

Please check the examination details below before entering your candidate information

Candidate surname

Other names

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

Centre Number

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Candidate Number

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**Wednesday 22 January 2020**

Morning (Time: 1 hour 30 minutes)

Paper Reference **WMA13/01**

**Mathematics**

**International Advanced Level**

**Pure Mathematics P3**

**You must have:**

Mathematical Formulae and Statistical Tables (Lilac), calculator

Total Marks

**Candidates may use any calculator permitted by Pearson regulations. 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.
- Inexact answers should be given to three significant figures unless otherwise stated.

### Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 9 questions in this question paper. 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.
- 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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Question 2 continued

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Q2

(Total 8 marks)







Question 3 continued

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Lined area for writing the answer to Question 3.

(Total 5 marks)

Q3



















Question 5 continued

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Lined area for writing the answer to Question 5.

(Total 8 marks)

Q5



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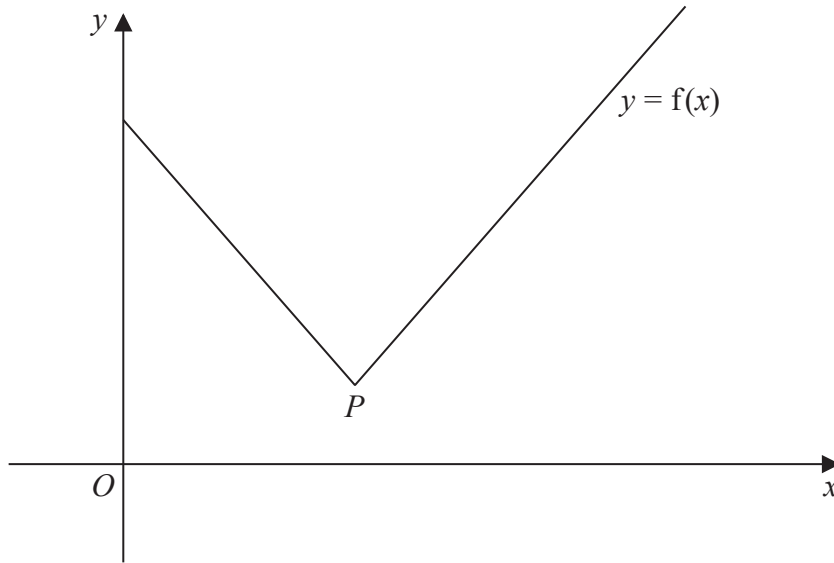


Figure 2

Figure 2 shows part of the graph with equation  $y = f(x)$ , where

$$f(x) = 2|2x - 5| + 3 \quad x \geq 0$$

The vertex of the graph is at point  $P$  as shown.

(a) State the coordinates of  $P$ . (2)

(b) Solve the equation  $f(x) = 3x - 2$  (4)

Given that the equation

$$f(x) = kx + 2$$

where  $k$  is a constant, has exactly two roots,

(c) find the range of values of  $k$ . (3)

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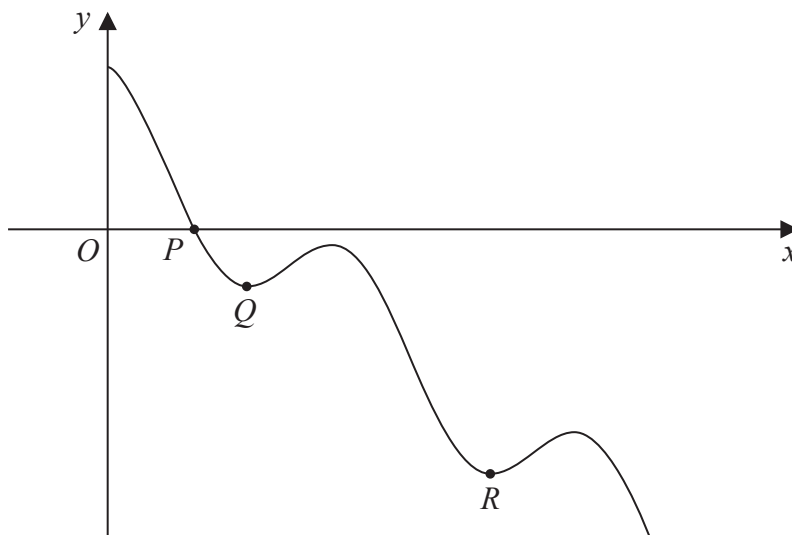


Figure 3

Figure 3 shows a sketch of part of the curve with equation

$$y = 2 \cos 3x - 3x + 4 \quad x > 0$$

where  $x$  is measured in radians.

The curve crosses the  $x$ -axis at the point  $P$ , as shown in Figure 3.

Given that the  $x$  coordinate of  $P$  is  $\alpha$ ,

- (a) show that  $\alpha$  lies between 0.8 and 0.9 (2)

The iteration formula

$$x_{n+1} = \frac{1}{3} \arccos(1.5x_n - 2)$$

can be used to find an approximate value for  $\alpha$ .

- (b) Using this iteration formula with  $x_1 = 0.8$  find, to 4 decimal places, the value of
- (i)  $x_2$
- (ii)  $x_5$  (3)

The point  $Q$  and the point  $R$  are local minimum points on the curve, as shown in Figure 3.

Given that the  $x$  coordinates of  $Q$  and  $R$  are  $\beta$  and  $\lambda$  respectively, and that they are the two smallest values of  $x$  at which local minima occur,

- (c) find, using calculus, the exact value of  $\beta$  and the exact value of  $\lambda$ . (6)

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