International GCSE in Mathematics A - Paper 4H mark scheme

Question	Working	Answer	Mark	AO	Notes	
1	$2 \times 2 \times 5$ or $2 \times 3 \times 5$ or $3 \times 3 \times 5$ or two of 20, 40, 60 … 30, 60, 90 … 45, 90, 105 $2 \times 2 \times 5$ and $2 \times 3 \times 5$ and $3 \times 3 \times 5$ or all of 20, 40, 60 , 80 … 180 30, 60, 90 … 180 45, 90, 105 … 180	180	3	AO1	M1 M1 A1	for one of 20, 30, 45 written as product of prime factors or list of at least 3 multiples of any two of 20, 30, 45 for 180 or $2 \times 2 \times 3 \times 3 \times 5$ oe
2		$7n - 5$ oe	2	AO1	M1 A1	for $7n + k$ (k may be zero)
3	$\frac{1}{2} \times (10 + 14) \times 9$ oe (= 108) '108' × 6 (=648) '648' × 0.7	453.6	4	AO2	M1 M1 M1 A1	for area of cross section (dep on previous M1) for volume of prism (independent) accept 454

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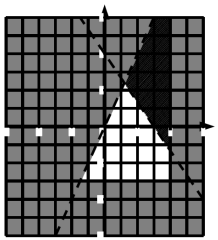
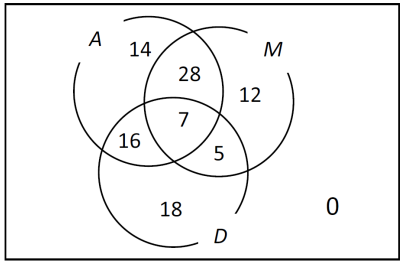
4 a		p^9	1	AO1	B1
b		m^{-12}	1	AO1	B1
c		1	1	AO1	B1
d		$2^{\frac{1}{3}}$	1	AO1	B1
e	$5x + 35 = 2x - 10$ or $x + 7 = \frac{2x}{5} - \frac{10}{5}$			AO1	M1 for removing bracket or dividing all terms by 5
	e.g. $5x - 2x = -10 - 35$ **or** $7 + \frac{10}{5} = \frac{2x}{5} + x$				M1 for isolating x terms in a correct equation
		-15	3		A1 dep on M1
5	14000 × 4 (=56000)			AO1	M1 NB. multiplication by 4 may occur before or after percentage decrease
	0.075 × '56000' (=4200) **or** 0.075 × 14000 (=1050)				M1
	'56000' – '42000' **or** 14000 – '1050'				M1 (dep)
		51 800	4		A1

Question	Working	Answer	Mark	AO	Notes
6 **a**		triangle with vertices (3, −1) (3, −4) (5, −4)	1	AO2	B1
b		Rotation		AO2	B1
		centre (−3, 0)			B1
		90° anticlockwise	3		B1 accept +90°, 270° clockwise, −270° NB. If more than one transformation then no marks can be awarded
7 **a**	4 × 15 (=60) **or** $\frac{a+b+c+d}{4}=15$ **or** 4 × 15 − 39	21	2	AO3	M1 A1
b	$d - a = 10$ **or** $a = 11$ **or** a = "21" – 10 **or** $b + c = 39 - 11 = 28$	14	2	AO3	M1 ft from (a) (can be implied by 11, b, c, 21 **OR** a, b, c, d with $b + c = 28$) A1 cao
8	0.02 × 40 000 (=800) **or** 1.02 × 40 000 (=40 800) **or** 2400 "40 800" × 0.02(=816) **and** "41 616" × 0.02(=832.32) **OR** 2448.32	42 448.32	3	AO1	M1 M1 (dep) method to find interest for year 2 **and** year 3 A1

