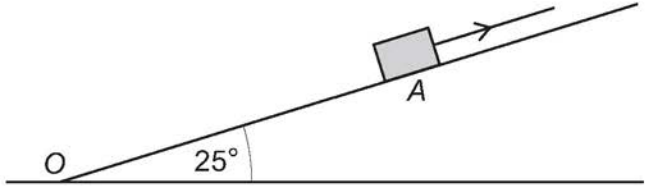
19 **In this question use $g = 9.8\,\text{m s}^{-2}$**

A rough wooden ramp is 10 metres long and is inclined at an angle of 25° above the horizontal. The bottom of the ramp is at the point *O*.

A crate of mass 20 kg is at rest at the point *A* on the ramp.

The crate is pulled up the ramp using a rope attached to the crate.

Once in motion, the rope remains taut and parallel to the line of greatest slope of the ramp.



19 (a) The tension in the rope is 230 N

The crate accelerates up the ramp at $1.2\,\text{m s}^{-2}$

Find the coefficient of friction between the crate and the ramp.

[7 marks]

19 (b) (i) The crate takes 3.8 seconds to reach the top of the ramp.

Find the distance *OA*.

[3 marks]

19 (b) (ii) Other than air resistance, state **one** assumption you have made about the crate in answering part **(b)(i)**.

[1 mark]