

**10** A curve  $C$  has equation

$$y = \frac{7x - 2}{2x - 3} \quad x \neq \frac{3}{2}$$

- (a) Write down an equation of the asymptote to  $C$  that is
- (i) parallel to the  $y$ -axis,
  - (ii) parallel to the  $x$ -axis.
- (b) Find the coordinates of the points of intersection of  $C$  with the coordinate axes.
- (c) Using calculus, show that at every point on the curve, the gradient of  $C$  is negative.
- (d) Using the axes on the opposite page, sketch  $C$ .  
Show clearly and label with their equation any asymptotes and the coordinates of the points of intersection of  $C$  with the coordinate axes.

The straight line  $l$  is the normal to  $C$  at the point  $A$ .  
The  $x$  coordinate of  $A$  is positive and the gradient of  $l$  is 17  
The line  $l$  also intersects  $C$  at the point  $B$ .

- (e) Find the exact coordinates of  $B$ . (7)

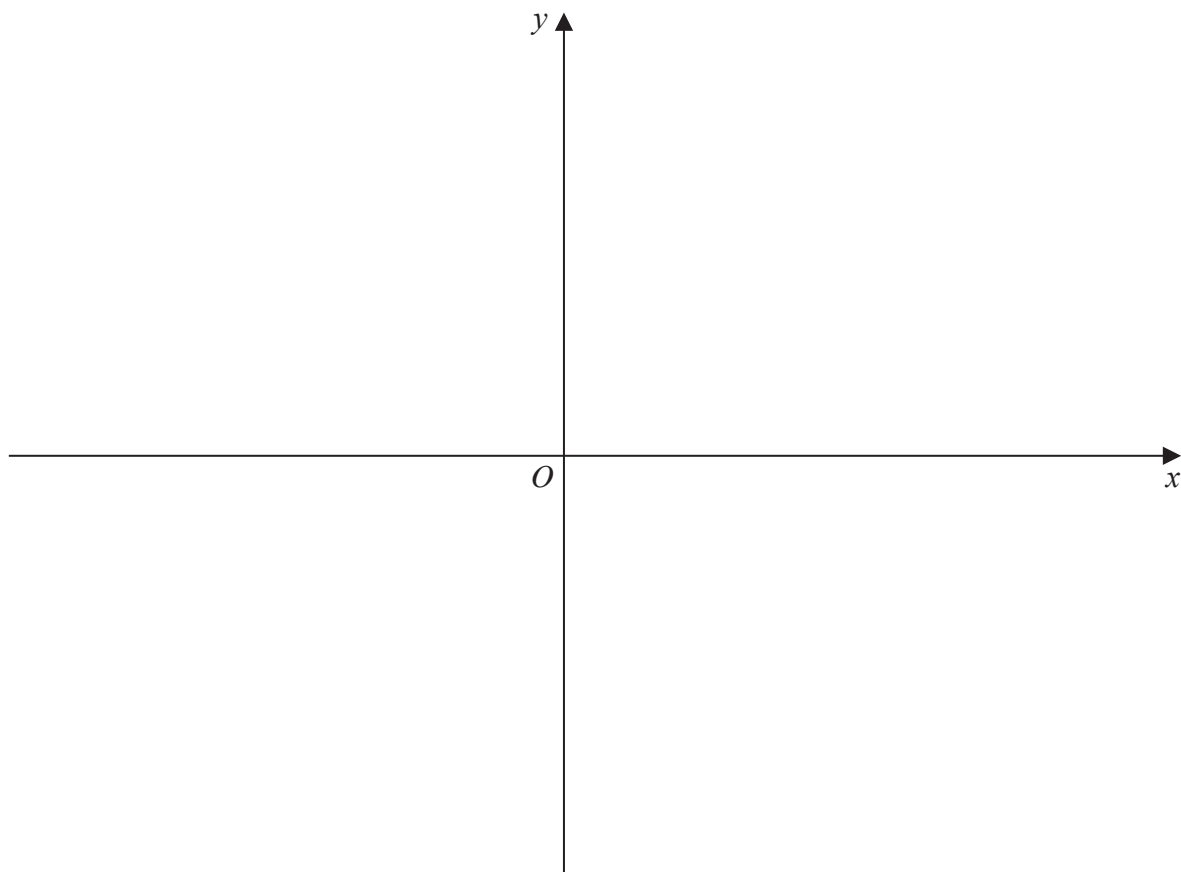
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## Question 10 continued



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**Question 10 continued**

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11

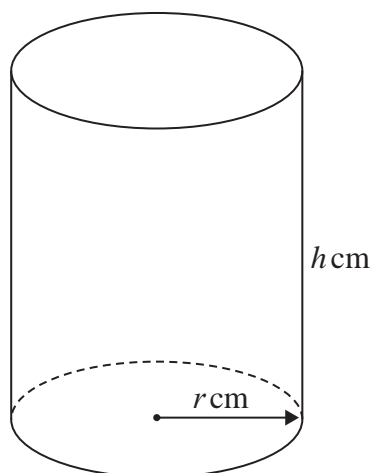
Diagram **NOT**  
accurately drawn**Figure 3**

Figure 3 shows a solid metal right circular cylinder of radius  $r$  cm and height  $h$  cm.

The total surface area of the cylinder is  $600\text{ cm}^2$

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

- (a) Show that  $V = 300r - \pi r^3$  (4)

Given that  $r$  can vary,

- (b) (i) use calculus to show that the exact value of  $r$  for which  $V$  is a maximum is

$$r = \sqrt{\frac{100}{\pi}}$$

- (ii) justify that this value of  $r$  gives a maximum value of  $V$  (5)

The cylinder is melted down and reformed into a sphere of radius  $p$  cm.

- (c) Find, to one decimal place, the greatest possible value of  $p$  (3)

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**(Total for Question 11 is 12 marks)****TOTAL FOR PAPER IS 100 MARKS**