

Please check the examination details below before entering your candidate information

Candidate surname					Other names									
<b>Pearson Edexcel</b>					Centre Number					Candidate Number				
<b>International GCSE</b>					<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>					<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>				
<b>Friday 11 January 2019</b>														
Morning (Time: 2 hours)							Paper Reference <b>4PM0/01</b>							
<b>Further Pure Mathematics</b>														
<b>Paper 1</b>														
Calculators may be used.												Total Marks		

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*

### Information

- 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.
- Check your answers if you have time at the end.

Turn over ►

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Pearson

Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

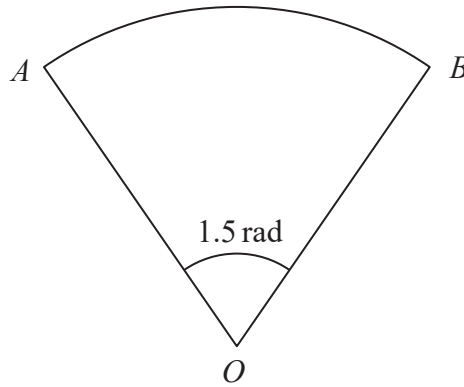


Diagram NOT  
accurately drawn

Figure 1

Figure 1 shows a sector  $OAB$  of a circle, centre  $O$ .

The area of the sector is  $27 \text{ cm}^2$

The size of angle  $AOB$  is 1.5 radians.

Find the perimeter of the sector.

(4)

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Question 1 continued

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(Total for Question 1 is 4 marks)



2 The sum of the first  $n$  terms of an arithmetic series is  $S_n$

$$\text{Given that } S_n = \sum_{r=1}^n (4r + 1)$$

(a) show that  $S_n = n(3 + 2n)$

(4)

The  $r$ th term of this arithmetic series is  $t_r$

$$\text{Given that } S_{n+3} = S_n + 3t_{15}$$

(b) find the value of  $n$ .

(4)

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Question 2 continued

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Question 2 continued

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(Total for Question 2 is 8 marks)



3

$$f(x) = (2x + 1)(x^2 + 5x - 3)$$

(a) Show that  $f(x) = 2x^3 + 11x^2 - x - 3$  (2)

(b) Hence use algebra to solve the equation  $2x^3 + 11x^2 - x - 3 = 0$

Give your roots to 3 decimal places where appropriate. (3)

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Question 3 continued

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(Total for Question 3 is 5 marks)



4

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

$$\tan A = \frac{\sin A}{\cos A}$$

(a) Show that the equation  $a \sin(x - 30)^\circ = b \sin(x + 30)^\circ$

can be written in the form  $\tan x^\circ = \frac{a + b}{\sqrt{3}(a - b)}$  (5)

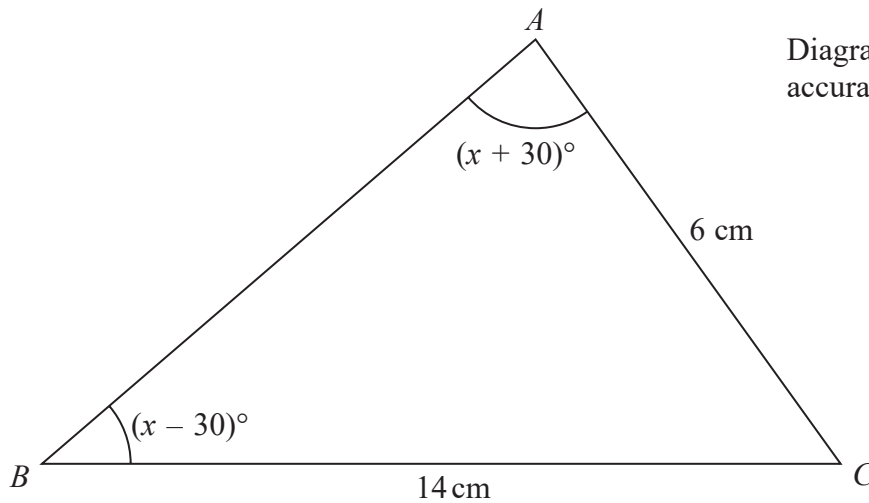


Diagram **NOT**  
accurately drawn

**Figure 2**

In triangle  $ABC$ ,  $AC = 6$  cm,  $BC = 14$  cm,  $\angle ABC = (x - 30)^\circ$  and  $\angle BAC = (x + 30)^\circ$  as shown in Figure 2.

(b) Find, in degrees to 1 decimal place, the size of  $\angle ACB$ . (4)

(c) Find, to 3 significant figures, the area of triangle  $ABC$ . (2)

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Question 4 continued

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Question 4 continued

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Question 4 continued

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(Total for Question 4 is 11 marks)



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5

$$f(x) = 2x^2 + 7x - 4$$

Given that  $f(x)$  can be written in the form  $A(x + B)^2 + C$

(a) find the value of  $A$ , the value of  $B$  and the value of  $C$ . (3)

(b) Write down

(i) the minimum value of  $f(x)$ ,

(ii) the value of  $x$  at which this minimum occurs. (2)

The equation  $f(x) = px - 6$  has unequal real roots.