Question	Working	Answer	Mark	AO	Notes	
9	$3x + y = 13$ **or** $6x + 2y = 26$ $-\ 3x - 6y = 27$ $+\ x - 2y = 9$			AO1	M1	multiplication of one equation with correct operation selected **or** rearrangement of one equation with substitution into second
	eg. $3x - 2 = 13$ **or** $15 + y = 13$				M1	(dep) correct method to find second variable
		5, −2	3		A1	for both solutions dependent on correct working
10	$\frac{14}{3} \div \frac{32}{9}$			AO1	M1	
	$\frac{14}{3} \times \frac{9}{32}$ **or** $\frac{126}{27} \div \frac{96}{27}$ **or** $\frac{42}{9} \div \frac{32}{9}$				M1	
		answer given	3		A1	correct answer from correct working
11	$(6 - 2) \times 180$ (=720)			AO2	M1	complete method to find sum of interior angles
	'720' – (86 + 123 + 140 + 105) (=266) **or** '720' – 454 (=266)				M1	dep on 1st method mark
	'266' ÷ 2				M1	dep on 1st method mark
		133	4		A1	

Question		Working	Answer	Mark	AO	Notes	
12	**a**		8, 25, 50, 90, 112, 120	1	AO3	B1	cao
	b	Plotting points from table at ends of interval			AO3	M1	± ½ sq ft from sensible table ie clear attempt to add frequencies
		Points joined with curve or line segments		2		A1	ft from points if 4 or 5 correct or if all points are plotted consistently within each interval at the correct heights Accept cf graph which is not joined to the origin **NB** A bar chart, unless it has a curve going consistently through a point in each bar, scores no points.
	c	60 (or 60.5) indicated on cf graph or stated			AO3	M1	for 60 (or 60.5) indicated on cf axis or stated
			approx 33	2		A1	If M1 scored, ft from cf graph If no indication of method, ft only from correct curve & if answer is correct (± ½ sq tolerance) award M1 A1
13		$P-c=\frac{1}{2}ab^2$			AO1	M1	Isolate term in b
		$\frac{2(P-c)}{a}=b^2$				M1	Isolate b^2
			$b=\sqrt{\frac{2(P-c)}{a}}$	3		A1	oe with b as the subject

Question	Working	Answer	Mark	AO	Notes
14 a	2 correct points plotted eg (0, 4) and (3, 0) $4x + 3y = 12$ drawn		2	AO1	M1 A1
b	correct region 		3	AO1	B3 Correct region B2 for $x = 4$ and $y = -3$ drawn **and** consistent shading correct for at least two inequalities B1 for $x = 4$ and $y = -3$ drawn
15 a			3	AO1	B3 Correct diagram B2 for 3 over-lapping circles with 7 in intersection **and** at least 2 other correct numbers B1 for 3 over-lapping circles with 7 in intersection
b		$\frac{34}{100}$ oe	1	AO3	B1 ft from diagram
c		$\frac{23}{46}$ oe	1	AO3	B1 ft from diagram

Question	Working	Answer	Mark	AO	Notes
16 a	$M = \frac{k}{g^3}$ or $M \propto \frac{k}{g^3}$			AO1	M1
	$24 = \frac{k}{2.5^3}$ oe or $(k = 375)$				M1 implies first M1
		$M = \frac{375}{g^3}$	3		A1 accept $M = \frac{k}{g^3}$ with $k = 375$ stated elsewhere in question
b	$(g =)\sqrt[3]{375 \div \left(\frac{1}{9}\right)}$ oe or $\sqrt[3]{3375}$			AO1	M1
		15	2		A1
17 a		−3	1	AO1	B1
b		2	1	AO1	B1
c	g(2) = 6			AO1	M1
		0.75 oe	2		A1
18	correct length scale factor			AO2	M1
	eg. $\sqrt{\frac{384}{864}}$ or $\frac{2}{3}$ or $\frac{3}{2}$				
	$\left(\frac{2}{3}\right)^3 \times 2457$				M1 for complete method
		728	3		A1

