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Paper 4 (Extended)

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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.

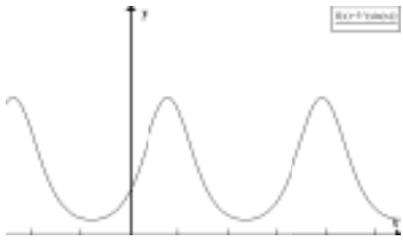
When a part of a question has two or more ‘method’ steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation ‘**dep**’ is used to indicate that a particular M or B mark is dependent on an earlier 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	Partial Marks
1(a)	1598 final answer	3	M2 for $(23\,970 \times 0.8) \div 12$ oe or M1 for $23\,970 \times 0.2$ or better or for $23\,970 \div 12$
1(b)(i)	23 500 nfw	3	M2 for $23\,970 \div 1.02$ oe or M1 for $23\,970 = 102\%$
1(b)(ii)	2024 nfw	3	M2 for $\frac{\log\left(\frac{30\,000}{23\,970}\right)}{\log 1.03}$ oe soi by 7.59...or sketch leading to 7.59 or 2 trials, one giving 7 and one giving 8 or M1 for $23\,970 \times \left(1 + \frac{3}{100}\right)^n$ [= 30 000] oe seen or reasonable sketch or 3 trials of $23\,970 \times 1.03^n$ or 1 trial giving 8.
2(a)(i)	Reflection, $y = x$	1	
2(a)(ii)	Enlargement [with centre] (2, 1) [scale factor] $\frac{1}{4}$ oe	2	B1 for each
2(a)(iii)	Translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$	2	B1 for each
2(b)(i)	Correct triangle (0, 0), (0, 2), (-2, 3)	2	SC1 for rotation 90° clockwise about (0, 0) or rotation 90° anti-clockwise about different centre
2(b)(ii)	Correct triangle (0, 0), (4, 0), (6, 2)	2	SC1 for stretch with s.f. = 2, x -axis invariant or stretch with y -axis invariant with different scale factor.
3(a)	6 points correct	3	B2 for 4 or 5 correct or B1 for 2 or 3 correct
3(b)	Positive	1	
3(c)(i)	$y = 0.787x + 0.356$ final answer	2	0.7874 to 0.7875, 0.3555 to 0.3556 B1 for one correct or for $y = 0.79x + 0.36$ final answer
3(c)(ii)	5.4[0]	1	FT from <i>their</i> (c)(i)

Question	Answer	Marks	Partial Marks
4(a)(i)	$\begin{pmatrix} -1.5 \\ 1 \end{pmatrix}$ oe	1	
4(a)(ii)	$\begin{pmatrix} 10 \\ -1 \end{pmatrix}$	2	B1 for each
4(a)(iii)	$\sqrt{13}$ final answer	2	M1 for $(-3)^2 + 2^2$ oe soi by 3.61 or 3.605 to 3.606 $\sqrt{13}$ in working implies M1
4(b)	Correct <i>B</i> clearly indicated	2	B1 for vector $\begin{pmatrix} 1 \\ 5 \end{pmatrix}$ drawn not from <i>A</i> or $\begin{pmatrix} 1 \\ 5 \end{pmatrix}$ seen or correctly following through, from <i>A</i> , their incorrect vector seen. or either $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ or $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$ correctly drawn only if one starts from <i>A</i> .
5(a)	2500	2	M1 for $119050 \div 47.62$
5(b)(i)	[0]6 10 or 6 10 am oe	2	B1 for [0]0 25 or [0]3 40 or 28 h 130 min oe seen
5(b)(ii)	722 or 721.7 ...	3	M1 for $4150 \div$ <i>their</i> 5h 45 min B1 for 5.75 oe
5(b)(iii)	5 h 32 (or 31.8 to 32[.0]) min	3	M1 for $4150 \div 750$ soi by 5.53 or 5.53 ... B1FT for correct conversion to hours and minutes
6(a)(i)	$[x =] cv$ oe	1	
6(a)(ii)	$[y =] kv^2$ oe	1	
6(a)(iii)	$[d =] cv + kv^2$ or $v(c + kv)$ oe	1	FT
6(b)(i)	$750 = 12c + 12^2 k$ oe	M1	isw any cancelling
6(b)(ii)	$2050 = 20c + 20^2 k$ oe	1	isw any cancelling
6(c)	$[c =] 2.5$ oe cao $[k =] 5$ cao	3	M1 for correctly eliminating one variable from <i>their</i> equations in this part. or sketches of lines A1 for either solution If zero scored SC1 for <i>their</i> values satisfying one equation.
6(d)	8100	2	M1 for correct substitution of 40 into <i>their</i> (a)(iii) containing <i>their</i> values of <i>c</i> and <i>k</i> .

