2020 MX1 **10** The quantities P, Q and R are connected by the related rates, **1**

$$\frac{dR}{dt} = -k^2 \qquad \frac{dP}{dt} = -l^2 \times \frac{dR}{dt} \qquad \frac{dP}{dt} = m^2 \times \frac{dQ}{dt}$$

where k, l and m are non-zero constants.

Which of the following statements is true?

A P is increasing and Q is increasing

B P is increasing and Q is decreasing

C P is decreasing and Q is increasing

D P is decreasing and Q is decreasing

A

$$\frac{dP}{dt} = -l^2 \times \frac{dR}{dt}$$

$$= -l^2 \times -k^2$$

$$= k^2l^2 > 0$$

$$k^2l^2 = m^2 \times \frac{dQ}{dt}$$

$$\frac{dQ}{dt} = \frac{k^2l^2}{m^2} > 0$$

$\therefore$ P is increasing and Q is increasing.

Alternately, as $\frac{dR}{dt} < 0$, so $\frac{dP}{dt} > 0$, and so P is increasing.

Hence, if $\frac{dP}{dt} > 0$, then $\frac{dQ}{dt} > 0$. This means Q is increasing.

State Mean: **0.75**