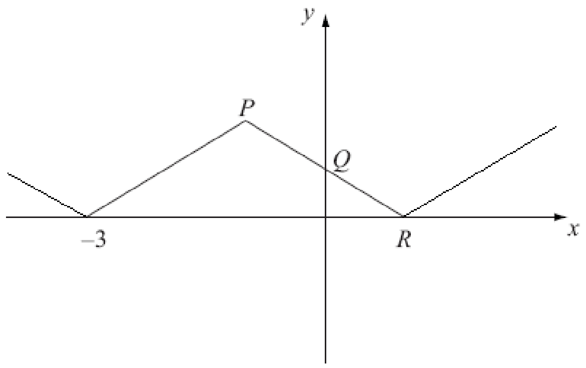
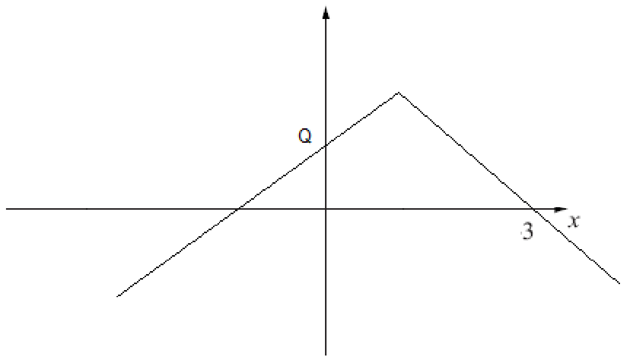
June 2008

6665 Core Mathematics C3

Question Number	Scheme	Marks
1 a)	$2 = e^{2x+1}$ Take natural logarithms $ln2 = 2x + 1$ $x = \frac{ln2-1}{2}$	 **M1** **A1 (2)**
b)	$\frac{dy}{dx} = 8e^{2x+1}$ $= 8e^{ln2} = 16$ $y - 8 = 16(x - \frac{ln2-1}{2})$ $y = 16x - 8ln2 + 16$ ($a = 16, b = 16 - 8ln2$)	**M1** **M1** **A1, A1 (4)** **(6 marks)**
2 a)	$f(x) = 5cosx + 12sinx = Rcos(x - a)$ $= Rcosxcosa + Rsinxsina$ Equating coefficients: $5 = Rcosa$ $12 = Rsina$ $tana = \frac{12}{5}$ a=1.176, R=13	 **M1** **M1** **A1, A1 (4)**
b)	$13cos(x - 1.18) = 6$ $x - 1.18 = \pm 1.09$ $x = 2.27, 0.0849$	**M1** **M1, A1 (for +/-)** **A1, A1 (5)**
c)	i) 13 (ft for value of R) ii) x-1.18=0 (implied or explanation why) x=1.18 (ft)	**B1 (1)** **M1** **B1 (2)** **(12 marks)**

This is a mark scheme for Edexcel 6665: C3 Mathematics for the June 2008 exam. The mark scheme cannot be guaranteed to be accurate and should only be used as a guide. Distribution of marks are estimates.

3a)		**B1 shape** **A1 intersects** **(2)**
b)		**B1 (reflect in y-axis)** **A1 (intersects x-axes at 3)** **(2)**
c)	P(-1,2) Q(0,1) R(1,0)	**A1** **A1** **A1 (3)**
d)	f(x): $1-x$, when $x>-1$ $3+x$, when $x\leq -1$ $1-x=0.5x$ $3+x=0.5x$ $x=\frac{2}{3}$, $x=-6$	**M1** **M1** **M1** **A1, A1 (5)** **(12 marks)**
4 a)	Denominator $(x-3)(x+1)$ at any point. $f(x)=\frac{2(x-1)}{(x-3)(x+1)}-\frac{x+1}{(x-3)(x+1)}$ $=\frac{x-3}{(x-3)(x+1)}$ $=\frac{1}{x+1}$	**B1** **M1** **M1** **A1 (4)**
b)	$f(x)=\frac{1}{3+1}=\frac{1}{4}$, **when x>3** $0<f(x)<\frac{1}{4}$	**M1** **A1 (2)**
c)	$yx+y=1$ $x=\frac{1-y}{y}$ $f^{-1}(x)=\frac{1-x}{x}$	**M1** **M1** **A1 (3)**
d)	$fg(x)=\frac{1}{2x^2-2}=\frac{1}{8}$ $x^2=5$ $x=\pm\sqrt{5}$	**M1** **M1** **A1 (3)** **(12 marks)**

5 a)	$\frac{sin^2\theta}{sin^2\theta}+\frac{cos^2\theta}{cos^2\theta}\equiv 1$ $1+cot^2\theta\equiv cosec^2\theta$	**M1** **A1 (2)**
b)	Substitute $cot^2\theta = cosec^2\theta - 1$ $2cosec^2\theta - 9cosec\theta - 5 = 0$ $(2cosec\theta + 1)(cosec\theta - 5) = 0$ $cosec\theta = -\frac{1}{2}, 5$ When $cosec\theta = \frac{1}{2}$, there is no solution $\theta = 11.5, 168.5$	**M1** **M1** **M1** **A1** **A1, A1 (6)** **(8 marks)**
6 a)	i) $\frac{dy}{dx} = 3e^{3x}(sinx + 2cosx) + e^{3x}(cosx - 2sinx)$ Correct f'(x) A1, Correct g'(x) A1, use of chain rule M1 $= e^{3x}(sinx + 7cosx)$ (or simplified answer – A2) ii) $\frac{dy}{dx} = 3x^2ln(5x+2) + \frac{5x^3}{5x+2}$ Use of chain rule M1. Correct g'(x) A1, correct answer,A1.	**A1, M1** **A1 (3)** **M1, A1, A1** **(3)**
b)	$\frac{dy}{dx} = \frac{6(x+1)^3 - 2(3x^2+6x-7)(x+1)}{(x+1)^4}$ M1 (Quotient), A1 correct fraction. $\frac{dy}{dx} = \frac{6x^2+12x+6-6x^2-12x+14}{(x+1)^3}$ Remove (x+1), M1. Expand brackets A1. $\frac{dy}{dx} = \frac{20}{(x+1)^3}$	**M1, A1** **M1, A1** **A1 (5)**
c)	$\frac{d^2y}{dx^2} = \frac{-20\times 3(x+1)^2}{(x+1)^6}$ $= -\frac{60}{(x+1)^4} = -\frac{15}{4}$ $16 = (x+1)^4$ $x = 1, -3$	**M1** **M1** **A1 (3)** **(14 marks)**
7 a)	f(1.4) = -0.568 f(1.45) = 0.246 Change in sign, therefore root in the interval.	**A1** **B1 (2)**
b)	$3x^3 - 2x - 6 = 0$ $x^3 = \frac{2x}{3} + 2$ $x^2 = \frac{2}{3} + \frac{2}{x}$ $x = \sqrt{\frac{2}{x} + \frac{2}{3}}$	**M1** **M1** **A1 (3)**
c)	$X_0 = 1.43$; $x_1=1.4371$; $x_2 1.4347$; $x_3=1.4355$	**A1, A1, A1** **(3)**
d)	f(1.4345) = -0.133; f(1.4355) = 0.00323 There is a change in sign between 1.4345 and 1.4355 – rounds to 1.435 – there must be a root in the interval.	**A1, A1** **B1 (3)** **(11 marks)**