GCSE (9-1)

Paper 2H (Calculator)

Practice set A

CM GCSE Practice Papers / Set A / Paper 2H (V1 FINAL)					
Question		**Working**	**Answer**	**Mark**	**Notes**
1	(a)		(1, 0)	1	B1 : cao
	(b)		rotation	3	B1 : correct orientation of the shape
					B2 : all the vertices of the shape correct at (0, –2), (0, –6) and (–3, –2). (B1 for one vertex wrong **or** all vertices consistently shifted by ± 1 unit). NB: candidates do **not** need to label the coordinates of P'
2			$2(m+1)(m+3)$	2	B1 : factor of 2 extracted
					B1 : for the factors $(m + 3)(m + 1)$
					SC: correct factorisation without 2 extracted, i.e. $(m+1)(2m+6)$ or $(2m+2)(m+3)$ is B1 B0.
3		$\frac{22.50}{1.2}=18.75$ $18.75-14.65=4.10$	£4.10	3	P1 : attempts to find the subtotal. This may be seen through dividing 22.50 by 1.2 **or** the equation $x + 0.2x = 22.50$ **or** stating that 120% of subtotal = 22.50 followed by an attempt to work 100%
					A1 : subtotal either £18.75 or 1875p (condone omission of units)
					A1 : correct price of drinks

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4		$BC = 6\tan 52 = 7.679...$ $MC = \frac{1}{2}BC = 3.8398...$ $CD = \sqrt{5^2 - (3.839...)^2}$ $= 3.202...$	3.20 cm	4	P1 : attempting to find *BC* using tan ratio (6/tan(52) is P1) A1 : length of *BC* correctly evaluated P1 : for $CD = \sqrt{5^2 - \left(\text{their } \frac{BC}{2}\right)^2}$ A1ft : correct length of *CD* to 2 decimal places **and** with a suitable unit (ft their *BC*)
5		Total goals scored in 25 rounds =2.80 × 25 = 70 A mean of 3.00 in 26 rounds would require total number of goals to be =3 × 26=78 The team need to score 8 goals.	8	3	M1 : for an attempt to calculate the total number of goals scored by the team in 25 rounds M1 : for an attempt to calculate the total number of goals required by the team after 26 rounds to obtain a mean of 3 A1 : cao
6			construction	2	M1 : for one side of a triangle drawn with length 3 cm A1 : fully correct construction with clear construction lines

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7		If x is prob. of landing 1, $x+x+x+2x=1 \Rightarrow x=\frac{1}{5}$ so prob. of landing on 4 is $\frac{2}{5}$ Prob. of score being 8 = P(4 and 4) $=\frac{4}{25}$ In 100 rounds, expectation is $100\times\frac{4}{25}=16$	16	4	P1 : correct process to find probability the die lands on 4 A1 : correct probability of the die landing on 4 P1 : attempts to find probability of getting two 4s **and** multiplies this probability by 100 A1 : 16 cao
8	(a)		description	2	B1 : Comment on size e.g. same size / magnitude / length B1 : Comment on direction e.g. (point in) opposite direction(s) / anti-parallel
	(b)		$\begin{pmatrix}-6\\-13\end{pmatrix}$	2	M1 : correct expression for 3**b** A1 : correct answer oe

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9	(a/i)		interval	1	B1 : correct error interval: $2.05 \le x < 2.15$
	(a/ii)		interval	1	B1 : correct error interval: $4.67 \le y < 4.68$
	(a/iii)		interval	1	B1 : correct error interval: $2.52 < y - x < 2.63$
	(b)	Upper bound of S: $\frac{3(2.15)-2}{4.67} = 0.9528...$ Lower bound of S: $\frac{3(2.05)-2}{4.68} = 0.8867...$	UB = {awrt} 0.95 LB = {awrt} 0.89	4	M1 : use of $x = 2.15$ and $y = 4.67$ in a formula A1 : correct upper bound, awrt 0.95 M1 : use of $x = 2.05$ and $y = 4.68$ in a formula A1 : correct lower bound, awrt 0.89
10	(a)	Gradient of tangent at $t = 4$ is $\frac{6.125-0.625}{4.6-3.4} = 6.25$ m/s	6.25	4	P1 : considers tangent line at $t = 4$ (can be implied) and links its gradient to the velocity at $t = 4$ P1 : finds two points that lie on the tangent line dP1 : correct expression for gradient of tgt line ft their two points A1 : correct velocity at $t = 4$. Accept answers in $5.90 \le v \le 6.60$

