Exercise #1

Draw force diagram

\[ \text{SMN} \]

What I Do

1. Practice
2. Draw physical situation
3. Identify gravitational force
4. Normal force
4. IDENTIFY USE FOR COMPONENTS

4.5 DEFINE GOOD COORDINATES

5. WRITE DOWN MOTION i.e. $F_x = ma$

$F_x = m g \sin \theta$

$a_x = g \sin \theta$
**Kinetic Friction**

\[ F \]

**Find Acceleration**

**Free Body Diagram**

\[ \vec{F} \]

\[ \vec{1 F} = \mu \vec{n} \]

**Motion in X Direction Only**

\[ \sum F_x = (1F - 1F) \hat{i} \]

\[ \sum F_x = F - \mu n = ma_x \]

\[ a_x = \frac{F - \mu n}{m} \]

\[ a_y = 0 \]

\[ \sum F_y = n - mg \Rightarrow n = mg \]

\[ = \frac{F - \mu mg}{m} \]

\[ a_x = \frac{F}{m} - \mu g \]
\[
\begin{align*}
\sum F_x &= F \cos \theta - f = \max \\
\sum F_y &= F \sin \theta + n - mg = m a_y = 0
\end{align*}
\]

\[
\max = F \cos \theta - f = F \cos \theta - \mu_n n
\]

\[
n = mg - F \sin \theta
\]

\[
\max = F \cos \theta - \mu_k [mg - F \sin \theta]
\]

\[
= \left[ \cos \theta \sqrt{mg} \right]
\]

\[
\max = F \left[ \cos \theta + \mu_k \sin \theta \right] - \mu_k mg
\]

\[
a_x = \frac{F}{m} \left[ \cos \theta + \mu_k \sin \theta \right] - \mu_k g
\]

\[\theta = 30^\circ\]
\[ a_x = \frac{F}{m} \left[ \frac{\sqrt{3}}{2} + \mu \epsilon \frac{1}{2} \right] - \mu \epsilon g \]

At \( \theta = 0 \)

\[ a_x = \frac{F}{m} - \mu \epsilon g \]

FORCE IS THE SAME

\( \cos \theta + \mu \epsilon \sin \theta > 1 \)

\( 1 - \cos \theta > \mu \epsilon \sin \theta \)

\( \mu \epsilon > 1 - \cos \theta \)

\( \mu \epsilon > \sin \phi \theta \)
(F \ a_x = 0)

\[
\frac{F}{m} [\cos \theta + \mu \cos \theta \sin \theta] = \mu \cos \theta \sin \theta
\]

\[
F = \frac{\mu \cos \theta \sin \theta}{\cos \theta + \mu \sin \theta}
\]

\[
\theta \approx \theta\cos
\]

\[
F = \mu \cos \theta \sin \theta
\]
If \( \cos \theta + \mu \cos \theta < 1 \), you require less torque.

\[ \mu_c = 0.1 \quad \mu_k = 0.5 \quad 0.9 \]
At Boundary \( V_B \)  

After Boundary

\[ m \dot{a} = -\frac{\mu N}{u} \dot{x} \]

\[ a_x = -\frac{\mu N}{u} \frac{\dot{x}}{L} \]

\[ V_x(t) = -\frac{\mu N}{u} t + V_0 \]

At \( t_f \)

\[ V(t_f) = 0 = -\frac{\mu N t_f}{u} + V_0 \]

\[ t_f = \frac{u V_0}{\mu N} \]
\[ P(\tau) = -\frac{M N}{2 m} \tau^2 + V_0 \tau \]

\[ P(\tau) = -\frac{M N}{2 m} \left( \frac{m v_0}{m N} \right)^2 + V_0 \left( \frac{m v_0}{m N} \right) \]

\[ = -\frac{M N}{2 m} \left( \frac{m^2 v_0^2}{m^2 N^2} \right) + \frac{m v_0^2}{m N} \]

\[ P(\tau) = \frac{1}{2} \frac{m v_0^2}{m N} \]

\text{DISTANCE} \times \text{FORCE} = \text{ENERGY}

\[ \frac{1}{2} \frac{m v_0^2}{m N} \times \text{DISTANCE} = \frac{1}{2} m v_0^2 \text{ (INITIAL ENERGY)} \]

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