edexcel
advancing learning, changing lives

Mark Scheme (Results)
January 2011

GCE

GCE Core Mathematics C4 (6666) Paper 1

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information, please call our GCE line on 0844 576 0025, our GCSE team on 0844 576 0027, or visit our website at www.edexcel.com.

If you have any subject specific questions about the content of this Mark Scheme that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

Ask The Expert can be accessed online at the following link:

http://www.edexcel.com/Aboutus/contact-us/

January 2011

Publications Code UA026241

All the material in this publication is copyright
© Edexcel Ltd 2011

General Instructions for Marking

1. The total number of marks for the paper is 75.

2. The Edexcel Mathematics mark schemes use the following types of marks:

   - **M** marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
   - **A** marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
   - **B** marks are unconditional accuracy marks (independent of M marks)
   - Marks should not be subdivided.

3. Abbreviations

   These are some of the traditional marking abbreviations that will appear in the mark schemes.

   - bod – benefit of doubt
   - ft – follow through
   - the symbol $\surd$ will be used for correct ft
   - cao – correct answer only
   - cso - correct solution only. There must be no errors in this part of the question to obtain this mark
   - isw – ignore subsequent working
   - awrt – answers which round to
   - SC: special case
   - oe – or equivalent (and appropriate)
   - dep – dependent
   - indep – independent
   - dp decimal places
   - sf significant figures
   - $*$ The answer is printed on the paper
   - $\sqsubset$ The second mark is dependent on gaining the first mark

January 2011
Core Mathematics C4 6666
Mark Scheme

Question Number	Scheme	Marks
1.	$\int x\sin 2x\,\mathrm{d}x = -\frac{x\cos 2x}{2} + \int \frac{\cos 2x}{2}\,\mathrm{d}x$ $= \quad \ldots \quad + \frac{\sin 2x}{4}$ $\left[\ \ldots \ \right]_0^{\frac{\pi}{2}} = \frac{\pi}{4}$	M1 A1 A1 M1 M1 A1 **[6]**
2.	$\frac{\mathrm{d}I}{\mathrm{d}t} = -16\ln(0.5)0.5^t$ At $t=3$ $\quad \frac{\mathrm{d}I}{\mathrm{d}t} = -16\ln(0.5)0.5^3$ $= -2\ln 0.5 = \ln 4$	M1 A1 M1 M1 A1 **[5]**

Question Number	Scheme	Marks
3. **(a)**	$\dfrac{5}{(x-1)(3x+2)} = \dfrac{A}{x-1} + \dfrac{B}{3x+2}$ $5 = A(3x+2) + B(x-1)$ $x \to 1 \qquad 5 = 5A \Rightarrow A = 1$ $x \to -\dfrac{2}{3} \qquad 5 = -\dfrac{5}{3}B \Rightarrow B = -3$	M1 A1 A1 (3)
(b)	$\displaystyle\int \frac{5}{(x-1)(3x+2)}\,dx = \int \left(\frac{1}{x-1} - \frac{3}{3x+2}\right)dx$ $= \ln(x-1) - \ln(3x+2) \quad (+C)$ ft constants	M1 A1ft A1ft (3)
(c)	$\displaystyle\int \frac{5}{(x-1)(3x+2)}\,dx = \int \left(\frac{1}{y}\right)dy$ $\ln(x-1) - \ln(3x+2) = \ln y \quad (+C)$ $y = \dfrac{K(x-1)}{3x+2}$ depends on first two Ms in (c) Using $(2, 8)$ $8 = \dfrac{K}{8}$ depends on first two Ms in (c) $y = \dfrac{64(x-1)}{3x+2}$	M1 M1 A1 M1 dep M1 dep A1 (6) **[12]**

Question Number	Scheme	Marks
4. **(a)**	$\overrightarrow{AB} = -2\mathbf{i} + 2\mathbf{j} - \mathbf{k} - (\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}) = -3\mathbf{i} + 5\mathbf{j} - 3\mathbf{k}$	M1 A1 (2)
(b)	$\mathbf{r} = \mathbf{i} - 3\mathbf{j} + 2\mathbf{k} + \lambda(-3\mathbf{i} + 5\mathbf{j} - 3\mathbf{k})$ or $\mathbf{r} = -2\mathbf{i} + 2\mathbf{j} - \mathbf{k} + \lambda(-3\mathbf{i} + 5\mathbf{j} - 3\mathbf{k})$	M1 A1ft (2)
(c)	$\overrightarrow{AC} = 2\mathbf{i} + p\mathbf{j} - 4\mathbf{k} - (\mathbf{i} - 3\mathbf{j} + 2\mathbf{k})$ $= \mathbf{i} + (p+3)\mathbf{j} - 6\mathbf{k}$ or $\overrightarrow{CA}$ $\overrightarrow{AC}.\overrightarrow{AB} = \begin{pmatrix} 1 \\ p+3 \\ -6 \end{pmatrix}.\begin{pmatrix} -3 \\ 5 \\ -3 \end{pmatrix} = 0$ $-3 + 5p + 15 + 18 = 0$ Leading to $p = -6$	B1 M1 M1 A1 (4)
(d)	$AC^2 = (2-1)^2 + (-6+3)^2 + (-4-2)^2 \quad (= 46)$ $AC = \sqrt{46}$ accept awrt 6.8	M1 A1 (2) **[10]**