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	(b)		Under-estimate	2	B1 : under-estimate C1 : reason, i.e. 'tangent line lies beneath the curve at $t = 4$', 'tangent line not as steep as curve $t = 4$', etc.
11		$0^3 + 2(0)^2 + 3(0) - 4 = -4$ $\{< 0\}$ $1^3 + 2(1)^2 + 3(1) - 4 = 2$ $\{> 0\}$ since there has been a change of sign {between (0,1) and the curve $y = x^3 + 2x^2 + 3x - 4$ is continuous on (0,1)}, the equation $x^3 + 2x^2 + 3x - 4 = 0$ has a solution in (0,1)	proof	3	M1 : substitutes 0 into $x^3 + 2x^2 + 3x - 4$ and evaluates expression M1 : substitutes 1 into $x^3 + 2x^2 + 3x - 4$ and evaluates expression A1 : fully correct workings and a conclusion that mentions that there is a solution because of a 'change of sign' – any other details in the conclusion are **not** required for the mark

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12		$a = 4$, $b = -5$, $c = -1$ $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(4)(-1)}}{2(4)}$ $x = \frac{5 \pm \sqrt{41}}{8}$, so x = 1.43 or –0.18	1.43, –0.18	3	M1 : substitutes correctly into the quadratic formula with $a = \pm 4$, $b = \pm 5$ and $c = \pm 1$ OR extracts factor of 4 and completes the square (need to see halving coefficient of x and subtraction of unwanted term) A1: sight of $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(4)(-1)}}{2(4)}$ or $\left(x - \frac{5}{8}\right)^2 - \left(\frac{5}{8}\right)^2 = \frac{1}{4}$ (or better) A1 : correct values of x to two decimal places
13		From A to B, Area scale factor = $\times 2$ Length scale factor = $\times\sqrt{2}$ So volume scale factor = $\times\left(\sqrt{2}\right)^3$ $\therefore$ volume of B = $1000 \times \left(\sqrt{2}\right)^3 = 2828.42...$	2800 (cm^3)	4	P1 : attempts to find length or volume scale factor A1 : correct volume scale factor dP1 : uses their volume scale factor correctly to find volume of B A1 : awrt 2800

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14			E A C B D	5	B5 : all 5 graphs correctly identified (B1 for each correct identification)

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15	(a)		diameter	1	B1 : correct term identified. Accept unambiguous identifications. Multiple ticks/circles score B0 unless their final response is made clear
	(b)	Area of entire circle is 25π cm^2	35	4	B1 : correct area of entire circle (25π) seen or implied. Condone omission of units
		Length of *AB* = 10 cos35 So area of *ABC* = $\frac{1}{2}(10)(10\cos 35)\sin 35 = 23.492...$ cm^2			P1 : method to work out area of *ABC* or *BCD*
					A1 : area of *ABC* or *BCD* correct
		Similarly area of *BCD* = 20.225… cm^2 So area of shaded region is $25\pi - 23.492... - 20.225... = 34.822...$			A1 : correct final area, awrt 35 (cm^2)

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Question		**Working**	**Answer**	**Mark**	**Notes**
16	(a)	$m\sqrt{1-\frac{v^2}{c^2}}=m_0$ $\sqrt{1-\frac{v^2}{c^2}}=\frac{m_0}{m}$ $1-\frac{v^2}{c^2}=\left(\frac{m_0}{m}\right)^2$ $\frac{v^2}{c^2}=1-\left(\frac{m_0}{m}\right)^2$ $c^2=\frac{v^2}{1-\left(\frac{m_0}{m}\right)^2}$ $c=\frac{v}{\sqrt{1-\left(\frac{m_0}{m}\right)^2}}$	$c=\frac{v}{\sqrt{1-\left(\frac{m_0}{m}\right)^2}}$	4	M1 : multiplies by $\sqrt{1-\frac{v^2}{c^2}}$ or divides by m_0 correctly A1 : obtains $1-\frac{v^2}{c^2}=\left(\frac{m_0}{m}\right)^2$ dM1 : attempts to make c^2 the subject A1 : correctly makes c the subject. Accept equivalent expressions, i.e. $c=\sqrt{\frac{v^2}{1-\left(\frac{m_0}{m}\right)^2}}$, $c=\frac{v}{\sqrt{\left(1-\frac{m_0}{m}\right)\left(1+\frac{m_0}{m}\right)}}$ etc.

