1. Two cyclists, A and B, are cycling along the same straight horizontal track.

The cyclists are modelled as particles and the motion of the cyclists is modelled as follows:

- At time $t = 0$, cyclist A passes through the point O with speed $2\,\text{m}\,\text{s}^{-1}$
- Cyclist A is moving in a straight line with constant acceleration $2\,\text{m}\,\text{s}^{-2}$
- At time $t = 2$ seconds, cyclist B starts from rest at O
- Cyclist B moves with constant acceleration $6\,\text{m}\,\text{s}^{-2}$ along the same straight line and in the same direction as cyclist A
- At time $t = T$ seconds, B overtakes A at the point X

Using the model,

(a) sketch, on the **same** axes, for the interval from $t = 0$ to $t = T$ seconds,

- a velocity-time graph for the motion of A
- a velocity-time graph for the motion of B

(2)

(b) explain why the two graphs must cross before time $t = T$ seconds,

(1)

(c) find the time when A and B are moving at the same speed,

(2)

(d) find the distance OX

(5)