

Edexcel Maths C3

Topic Questions from Papers

Exponentials & Logarithms

Given that there were 300 orchids when the study started,

- (d) Hence show that the population cannot exceed 2800. (2)

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Question 7 continued

Lined area for writing the answer to Question 7.

Q7

(Total 10 marks)

TOTAL FOR PAPER: 75 MARKS

END





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Question 8 continued

Handwriting practice lines for Question 8 continued.

Q8

(Total 7 marks)

TOTAL FOR PAPER: 75 MARKS

END



where R is the number of atoms at time t years and c is a positive constant.

- (a) Find the number of atoms when the substance started to decay.

(1)

It takes 5730 years for half of the substance to decay.

- (b) Find the value of c to 3 significant figures.

(4)

- (c) Calculate the number of atoms that will be left when $t = 22\,920$.

(2)

- (d) In the space provided on page 13, sketch the graph of R against t .

(2)

4. (i) Differentiate with respect to x

$$(a) \quad x^2 \cos 3x \quad (3)$$

$$(b) \quad \frac{\ln(x^2+1)}{x^2+1} \tag{4}$$

(ii) A curve C has the equation

$$y = \sqrt[3]{4x+1}, \quad x > -\frac{1}{4}, \quad y > 0$$

The point P on the curve has x-coordinate 2. Find an equation of the tangent to C at P in the form $ax+by+c=0$, where a , b and c are integers.

(6)



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6.

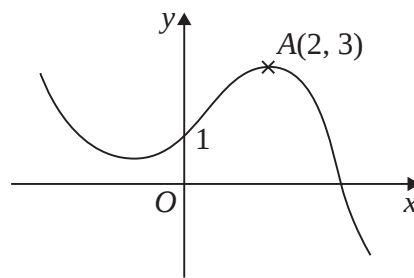
**Figure 1**

Figure 1 shows a sketch of the graph of $y = f(x)$.

The graph intersects the y -axis at the point $(0, 1)$ and the point $A(2, 3)$ is the maximum turning point.

Sketch, on separate axes, the graphs of

- (i) $y = f(-x) + 1$,
- (ii) $y = f(x + 2) + 3$,
- (iii) $y = 2f(2x)$.

On each sketch, show the coordinates of the point at which your graph intersects the y -axis and the coordinates of the point to which A is transformed.

(9)

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Question 9 continued

Handwriting practice area with horizontal lines.

Q9

(Total 15 marks)

TOTAL FOR PAPER: 75 MARKS

END



where A and k are positive constants.

Given that the initial temperature of the tea was 90°C ,

- (a) find the value of A .

(2)

The tea takes 5 minutes to decrease in temperature from 90°C to 55°C.

- (b) Show that $k = \frac{1}{5} \ln 2$.

(3)

- (c) Find the rate at which the temperature of the tea is decreasing at the instant when $t = 10$. Give your answer, in $^{\circ}\text{C}$ per minute, to 3 decimal places.

(3)

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Question 4 continued

Lined area for writing the answer to Question 4.



5.

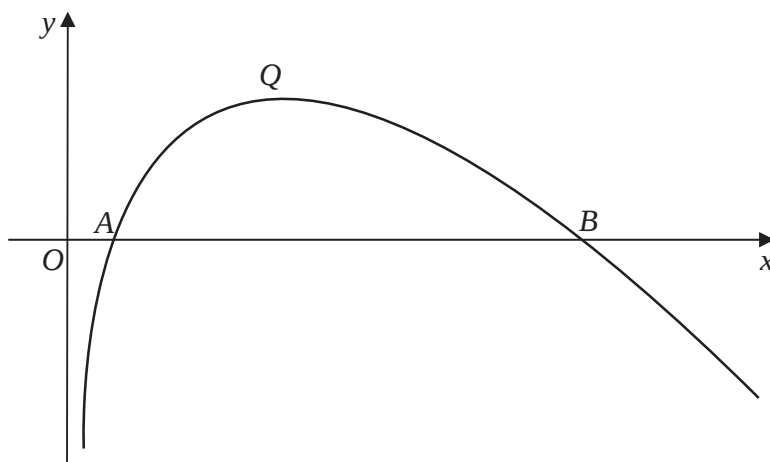


Figure 1

Figure 1 shows a sketch of part of the curve with equation $y = f(x)$, where

$$f(x) = (8 - x) \ln x, \quad x > 0$$

The curve cuts the x -axis at the points A and B and has a maximum turning point at Q , as shown in Figure 1.

(a) Write down the coordinates of A and the coordinates of B . (2)

(b) Find $f'(x)$. (3)

(c) Show that the x -coordinate of Q lies between 3.5 and 3.6 (2)

(d) Show that the x -coordinate of Q is the solution of

$$x = \frac{8}{1 + \ln x} \quad (3)$$

To find an approximation for the x -coordinate of Q , the iteration formula

$$x_{n+1} = \frac{8}{1 + \ln x_n}$$

is used.

(e) Taking $x_0 = 3.55$, find the values of x_1 , x_2 and x_3 .
Give your answers to 3 decimal places. (3)



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Question 5 continued

Lined area for writing the answer to Question 5.



