 6^2 - 2 \times 8 \times 6 \cos[\dots]$
	117.3 or 117.2 to 117.3	B1	
9(b)	$[\sin =] \frac{6 \times \sin(\text{their}(a))}{12}$ oe	M2	M1 for $\frac{6}{\sin A} = \frac{12}{\sin(\text{their}(a))}$ oe
	26.4 or 26.5 or 26.37 to 26.46	B1	
10(a)	Correct Graph 	3	M1 for sine graph with one max and one min A1 for x -intercepts at 150 and 330 (approx.) A1 for positive y -intercept
10(b)	Correct Graph with second intersection with other graph (if correct) below x -axis	2	M1 for correct shape
10(c)	6.18 or 6.175... 159 or 158.5 to 158.6 320 or 320.3 to 320.4	3	B1 for each
11(a)(i)	275	1	
11(a)(ii)	2.5 oe	2	M1 for $275 \div 110$

Question	Answer	Marks	Partial Marks
11(b)	09 00 oe	3	B2 for 1 h 42 mins or 102 mins soi or M1 for $170 \div 100$ oe If 0 scored, SC1 for correct conversion of <i>their</i> decimal time into hours and mins
11(c)	24.6 or 24.63...	3	M2 for $\frac{215}{12.5} \times 1.432$ or M1 for $\frac{215}{12.5}$ or 215×1.432 or $\frac{1.432}{12.5}$ soi
11(d)(i)	$\frac{325}{90+x} - \frac{110}{30+2x} = \frac{3}{2}$ oe	M2	or M1 for $\frac{325}{90+x}$ or $\frac{110}{30+2x}$
	$650(30+2x) - 220(90+x)$ $= 3(90+x)(30+2x)$ oe	M1	Dependent on first equation containing the three terms. Correctly eliminating fractions
	Correct completion to $x^2 - 75x + 1400$ with no errors or omissions	A2	B1 for $2700 + 180x + 30x + 2x^2$ soi
11(d)(ii)	125 and 130	3	B2 for one or for 35 and 40 or B1 for 35 or 40 or M1 for $\frac{-(-75) \pm \sqrt{(-75)^2 - (4)(1)(1400)}}{2 \times 1}$ or sketch of parabola with two positive zeros or $(x - 35)(x - 40)$