Question	Working	Answer	Mark	AO	Notes
19		E, B, D, A	3	AO1	B3 All correct B2 for 3 correct B1 for 2 correct
20 a	$\frac{4}{9}\times\frac{3}{8}$			AO3	M1
		$\frac{1}{6}$	2		A1 oe, eg $\frac{12}{72}$ Allow 0.16(666...) rounded or truncated to at least 2dp
b	$\frac{5}{9}\times\frac{4}{8}+\frac{4}{9}\times\frac{5}{8}$ or $\frac{20}{72}+\frac{20}{72}$ oe or $1-\frac{4}{9}\times\frac{3}{8}-\frac{5}{9}\times\frac{4}{8}$ or $1-\frac{'1'}{6}-\frac{5}{9}\times\frac{4}{8}$ oe	$\frac{5}{9}$		AO3	M2 M1 for $\frac{4}{9}\times\frac{5}{8}$ or $\frac{5}{9}\times\frac{4}{8}$ or $\frac{20}{72}$ oe Accept fractions evaluated $\frac{20}{72}=0.27\dot{7}$, $\frac{12}{72}=0.16\dot{6}$ rounded or truncated to at least 2dp
			3		A1 oe, eg. $\frac{40}{72}$ or $\frac{20}{36}$

Question	Working	Answer	Mark	AO	Notes
21	$\frac{\sin 47}{13.8} = \frac{\sin MLN}{8.5}$			AO2	M1 Or method using a right angled triangle to find length MX (MX is perpendicular to LN) $\sin 47 = \frac{MX}{8.5}$
	$MLN = \sin^{-1}\left(\frac{\sin 47 \times 8.5}{13.8}\right)$				M1 or $\cos^{-1} = \frac{8.5 \sin 47}{13.8}$
	$MLN = 26.7(73...)$				A1 $LMX = 63.232$
	$LMN = 180 - 47 -$ '26.7...' or 106(.2260622…)				M1 $LMN = 63.232 + (180 - (90+47))\ldots$ or 106(.2260622…)
	$\frac{1}{2} \times 8.5 \times 13.8 \times \sin("106")$				M1
		56.3	6		A1 Accept an answer that rounds to 56.3 or 56.4 unless clearly obtained from incorrect working.
22 a	$2(x^2 - 4x) + 9$ **or** $2(x^2 - 4x + \frac{9}{2})$			AO1	M1
	$2((x-2)^2 - 2^2) + 9$ **or** $2((x-2)^2 - 2^2 + \frac{9}{2})$				M1
		$2(x-2)^2 + 1$	3		A1
b		explanation	1	AO1	B1 eg. Because minimum is at (2, 1)

Question	Working	Answer	Mark	AO	Notes	
23	$\overrightarrow{BC} = \overrightarrow{BA} + \overrightarrow{AC}$ or $\begin{pmatrix}-2\\-3\end{pmatrix}+\begin{pmatrix}9\\4\end{pmatrix}$ or $\begin{pmatrix}7\\1\end{pmatrix}$			AO2	M1	
	$\sqrt{'7'^2+'1'^2}$				M1	dep
		$\sqrt{50}$ oe	3		A1	accept 7.07(06…)
24	$\dfrac{\left(\sqrt{12}-1\right)\left(2+\sqrt{3}\right)}{\left(2-\sqrt{3}\right)\left(2+\sqrt{3}\right)}$			AO1	M1	method to rationalise
	$\dfrac{2\sqrt{12}-2+\sqrt{12}\sqrt{3}-\sqrt{3}}{4-3}$				M1	correct expansion of brackets
	$\sqrt{12}=2\sqrt{3}$				B1	may be seen before expansion
		shown	4		A1	answer from fully correct working with all steps seen
25	$(v=)\ 3t^2-5\times 2t-8$			AO1	M1	for 2 out of 3 terms differentiated correctly
	$3t^2-10t-8=0$				A1	correct equation
	$(3t+2)(t-4)=0$				M1	for method to solve quadratic
		4	4		A1	$t = 4$ only