

Write your name here

Surname

Other names

Pearson Edexcel
Level 3 GCE

Centre Number

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Candidate Number

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Mathematics

Advanced Subsidiary

Paper 1: Pure Mathematics

Sample Assessment Material for first teaching September 2017

Time: 2 hours

Paper Reference

8MA0/01**You must have:**

Mathematical Formulae and Statistical Tables, calculator

Total Marks

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Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic 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).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** the 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.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 17 questions in this question paper. The total mark for this paper is 100.
- 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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Answer ALL questions. Write your answers in the spaces provided.

1. The line l passes through the points $A(3, 1)$ and $B(4, -2)$.

Find an equation for l .

(3)

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(Total for Question 1 is 3 marks)

3. Given that the point A has position vector $3\mathbf{i} - 7\mathbf{j}$ and the point B has position vector $8\mathbf{i} + 3\mathbf{j}$,

(a) find the vector \overrightarrow{AB} (2)

(b) Find $|\overrightarrow{AB}|$. Give your answer as a simplified surd. (2)

(Total for Question 3 is 4 marks)

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5. Given that

$$f(x) = 2x + 3 + \frac{12}{x^2}, \quad x > 0$$

show that $\int_1^{2\sqrt{2}} f(x) dx = 16 + 3\sqrt{2}$

(5)

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(Total for Question 5 is 5 marks)

6. Prove, from first principles, that the derivative of $3x^2$ is $6x$.

(4)

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(Total for Question 6 is 4 marks)

8.

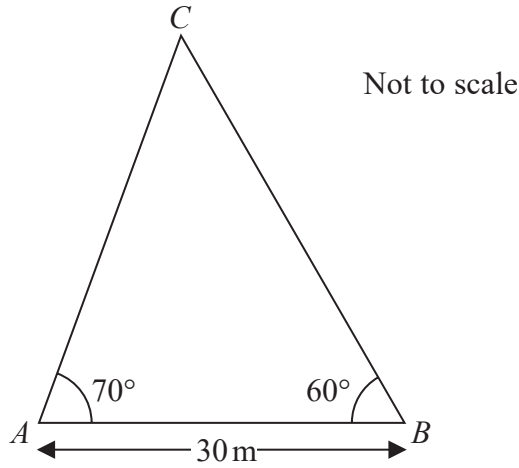


Figure 1

A triangular lawn is modelled by the triangle ABC , shown in Figure 1. The length AB is to be 30 m long.

Given that angle $BAC = 70^\circ$ and angle $ABC = 60^\circ$,

(a) calculate the area of the lawn to 3 significant figures. (4)

(b) Why is your answer unlikely to be accurate to the nearest square metre? (1)

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Question 8 continued

Ruled writing area for the answer to Question 8.

(Total for Question 8 is 5 marks)

9. Solve, for $360^\circ \leq x < 540^\circ$,

$$12 \sin^2 x + 7 \cos x - 13 = 0$$

Give your answers to one decimal place.

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

(5)

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10. The equation $kx^2 + 4kx + 3 = 0$, where k is a constant, has no real roots.

Prove that

$$0 \leq k < \frac{3}{4} \quad (4)$$

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(Total for Question 10 is 4 marks)

11. (a) Prove that for all positive values of x and y

$$\sqrt{xy} \leq \frac{x + y}{2} \quad (2)$$

(b) Prove by counter example that this is not true when x and y are both negative. (1)

(Total for Question 11 is 3 marks)

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12. A student was asked to give the exact solution to the equation

$$2^{2x+4} - 9(2^x) = 0$$

The student's attempt is shown below:

$$2^{2x+4} - 9(2^x) = 0$$

$$2^{2x} + 2^4 - 9(2^x) = 0$$

$$\text{Let } 2^x = y$$

$$y^2 - 9y + 8 = 0$$

$$(y - 8)(y - 1) = 0$$

$$y = 8 \text{ or } y = 1$$

$$\text{So } x = 3 \text{ or } x = 0$$

(a) Identify the two errors made by the student.

(2)

(b) Find the exact solution to the equation.

(2)

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13. (a) Factorise completely $x^3 + 10x^2 + 25x$ (2)

(b) Sketch the curve with equation

$$y = x^3 + 10x^2 + 25x$$

showing the coordinates of the points at which the curve cuts or touches the x -axis. (2)

The point with coordinates $(-3, 0)$ lies on the curve with equation

$$y = (x + a)^3 + 10(x + a)^2 + 25(x + a)$$

where a is a constant.

(c) Find the two possible values of a . (3)

Lined area for student answers.

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Question 13 continued

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(Total for Question 13 is 7 marks)

14.

