Questions taken from the WJEC SAMS Paper 1

Question Number	Solution	Mark	AO	Notes
1. (a)	$A(1, -3)$ A correct method for finding the radius, e.g., trying to rewrite the equation of the circle in the form $(x-a)^2 + (y-b)^2 = r^2$ Radius = 5	B1 M1 A1	AO1 AO1 AO1	
(b)	Gradient $AP = \dfrac{\text{increase in } y}{\text{increase in } x}$ Gradient $AP = \dfrac{(-7)-(-3)}{4-1} = -\dfrac{4}{3}$ Use of $m_{tan} \times m_{rad} = -1$ Equation of tangent is: $y-(-7) = \dfrac{3}{4}(x-4)$	M1 A1 M1 A1 **[7]**	AO1 AO1 AO1 AO1	(f.t. candidate's coordinates for *A*) (f.t. candidate's gradient for *AP*)
2.	$7\sin^2\theta + 1 = 3(1-\sin^2\theta) - \sin^2\theta$ An attempt to collect terms, form and solve a quadratic equation in $\sin\theta$, either by using the quadratic formula or by getting the expression into the form $(a\sin\theta + b)(c\sin\theta + d)$, with $a \times c$ = candidate's coefficient of $\sin^2\theta$ and $b \times d$ = candidate's constant $10\sin^2\theta + \sin\theta - 2 = 0$ $\Rightarrow (2\sin\theta + 1)(5\sin\theta - 2) = 0$ $\Rightarrow \sin\theta = -\dfrac{1}{2}, \sin\theta = \dfrac{2}{5}$ $\theta = 210°, 330°$ $\theta = 23{\cdot}57(8178\ldots)°, 156{\cdot}42(182\ldots)°$ Note: Subtract 1 mark for each additional root in range for each branch, ignore roots outside range. $\sin\theta$ = +, –, f.t. for 3 marks, $\sin\theta$ = –, –, f.t. for 2 marks $\sin\theta$ = +, +, f.t. for 1 mark	M1 m1 A1 B1 B1 B1 **[6]**	AO1 AO1 AO1 AO1 AO1 AO1	(correct use of $\cos^2\theta = 1 - \sin^2\theta$) (c.a.o.)

3.		$y + k = (x + h)^3$ $y + k = x^3 + 3x^2h + 3xh^2 + h^3$ Subtracting y from above to find k $k = 3x^2h + 3xh^2 + h^3$ Dividing by h and letting $h \to 0$ $\frac{dy}{dx} = \lim_{h \to 0} \frac{k}{h} = 3x^2$	M1 A1 M1 A1 M1 A1 **[6]**	AO2 AO2 AO2 AO2 AO2 AO2	(c.a.o.)
4.		Correct use of the Factor Theorem to find at least one factor of $f(x)$ At least two factors of $f(x)$ $f(x) = (x + 3)(x - 4)(2x - 5)$ Use of the fact that $f(x)$ intersects the y-axis when $x = 0$ $f(x)$ intersects the y-axis at (0, 60)	M1 A1 A1 M1 A1 **[5]**	AO3 AO3 AO3 AO3 AO3	(accept $(x - 2{\cdot}5)$ as a factor) (c.a.o.) (f.t. candidate's expression for $f(x)$)
5.	(a)	A correct method for finding the coordinates of the mid-point of AB D has coordinates $(-1, 5)$	M1 A1	AO1 AO1	
		Gradient of $AB = \frac{\text{increase in } y}{\text{increase in } x}$	M1	AO1	
		Gradient of $AB = -\frac{6}{2}$	A1	AO1	(or equivalent)
		Gradient of $CD = \frac{\text{increase in } y}{\text{increase in } x}$	(M1)	(AO1)	(to be awarded only if the previous M1 is not awarded)
		Gradient of $CD = \frac{7}{21}$	A1	AO1	(or equivalent)
		$-\frac{6}{2} \times \frac{7}{21} = -1 \Rightarrow$ AB is perpendicular to CD	B1	AO2	
	(b)	A correct method for finding the length of AD or CD $AD = \sqrt{10}$ $CD = \sqrt{490}$ $\tan C\hat{A}B = \frac{CD}{AD}$ $\tan C\hat{A}B = 7$	M1 A1 A1 M1 A1	AO1 AO1 AO1 AO1 AO1	
	(c)	Isosceles	B1 **[12]**	AO2	

13.	(a)	Choice of variable (x) for $AB \Rightarrow AC = x + 2$	B1	AO3	
		$(x+2)^2 = x^2 + 12^2 - 2 \times x \times 12 \times \frac{2}{3}$	M1	AO3	
		$x^2 + 4x + 4 = x^2 + 144 - 16x$ $20x = 140 \Rightarrow x = 7$	A1	AO3	
		$AB = 7$, $AC = 9$	A1	AO3	(Amend proof for candidates who choose $AC = x$)
	(b)	$\sin A\hat{B}C = \frac{\sqrt{5}}{3}$	B1	AO1	
		$\frac{\sin B\hat{A}C}{12} = \frac{\sin A\hat{B}C}{9}$	M1	AO1	f.t. candidate's derived values for AC and $\sin A\hat{B}C$)
		$\sin B\hat{A}C = \frac{4\sqrt{5}}{9}$	A1 **[7]**	AO1	(c.a.o.)
14.	(a)	Height of box $= \frac{9000}{2x^2}$	B1	AO3	(o.e.)
		$S = 2 \times (2x \times x + \frac{9000}{2x^2} \times x + \frac{9000}{2x^2} \times 2x$	M1	AO3	(f.t. candidate's derived expression for height of box in terms of x)
		$S = 4x^2 + \frac{27000}{x}$	A1	AO3	(convincing)
	(b)	$\frac{dS}{dx} = 8x - \frac{27000}{x^2}$	B1	AO1	
		Putting derived $\frac{dS}{dx} = 0$	M1	AO1	
		$x = 15$	A1	AO1	(f.t. candidate's $\frac{dS}{dx}$)
		Stationary value of S at $x = 15$ is 2700	A1	AO1	(c.a.o)
		A correct method for finding nature of the stationary point yielding a minimum value	B1 **[8]**	AO1	