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Mark Scheme (Results)
January 2010

GCE

Core Mathematics C1 (6663)

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Core Mathematics C1 6663
Mark Scheme

Question number	Scheme	Marks
Q1	$x^4 \to kx^3$ or $x^{1/3} \to kx^{-2/3}$ or $3 \to 0$ (k a non-zero constant)	M1
	$\left(\frac{dy}{dx}=\right)$ $4x^3$.......... , with '3' differentiated to zero (or 'vanishing')	A1
	$\left(\frac{dy}{dx}=\right)$ .... $+\frac{1}{3}x^{-2/3}$ or equivalent, e.g. $\frac{1}{3\sqrt[3]{x^2}}$ or $\frac{1}{3\left(\sqrt[3]{x}\right)^2}$	A1
		[3]
	1st A1 requires $4x^3$, <u>and</u> 3 differentiated to zero. Having '$+C$' loses the 1st A mark. Terms not added, but otherwise correct, e.g. $4x^3$, $\frac{1}{3}x^{-2/3}$ loses the 2nd A mark.	

Question number	Scheme	Marks
Q4	$x\sqrt{x} = x^{\frac{3}{2}}$ (Seen, or implied by correct integration)	B1
	$x^{-\frac{1}{2}} \to kx^{\frac{1}{2}}$ or $x^{\frac{3}{2}} \to kx^{\frac{5}{2}}$ (k a non-zero constant)	M1
	$(y =)\ \dfrac{5x^{\frac{1}{2}}}{\frac{1}{2}} \ldots + \dfrac{x^{\frac{5}{2}}}{\frac{5}{2}}\ (+C)$ ("$y =$" and " $+C$" are not required for these marks)	A1... A1
	$35 = \dfrac{5 \times 4^{\frac{1}{2}}}{\frac{1}{2}} + \dfrac{4^{\frac{5}{2}}}{\frac{5}{2}} + C$ An equation in C is required (see conditions below). (With their terms simplified or unsimplified).	M1
	$C = \dfrac{11}{5}$ or equivalent $2\dfrac{1}{5}$, 2.2	A1
	$y = 10x^{\frac{1}{2}} + \dfrac{2x^{\frac{5}{2}}}{5} + \dfrac{11}{5}$ (Or equivalent simplified)	A1 ft
	I.s.w. if necessary, e.g. $y = 10x^{\frac{1}{2}} + \dfrac{2x^{\frac{5}{2}}}{5} + \dfrac{11}{5} = 50x^{\frac{1}{2}} + 2x^{\frac{5}{2}} + 11$ The final A mark requires an equation "$y = \ldots$" with correct x terms (see below).	**[7]**
	B mark: $x^{\frac{3}{2}}$ often appears from integration of $\sqrt{x}$, which is B0. 1st A: Any unsimplified or simplified correct form, e.g. $\dfrac{5\sqrt{x}}{0.5}$. 2nd A: Any unsimplified or simplified correct form, e.g. $\dfrac{x^2\sqrt{x}}{2.5}$, $\dfrac{2\left(\sqrt{x}\right)^5}{5}$. 2nd M: Attempting to use $x = 4$ and $y = 35$ in a changed function (even if differentiated) to form an equation in C. 3rd A: Obtaining $C = \dfrac{11}{5}$ with no earlier incorrect work. 4th A: Follow-through only the value of C (i.e. the other terms must be correct). Accept equivalent simplified terms such as $10\sqrt{x} + 0.4x^2\sqrt{x}$ ...	

Question number	Scheme	Marks
Q6	(a) $y=\dfrac{x^2-5x-24}{x}=x-5-24x^{-1}$ (or equiv., e.g. $x+3-8-\dfrac{24}{x}$)	M1 A1
	$\dfrac{dy}{dx}=1+24x^{-2}$ or $\dfrac{dy}{dx}=1+\dfrac{24}{x^2}$	M1 A1 (4)
	(b) $x = 2$: $y=-15$ Allow if seen in part (a).	B1
	$\left(\dfrac{dy}{dx}=\right)$ $1+\dfrac{24}{4}=7$ Follow-through from candidate's non-constant $\dfrac{dy}{dx}$. This must be simplified to a "single value".	B1ft
	$y+15=7(x-2)$ (or equiv., e.g. $y=7x-29$) Allow $\dfrac{y+15}{x-2}=7$	M1 A1 (4) **[8]**
	(a) 1st M: Mult. out to get x^2+bx+c, $b\neq 0$, $c\neq 0$ and dividing by x (not x^2). Obtaining one correct term, e.g. x…….. is sufficient evidence of a division attempt. 2nd M: Dependent on the 1st M: Evidence of $x^n \to kx^{n-1}$ for one x term (i.e. not just the constant term) is sufficient). Note that mark is not given if, for example, the numerator and denominator are differentiated separately. A mistake in the 'middle term', e.g. $x+5-24x^{-1}$, does not invalidate the 2nd A mark, so M1 A0 M1 A1 is possible. (b) B1ft: For evaluation, using x = 2, of their $\dfrac{dy}{dx}$, even if unlabelled or called y. M: For the equation, in any form, of a straight line through (2, '−15') with candidate's $\dfrac{dy}{dx}$ value as gradient. Alternative is to use (2, '−15') in $y=mx+c$ to find a value for c, in which case $y=7x+c$ leading to $c=-29$ is sufficient for the A1). . (See general principles for straight line equations at the end of the scheme). Final A: 'Unsimplified' forms are acceptable, but… $y-(-15)=7(x-2)$ is A0 (unresolved 'minus minus').	