(c) Find the set of possible values of  $p$ . (5)

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Question 5 continued

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Question 5 continued

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Question 5 continued

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(Total for Question 5 is 10 marks)



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6 Given that  $y = x^2\sqrt{(2x - 3)}$

(a) show that  $\frac{dy}{dx} = \frac{x(5x - 6)}{\sqrt{(2x - 3)}}$  (4)

(b) find the value of  $\frac{dy}{dx}$  when  $x = 2$  (1)

The curve  $C$  has equation  $y = x^2\sqrt{(2x - 3)}$

(c) Find an equation of the normal to  $C$  at the point on  $C$  where  $x = 2$   
Give your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. (5)

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Question 6 continued

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 10 marks)



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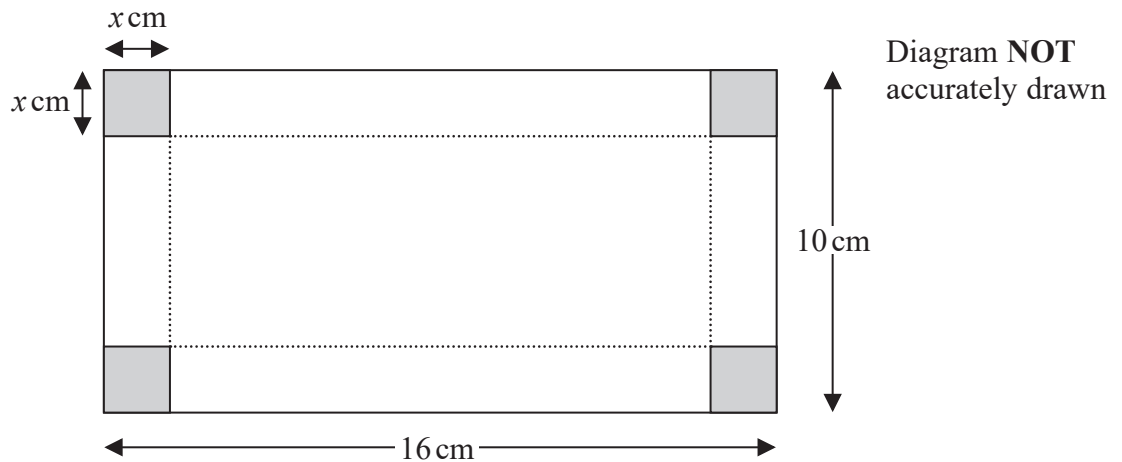


Figure 3

Figure 3 shows a rectangular sheet of metal 10 cm by 16 cm. A square of side  $x$  cm is cut away from each corner of the sheet. The sheet is then folded along the dotted lines to form an open box.

The volume of the box is  $V \text{ cm}^3$

- (a) Show that  $V = 4x^3 - 52x^2 + 160x$  (3)
- (b) Using calculus, find the value of  $x$  for which  $V$  is a maximum, justifying that this value of  $x$  gives a maximum value of  $V$ . (5)
- (c) Find the maximum value of  $V$ . (2)



Question 7 continued

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Question 7 continued

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Question 7 continued

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(Total for Question 7 is 10 marks)



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8 A curve  $C$  has equation  $y = \frac{5x - 3}{2x - 1}$   $x \neq \frac{1}{2}$

(a) Write down an equation of the asymptote to  $C$  that is

- (i) parallel to the  $y$ -axis,
- (ii) parallel to the  $x$ -axis.

(2)

(b) Find the coordinates of the points of intersection of  $C$  with the coordinate axes.

(2)

(c) Using calculus show that at every point on the curve, the gradient of  $C$  is positive.

(4)

(d) Using the axes on the opposite page, sketch  $C$ , showing clearly the asymptotes and the coordinates of the points of intersection of  $C$  with the coordinate axes.

(3)

The line  $l$  is the tangent to  $C$  at the point on the curve where  $x = 1$

(e) Find an equation of  $l$ , giving your answer in the form  $y = mx + c$

(4)

