AQA Core 1 2016 Unofficial Mark scheme (Dan O'F.)

Disclaimer: The marks for each question are accurate but as to where they are allocated exactly is only an estimate based on the responses to previous papers. FT/ECF (Using a wrong answer from previous question part that will still allow you to earn method marks) has not been included as their use is difficult to gauge. Please bear in mind that FT/ECF could allow you to gain additional marks. A grade range estimate is shown below, based on previous years and the difficulty of the paper:

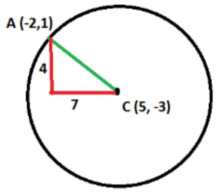
A: 60−64	D: 43−46
B: 55−58	E: 37−40
C: 50−52	

Q1	Question	Solution	Mark	Total
(a)	Find 'm' from $5x + 3y + 3 = 0$	$3y = -5x - 3$ $\therefore\ y = -\frac{5}{3}x - 1$	M1	
		$\therefore\ m = -\frac{5}{3}$	A1	2
(b)	AB & another line intersect at B, Find co-ordinates of B.	$5x + 3y + 3 = 0$ & other equation identified as simultaneous equation.	M1	
		$X = -3$ **Or** $y = 4$	A1	
		$B = (-3,4)$	A1	3
(C)	Co-ordinates involving K [e.g. (2k-3, k +4) or whatever it was]on the line, Find K.	When $x =$ (e.g.) $(2k-3)$, $y =$ (e.g.) $(k+4)$		
		$\Rightarrow 5(2k-3) + 3(k+4) + 3 = 0$	M1	
		$\Rightarrow K = -30$	A1	2
		Total		**7**

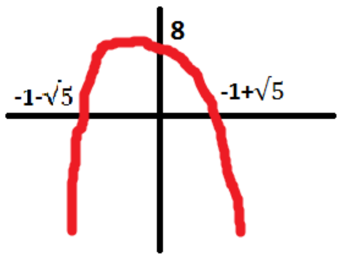
Q2	Question	Solution	Mark	Total	Comments
(a)	Simplify $(3\sqrt{5})^2$	$\therefore = (3\text{x}3) \text{ x } (\sqrt{5} \text{ x } \sqrt{5})$ $\therefore = 9 \text{ x } 5$ $\therefore = 45$	B1	1	
(b)	Simplify $\frac{(3\sqrt{5})\char94 2+\sqrt{5}}{7+3\sqrt{5}}$ with your answer in the form $m + n\sqrt{5}$	$\frac{(3\sqrt{5})\char94 2+\sqrt{5}}{7+3\sqrt{5}} \text{ x } \frac{7-3\sqrt{5}}{7-3\sqrt{5}}$	M1		45 correctly 'subbed in' from part a)
		Numerator $= 300 - 128\sqrt{5}$	M1		
		Denominator $= 4$	M1		
		$\therefore = 75 - 32\sqrt{5}$	A1	4	
		Total		**5**	

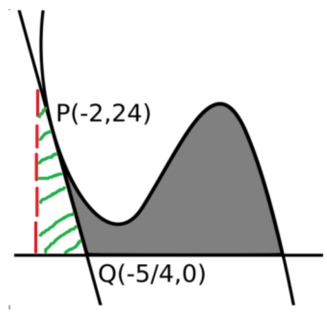
Q3	Question	Solution	Mark	Total	Comments
(a)(i)	Write $x^2 - 7x + 2$ in the form $(x-p)^2 + q$	$(x - \frac{7}{2})^2$	M1		Simplest form but decimals accepted, e.g -3.5 & 20.25
		$(x - \frac{7}{2})^2 - \frac{41}{4}$	A1	2	
(ii)	Write down the minimum value of the curve.	$-\frac{41}{4}$	B1	1	
(b)	Describe the geometrical transformation that maps the graph of $y = x^2 - 7x + 2$ onto $y = (x-4)^2$	Translation	B1		'Translation' = 1 mark
		By vector $\begin{pmatrix} \frac{1}{2} \\ \frac{41}{4} \end{pmatrix}$	A1 A1	3	Must have fully correct vector for next 2 marks. Word 'vector' can be stated / implied.
		Total		**6**	

