Friction – Q1[4 marks] (3/6/21)

Exam Boards

OCR : AL (Year 2)

MEI: AL (Year 2)

AQA: AL (Year 2)

Edx: AL (Year 2)

A sledge with a child onboard is being pulled along on level ground, at a constant speed, by means of a rope inclined at 30° to the horizontal. The sledge and child together have a mass of $100kg$. The coefficient of friction between the sledge and the ground is $\frac{1}{10}$. Assuming that $g = 10$, find the tension in the rope.

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Solution

Let T be the tension, and let R be the normal reaction of the ground on the sledge. Then, applying N2L vertically:

$R + Tsin30° = 100g$ [1 mark]

Applying N2L horizontally, $Tcos30° = \mu R$ [1 mark]

Hence $T\left(\frac{\sqrt{3}}{2}\right) = \frac{1}{10}\left(1000 - \frac{T}{2}\right)$, [1 mark]

so that $T\left(\frac{\sqrt{3}}{2} + \frac{1}{20}\right) = 100$

and $T = 109\ N\ (3sf)$ [1 mark]