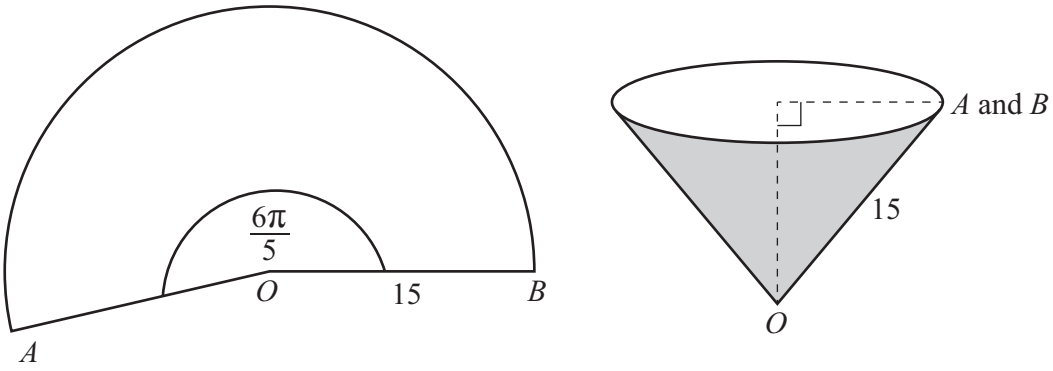
9 In this question, all lengths are in centimetres and all angles are in radians.



The diagram shows a sector AOB of a circle, centre O, radius 15.
Angle $AOB = \frac{6\pi}{5}$.
The sector is made into a cone with points A and B touching, as shown.

(a) Find the curved surface area of the cone. [2]

The top of the cone is a horizontal circle.

(b) Find the circumference of the circular top. [2]

(c) Hence find the radius of the circular top and the perpendicular height of the cone. [2]

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(d) Water is poured into the cone.
When the depth of the water in the cone is h, the radius of the circular top of the water is r.

(i) Find an expression for r in terms of h. [1]

(ii) The water is poured into the cone at a constant rate of $27\,\text{cm}^3$ per second.

Find the rate at which the depth of the water is rising when the depth of the water is 4. [5]

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10 A particle P moves in a straight line.
t seconds after passing a fixed point, O, the acceleration of P, $a\,\text{ms}^{-2}$, is given by

$$a = t^2 - 2 \qquad \text{for } 0 \leqslant t \leqslant 4$$
$$a = 19 - 5\text{e}^{8-2t} \qquad \text{for } 4 \leqslant t \leqslant 10.$$

When $t = 3$, the velocity of P is $-\frac{1}{3}\text{ms}^{-1}$ and its displacement from O is $-\frac{1}{4}\text{m}$.

(a) (i) Find the velocity of P when $t = 4$. [3]

(ii) Find the displacement of P from O when $t = 4$. [3]

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