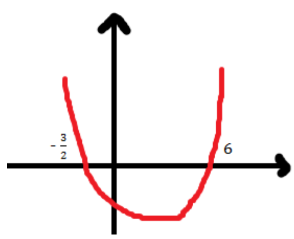
Q4	Question	Solution	Mark	Total	Comments
(a)(i)	Show that $(x+3)$ is a factor of $x^3-5x^2-8x+48$	$P(-3)=$ $(-3)^3-5(-3)^2-8(-3)+48$	M1		$P(-3)$ attempted NOT long division.
		$\therefore =-27-45+24+48=0$ $\Rightarrow (x+3)$ is a factor	A1	2	Must have statement for A1.
(ii)	Express $x^3-5x^2-8x+48$ as a product of 3 linear factors.	$\therefore =(x+3)(x^2-8x+16)$	M1		Division used to obtain 1 linear and 1 quadratic factor of p(x).
		$\therefore (x^2-8x+16)=$ $(x-4)(x-4)$	M1		Factorise quadratic for 2nd M1.
		$\therefore p(x)=(x+3)(x-4)(x-4)$	A1	3	3 linear factors for A1
(b)(i)	Use the remainder theorem to find the remainder when p(x) is divided by $(x-2)$	$P(2)=2^3-5(2)^2-8(2)+48$	M1		'Sub. in' 2 to polynomial.
		$\therefore$ remainder $=20$	A1	2	
(ii)	Express $x^3-5x^2-8x+48$ in the form $(x-2)$	$P(x)=(x-2)(x^2+bx+c)$ where $b=-3$ And $c=-14$	M1		Division used to obtain 1 linear and 1 quadratic factor of p(x).
		$r=48-28=20$	M1		(r could also be obtained from previous question)
		$P(x)=$ $(x-2)(x^2-3x-14)+20$	A1	3	P(x) expressed in correct form.
		Total		**10**	

Q5	Question	Solution	Mark	Total	Comments
(a)	Centre C $(5,-3)$ given and A $(-2,1)$. Write the equation of the circle in form $(x-a)^2+(y-b)^2=k$	Use co-ordinates of C to obtain $(x-5)^2+(y+3)^2=k$ Use Pythagoras' theorem to obtain k, as demonstrated below. $(4^2+7^2=r^2=k)$  Obtain $(x-a)^2+(y-b)^2=65$	M1 M1 A1	 3	Use knowledge that $C=(-a,-b)$ from $(x-a)^2+(y-b)^2=r^2$ Do NOT allow r ,or, $k=\sqrt{65}$ Fully correct equation in completed square form.
(b)	Points A & B form the diameter. Find the co-ordinates of B.	For B, $x=5+7$ **OR** $y=(-3)-4$ $\therefore$ B $=(12,-7)$	M1 A1	 2	Use the distance from C to A to find the distance from C to B. (Probably!) Doesn't have to be in co-ordinate brackets.
(c)	Calculate the equation of the tangent at A. (In form $px+qy+n=0$)	Grad of radius (normal) $=\frac{1+3}{-2-5}$ $\therefore =-\frac{4}{7}$ $\therefore$ gradient of tangent $=\frac{-1}{\frac{-4}{7}}$ $=\frac{7}{4}$ $\therefore y-(1)=\frac{7}{4}(x+2)$ $\therefore 7x-4y+18=0$	M1 M1 M1 M1 A1	 5	Allow $y=mx+c$ method. Must be in this form for A1.

(d)	Given that T is on tangent at A & length of AT = 4, find Length of CT.	Identify that $CT^2 = CA^2 + AT^2$ $\therefore CT^2 = 65 + 4^2$ $\therefore CT^2 = 81$ $\therefore CT = \sqrt{81}$ $= 9$	M1 M1 A1	3	Use of Pythagoras. Must simplify √81 to 9 for A1.
		Total		**13**	

Q6	**Question**	**Solution**	**Mark**	**Total**	**Comments**
(a)(i)	Curve $y = 8-4x-2x^2$ is given. Find the x-intercepts of the curve in the form $m \pm \sqrt{n}$	When y = 0 $\Rightarrow 8-4x-2x^2 = 0$ $\Rightarrow a = -2, b = -4, c = 8$ $\Rightarrow x = -1 \pm \sqrt{5}$	M1 A1	2	Quadratic formula /similar used (not factorising) Must be in this form for A1.
(ii)	Sketch the graph of $y = 8-4x-2x^2$, showing the y-intercept.		B1 B1	2	−ve (n) shape, max point NOT on y-axis for B1 y intercept & roots stated for 2nd B1.
(b)(i)	$y = k(x+4)$ meets the curve at a tangent. Hence show that: $2x^2 + (k+4)x + 4(k-2) = 0$	$\therefore k(x+4) = 8-4x-2x^2$ $\therefore kx + 4k = 8-4x-2x^2$ $\therefore 8 -4x -kx -4k -2x^2 = 0$ $\therefore 2x^2 + (k+4)x + 4(k-2) = 0$	A1	1	Must be in this form.
(ii)	Hence find the 2 possible values of k.	Tangent $\Rightarrow b^2-4ac = 0$ $\therefore (k+4)^2 - [4 \times 2(4k-8)] = 0$ $\therefore k^2 - 24k + 80 = 0$ $\therefore k = -20$,or, $k = -4$	M1 M1 A1	3	Correct substitution of a, b, c values into discriminant.
		Total		**8**	

