Mark Scheme (Results)
Summer 2010

GCE

Core Mathematics C1 (6663)

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Question Number	Scheme	Marks
2.	$\frac{8x^4}{4}+\frac{6x^{\frac{3}{2}}}{\frac{3}{2}}-5x+c$	M1 A1
	$= 2x^4+4x^{\frac{3}{2}},-5x+c$	A1 A1
		4
	Notes	
	M1 for some attempt to integrate a term in *x*: $x^n \to x^{n+1}$ 1st A1 for correct, possibly un-simplified x^4 or $x^{\frac{3}{2}}$ term. e.g. $\frac{8x^4}{4}$ or $\frac{6x^{\frac{3}{2}}}{\frac{3}{2}}$ 2nd A1 for both $2x^4$ and $4x^{\frac{3}{2}}$ terms correct and simplified on the same line N.B. some candidates write $4\sqrt{x^3}$ or $4x^{1\frac{1}{2}}$ which are, of course, fine for A1 3rd A1 for $-5x+c$. Accept $-5x^1+c$. The +*c* must appear on the same line as the $-5x$ N.B. We do not need to see one line with a fully correct integral Ignore ISW (ignore incorrect subsequent working) if a correct answer is followed by an incorrect version. Condone poor use of notation e.g. $\int 2x^4+4x^{\frac{3}{2}}-5x+c$ will score full marks.	

Question Number	Scheme	Marks
7.	$\dfrac{3x^2+2}{x}=3x+2x^{-1}$ $(y'=)\,24x^2, -2x^{-\frac{1}{2}}, +3-2x^{-2}$ $\left[24x^2-2x^{-\frac{1}{2}}+3-2x^{-2}\right]$	M1 A1 M1 A1 A1A1 **6**
	Notes	
	1st M1 for attempting to divide(one term correct) 1st A1 for both terms correct on the same line, accept $3x^1$ for $3x$ or $\dfrac{2}{x}$ for $2x^{-1}$ These first two marks may be implied by a correct differentiation at the end. 2nd M1 for an attempt to differentiate $x^n \to x^{n-1}$ for at least one term of their expression "Differentiating" $\dfrac{3x^2+2}{x}$ and getting $\dfrac{6x}{1}$ is M0 2nd A1 for $24x^2$ only 3rd A1 for $-2x^{-\frac{1}{2}}$ allow $\dfrac{-2}{\sqrt{x}}$. Must be simplified to this, not e.g. $\dfrac{-4}{2}x^{-\frac{1}{2}}$ 4th A1 for $3-2x^{-2}$ allow $\dfrac{-2}{x^2}$. Both terms needed. Condone $3+(-2)x^{-2}$ If "+c" is included then they lose this final mark They do not need one line with all terms correct for full marks. Award marks when first seen in this question and apply ISW. Condone a mixed line of some differentiation and some division e.g. $24x^2-4x^{\frac{1}{2}}+3x+2x^{-1}$ can score 1st M1A1 and 2nd M1A1	
Quotient /Product Rule	$\dfrac{x(6x)-(3x^2+2)\times 1}{x^2}$ or $6x(x^{-1})+(3x^2+2)(-x^{-2})$ $\dfrac{3x^2-2}{x^2}$ or $3-\dfrac{2}{x^2}$ (o.e.)	1st M1 for an attempt: $\frac{P-Q}{x^2}$ or $R+(-S)$ with one of P,Q or R,S correct. 1st A1 for a correct expression 4th A1 same rules as above

Question Number	Scheme	Marks
11. **(a)**	$(y=)\dfrac{3x^2}{2}-\dfrac{5x^{\frac{1}{2}}}{\frac{1}{2}}-2x \quad (+c)$	M1A1A1
	$\text{f}(4)=5 \quad \Rightarrow 5=\frac{3}{2}\times 16-10\times 2-8+c$	M1
	$\underline{c=9}$	A1 (5)
	$\left[\text{f}(x)=\frac{3}{2}x^2-10x^{\frac{1}{2}}-2x+9\right]$	
(b)	$m=3\times 4-\dfrac{5}{2}-2 \quad \left(=7.5 \text{ or } \dfrac{15}{2}\right)$	M1
	Equation is: $y-5=\dfrac{15}{2}(x-4)$	M1A1
	$\underline{2y-15x+50=0}$ o.e.	A1 (4) **(9marks)**
(a)	1st M1 for an attempt to integrate $x^n \to x^{n+1}$ 1st A1 for at least 2 correct terms in *x* (unsimplified) 2nd A1 for all 3 terms in *x* correct (condone missing +*c* at this point). Needn't be simplified 2nd M1 for using the point (4, 5) to form a linear equation for *c*. Must use *x* = 4 and *y* = 5 and have no *x* term and the function must have "changed". 3rd A1 for *c* = 9. The final expression is not required.	
(b)	1st M1 for an attempt to evaluate $\text{f}'(4)$. Some correct use of *x* = 4 in $\text{f}'(x)$ but condone slips. They must therefore have at least 3×4 or $-\frac{5}{2}$ and clearly be using $\text{f}'(x)$ with *x* = 4. Award this mark wherever it is seen. 2nd M1 for using their value of *m* [or their $-\dfrac{1}{m}$] (provided it clearly comes from using *x* = 4 in f'(*x*)) to form an equation of the line through (4,5)). Allow this mark for an attempt at a normal or tangent. Their *m* must be numerical. Use of *y* = *mx* +*c* scores this mark when *c* is found. 1st A1 for any correct expression for the equation of the line 2nd A1 for any correct equation with integer coefficients. An "=" is required. e.g. 2*y* = 15*x* − 50 etc as long as the equation is correct and has integer coefficients.	
Normal	Attempt at normal can score both M marks in (b) but A0A0	