Question Number	Scheme	Marks
5.		
(a)	$(2-3x)^{-2} = 2^{-2}\left(1-\frac{3}{2}x\right)^{-2}$	B1
	$\left(1-\frac{3}{2}x\right)^{-2} = 1+(-2)\left(-\frac{3}{2}x\right)+\frac{-2.-3}{1.2}\left(-\frac{3}{2}x\right)^2+\frac{-2.-3.-4}{1.2.3}\left(-\frac{3}{2}x\right)^3+\ ...$	M1 A1
	$=1+3x+\frac{27}{4}x^2+\frac{27}{2}x^3+\ ...$	
	$(2-3x)^{-2} = \frac{1}{4}+\frac{3}{4}x+\frac{27}{16}x^2+\frac{27}{8}x^3+\ ...$	M1 A1 (5)
(b)	$f(x) = (a+bx)\left(\frac{1}{4}+\frac{3}{4}x+\frac{27}{16}x^2+\frac{27}{8}x^3+\ ...\right)$	
	Coefficient of x; $\frac{3a}{4}+\frac{b}{4}=0 \quad (3a+b=0)$	M1
	Coefficient of x^2; $\frac{27a}{16}+\frac{3b}{4}=\frac{9}{16} \quad (9a+4b=3)$ A1 either correct	M1 A1
	Leading to $a=-1,\ b=3$	M1 A1 (5)
(c)	Coefficient of x^3 is $\frac{27a}{8}+\frac{27b}{16}=\frac{27}{8}\times(-1)+\frac{27}{16}\times 3$	M1 A1ft
	$=\frac{27}{16}$ cao	A1 (3)
		[13]

Question Number	Scheme	Marks
6. **(a)**	$\frac{dx}{dt}=\frac{1}{t}, \quad \frac{dy}{dt}=2t$	
	$\frac{dy}{dx}=2t^2$	M1 A1
	Using $mm'=-1$, at $t=3$	
	$m'=-\frac{1}{18}$	M1 A1
	$y-7=-\frac{1}{18}(x-\ln 3)$	M1 A1 (6)
(b)	$x=\ln t \Rightarrow t=e^x$	B1
	$y=e^{2x}-2$	M1 A1 (3)
(c)	$V=\pi\int\left(e^{2x}-2\right)^2 dx$	M1
	$\int\left(e^{2x}-2\right)^2 dx=\int\left(e^{4x}-4e^{2x}+4\right)dx$	M1
	$=\frac{e^{4x}}{4}-\frac{4e^{2x}}{2}+4x$	M1 A1
	$\pi\left[\frac{e^{4x}}{4}-\frac{4e^{2x}}{2}+4x\right]_{\ln 2}^{\ln 4}=\pi\left[(64-32+4\ln 4)-(4-8+4\ln 2)\right]$	M1
	$=\pi(36+4\ln 2)$	A1
		(6) **[15]**
	Alternative to (c) *using parameters*	
	$V=\pi\int\left(t^2-2\right)^2\frac{dx}{dt}dt$	M1
	$\int\left(\left(t^2-2\right)^2\times\frac{1}{t}\right)dt=\int\left(t^3-4t+\frac{4}{t}\right)dt$	M1
	$=\frac{t^4}{4}-2t^2+4\ln t$	M1 A1
	The limits are $t=2$ and $t=4$	
	$\pi\left[\frac{t^4}{4}-2t^2+4\ln t\right]_2^4=\pi\left[(64-32+4\ln 4)-(4-8+4\ln 2)\right]$	M1
	$=\pi(36+4\ln 2)$	A1
		(6)

Question Number	Scheme	Marks
7. **(a)**	$x=3 \Rightarrow y=0.1847$ awrt $x=5 \Rightarrow y=0.1667$ awrt or $\frac{1}{6}$	B1 B1 (2)
(b)	$I \approx \underline{\underline{\frac{1}{2}}}\left[0.2+0.1667+2\left(0.1847+0.1745\right)\right]$ ≈ 0.543 0.542 or 0.543	B1 M1 A1ft A1 (4)
(c)	$\frac{\mathrm{d}x}{\mathrm{d}u}=2\left(u-4\right)$ $\int \frac{1}{4+\sqrt{\left(x-1\right)}}\mathrm{d}x=\int \frac{1}{u}\times 2\left(u-4\right)\mathrm{d}u$ $=\int\left(2-\frac{8}{u}\right)\mathrm{d}u$ $=2u-8\ln u$ $x=2 \Rightarrow u=5,\ x=5 \Rightarrow u=6$ $\left[2u-8\ln u\right]_5^6=\left(12-8\ln 6\right)-\left(10-8\ln 5\right)$ $=2+8\ln\left(\frac{5}{6}\right)$	B1 M1 A1 M1 A1 B1 M1 A1 (8) **[14]**

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467
Fax 01623 450481

Email publications@linneydirect.com

Order Code UA026241 January 2011

For more information on Edexcel qualifications, please visit www.edexcel.com/quals

Edexcel Limited. Registered in England and Wales no.4496750
Registered Office: One90 High Holborn, London, WC1V 7BH