Question	Answer	Marks	Partial Marks
7(a)	Correct sketch showing bearings and distances	3	B1 for 310° bearing approx correct (270 to 360) and marked B1 for 250° bearing approx correct (180 to 270) and marked B1 for distances correctly marked
7(b)	120	1	
7(c)	$40^2 + 65^2 - 2 \times 40 \times 65 \times \cos \textit{their} 120$	M1	<i>their</i> 120 must be between 0 and 180 Allow $\cos 120 = \frac{40^2 + 65^2 - []^2}{2 \times 40 \times 65}$
	91.78 to 91.79	A2	A1 for 8425 or $5\sqrt{337}$
7(d)	288 or 287.8...	4	M2 for $\frac{40 \sin(\textit{their} 120)}{91.8}$ oe or M1 for $\frac{\sin \theta}{40} = \frac{\sin(\textit{their} 120)}{91.8}$ oe If cosine rule used, M2 for explicit expression or M1 for implicit. A1 for 22.2 or 22.16 to 22.17... If 0 scored SC2 for answer 108 or 107.8...
8(a)	 Correct sketch	3	With correct shape with two max on right of y-axis and one on left, all above x-axis and reasonable quality or B2 for correct shape and all above x-axis or B1 for correct shape
8(b)	-270, 90, 450	3	B1 for each SC2 for all correct but with y co-ords or SC1 for two correct with y co-ords
8(c)	750, 870	2	B1 for each
8(d)	$x < 54.7$	1	54.74 to 54.75
	$164 < x < 267$	2	163.5 to 163.6, 266.6... B1 for one inequality or B1 for both values seen If 0 scored, B1 for straight line with negative gradient crossing curve three times between $x = 0$ and $x = 400$. May be freehand.

Question	Answer	Marks	Partial Marks
9(a)(i)	$\frac{1}{2} \times x \times (x+2) \times \frac{\sqrt{3}}{2}$ oe or better final answer	2	M1 for $\frac{1}{2} \times x \times (x+2) \times \sin 60$
9(a)(ii)	equating to $18\sqrt{3}$ and correct elimination of $\sqrt{3}$	M1	Dependent on correct answer used from (a)(i) or answer to (a)(i) contains sin60 but is otherwise correct.
	Completion with at least one step	A1	No errors or omissions
9(b)(i)	7.54 or 7.544... , -9.54 or -9.544...	2	B1 for each If 0 scored, M1 for substitution in formula or sketch or $(x+1)^2 - 73$ or better
9(b)(ii)	6.53 or 6.54 or 6.529 to 6.536...	2	M1 for $\sin 60 = \frac{[]}{\text{their } 7.54}$ oe
10(a)(i)	$[y =] \frac{1}{2}x + 1$	3	M1 for gradient = $\frac{8-2}{14-2}$ oe M1 for correct substitution of (2, 2) or (14, 8) into $y = (\text{their } m)x + c$ oe soi
10(a)(ii)	$[y =] -2x + 26$	3	M1 for gradient = $\frac{-1}{\text{their } \frac{1}{2}}$ M1 for substituting (11, 4) into $y = (\text{their } -2)x + c$ oe soi
10(b)	Correct substitution and completion of (10, 6) for both lines oe	2	B1 for either OR M1 for correct elimination of x or y from equations A1 for completion to solution (10, 6)
10(c)	(9, 8)	1	
10(d)	30 cao	4	M3 for $\left[\frac{1}{2}\right] \times \sqrt{12^2 + 6^2} \times \sqrt{2^2 + 4^2}$ oe or B2 for two of $\sqrt{12^2 + 6^2}$ oe (AC), $\sqrt{2^2 + 4^2}$ oe (BD or MC), $\sqrt{8^2 + 4^2}$ oe (AM), $\sqrt{2^2 + 1^2}$ oe (MD or MB) or B1 for one of these. (M is the intersection of AC and BD) OR M3 for full area e.g. $[0.5 \times 12 \times 6 - 0.5 \times 6 \times 7] \times 2$ or B2 for 2 correct areas evaluated or B1 for 1 correct area evaluated

Question	Answer	Marks	Partial Marks
11(a)	12.9 or 12.86 to 12.87	2	M1 for evidence of at least three mid-interval values 9.5, 11, 13, 15.5 soi by 95, 550, 845, 697.5 or 2187.5
11(b)	Correct Histogram	4	B1 for correct bar widths no gaps B3 for 4 correct heights and corresponding scale from 0 or B2 for 3 correct heights and corresponding scale from 0 or B1 for 2 correct heights and corresponding scale from 0 or B1 for 3 correct frequency densities soi
11(c)(i)	$\frac{198}{2873}$ oe	2	M1 for $\frac{45}{170} \times \frac{44}{169}$
11(c)(ii)	$\frac{100}{2873}$ oe	3	M2 for $\frac{10}{170} \times \frac{50}{169} + \frac{50}{170} \times \frac{10}{169}$ oe or M1 for $\frac{10}{170} \times \frac{50}{169}$
12(a)	11	1	
12(b)	6	2	B1 for $h(2) = 1$ soi or $4(x^2 - 3) + 2$ or better
12(c)	-3	2	M1 for $4x = -10 - 2$
12(d)	$h(x) \geq -3$	1	Allow $y \geq -3$
12(e)	$\frac{x-2}{4}$ oe final answer	2	M1 for $y - 2 = 4x$ or $x = 4y + 2$ or $\frac{y}{4} = x + \frac{2}{4}$
12(f)	Stretch x -axis invariant [Scale factor] 2 OR Reflection $y = -2.70 + 6.75$ OR Rotation (2.5, 0) 167 (167.47) or 12.5 (12.53) clockwise	3 M1 A2 M1 A1 A1	B1 for each
12(g)	$[y =] x^2 - 4x + 1$	3	M2 for $y = (x - 2)^2 - 3$ or M1 for $x - 2$ seen in a quadratic If 0 scored, SC1 for $y = x^2 + 4x + 1$