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- 1. Find the first 3 terms, in ascending powers of  $x$ , of the binomial expansion of

$$(2 - 3x)^5$$

giving each term in its simplest form.

**(4)**

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**Q1**

**(Total 4 marks)**





3.

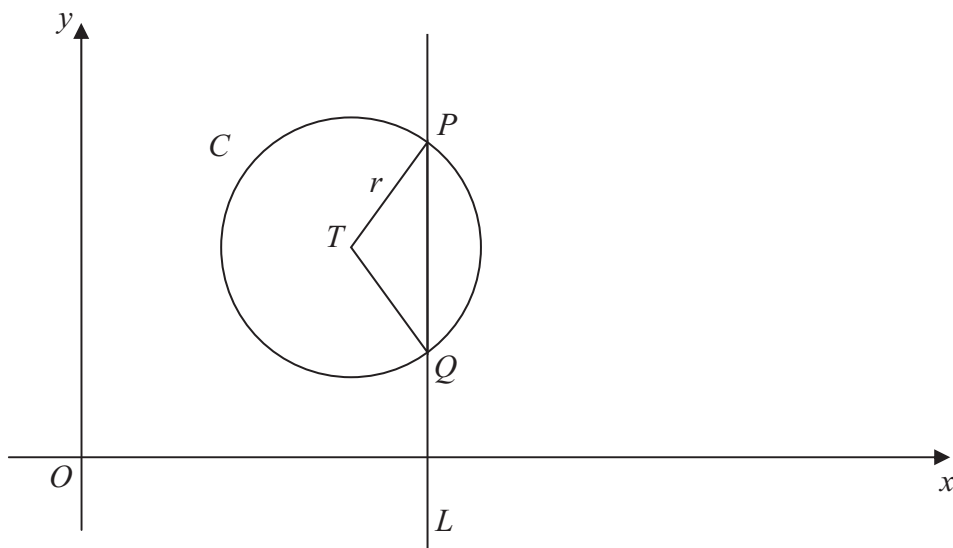


Figure 1

The circle  $C$  with centre  $T$  and radius  $r$  has equation

$$x^2 + y^2 - 20x - 16y + 139 = 0$$

(a) Find the coordinates of the centre of  $C$ . (3)

(b) Show that  $r = 5$  (2)

The line  $L$  has equation  $x = 13$  and crosses  $C$  at the points  $P$  and  $Q$  as shown in Figure 1.

(c) Find the  $y$  coordinate of  $P$  and the  $y$  coordinate of  $Q$ . (3)

Given that, to 3 decimal places, the angle  $PTQ$  is 1.855 radians,

(d) find the perimeter of the sector  $PTQ$ . (3)

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5.

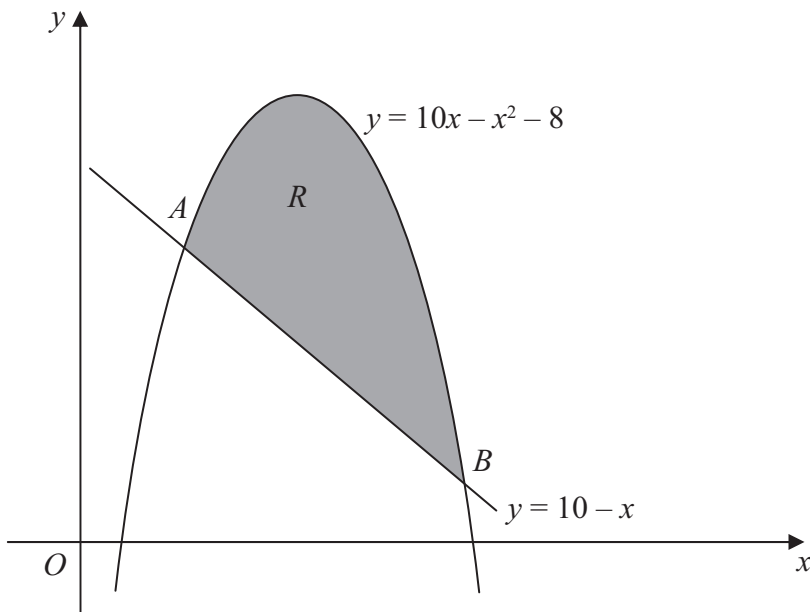


Figure 2

Figure 2 shows the line with equation  $y = 10 - x$  and the curve with equation  $y = 10x - x^2 - 8$

The line and the curve intersect at the points  $A$  and  $B$ , and  $O$  is the origin.

(a) Calculate the coordinates of  $A$  and the coordinates of  $B$ . (5)

The shaded area  $R$  is bounded by the line and the curve, as shown in Figure 2.

(b) Calculate the exact area of  $R$ . (7)

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8.

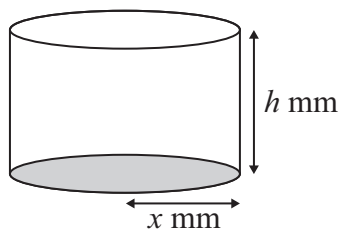


Figure 3

A manufacturer produces pain relieving tablets. Each tablet is in the shape of a solid circular cylinder with base radius  $x \text{ mm}$  and height  $h \text{ mm}$ , as shown in Figure 3.

Given that the volume of each tablet has to be  $60 \text{ mm}^3$ ,

(a) express  $h$  in terms of  $x$ , (1)

(b) show that the surface area,  $A \text{ mm}^2$ , of a tablet is given by  $A = 2\pi x^2 + \frac{120}{x}$  (3)

The manufacturer needs to minimise the surface area  $A \text{ mm}^2$ , of a tablet.

(c) Use calculus to find the value of  $x$  for which  $A$  is a minimum. (5)

(d) Calculate the minimum value of  $A$ , giving your answer to the nearest integer. (2)

(e) Show that this value of  $A$  is a minimum. (2)

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**Question 9 continued**

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**Q9**

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**(Total 11 marks)**

**TOTAL FOR PAPER: 75 MARKS**

**END**

