Year 1 – Week 18 Exam Questions

Mark Scheme

From Paper 1

Q	Marking Instructions	AO	Marks	Typical Solution
5	Demonstrates a clear understanding that $\sin x = 0$ is a solution, and that this has not been properly taken into account.	AO2.3	R1	$\sin x = 0$ leads to a solution, but when she cancelled $\sin x$ she effectively assumed it was not equal to 0 and hence lost a number of solutions.
	Explains that cancelling $\sin x$ is not allowed if it is zero / only allowed if it is non-zero	AO2.4	E1	
	Total		**2**	

Q	Marking Instructions	AO	Marks	Typical Solution
6	Translates given information into an equation by using the formula for the area of triangle or parallelogram to form a correct equation	AO3.1a	M1	AB × AD × $\sin\alpha = 24$ hence $6 \times 4.5 \times \sin\alpha = 24$
	Rearranges 'their' equation to obtain a correct value of $\sin\alpha$	AO1.1b	A1F	$\sin\alpha = \frac{24}{27} = \frac{8}{9}$
	Uses 'their' $\sin\alpha$ value to identify an appropriate right-angled triangle **or** uses identities **and** deduces exact ratio of $\tan\alpha$ – positive or negative Condone only positive ratio seen	AO2.2a	M1	Sides of right angled triangle are 8, 9 and $\sqrt{17}$ Hence $\tan\alpha = \pm\frac{8}{\sqrt{17}}$
	Relates back to mathematical context of problem and hence chooses negative ratio – accept any equivalent exact form FT 'their' tan values for obtuse α	AO3.2a	A1F	α is one of the largest angles and must be obtuse hence tangent is negative $\tan\alpha = -\frac{8}{\sqrt{17}} = -\frac{8\sqrt{17}}{17}$
	Total		**4**	

Q	Marking Instructions	AO	Marks	Typical Solution
8(a)	Uses binomial theorem to expand bracket – correct unsimplified expression but condone sign error	AO1.1a	M1	$1+\binom{10}{1}(-2x)^1+\binom{10}{2}(-2x)^2$
	Obtains constant term and x term, both correct	AO1.1b	A1	$=1-20x+180x^2...$
	Obtains correct x^2 term	AO1.1b	A1	
(b)	Selects x = 0.001	AO3.1a	B1	Substituting $x = 0.001$
	Substitutes 'their' chosen value of x into 'their' expansion from part **(a)** to obtain a 5 decimal place value	AO1.1a	M1	1 – 0.020 + 0.000180 = 0.98018
	Gives a correct explanation to confirm that the value found from the calculator is 0.98018 to 5 decimal places which is the same as the value found by using the expansion	AO2.4	A1	0.998^{10} = 0.980179… = 0.98018 to 5 dp, which matches Carly's value.
	Total		**6**	

Q	Marking Instructions	AO	Marks	Typical Solution
12(a)	Rewrites given expression with a fractional power and negative power – at least one index form must be correct	AO1.1a	M1	$y = 6x^{\frac{3}{2}} + 32x^{-1}$
	Both terms correct	AO1.1b	A1	
	Differentiates 'their' rewritten expression – at least one term correct	AO1.1a	M1	$\frac{dy}{dx} = 6\times\frac{3}{2}\times x^{\frac{1}{2}} - 32x^{-2}$ $= 9\sqrt{x} - \frac{32}{x^2}$
	Both terms correct for 'their' expression	AO1.1b	A1F	
(b)	Finds the equation of the tangent, a clear attempt must be seen	AO3.1a	M1	When $x = 4$,
	Evaluates 'their' $\frac{dy}{dx}$ (from part **(a)**) correctly (when $x = 4$)	AO1.1b	A1F	$\frac{dy}{dx} = 9\times2 - \frac{32}{16} = 16$ and
	Obtains correct y value (when $x = 4$)	AO1.1b	A1	$y = 6\times4\times2 + \frac{32}{4} = 56$
	Obtains correct form of the equation of a straight line using 'their' values for y and $\frac{dy}{dx}$	AO1.1b	A1F	Tangent: $y - 56 = 16(x - 4)$
	Deduces value required at x-axis is when y equals 0 (follow through from 'their' equation) Both coordinates needed, any form	AO2.2a	A1F	When $y = 0$, $x = 4 - \frac{56}{16} = 0.5$ (0.5, 0)
	Total		**9**	