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8. The value of Bob's car can be calculated from the formula

$$V = 17000e^{-0.25t} + 2000e^{-0.5t} + 500$$

where V is the value of the car in pounds (£) and t is the age in years.

- (a) Find the value of the car when $t = 0$

(1)

- (b) Calculate the exact value of t when $V = 9500$

(4)

- (c) Find the rate at which the value of the car is decreasing at the instant when $t = 8$. Give your answer in pounds per year to the nearest pound.

(4)



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Question 8 continued

Lined area for writing the answer to Question 8.

Q8

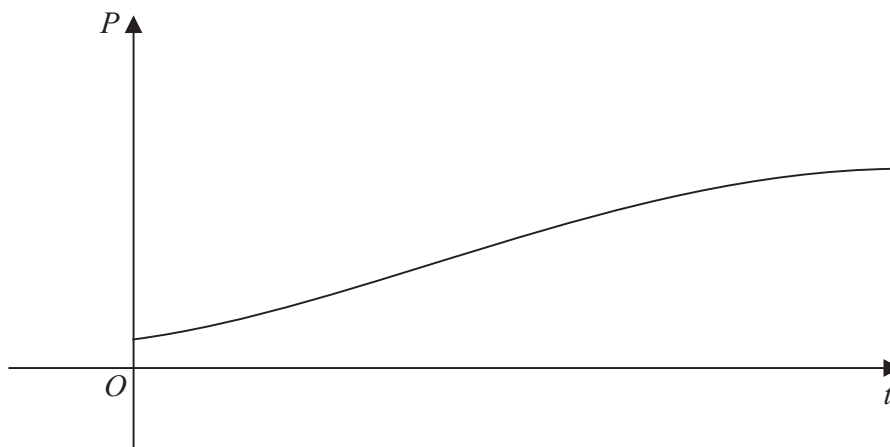
(Total 9 marks)

TOTAL FOR PAPER: 75 MARKS

END



8.

**Figure 3**

The population of a town is being studied. The population P , at time t years from the start of the study, is assumed to be

$$P = \frac{8000}{1 + 7e^{-kt}}, \quad t \geq 0,$$

where k is a positive constant.

The graph of P against t is shown in Figure 3.

Use the given equation to

(a) find the population at the start of the study, (2)

(b) find a value for the expected upper limit of the population. (1)

Given also that the population reaches 2500 at 3 years from the start of the study,

(c) calculate the value of k to 3 decimal places. (5)

Using this value for k ,

(d) find the population at 10 years from the start of the study, giving your answer to 3 significant figures. (2)

(e) Find, using $\frac{dP}{dt}$, the rate at which the population is growing at 10 years from the start of the study. (3)



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Question 8 continued

Lined area for writing the answer to Question 8.

Q8

(Total 13 marks)

TOTAL FOR PAPER: 75 MARKS

END



6. Find algebraically the exact solutions to the equations

(b) $2^x e^{3x+1} = 10$

Give your answer to (b) in the form $\frac{a + \ln b}{c + \ln d}$ where a, b, c and d are integers.

Core Mathematics C3

Candidates sitting C3 may also require those formulae listed under Core Mathematics C1 and C2.

Logarithms and exponentials

$$e^{x \ln a} = a^x$$

Trigonometric identities

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B} \quad (A \pm B \neq (k + \frac{1}{2})\pi)$$

$$\sin A + \sin B = 2 \sin \frac{A+B}{2} \cos \frac{A-B}{2}$$

$$\sin A - \sin B = 2 \cos \frac{A+B}{2} \sin \frac{A-B}{2}$$

$$\cos A + \cos B = 2 \cos \frac{A+B}{2} \cos \frac{A-B}{2}$$

$$\cos A - \cos B = -2 \sin \frac{A+B}{2} \sin \frac{A-B}{2}$$

Differentiation

f(x)	f'(x)
$\tan kx$	$k \sec^2 kx$
$\sec x$	$\sec x \tan x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
$\frac{f(x)}{g(x)}$	$\frac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$

Core Mathematics C2

Candidates sitting C2 may also require those formulae listed under Core Mathematics C1.

Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Binomial series

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1}b + \binom{n}{2} a^{n-2}b^2 + \dots + \binom{n}{r} a^{n-r}b^r + \dots + b^n \quad (n \in \mathbb{N})$$

$$\text{where } \binom{n}{r} = {}^nC_r = \frac{n!}{r!(n-r)!}$$

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{1 \times 2} x^2 + \dots + \frac{n(n-1)\dots(n-r+1)}{1 \times 2 \times \dots \times r} x^r + \dots \quad (|x| < 1, n \in \mathbb{R})$$

Logarithms and exponentials

$$\log_a x = \frac{\log_b x}{\log_b a}$$

Geometric series

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r}$$

$$S_\infty = \frac{a}{1-r} \text{ for } |r| < 1$$

Numerical integration

$$\text{The trapezium rule: } \int_a^b y \, dx \approx \frac{1}{2} h \{(y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1})\}, \text{ where } h = \frac{b-a}{n}$$

Core Mathematics C1

Mensuration

$$\text{Surface area of sphere} = 4\pi r^2$$

$$\text{Area of curved surface of cone} = \pi r \times \text{slant height}$$

Arithmetic series

$$u_n = a + (n - 1)d$$

$$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n[2a + (n - 1)d]$$