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Question		Working	Answer	Mark	Notes
	(b)	Way 1: $c=\dfrac{2.85\times10^{8}}{\sqrt{1-\left(\dfrac{1.67}{5.35}\right)^{2}}}\approx3.00\times10^{8}$ $\therefore$ at 2.31×10^{8}, $m=\dfrac{1.67\times10^{-27}}{\sqrt{1-\left(\dfrac{2.31}{3}\right)^{2}}}=2.62\times10^{-27}$	{awrt} 2.6×10^{-27} (kg)	4	**Way 1 :** M1 : substitutes correct values into their formula for *c*
					A1 : correct value of *c* seen or implied
					dM1 : substitutes correct values into formula for *m* with their *c*
					A1 : awrt 2.6×10^{-27}
		Way 2: $\dfrac{2.85}{\sqrt{1-\left(\dfrac{1.67\times10^{-27}}{5.35}\right)^{2}}}=\dfrac{2.31}{\sqrt{1-\left(\dfrac{1.67}{m}\right)^{2}}}$ $\Rightarrow1-\left(\dfrac{1.67\times10^{-27}}{m}\right)^{2}=0.5929...$ $\Rightarrow m=\dfrac{1.67\times10^{-27}}{\sqrt{1-0.5929...}}=2.62\times10^{-27}$			**Way 2:** M1 : correct **expression** on LHS (no need to see RHS). Condone inclusion/omission of $\times10^{8}$ on numerator and $\times10^{-27}$ in denominator
					A1 : for $\dfrac{2.85}{\sqrt{1-\left(\dfrac{1.67\times10^{-27}}{5.35}\right)^{2}}}=\dfrac{2.31}{\sqrt{1-\left(\dfrac{1.67}{m}\right)^{2}}}$ oe
					dM1 : attempts to make *m* the subject
					A1 : awrt 2.6×10^{-27}

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17	(a)		25	1	B1 : cao
	(b)	*y* coordinate of *P* is 4 Gradient of *OP* is $\frac{4}{3}$ So gradient of tangent is $-\frac{3}{4}$	$-\frac{3}{4}$	4	M1 : substitutes 3 into $x^2 + y^2 = k$ with a numerical value for *k*
					A1 : *y* coordinate of *P* is 4
					dM1 : gradient of *OP* as ‘their 4’/3
					A1 : correct gradient of tangent line *l*
	(c)	Equation of tangent of the form $y = -\frac{3}{4}x + c$ Since tangent passes through *P*, $c = 4 + \frac{3}{4}(3) = \frac{25}{4}$ $\therefore$ equation of *l* is $y = -\frac{3}{4}x + \frac{25}{4}$	$y = -\frac{3}{4}x + \frac{25}{4}$	3	M1 : equation tangent of the form $y = '-\frac{3}{4}'x + c$ ft their –3/4
					M1 : substitutes coordinates of *P* in and attempts to find ‘*c*’
					A1 : correct equation of tangent line *l* oe

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Question		**Working**	**Answer**	**Mark**	**Notes**
18		$\sqrt{125} = \sqrt{25 \times 5} = \sqrt{25}\sqrt{5} = 5\sqrt{5}$ $\frac{5\left(1-\sqrt{5}\right)}{\sqrt{5}} = \sqrt{5}\left(1-\sqrt{5}\right) = \sqrt{5}-5$ $\sqrt{125} - 2\sqrt{5} + \frac{5\left(1-\sqrt{5}\right)}{\sqrt{5}} \equiv \ldots$ $\ldots \equiv 5\sqrt{5} - 2\sqrt{5} - 5 + \sqrt{5}$ $\equiv -5 + 4\sqrt{5}$ so $a = -5$, $b = 4$	$-5+4\sqrt{5}$	5	B1 : $\sqrt{125} = 5\sqrt{5}$ M1 : expands $5\left(1-\sqrt{5}\right)$ or multiplies top **and** bottom of $\frac{5}{\sqrt{5}}\left(1-\sqrt{5}\right)$ by $\sqrt{5}$ A1 : obtains $\frac{5\left(1-\sqrt{5}\right)}{\sqrt{5}} = \sqrt{5}-5$, may be implied dM1 : puts all simplified terms from original expression together and collects like terms A1 : cao. Accept $-5+4\sqrt{5}$ or values of *a* and *b* stated. A0 if candidates give final answer and values of *a* and *b* and they contradict