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Question Number	Scheme	Marks
3	(a) $\left(\frac{dy}{dx}=\right)\ 2x-\frac{1}{2}kx^{-\frac{1}{2}}$ (Having an extra term, e.g. $+C$, is A0)	M1 A1 (2)
	(b) Substituting $x = 4$ into their $\frac{dy}{dx}$ and 'compare with zero' (The mark is allowed for : $<, >, =, \leq, \geq$) $8-\frac{k}{4}<0$ $k > 32$ (or $32 < k$) Correct inequality needed	M1 A1 (2) **4**
	(a) M: $x^2 \to cx$ or $k\sqrt{x} \to cx^{-\frac{1}{2}}$ (c constant, $c \neq 0$) (b) Substitution of $x = 4$ into y scores M0. However, $\frac{dy}{dx}$ is sometimes called y, and in this case the M mark can be given. $\frac{dy}{dx}=0$ may be 'implied' for M1, when, for example, a value of k or an inequality solution for k is found. Working must be seen to justify marks in (b), i.e. $k > 32$ alone is M0 A0.	

Question Number	Scheme	Marks
8	(a) $\frac{dy}{dx} = 3x^2 - 20x + k$ (Differentiation is required)	M1 A1
	At $x = 2$, $\frac{dy}{dx} = 0$, so $12 - 40 + k = 0$ $k = 28$ (*)	A1 cso
	<u>N.B. The '= 0' must be seen at some stage to score the final mark.</u>	
	<u>Alternatively</u>: (using $k = 28$)	
	$\frac{dy}{dx} = 3x^2 - 20x + 28$ (M1 A1)	
	'Assuming' $k = 28$ only scores the final cso mark if there is justification that $\frac{dy}{dx} = 0$ at $x = 2$ represents the <u>maximum</u> turning point.	(3)
	(b) $\int (x^3 - 10x^2 + 28x)\,dx = \frac{x^4}{4} - \frac{10x^3}{3} + \frac{28x^2}{2}$ Allow $\frac{kx^2}{2}$ for $\frac{28x^2}{2}$	M1 A1
	$\left[\frac{x^4}{4} - \frac{10x^3}{3} + 14x^2\right]_0^2 = ...$ $\left(= 4 - \frac{80}{3} + 56 = \frac{100}{3}\right)$	M1
	(With limits 0 to 2, substitute the limit 2 into a 'changed function')	
	y-coordinate of $P = 8 - 40 + 56 = 24$ <u>Allow if seen in part (a)</u>	B1
	(The B1 for 24 may be scored by implication from later working)	
	Area of rectangle = $2 \times (\text{their } y\text{-coordinate of } P)$	
	Area of R = (their 48) $- \left(\text{their } \frac{100}{3}\right)$ $= \frac{44}{3}$ $\left(14\frac{2}{3} \text{ or } 14.\dot{6}\right)$	M1 A1
	If the subtraction is the 'wrong way round', the final A mark is lost.	(6) **9**
	(a) M: $x^n \to cx^{n-1}$ (c constant, $c \neq 0$) for one term, seen <u>in part (a)</u>. (b) 1st M: $x^n \to cx^{n+1}$ (c constant, $c \neq 0$) for one term. Integrating the <u>gradient function</u> loses this M mark. 2ndM: Requires use of limits 0 and 2, with 2 substituted into a 'changed function'. (It may, for example, have been differentiated). Final M: Subtract their values either way round. This mark is dependent on the use of calculus and a correct method attempt for the area of the rectangle. A1: Must be <u>exact</u>, not 14.67 or similar, but isw after seeing, say, $\frac{44}{3}$. <u>Alternative</u>: (effectively finding area of rectangle by integration) $\int \{24 - (x^3 - 10x^2 + 28x)\}\,dx = 24x - \left(\frac{x^4}{4} - \frac{10x^3}{3} + \frac{28x^2}{2}\right)$, etc. This can be marked equivalently, with the 1st A being for integrating the same 3 terms correctly. The 3rd M (for subtraction) will be scored at the same stage as the 2nd M. If the subtraction is the 'wrong way round', the final A mark is lost.	