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MARK SCHEME

Maximum Mark: 120

Published

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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.

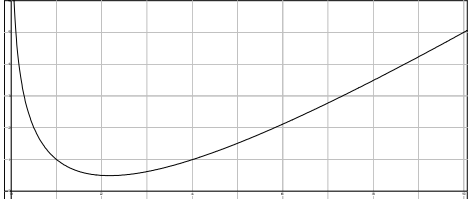
When a part of a question has two or more ‘method’ steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation ‘**dep**’ is used to indicate that a particular M or B mark is dependent on an earlier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

Abbreviations

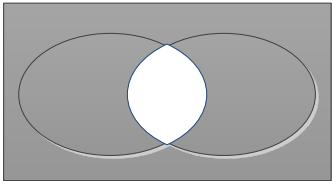
awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfww	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Part Marks
1(a)	Image at (0, 5), (3, 5), (3, 3)	2	SC1 for translation $\begin{pmatrix} -2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 7 \end{pmatrix}$
1(b)(i)	Image at (2, 2), (5, 2), (5, 4)	1	
1(b)(ii)	Image at (−4, −2), (−7, −2), (−7, −4)	1	
1(b)(iii)	Rotation 180 [centre] (−1, 0)	3	B1 for each
1(c)	Stretch [factor]2 x-axis oe invariant	3	B1 for each
2(a)(i)	44	2	M1 for [angle BAC or DEC =] $180 - 2 \times 68$, soi by angle $CDE = 44$ or M1 for angle $BAC = \text{their angle } CDE$
2(a)(ii)	isosceles	1	
2(b)	162	3	M2 for $180 - \frac{360}{20}$ or $\frac{180 \times (20 - 2)}{20}$ or M1 for $\frac{360}{20}$ or $180 \times (20 - 2)$
2(c)(i)	Angle sum of triangle oe	1	
2(c)(ii)(a)	similar	1	
2(c)(ii)(b)	5.4	2	M1 for $\frac{5}{3} = \frac{9}{QR}$ oe
3(a)(i)	6.5	1	
3(a)(ii)	4.5	1	
3(a)(iii)	3	1	
3(b)(i)	Positive	1	
3(b)(ii)	13	1	
3(b)(iii)	15.5	1	
3(b)(iv)	$7.32t - 55.3$	2	(7.322 to 7.323) $t - (55.25 \dots)$ B1 for $7.32t + k$ or $kt - 55.3$ or SC1 for $7.3t - 55$
3(b)(v)	Correct line (positive gradient and not below the x-axis)	2	B1 for positive gradient

Question	Answer	Marks	Part Marks
4(a)(i)	5 : 4	2	B1 for any other correct ratio
4(a)(ii)	41.68	2	M1 for $0.16 \times 260.5[0]$ oe
4(a)(iii)	12.5[0]	3	M2 for $11.25 \div 0.9$ oe or M1 for recognising 11.25 as 90%
4(a)(iv)	300 nfw	3	M2 for $\frac{200 \times 2 \times 25}{100} + 200$ oe or M1 for $\frac{200 \times 2 \times 25}{100}$ oe (implied by 100 nfw)
4(a)(v)	311.72	3	M2 for 190×1.02^{25} oe or M1 for 190×1.02^n oe where $n > 1$
4(b)	17	3	B2 for 16.5 or 16.52 to 16.53 or M2 for $\frac{\log\left(\frac{300}{120}\right)}{\log 1.057}$ or appropriate sketch or $120 \times 1.057^n = 300$ and at least 2 trials which reach from 250 to 350 or M1 for $120 \times 1.057^n [= 300]$
5(a)	804 or 804.2 to 804.4	3	M1 for $\frac{1}{3}\pi \times 8^2 \times 16$ M1 for $\frac{4}{3}\pi \times 4^3$
5(b)	450 or 449.5 to 449.6...	3	M2 for $\pi \times 8 \times \sqrt{8^2 + 16^2}$ or M1 for $\sqrt{8^2 + 16^2}$ or $\pi \times 8 \times \text{their } l$

Question	Answer	Marks	Part Marks
5(c)	8.94 or 8.944...	4	<p>P is point of contact between slant edge and circle. B2 for $PV = 8$ nfw or M1 for $\frac{8}{4} = \frac{16}{PV}$ oe M1 for $OV^2 = 4^2 + PV^2$</p> <p>OR</p> <p>B2 for $l = \sqrt{320}$ oe or M1 for $l^2 = 8^2 + 16^2$ M1 for $\frac{8}{4} = \frac{l}{OV}$ soi</p> <p>OR</p> <p>x is semi-vertical angle of cone M1 for $\tan x = \frac{8}{16}$ oe M2 for $\frac{4}{\sin x}$ or M1 for $\frac{4}{OV} = \sin x$</p>
6(a)	Correct sketch 	2	B1 for correct shape
6(b)	(2.17, 0.488) or (2.171..., 0.4877...)	2	B1 for each
6(c)	$0.488 \leq f(x) \leq 1.51$ or $0.4877... \leq f(x) \leq 1.505...$	2	FT <i>their</i> 0.488 B1 for $0.488 \leq f(x)$ oe or $f(x) \leq 1.51$ oe
6(d)	0.502 or 0.5015... 5.83 or 5.827...	2	B1 for each
6(e)	$0.502 < x < 5.83$ or $0.5015... < x < 5.827...$	1	FT <i>their</i> (d)
6(f)(i)	15.[0] or 15.00... 25.[0] or 25.00... 35.[0] or 35.00...	1	
6(f)(ii)	[an] asymptote oe	1	

