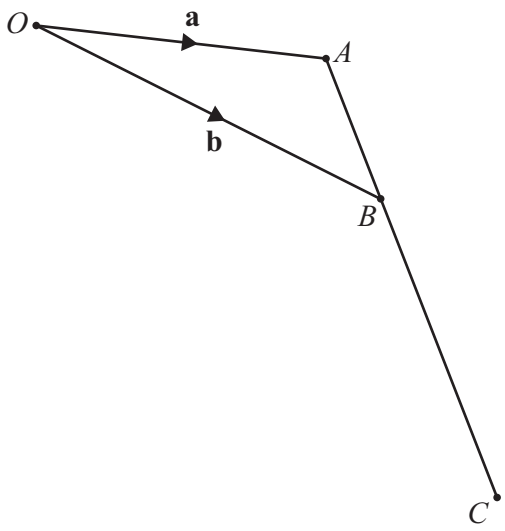
**10**




The diagram shows four points, $O$, $A$, $B$ and $C$.

$A$, $B$ and $C$ lie in a straight line and are such that $\frac{AB}{AC} = \frac{1}{3}$.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

**(a)** Find $\overrightarrow{OC}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.
Simplify your answer. [3]

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**(b)** The line $OA$ is extended to the point $D$ such that $OA : AD = 2 : 7$.
Point $E$ lies on $CD$ such that $\overrightarrow{OE} = \lambda\mathbf{b}$.

Find the value of $\lambda$. [5]

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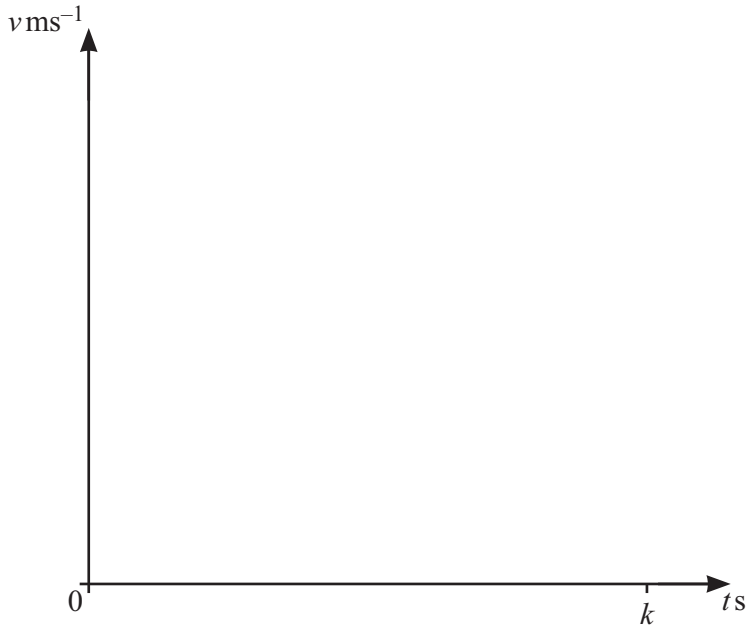
**11** A particle $P$ moves in a straight line and passes through a fixed point $O$.
At time $t$ seconds, its displacement from $O$, $s$ metres, is given by

$$s = t + 6t^2 - t^3 \qquad \text{for } 0 \leqslant t \leqslant 3$$

$$s = 12t - \frac{1}{3}t^2 - 3 \qquad \text{for } 3 \leqslant t \leqslant k \qquad \text{where } k \text{ is a constant.}$$

It is given that, for $3 \leqslant t \leqslant k$, the velocity of $P$ is positive and its acceleration is negative.

**(a)** The maximum velocity of $P$ occurs when $t = 2$.
On the axes below, sketch a velocity–time graph for the first $k$ seconds of the motion of $P$. [4]




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