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Question Number	Scheme	Marks
Q7 (a)	**Puts** y = 0 and attempts to solve quadratic e.g. $(x-4)(x-1)=0$ Points are (1,0) and (4, 0)	M1 A1 (2)
(b)	x = 5 gives y = 25 - 25 + 4 and so (5, 4) lies on the curve	B1cso (1)
(c)	$\int(x^2-5x+4)\,dx=\frac{1}{3}x^3-\frac{5}{2}x^2+4x$ (+ c)	M1A1 (2)
(d)	Area of triangle = $\frac{1}{2}\times4\times4=8$ or $\int(x-1)\,dx=\frac{1}{2}x^2-x$ with limits 1 and 5 to give 8	B1
	Area under the curve = $\int_4^5$ $\frac{1}{3}\times5^3-\frac{5}{2}\times5^2+4\times5$ $\left[=-\frac{5}{6}\right]$	M1
	$\frac{1}{3}\times4^3-\frac{5}{2}\times4^2+4\times4$ $\left[=-\frac{8}{3}\right]$	M1
	$\int_4^5 = -\frac{5}{6}--\frac{8}{3}=\frac{11}{6}$ or equivalent (allow 1.83 or 1.8 here)	A1 cao
	Area of R = $8-\frac{11}{6}=6\frac{1}{6}$ or $\frac{37}{6}$ or $6.1\dot{6}$ (not 6.17)	A1 cao (5)
		[10]
(a)	M1 for attempt to find L and M A1 Accept x = 1 and x = 4 , then isw or accept L =(1,0) , M = (4,0) Do not accept L = 1, M = 4 nor (0 , 1), (0 , 4) (unless subsequent work) Do not need to distinguish L and M. Answers imply M1A1.	
(b)	See substitution, working should be shown, need conclusion which could be just y = 4 or a tick. Allow y = 25 - 25 + 4 = 4 But not 25 - 25 + 4 = 4. ($y=4$ may appear at start) Usually 0 = 0 or 4 = 4 is B0	
(c)	M1 for attempt to integrate $x^2\to kx^3, x\to kx^2$ or $4\to4x$ A1 for correct integration of all three terms (do not need constant) isw. Mark correct work when seen. So e.g. $\frac{1}{3}x^3-\frac{5}{2}x^2+4x$ is A1 then $2x^3-15x^2+24x$ would be ignored as subsequent work.	
(d)	B1 for this triangle only (not triangle LMN) 1st M1 for substituting 5 into their changed function 2nd M1 for substituting 4 into their changed function	
(d)	Alternative method: $\int_1^5(x-1)-(x^2-5x+4)dx+\int_1^4 x^2-5x+4dx$ can lead to correct answer Constructs $\int_1^5(x-1)-(x^2-5x+4)dx$ is B1 M1 for substituting 5 and 1 and subtracting in first integral M1 for substituting 4 and 1 and subtracting in second integral A1 for answer to first integral i.e. $\frac{32}{3}$ (allow 10.7) and A1 for final answer as before..	

(d)	Another alternative $\int_4^5 (x-1)-(x^2-5x+4)\mathrm{d}x + \textit{area of triangle LMP}$ Constructs $\int_4^5 (x-1)-(x^2-5x+4)\mathrm{d}x$ is B1 M1 for substituting 5 and 4 and subtracting in first integral M1 for complete method to find area of triangle (4.5) A1 for answer to first integral i.e. $\frac{5}{3}$ and A1 for final answer as before.
(d)	Could also use $\int_4^5 (4x-16)-(x^2-5x+4)\mathrm{d}x + \textit{area of triangle LMN}$ Similar scheme to previous one. Triangle has area 6 A1 for finding Integral has value $\frac{1}{6}$ and A1 for final answer as before.

Question Number	Scheme	Marks
Q9 (a)	$\left[y = 12x^{\frac{1}{2}} - x^{\frac{3}{2}} - 10\right]$	
	$[y' =]$ $6x^{-\frac{1}{2}} - \frac{3}{2}x^{\frac{1}{2}}$	M1 A1
	Puts their $\frac{6}{x^{\frac{1}{2}}} - \frac{3}{2}x^{\frac{1}{2}} = 0$	M1
	So $x =$ $, \frac{12}{3} = 4$ (If $x = 0$ appears also as solution then lose A1)	M1, A1
	$x = 4, \Rightarrow y = 12\times 2 - 4^{\frac{3}{2}} - 10$, so $y = 6$	dM1,A1 (7)
(b)	$y'' = -3x^{-\frac{3}{2}} - \frac{3}{4}x^{-\frac{1}{2}}$	M1A1 (2)
(c)	[Since $x > 0$] It is a maximum	B1 (1) **[10]**
(a)	1st M1 for an attempt to differentiate a fractional power $x^n \to x^{n-1}$ A1 a.e.f – can be unsimplified 2nd M1 for forming a suitable equation using their $y'=0$ 3rd M1 for correct processing of fractional powers leading to $x =$ … (Can be implied by $x = 4$) A1 is for $x = 4$ only. If $x = 0$ also seen and not discarded they lose this mark only. 4th M1 for substituting their value of x back into y to find y value. Dependent on three previous M marks. Must see evidence of the substitution with attempt at fractional powers to give M1A0, but $y = 6$ can imply M1A1	
(b)	M1 for differentiating their y' again A1 should be simplified	
(c)	B1 . Clear conclusion needed and must follow correct y'' It is dependent on previous A mark (Do not need to have found x earlier). (Treat parts (a),(b) and (c) together for award of marks)	