

Mechanics II – QUIZ – (5 marks)

Friction - May 9, 2019

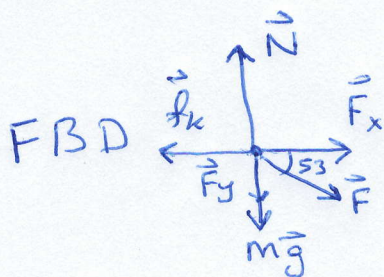
Name: **KEY**

Group A

Question 1

The man pushes/pulls with a force of 200 N. The child and sled has a mass of 30 kg and the coefficient of kinetic friction is 0.1.

- What is the frictional force opposing his efforts?
- What is the acceleration of the child?



$$F_x = F \cos 53$$

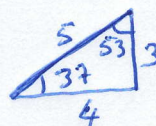
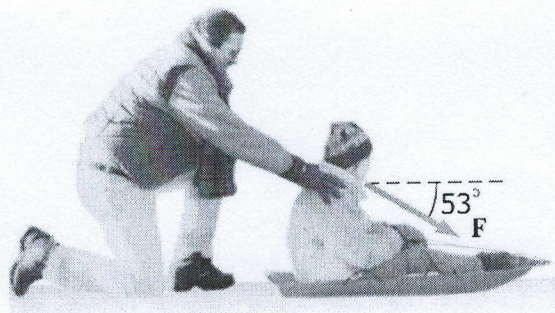
$$= 200 \cdot (0,6)$$

$$= \underline{120 \text{ N}}$$

$$F_y = F \sin 53$$

$$= 200 (0,8)$$

$$= \underline{160 \text{ N}}$$



$$\cos 53 = \frac{3}{5} = 0,6$$

$$\cos 37 = \frac{4}{5} = 0,8$$

$$\sin 53 = \frac{4}{5} = 0,8$$

$$\sin 37 = \frac{3}{5} = 0,6$$

along x direction

$$F_{\text{net}} = m \vec{a}_{\text{net}}$$

$$\vec{F}_x + \vec{f}_k = m \vec{a}_x$$

$$F_x - f_k = m a_x$$

$$120 - 46 = 30 \cdot a_x$$

$$74 = 30 \cdot a_x$$

$$a_x = \frac{74}{30}$$

$$a_x = \underline{2,47 \frac{\text{m}}{\text{s}^2}} \quad \textcircled{b}$$

along y direction

$$\vec{N} + m \vec{g} + \vec{F}_y = 0$$

$$N = mg + F_y$$

$$N = 30 \cdot 10 + 160$$

$$N = 460 \text{ N}$$

$$f_k = \mu N = (0,1) \cdot (460) = 46 \text{ N}$$

$$f_k = \underline{46 \text{ N}} \quad \textcircled{a}$$

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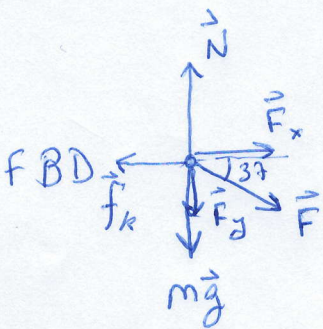
Name: KEY

Group B

Question 1

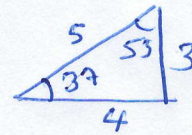
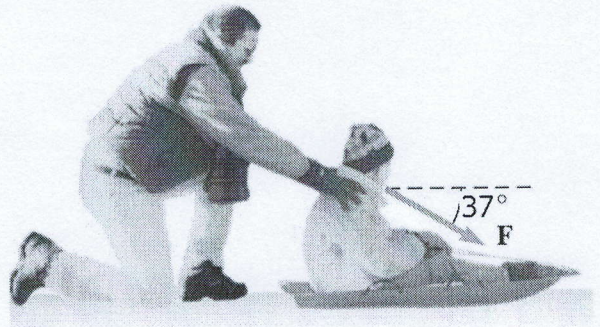
The man pushes/pulls with a force of 200 N. The child and sled has a mass of 30 kg and the coefficient of kinetic friction is 0.2.

- What is the frictional force opposing his efforts?
- What is the acceleration of the child?



$$\begin{aligned} F_x &= F \cos 37^\circ \\ &= 200 \cdot (0.8) \\ &= \underline{160 \text{ N}} \end{aligned}$$

$$\begin{aligned} F_y &= F \sin 37^\circ \\ &= 200 \cdot (0.6) \\ &= \underline{120 \text{ N}} \end{aligned}$$



$$\cos 37^\circ = \frac{4}{5} = 0.8$$

$$\cos 53^\circ = \frac{3}{5} = 0.6$$

$$\sin 37^\circ = \frac{3}{5} = 0.6$$

$$\cos 53^\circ = \frac{4}{5} = 0.8$$

along x direction

$$\vec{F}_{\text{net}} = m \vec{a}_{\text{net}}$$

$$F_x - f_k = m a_x$$

$$160 - 84 = 30 \cdot a_x$$

$$76 = 30 a_x$$

$$a_x = \frac{76}{30}$$

$$\boxed{a_x = 2.53 \frac{\text{m}}{\text{s}^2}} \quad \text{(b)}$$

along y direction

$$\vec{N} - m\vec{g} + \vec{F}_y = 0 \quad N = mg + F_y$$

$$= 30 \cdot 10 + 120$$

$$= 300 + 120$$

$$= 420 \text{ N}$$

$$f_k = \mu N = (0.2)(420) = 84 \text{ N}$$

$$\text{(a)} \quad \boxed{f_k = 84 \text{ N}}$$