

**20** **10** The quantities  $P$ ,  $Q$  and  $R$  are connected by the related rates,

**1**

**MX**  
**1**

$$\frac{dR}{dt} = -k^2$$

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

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

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**

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

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

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

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

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

$\therefore P$  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**

\* These solutions have been provided by [projectmaths](http://projectmaths.com.au) and are not supplied or endorsed by NESA.

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