

Write your name here

Surname

Other names

Pearson Edexcel
Level 3 GCE

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

Mathematics

Advanced

Paper 1: Pure Mathematics 1

Wednesday 6 June 2018 – Morning

Time: 2 hours

Paper Reference

9MA0/01

You must have:

Mathematical Formulae and Statistical Tables, calculator

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).
- **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.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 14 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

Turn over ►

P58348A

©2018 Pearson Education Ltd.

1/1/1/1/



Pearson

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

1. Given that θ is small and is measured in radians, use the small angle approximations to find an approximate value of

$$\frac{1 - \cos 4\theta}{2\theta \sin 3\theta}$$

(3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



3.

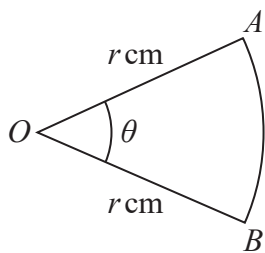


Figure 1

Figure 1 shows a sector AOB of a circle with centre O and radius $r \text{ cm}$.

The angle AOB is θ radians.

The area of the sector AOB is 11 cm^2

Given that the perimeter of the sector is 4 times the length of the arc AB , find the exact value of r .

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



4. The curve with equation $y = 2 \ln(8 - x)$ meets the line $y = x$ at a single point, $x = \alpha$.

(a) Show that $3 < \alpha < 4$

(2)

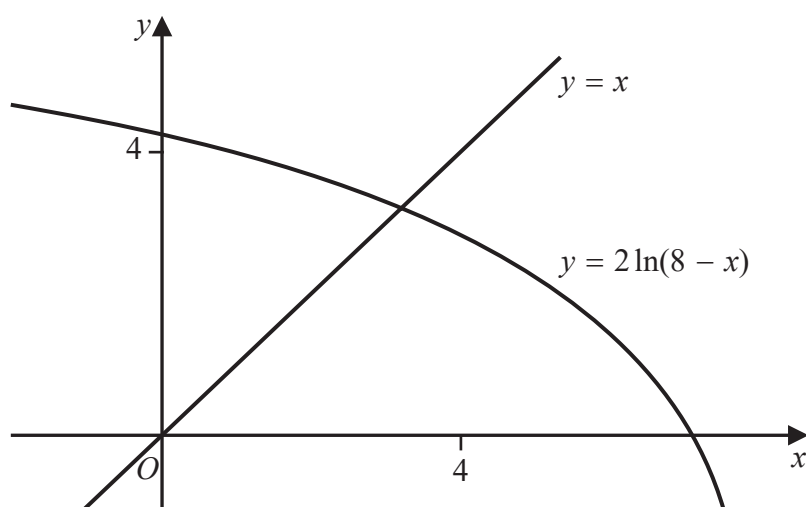


Figure 2

Figure 2 shows the graph of $y = 2 \ln(8 - x)$ and the graph of $y = x$.

A student uses the iteration formula

$$x_{n+1} = 2 \ln(8 - x_n), \quad n \in \mathbb{N}$$

in an attempt to find an approximation for α .

Using the graph and starting with $x_1 = 4$

(b) determine whether or not this iteration formula can be used to find an approximation for α , justifying your answer.

(2)



5. Given that

$$y = \frac{3\sin\theta}{2\sin\theta + 2\cos\theta} \quad -\frac{\pi}{4} < \theta < \frac{3\pi}{4}$$

show that

$$\frac{dy}{d\theta} = \frac{A}{1 + \sin 2\theta} \quad -\frac{\pi}{4} < \theta < \frac{3\pi}{4}$$

where A is a rational constant to be found.

(5)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



6.

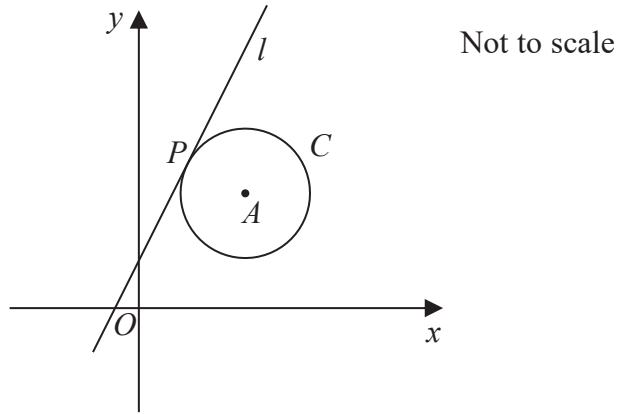


Figure 3

The circle C has centre A with coordinates $(7, 5)$.

