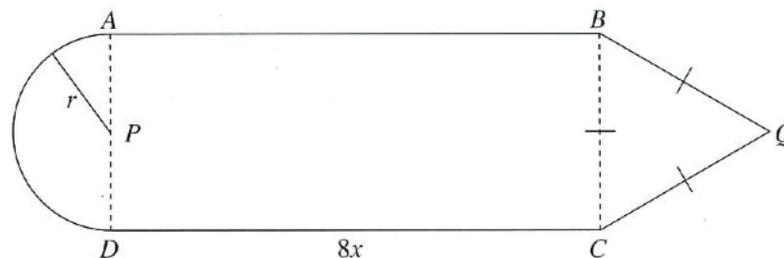


- 1 Find the coordinates of the turning points on the curve $y = 3x^2 - \frac{1}{x} - 7x + 3$. Determine whether the turning points are maximum or minimum points.

- 2 A piece of wire 24 cm long is cut into two pieces where one is bent to form a square of side x cm and the other to form a circle of radius r cm.
 - (a) Express r in terms of x .
 - (b) Determine the value of x for which the sum of the areas of the square and the circle is a minimum.

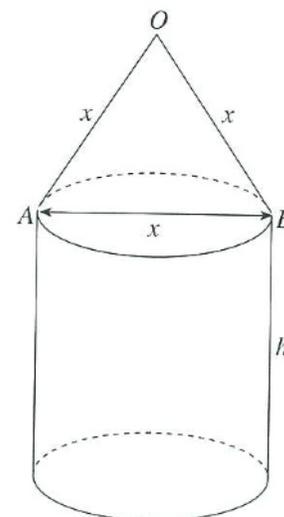
- 3 The diagram shows a piece of wire of length 560 cm, bent into a rectangle $ABCD$ with a semicircle at one end and an equilateral triangle at the other. The radius of the circle is r and the length of the rectangle is $8x$.
 - (a) Express x in terms of r and hence, show that the area, A , of the enclosed region is given by $A = 560r + \left(\sqrt{3} - 4 - \frac{\pi}{2}\right)r^2$.
 - (b) Find the value of r that give a stationary value of A . Determine whether it is a maximum or a minimum.



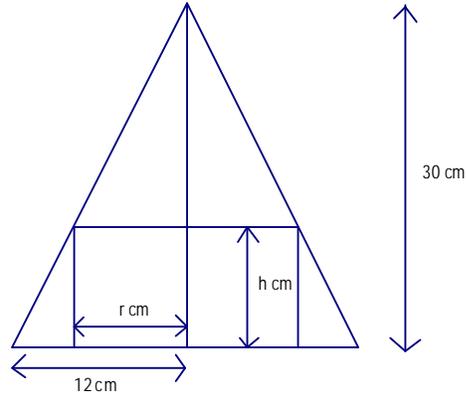
- 4 A solid wooden toy is made up of a right circular cone fixed to a right circular cylinder of diameter x cm and height h cm as shown in the diagram. Given that the slant height of the cone is x cm and the volume of the toy is $60\pi \text{ cm}^3$, express h in terms of x and show that the total surface area of

the toy, A , is given by $A = \pi x^2 \left(\frac{3}{4} - \frac{\sqrt{3}}{6} \right) + \frac{240\pi}{x}$.

Hence, find the value of x for which A has a stationary value and determine whether this value of A is a maximum or a minimum.



- 5 The diagram shows the cross-section of a hollow cone of height 30 cm and base radius 12 cm and a solid cylinder of radius r cm and height h cm. Both stand on a horizontal surface with the cylinder inside the cone. The upper circular edge of the cylinder is in contact with the cone.



- (i) Express h in terms of r and hence show that the volume, $V \text{ cm}^3$, of the cylinder is given by

$$V = \pi(30r^2 - \frac{5}{2}r^3)$$

Given that r can vary,

- (ii) find the volume of the largest cylinder which can stand inside the cone and show that, in this case, the cylinder occupies $\frac{4}{9}$ of the volume of the cone.

- 6 Two quantities x and y , both positive, are connected by the relation $x + y = 10$. Find the maximum and minimum values of x^3y^2 .