Example 1.3

Suppose a mug has the shape of a cylinder, and is being filled with water. At a particular point in time, the height of the water is rising at a rate of 1cm per second. If the circumference of the mug is 6π cm, what is the rate of increase of (the volume of) water in the mug?

$V = \pi r^2 h$. Circumference $= 2\pi r = 6\pi \implies r = 3 \implies V = 9\pi h$.

$$\frac{dV}{dt} = 9\pi \frac{dh}{dt} = 9\pi(1) = 9\pi \text{ (cubic cemtimetres per second)}$$