Surname	
Other Names	
Candidate Signature	

Centre Number						Candidate Number				

Examiner Comments	

Total Marks

FURTHER MATHEMATICS

AS LEVEL FURTHER PURE MATHEMATICS 1

CM

Bronze Set A (Edexcel Version)

Time allowed: 50 minutes

Instructions to candidates:

• In the boxes above, write your centre number, candidate number, your surname, other names and signature.

• Answer ALL of the questions.

• You must write your answer for each question in the spaces provided.

• You may use a calculator.

Information to candidates:

• Full marks may only be obtained for answers to ALL of the questions.

• The marks for individual questions and parts of the questions are shown in round brackets.

• There are 5 questions in this question paper. The total mark for this paper is 40.

Advice to candidates:

• You should ensure your answers to parts of the question are clearly labelled.

• You should show sufficient working to make your workings clear to the Examiner.

• Answers without working may not gain full credit.

1 1 3 3 1 2 2 1 8 0 0 0 4

1 The variable y satisfies the differential equation

$$\frac{d^2y}{dx^2} = 3\sin x + y^2\frac{dy}{dx}$$

Given that $y = 1$ and $\frac{dy}{dx} = 5$ at $x = 4$, use the approximations

$$\left(\frac{d^2y}{dx^2}\right)_0 \approx \frac{y_1 - 2y_0 + y_{-1}}{h^2} \qquad \left(\frac{dy}{dx}\right)_0 \approx \frac{y_1 - y_{-1}}{2h}$$

with $h = 0.5$ to find an approximation for y at $x = 3.5$.

Give your answer correct to two decimal places. **(5)**

Question 1 continued

TOTAL 5 MARKS

2 Solve the inequality

$$1-\frac{x}{x+2}<\frac{4}{x+1}$$

Express your solution using set notation. **(6)**

Question 2 continued

TOTAL 6 MARKS

3 Relative to a fixed origin O, the points A, B and C have position vectors $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$, where

$$\mathbf{a} = 4\mathbf{i} + 2\mathbf{j} - \mathbf{k} \qquad \mathbf{b} = -\mathbf{i} + 3\mathbf{j} + 2\mathbf{k} \qquad \mathbf{c} = k\mathbf{i} - \mathbf{j}$$

and k is a constant.

(a) Calculate $\mathbf{a} \times \mathbf{b}$. **(3)**

Figure 1 below shows the parallelepiped P.

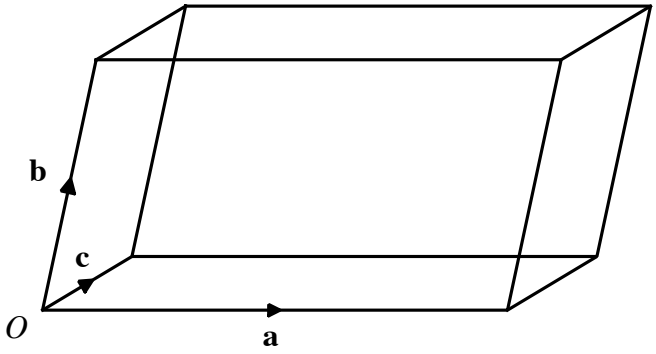

Figure 1

(b) Find the values of k such that the volume of P is 10. **(4)**

Question 3 continued

TOTAL 7 MARKS

4

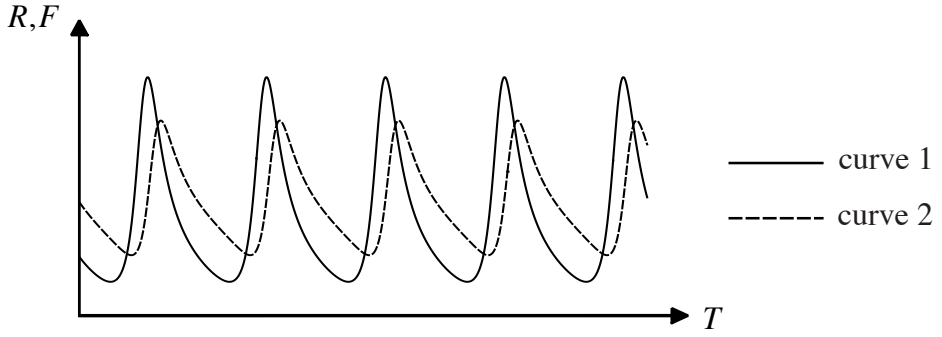

Figure 2

A biologist is studying the population dynamics of rabbits and foxes living in the same habitat. Figure 2 above shows the size of the population for each species, in thousands, over 30 time units according to a model that the biologist is using.

The number of rabbits in the population, in thousands, at time T is R. The number of foxes in the population, in thousands, at time T is F.

The biologist models R and F using the following equations

$$R = \frac{48 + 29\cos(T) - 3\sin(T)}{3 + 2.2\cos(T) + 0.5\sin(T)}$$

$$F = 5 + \frac{40 + 26.3\cos(T) + 11\sin(T)}{3 + 1.5\sin(T) + 1.7\cos(T)}$$

where $0 \leq T \leq 30$.

(a) Using the models and Figure 2, determine which curve corresponds to the rabbits and which curve corresponds to the foxes. Justify your answer. **(2)**

Using the substitution $t = \tan\left(\frac{T}{2}\right)$,

(b) prove that the equation for the population of the rabbits can be written as

$$R = \frac{19t^2 - 6t + 77}{0.8t^2 + t + 5.2}$$ **(3)**

(c) Find the third time in the biologist's model where the number of rabbits in the population is 25 000. **(5)**

The equation for the population of the foxes can be similarly written as

$$F = 5 + \frac{13.7t^2 + 22t + 66.3}{1.3t^2 + 3t + 4.2}$$

The number of foxes in the population is never 23 000 or more.

(d) Show that this is not true in the biologist's model. **(3)**

Question 4 continued

Question 4 continued

Question 4 continued

TOTAL 13 MARKS

5 The rectangular hyperbola R has the equation $xy = 25$.

The tangent to R at the point $P(5t, 5t^{-1})$ is the line T_1.

(a) Show that the equation of the line T_1 can be given by

$$t^2y + x = 10t$$

(4)

The point $Q(5s, 5s^{-1})$ also lies on R, where $t \neq s$.

The tangent to R at Q is the line T_2.

(b) Write down an equation for the line T_2. **(1)**

(c) Find the coordinates of intersection of the lines T_1 and T_2.
Give your answer in its simplest form. **(4)**

Question 5 continued

END OF SECTION **TOTAL 9 MARKS**

TOTAL FOR SECTION IS 40 MARKS