Question	Answer	Marks	Part Marks
7(a)	9.77 or 9.766...	3	M2 for $\frac{8}{\cos 35}$ oe or M1 for $\cos 35 = \frac{8}{AB}$ oe
7(b)	60.6 or 60.61...	3	M2 for $\frac{6^2 + 9^2 - 8^2}{2 \times 6 \times 9}$ or M1 for $8^2 = 6^2 + 9^2 - 2 \times 6 \times 9 \cos C$
8(a)	10	1	
8(b)	4	2	M1 for $[h(1) =] \frac{1}{2}$ or for $[gh(x) =] 3 + 2\left(\frac{1}{x+1}\right)$
8(c)	$5x^2 + 12x + 11$	3	M1 for $(3 + 2x)^2 + 1 + x^2 + 1$ B1 for $9 + 6x + 6x + 4x^2$ or better for $(3 + 2x)^2$
8(d)	$\frac{1}{x} - 1$ or $\frac{1-x}{x}$ oe final answer	3	M1 correct first step M1 correct second step
8(e)(i)	-1	2	M1 for $3 + 2x = 1$
8(e)(ii)	5	1	
9(a)	15, 7, 12 correctly placed	2	B1 for two correctly placed or M1 for $41 - (40 - 6)$ seen oe or correct equation
9(b)(i)	7	1	FT <i>their</i> Venn diagram
9(b)(ii)	28	1	FT <i>their</i> Venn diagram
9(c)	15	1	FT <i>their</i> Venn diagram
9(d)	$\frac{462}{1560}$ oe	2	M1 for $\frac{22}{40} \times \frac{21}{39}$
9(e)(i)	$\frac{7}{19}$	1	FT <i>their</i> Venn diagram
9(e)(ii)	$\frac{168}{342}$ oe	3	M2 for $\frac{\text{their } 7}{19} \times \frac{\text{their } 12}{18} + \frac{\text{their } 12}{19} \times \frac{\text{their } 7}{18}$ oe or M1 for one of these products
9(f)	8	3	M2 for $\frac{\text{their } 7 + n}{40 + n} = \frac{5}{16}$ oe or M1 for at least two trials

Question	Answer	Marks	Part Marks
9(g)		1	
10(a)(i)	3.0875	2	M1 for 2.75, 3.125, 3.5 soi
10(a)(ii)	Correct histogram	3	B1 correct widths B1 for two correct heights
10(b)(i)	$\frac{200}{x} - \frac{200}{x+10} = \frac{20}{60}$ oe	B2	B1 for $\frac{200}{x}$ or $\frac{200}{x+10}$
	$60 \times 200(x+10) - 60 \times 200x = 20x(x+10)$ oe	M1	i.e. correctly clearing fractions or all over common denominator
	$x^2 + 10x - 6000 = 0$	A1	completion with at least one interim line and without any errors or omissions
10(b)(ii)	2 h 45 min	4	B2 for 72.6 or 72.62... or M1 for correct use of formula or correct sketch M1 for $200 \div \text{their positive } x$, implied by 2.75.....
11(a)(i)	$-a + b$ oe	1	
11(a)(ii)	$-\frac{1}{4}a + \frac{1}{4}b$ oe	1	FT <i>their</i> (i)
11(a)(iii)	$\frac{3}{4}a + \frac{1}{4}b$ oe	2	B1 for correct unsimplified answer or a correct route
11(b)	(6.5, 1.5)	3	FT <i>their</i> (a)(iii) B2 for $\begin{pmatrix} 6.5 \\ 1.5 \end{pmatrix}$ or M1 for $\frac{3}{4} \times \begin{pmatrix} 8 \\ 0 \end{pmatrix} + \frac{1}{4} \times \begin{pmatrix} 2 \\ 6 \end{pmatrix}$ OR B2 for (5, 3) at M or $[\overrightarrow{OM} =] \begin{pmatrix} 5 \\ 3 \end{pmatrix}$ or B1 for $(k, 3)$ or $(5, k)$ at M or $[\overrightarrow{OM} =] \begin{pmatrix} k \\ 3 \end{pmatrix}$ or $\begin{pmatrix} 5 \\ k \end{pmatrix}$