4. The combined mass of a cyclist and her cycle is 70 kg.

The cyclist travels on a straight horizontal road with constant acceleration $0.4\,\text{m s}^{-2}$

The resistance to the motion is modelled as a constant force of magnitude 30 N.

(a) Using this model, find the rate at which the cyclist is working, at the instant when her speed is $5\,\text{m s}^{-1}$

(4)

The cyclist travels in a straight line **down** a hill from a point A to a point B, where $AB = 250\,\text{m}$

- at the instant she passes A, her speed is $5\,\text{m s}^{-1}$ and she **stops** pedalling
- at the instant she passes B, her speed is $8\,\text{m s}^{-1}$
- the resistance to the motion is modelled as a constant force of magnitude 30 N

(b) Use this model with the work-energy principle to find the change in vertical height from A to B.

(5)

The cyclist travels **up** a hill from a point C to a point D, where $CD = 200\,\text{m}$.

- she travels from C to D with constant speed, $8\,\text{m s}^{-1}$
- she travels in a straight line at 5° to the horizontal
- the resistance to the motion from non-gravitational forces is modelled as a constant force of magnitude 30 N

(c) Use this model to find the total work done by the cyclist as she moves from C to D.

(3)

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Question 4 continued

(Total for Question 4 is 12 marks)