

Write your name here

Surname

Other names

**Pearson Edexcel**  
**International**  
**Advanced Level**

Centre Number

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Candidate Number

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# Core Mathematics C3

## Advanced

Monday 27 January 2014 – Morning

**Time: 1 hour 30 minutes**

Paper Reference

**6665A/01****You must have:**

Mathematical Formulae and Statistical Tables (Pink)

Total Marks

**Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

### Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

### Information

- The total mark for this paper is 75.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**1.**

$$f(x) = \sec x + 3x - 2, \quad -\frac{\pi}{2} < x < \frac{\pi}{2}$$

- (a) Show that there is a root of  $f(x) = 0$  in the interval  $[0.2, 0.4]$

(2)

- (b) Show that the equation  $f(x) = 0$  can be written in the form

$$x = \frac{2}{3} - \frac{1}{3\cos x}$$

(1)

The solution of  $f(x) = 0$  is  $\alpha$ , where  $\alpha = 0.3$  to 1 decimal place.

- (c) Starting with  $x_0 = 0.3$ , use the iterative formula

$$x_{n+1} = \frac{2}{3} - \frac{1}{3\cos x_n}$$

to calculate the values of  $x_1$ ,  $x_2$  and  $x_3$ , giving your answers to 4 decimal places.

(3)

- (d) State the value of  $\alpha$  correct to 3 decimal places.

(1)



## Q1

**(Total 7 marks)**



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$$f(x) = \frac{15}{3x+4} - \frac{2x}{x-1} + \frac{14}{(3x+4)(x-1)}, \quad x > 1$$

- (b) Hence, or otherwise, find  $f'(x)$ , giving your answer as a single fraction in its simplest form. (3)



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Q2

**(Total 7 marks)**



**3.** (a) By writing  $\operatorname{cosec} x$  as  $\frac{1}{\sin x}$ , show that

$$\frac{d(\operatorname{cosec} x)}{dx} = -\operatorname{cosec} x \cot x \quad (3)$$

Given that  $y = e^{3x} \operatorname{cosec} 2x$ ,  $0 < x < \frac{\pi}{2}$ ,

(b) find an expression for  $\frac{dy}{dx}$ . (3)

The curve with equation  $y = e^{3x} \operatorname{cosec} 2x$ ,  $0 < x < \frac{\pi}{2}$ , has a single turning point.

(c) Show that the  $x$ -coordinate of this turning point is at  $x = \frac{1}{2} \arctan k$  where the value of the constant  $k$  should be found. (2)





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**(Total 8 marks)**

Q3

9

**Turn over**



4. A pot of coffee is delivered to a meeting room at 11am. At a time  $t$  minutes after 11am the temperature,  $\theta$  °C, of the coffee in the pot is given by the equation

where  $A$  and  $k$  are positive constants.

Given also that the temperature of the coffee at 11am is  $85^{\circ}\text{C}$  and that 15 minutes later it is  $58^{\circ}\text{C}$ ,

- (a) find the value of  $A$ .

(1)

- (b) Show that  $k = \frac{1}{15} \ln\left(\frac{20}{11}\right)$

(3)

- (c) Find, to the nearest minute, the time at which the temperature of the coffee reaches  $50^{\circ}\text{C}$ .

(4)



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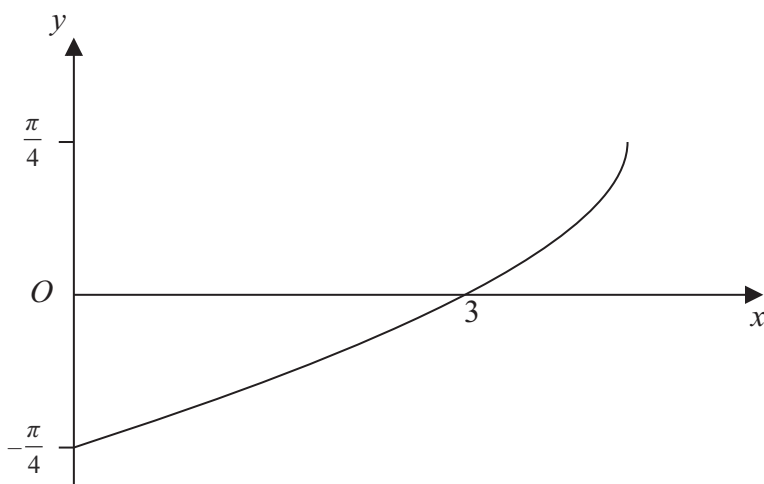
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**(Total 8 marks)**

Q4



5.



### Figure 1

The curve shown in Figure 1 has equation

$$x = 3 \sin y + 3 \cos y, \quad -\frac{\pi}{4} < y < \frac{\pi}{4}$$

(a) Express the equation of the curve in the form

$$x = R \sin(y + \alpha), \text{ where } R \text{ and } \alpha \text{ are constants, } R > 0 \text{ and } 0 < \alpha < \frac{\pi}{2} \quad (3)$$

(b) Find the coordinates of the point on the curve where the value of  $\frac{dy}{dx}$  is  $\frac{1}{2}$ .

Give your answers to 3 decimal places.

(6)



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**Question 5 continued**



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**Question 5 continued**

**Q5**

**(Total 9 marks)**



6. Given that  $a$  and  $b$  are constants and that  $0 < a < b$ ,

(a) on separate diagrams, sketch the graph with equation

(i)  $y = |2x + a|$ ,

(ii)  $y = |2x + a| - b$ .

Show on each sketch the coordinates of each point at which the graph crosses or meets the axes.

(6)

(b) Solve, for  $x$ , the equation

$$|2x + a| - b = \frac{1}{3}x$$

giving any answers in terms of  $a$  and  $b$ .

(4)



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**Question 6 continued**



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Question 6 continued

Q6

(Total 10 marks)



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7. (i) (a) Prove that

$$\cos 3\theta \equiv 4 \cos^3 \theta - 3 \cos \theta$$

$$\cos(A + B) \equiv \cos A \cos B - \sin A \sin B)$$

(4)

(b) Hence solve the equation

$$2 \cos 3\theta + \cos 2\theta + 1 = 0$$

giving answers in the interval  $0 \leq \theta \leq \pi$ .

Solutions based entirely on graphical or numerical methods are not acceptable.

(6)

(ii) Given that  $\theta = \arcsin x$  and that  $0 < \theta < \frac{\pi}{2}$ , show that

$$\cot \theta = \frac{\sqrt{(1-x^2)}}{x}, \quad 0 < x < 1 \quad (3)$$



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**Turn over**



**8.** The function  $f$  is defined by

$$f: x \rightarrow 3 - 2e^{-x}, \quad x \in \mathbb{R}$$

- (a) Find the inverse function,  $f^{-1}(x)$  and give its domain.

(5)

- (b) Solve the equation  $f^{-1}(x) = \ln x$ .

(4)

The equation  $f(t) = ke^t$ , where  $k$  is a positive constant, has exactly one real solution.

- (c) Find the value of  $k$ .

(4)



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### Question 8 continued



**Q8**

**(Total 13 marks)**

**TOTAL FOR PAPER: 75 MARKS**

**END**

