Answer on Question #72728 - Physics / Classical Mechanics

A boy pushes a box with a mass of $m = 20$ kg with a force of $F = 150$ N at $\alpha = 45°$ angle towards the bottom of the x axis. Calculate the a) friction force and b) acceleration of the box. The friction coefficient with the floor is $\mu = 0.2$.

Solution:

Let us apply a Newton's second law

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

in projection on the axis

$$ma = F\cos\alpha - F_{\text{frict}}$$

$$0 = -F\sin\alpha + N - mg$$

$$F_{\text{frict}} = \mu N$$

So

$$N = mg + F\sin\alpha$$

$$F_{\text{frict}} = \mu(mg + F\sin\alpha) = 0.2(20 \times 9.8 + 150\sin 45°) = 60.4 \text{ N}$$

Acceleration

$$a = \frac{F\cos\alpha - F_{\text{frict}}}{m} = \frac{150\cos 45° - 60.4}{20} = 2.3\frac{\text{m}}{\text{s}^2}$$

Answers: 60.4 N, $2.3\frac{\text{m}}{\text{s}^2}$