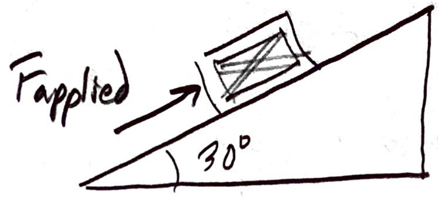
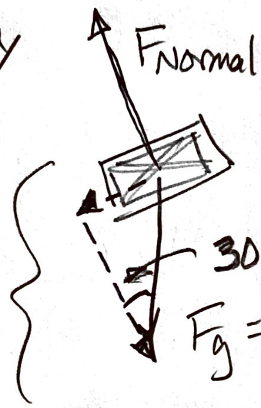
5.67

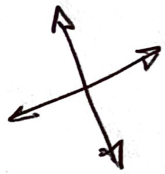


m = 2.0 kg

a) Without force applied what is box's acceleration down the "perfectly smooth" (frictionless) ramp?

Free-body





tilt axes!

Split F_g up into $F_{\parallel}$ & $F_{\perp}$

$F_g = mg = (2)(9.8) = \underline{19.6N}$

$F_{\parallel} = F_g \sin 30 = \underline{9.8N}$

$F_g = 19.6N$

$F_{\perp} = F_g \cos 30 = \underline{17.0N}$

$F_{\parallel}$ is what pulls the block down the ramp.

$\Sigma F_x = ma$

$F_{\parallel} = ma$

$9.8 = 2a$

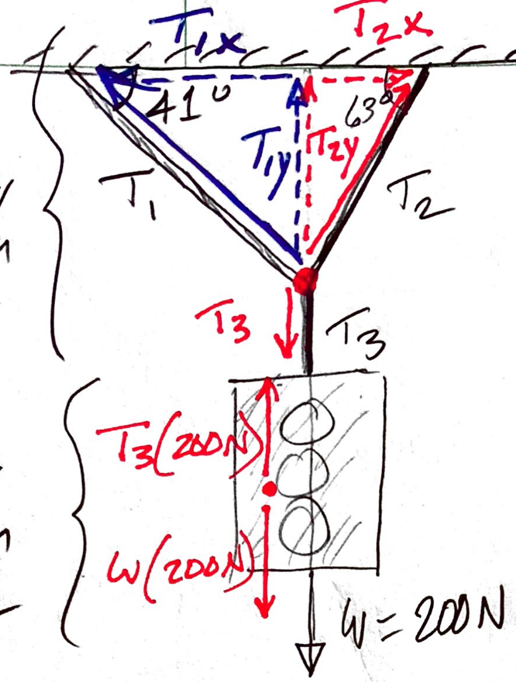
$a = \boxed{4.90 m/s^2}$

b) A force of $F_{\parallel} = 9.8N$ applied up along the ramp would give it 0 acceleration. Therefore it could move at constant velocity.

5.71

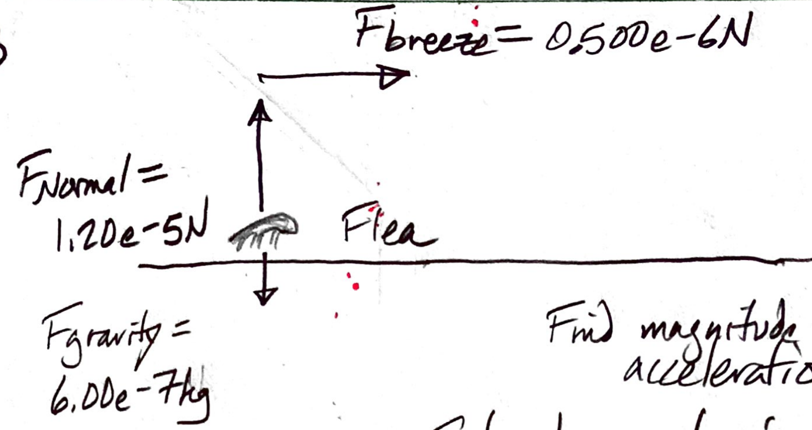
Free-body diagram #2

Free-body diagram #1



Draw free-body diagram in red! & blue!

6.28



Find magnitude & direction of acceleration.

Solve by analyzing x & y directions separately.

$\Sigma F_x = ma_x$

$F_{breeze} = m_{flea} a_x$

$0.5e-6 = (6e-7)a$

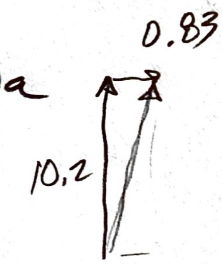
$a_x = 0.83\ m/s^2$

$\Sigma F_y = ma_y$

$F_{Normal} - F_g = ma$

$1.2e5N - (6e-7kg)(9.8\ m/s^2) = (6e-7kg)a$

$a_y = 10.2\ m/s^2$

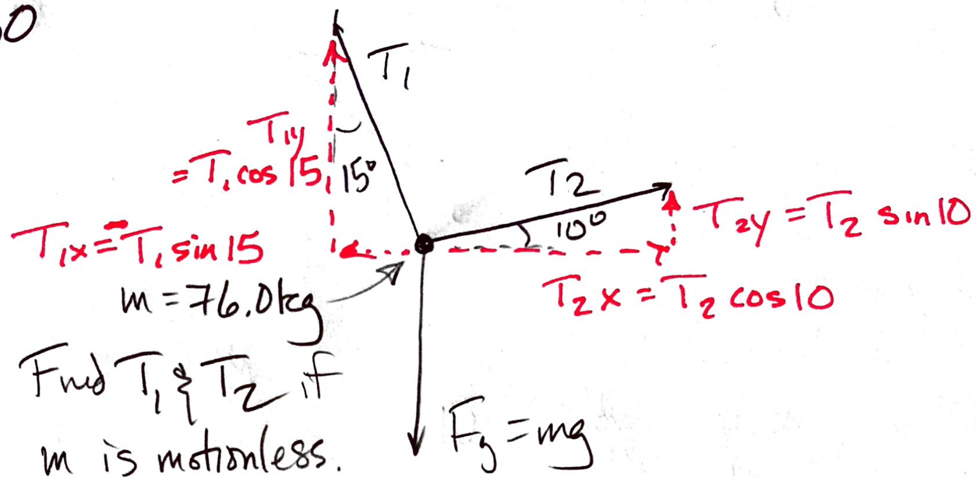


$a = (0.83i + 10.2j)\ m/s^2$

$a = \sqrt{0.83^2 + 10.2^2} = \boxed{10.2\ m/s^2}$

$\theta = \tan^{-1}\frac{10.2}{0.83} = \boxed{85.3^\circ}$

6.30



Find T_1 & T_2 if m is motionless.

Horizontal: $\Sigma F_x = ma$

$$T_{2x} - T_{1x} = 0$$

$$T_2 \cos 10 - T_1 \sin 15 = 0$$

$$T_2 \cos 10 = T_1 \sin 15$$

$$T_2 = T_1 \frac{\sin 15}{\cos 10}$$

$$T_2 = 0.2628\, T_1$$

Vertical: $\Sigma F_y = ma$

$$T_{2y} + T_{1y} - F_g = 0$$

$$T_2 \sin 10 + T_1 \cos 15 - (76)(9.8) = 0$$

$$(0.2628\, T_1) \sin 10 + T_1 \cos 15 = 744.8$$

$$1.012\, T_1 = 744.8$$

$$T_1 = \boxed{736\ \text{N}}$$

$$T_2 = \boxed{193\ \text{N}}$$