The line l , with equation $y = 2x + 1$, is the tangent to C at the point P , as shown in Figure 3.

(a) Show that an equation of the line PA is $2y + x = 17$ (3)

(b) Find an equation for C . (4)

The line with equation $y = 2x + k$, $k \neq 1$ is also a tangent to C .

(c) Find the value of the constant k . (3)



7. Given that $k \in \mathbb{Z}^+$

(a) show that $\int_k^{3k} \frac{2}{(3x - k)} dx$ is independent of k , (4)

(b) show that $\int_k^{2k} \frac{2}{(2x - k)^2} dx$ is inversely proportional to k . (3)



Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



9.

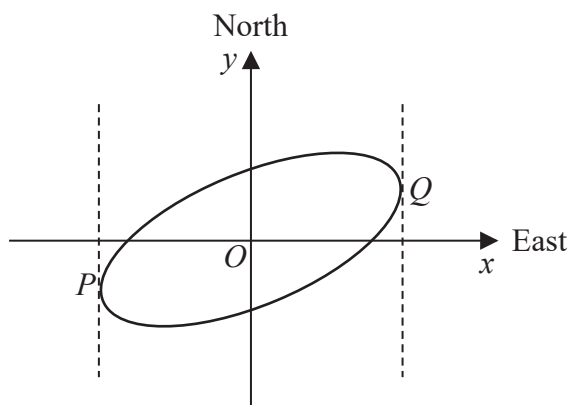


Figure 4

Figure 4 shows a sketch of the curve with equation $x^2 - 2xy + 3y^2 = 50$

(a) Show that $\frac{dy}{dx} = \frac{y-x}{3y-x}$ (4)

The curve is used to model the shape of a cycle track with both x and y measured in km.

The points P and Q represent points that are furthest west and furthest east of the origin O , as shown in Figure 4.

Using part (a),

(b) find the exact coordinates of the point P . (5)

(c) Explain briefly how to find the coordinates of the point that is furthest north of the origin O . (You **do not** need to carry out this calculation). (1)



Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Lined writing area for the answer to Question 9.



Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 9 is 10 marks)



P 5 8 3 4 8 A 0 2 5 4 4

10. The height above ground, H metres, of a passenger on a roller coaster can be modelled by the differential equation

$$\frac{dH}{dt} = \frac{H \cos(0.25t)}{40}$$

where t is the time, in seconds, from the start of the ride.

Given that the passenger is 5 m above the ground at the start of the ride,

(a) show that $H = 5e^{0.1 \sin(0.25t)}$ (5)

(b) State the maximum height of the passenger above the ground. (1)

The passenger reaches the maximum height, for the second time, T seconds after the start of the ride.

(c) Find the value of T . (2)



Question 10 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 10 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Multiple horizontal lines for writing.

(Total for Question 10 is 8 marks)



P 5 8 3 4 8 A 0 2 9 4 4

11. (a) Use binomial expansions to show that $\sqrt{\frac{1+4x}{1-x}} \approx 1 + \frac{5}{2}x - \frac{5}{8}x^2$ (6)

A student substitutes $x = \frac{1}{2}$ into both sides of the approximation shown in part (a) in an attempt to find an approximation to $\sqrt{6}$

(b) Give a reason why the student **should not** use $x = \frac{1}{2}$ (1)

(c) Substitute $x = \frac{1}{11}$ into

$$\sqrt{\frac{1+4x}{1-x}} = 1 + \frac{5}{2}x - \frac{5}{8}x^2$$

to obtain an approximation to $\sqrt{6}$. Give your answer as a fraction in its simplest form. (3)



Question 11 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 11 is 10 marks)



P 5 8 3 4 8 A 0 3 3 4 4

13. Show that

$$\int_0^2 2x\sqrt{x+2} \, dx = \frac{32}{15}(2 + \sqrt{2})$$

(7)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