14	Applies Newton's 2nd Law to form a 3 term equation Award mark even if signs not correct	AO1.1a	M1	$F - 80 \times 10 = -80 \times 1.5$
	Obtains a correct 3 term equation.	AO1.1b	A1	$F - 800 = -120$
	Obtains correct reaction force. Must be given to 1 sf FT from incorrect 3 term equation provided M1 mark was awarded (condone omission of units)	AO1.1b	A1F	$F = 680 = 700$ (N) to 1 sf
	Total		**3**	

From Paper 2

Q	Marking Instructions	AO	Marks	Typical Solution
7	Divides or multiplies by $\cos\theta$	AO3.1a	M1	$\frac{\sin\theta\tan\theta}{\cos\theta} + 2\frac{\sin\theta}{\cos\theta} = 3$
	Obtains correct quadratic	AO1.1b	A1	$\tan^2\theta + 2\tan\theta - 3 = 0$
	Applies a correct method to solve 'their' quadratic PI	AO1.1a	M1	$(\tan\theta + 3)(\tan\theta - 1) = 0$ $\tan\theta = 1$ or -3
	Finds two correct values of tan θ from 'their' quadratic	AO1.1b	A1F	$\theta = 45^\circ$ or 108° **ALT** $\sin\theta\tan\theta\cos\theta + 2\sin\theta\cos\theta = 3\cos^2\theta$
	Obtains two correct answers CAO	AO1.1b	A1	$\sin^2\theta + 2\sin\theta\cos\theta - 3\cos^2\theta = 0$ $(\sin\theta + 3\cos\theta)(\sin\theta - \cos\theta) = 0$ $\tan\theta = 1$ or -3 $\theta = 45^\circ$ or 108°
	Total		**5**	

Q	Marking Instructions	AO	Marks	Typical Solution
11(a)(i)	States correct radius CAO	AO1.2	B1	Radius $=\sqrt{5}$
(a)(ii)	States correct centre CAO	AO1.2	B1	C is (7, –2)
(b)	Finds gradient of the line through the points *P* and 'their' *C* (as found in part **(a)**) Condone one sign error	AO3.1a	M1	Gradient $CP=\frac{-1-(-2)}{5-7}=-\frac{1}{2}$
	Correct tangent gradient obtained from 'their' *CP* gradient	AO3.1a	M1	So tangent gradient = 2
	Uses a correct form for the equation of a straight line with correct coordinates of *P* and 'their' tangent gradient	AO1.1a	M1	$y-(-1)=2(x-5)$
	States correct final answer in required form ($y=mx+c$) FT from 'their' *C* found in part **(a)**	AO1.1b	A1F	$y=2x-11$
(c)	Identifies *QTC* as a right-angled triangle PI	AO3.1a	M1	*QTC* is a right-angled triangle so we can use Pythagoras
	Finds *QC* or QC^2 FT 'their' *C* found in part **(a)**	AO1.1b	B1F	$QC^2=(7-3)^2+(-2-3)^2$
	Uses Pythagoras' theorem correctly for 'their' triangle	AO1.1a	M1	$4^2+5^2=(\sqrt{5})^2+QT^2$
	Correct evaluation of length of *QT* FT 'their' *QC* and 'their' radius found in part **(a)**	AO1.1b	A1F	$QT^2=36$ so $QT=6$
	Total		**10**	

Q	Marking Instructions	AO	Marks	Typical Solution
13	Circles correct answer	AO1.1b	B1	0.26
	Total		**1**	

15	Finds P(Drop and Beanstalk and Giant)	AO1.1a	M1	$\frac{80}{225} \times \frac{75}{224} \times \frac{70}{223}$
	Multiplies by 6 to obtain correct answer	AO1.1b	A1	$\frac{80}{225} \times \frac{75}{224} \times \frac{70}{223} \times 6 = 0.224$
	Total		**2**	