Q7	Question	Solution	Mark	Total	Comments
(a)(i)	The curve $y = 4 - x^2 - 3x^3$ is given. Find the equation of the tangent at P $(-2, 24)$ giving your answer in the form $y = mx + c$	$\frac{dy}{dx} = -2x - 9x^2$	M1 A1		1 term correct All correct
		$\therefore$ when $x = -2$, $\frac{dy}{dx} = -2(-2) - 9(-2)^2$	M1		Sub in $x = -2$
		$\therefore y - 24 = -32(x+2)$	M1		Sub $\frac{dy}{dx}$ and x & y of P into equation.
		$\therefore y = -32x - 40$	A1	5	Rearrange to get $y = mx + c$
(ii)	Find the x co-ordinate of Q.	When $y = 0$ $\Rightarrow -32x - 40 = 0$ $\Rightarrow x = -\frac{5}{4}$	B1	1	Accept -1.25 and $-1\frac{1}{4}$
(b)(i)	Calculate $\int_{-2}^{1} 4 - x^2 - 3x^3 \, dx$	$\left[\frac{-3x^4}{4} - \frac{x^3}{3} + 4x\right]_{-2}^{1}$	M1 A1		2 terms correct all correct
		$\therefore = [4 - \frac{1}{3} - \frac{3}{4}] - [-8 + \frac{8}{3} - 12]$	M1		Attempt to correctly use limits
			A1		Correct, unsimplified
		$= \frac{81}{4}$	A1	5	Accept 20.25 and $20\frac{1}{4}$
(ii)	Hence determine the area of the shaded region bounded by the curve between Q & R (1, 0).	Area of triangle (see below) = $\frac{24 + \frac{3}{4}}{2} = 9$ (units^2)	B1		
		$\therefore$ shaded area $= (\frac{81}{4} - 9)$	M1		
		$= \frac{45}{4}$	A1	3	OE ; accept 11.25 and $11\frac{1}{4}$
					
		Total		**14**	

Q8	Question	Solution	Mark	Total	Comments
(a)(i)	The gradient of a curve is given by $\frac{dy}{dx} = 54 + 27x - 6x^2$ Calculate d^2y/dx^2	$d^2y/dx^2 = 27 - 12x$	M1 A1	2	1 term correct all correct
(ii)	The curve passes through the point P $(-1\frac{1}{2}, 4)$. Verify that there is a minimum point at P.	When $x = -1\frac{1}{2}$ $\Rightarrow \frac{dy}{dx} = 54 + 27(-1\frac{1}{2}) - 6(-1\frac{1}{2})^2$ $= 0$ $\Rightarrow$ stationary point When $x = -1\frac{1}{2}$ $\Rightarrow d^2y/dx^2 = 27 - 12(-1\frac{1}{2})$ $= 45 > 0$ $\Rightarrow$minimum point (at $x = -1\frac{1}{2}$)	 M1 M1 M1 A1	 4	Must prove $\frac{dy}{dx} = 0$ for M1 Must have statement. Prove $d^2y/dx^2 > 0$ Must have statement for A1
(b)(i)	Hence show that, when y is decreasing, $2x^2 - 9x - 18 > 0$	When y is decreasing $\Rightarrow \frac{dy}{dx} < 0$ $\Rightarrow 54 + 27x - 6x^2 < 0$ $\Rightarrow 6x^2 - 27x - 54 > 0$ $\Rightarrow 2x^2 - 9x - 18 > 0$ as req'd	M1 A1	 2	Attempt to show that $\frac{dy}{dx} < 0$ Clear that >0. 'Be convinced' Correct inequality.
(ii)	Hence solve $2x^2 - 9x - 18 > 0$	$\therefore (k-6)(2k+3) > 0$ $\therefore$ Critical values are $k = 6$ and $-\frac{3}{2}$  $\therefore k > 6, \quad k < -\frac{3}{2}$	M1 A1 M1 A1		Correct factors / use of quadratic formula. Use of sign diagram **OR** graph Fraction must be simplified for A1.
		Total		**12**	