Related Rates of Change

Tips for success on these type of questions

You often need to interpret a word problem. Write down what you know and what you are expected to find:

The sides of a cube are increasing at 0.5 cms^{-1} $\frac{dx}{dt} = 0.5$

When the sides of the cube are 5cm, what is the rate at which the **surface area** is increasing?

$\frac{dA}{dt} = ?$

The radius of a cone is 6cm. The radius is increasing at 0.5 cms^{-1} $\frac{dr}{dt} = 0.5$

The height of the same cone is 5cm. The height is increasing at a rate of 1cms^{-1} $\frac{dh}{dt} = 1$

Find the rate at which the volume of the cone is increasing.

$\frac{dV}{dt} = ?$

Often you are required to set up a formula that connects the variables in the question. Make sure that you set up and use your variables carefully:

length of side $= x$

The sides of a cube are increasing at 0.5 cms^{-1}

When the sides of the cube are 5cm, what is the rate at which the **surface area** is increasing?

$A = 6x^2$

radius = r

The radius of a cone is 6cm. The radius is increasing at 0.5 cms^{-1}

The height of the same cone is 5cm. The height is increasing at a rate of 1cms^{-1}

height = h

Find the rate at which the volume of the cone is increasing.

$V = \frac{1}{3}\pi r^2 h$

Rate of change is usually with respect to **time**. Take your formula and differentiate it with respect to time, ***t***. This will involve implicit differentiation:

$$A = 6x^2$$

$$\frac{dA}{dt} = 12x\frac{dx}{dt}$$

$$V = \frac{1}{3}\pi r^2 h$$

$$\frac{dV}{dt} = \frac{1}{3}\pi\left(r^2\frac{dh}{dt} + h\cdot 2r\frac{dr}{dt}\right)$$

We have to use the product rule here

All you have to do now is input all the information that we know and work out the unknown rate.