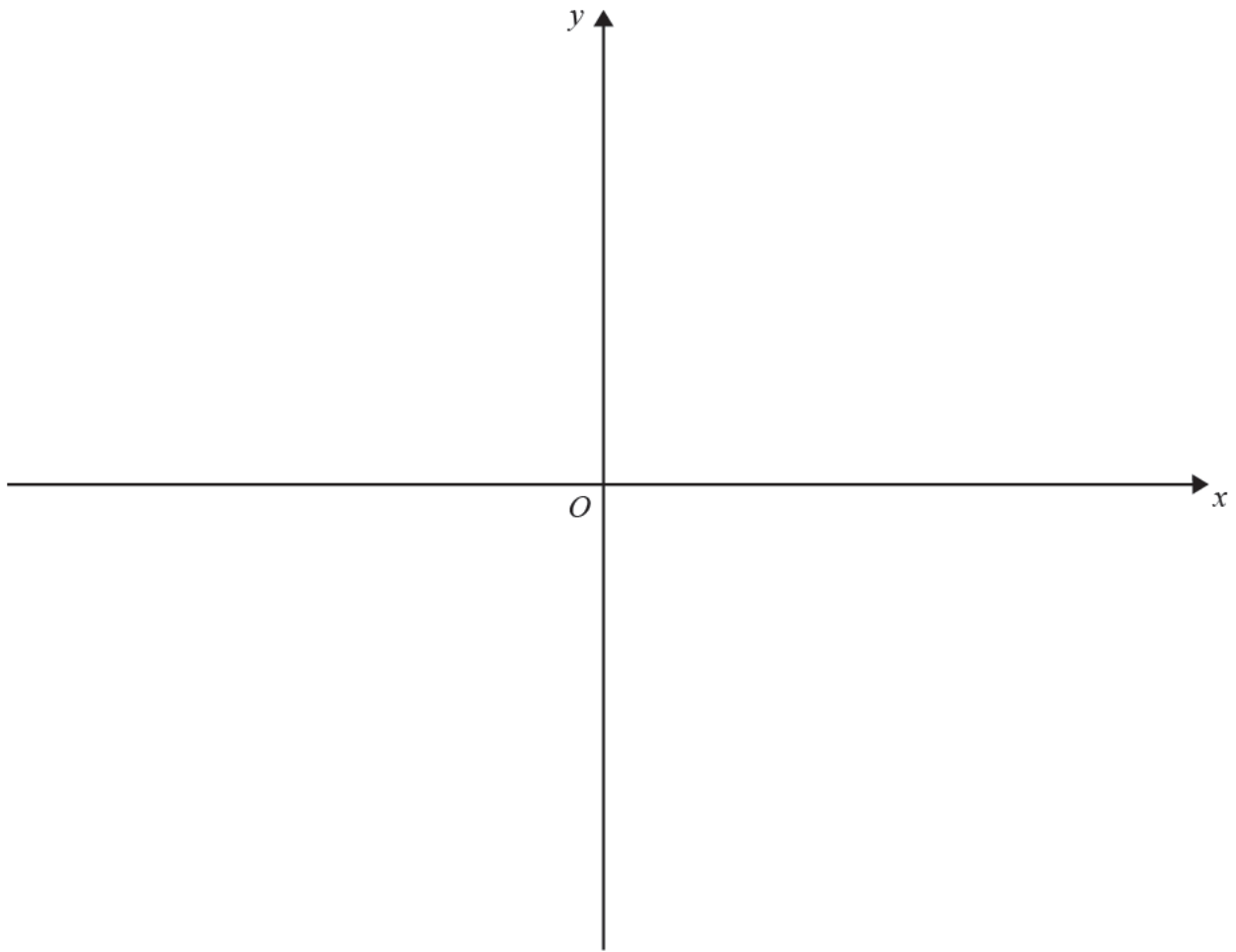
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Question 8 continued



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Question 8 continued

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(Total for Question 8 is 15 marks)



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- 9 The point  $A$  has coordinates  $(-3, -6)$  and the point  $B$  has coordinates  $(5, -2)$

The line  $l$  passes through the point  $A$  and the point  $B$ .

- (a) Find an equation of  $l$ , giving your answer in the form  $y = mx + c$  (3)

The point  $P$  has coordinates  $(k, -2)$ . The line through  $A$  and  $P$  is perpendicular to  $l$ .

- (b) Show that  $k = -5$  (3)

The point  $Q$  has coordinates  $(e, f)$ . The line through  $B$  and  $Q$  is also perpendicular to  $l$ .

Given that the length of  $PQ$  is  $\sqrt{85}$  and that  $f > 0$

- (c) find the coordinates of  $Q$ . (6)

- (d) Calculate the area of quadrilateral  $ABQP$ . (4)

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Question 9 continued

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 16 marks)



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10 (a) Expand  $(1 - 2x)^{\frac{1}{2}}$  in ascending powers of  $x$  up to and including the term in  $x^3$ , simplifying each term as far as possible. (3)

(b) Write down the range of values of  $x$  for which your expansion is valid. (1)

$$f(x) = \frac{2 - x^2}{\sqrt{1 - 2x}}$$

(c) Find the series expansion of  $f(x)$  in ascending powers of  $x$  up to and including the term in  $x^3$ , simplifying each term as far as possible. (3)

The region  $R$  is bounded by the curve with equation  $y = f(x)$ , the positive  $x$ -axis, the positive  $y$ -axis and the line with equation  $x = 0.2$

(d) Using your expansion of  $f(x)$  and algebraic integration, find an estimate for the area of  $R$ , giving your answer to 4 decimal places. (4)

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 11 marks)

TOTAL FOR PAPER IS 100 MARKS