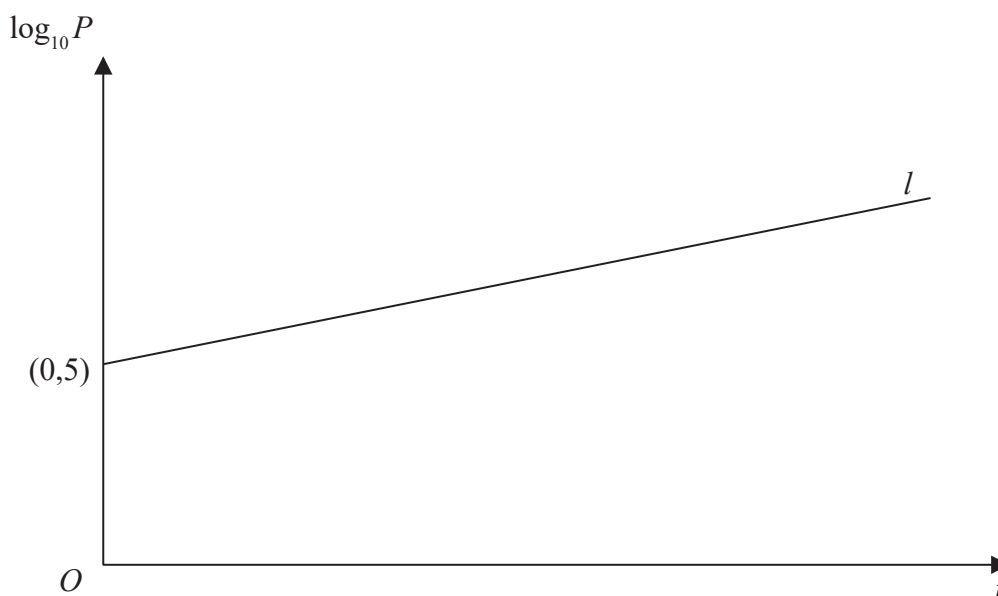


Figure 2

A town's population, P , is modelled by the equation $P = ab^t$, where a and b are constants and t is the number of years since the population was first recorded.

The line l shown in Figure 2 illustrates the linear relationship between t and $\log_{10} P$ for the population over a period of 100 years.

The line l meets the vertical axis at $(0, 5)$ as shown. The gradient of l is $\frac{1}{200}$.

- (a) Write down an equation for l . (2)
- (b) Find the value of a and the value of b . (4)
- (c) With reference to the model interpret
- (i) the value of the constant a ,
 - (ii) the value of the constant b . (2)
- (d) Find
- (i) the population predicted by the model when $t = 100$, giving your answer to the nearest hundred thousand,
 - (ii) the number of years it takes the population to reach 200 000, according to the model. (3)
- (e) State two reasons why this may not be a realistic population model. (2)

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Question 14 continued

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(Total for Question 14 is 13 marks)

15.

Diagram not drawn to scale

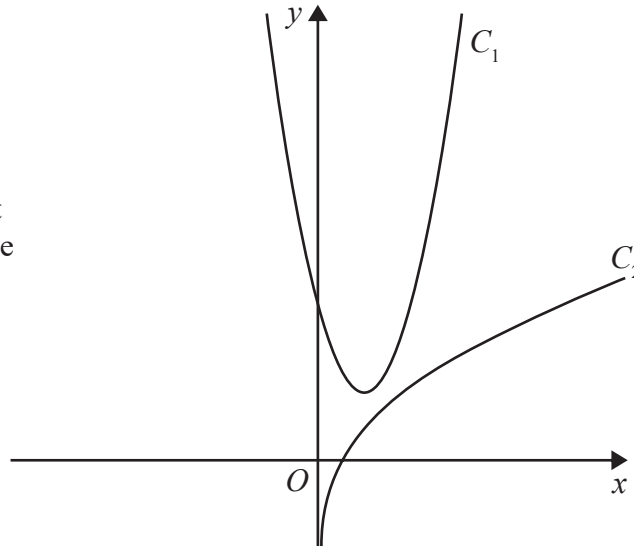


Figure 3

The curve C_1 , shown in Figure 3, has equation $y = 4x^2 - 6x + 4$.

The point $P\left(\frac{1}{2}, 2\right)$ lies on C_1

The curve C_2 , also shown in Figure 3, has equation $y = \frac{1}{2}x + \ln(2x)$.

The normal to C_1 at the point P meets C_2 at the point Q .

Find the exact coordinates of Q .

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

(8)

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16.

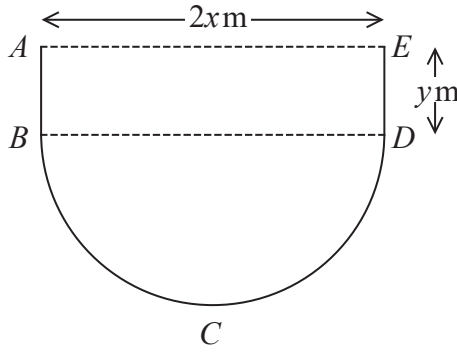


Figure 4

Figure 4 shows the plan view of the design for a swimming pool.

The shape of this pool $ABCDEA$ consists of a rectangular section $ABDE$ joined to a semicircular section BCD as shown in Figure 4.

Given that $AE = 2x$ metres, $ED = y$ metres and the area of the pool is 250 m^2 ,

(a) show that the perimeter, P metres, of the pool is given by

$$P = 2x + \frac{250}{x} + \frac{\pi x}{2} \tag{4}$$

(b) Explain why $0 < x < \sqrt{\frac{500}{\pi}}$ (2)

(c) Find the minimum perimeter of the pool, giving your answer to 3 significant figures. (4)

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17. A circle C with centre at $(-2, 6)$ passes through the point $(10, 11)$.

(a) Show that the circle C also passes through the point $(10, 1)$.

(3)

The tangent to the circle C at the point $(10, 11)$ meets the y axis at the point P and the tangent to the circle C at the point $(10, 1)$ meets the y axis at the point Q .

(b) Show that the distance PQ is 58 explaining your method clearly.

(7)

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