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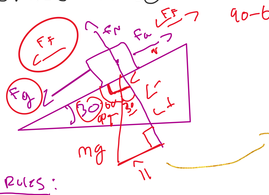
(5) Inclined Force



General Rules:

$F_N = mg\cos\theta$

$F_g = mg\sin\theta$ ← accelerates block down incline

$a_x = g\sin\theta$

when F_g is only force in the x

$\sum F_{net\,x} = F_g$

$ma_x = mg\sin\theta$

$a_x = g\sin\theta$

$F_k = \mu_k F_N$

$F_s \leq \mu_s F_N$

$a_x = g\sin\theta - \mu_k g\cos\theta$

when there is friction moving down block

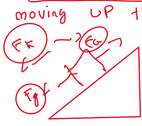
$\sum F_x = F_g + (-F_k)$ $\quad F_k = \mu_k F_N$

$ma_x = mg\sin\theta - \mu_k mg\cos\theta$ $\quad F_N$

$a_x = g\sin\theta - \mu_k g\cos\theta$

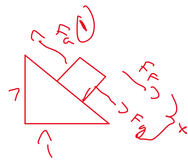
$a_x = -g\sin\theta - \mu_k g\cos\theta$

moving up the incline



$a_x = -g\sin\theta + \mu_k g\cos\theta$

when moving up reverse incline



Question: A block slides down a 30° incline starting from rest.

a) Find acceleration of block

b) find final speed of block after it travels 200m down the incline.

Solution:

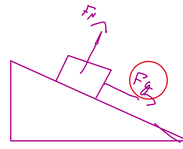
Givens/Unknowns:

$\theta = 30°$ $\quad V_i = ?$

$\Delta d = 200m$

$a_x = ?$

$V_f = ?$



$F_g = mg\sin\theta$

$\sum F_{net\,x} = F_g$

$ma_x = mg\sin\theta$

$a_x = g\sin\theta$

$= 9.81\sin 30$

$= 4.905 m/s^2$

$V_f^2 = V_i^2 + 2a\Delta d$ ← BIGS

$V_f^2 = 0 + 2(4.905)200$

$V_f^2 = 1960$

$V_f = 44.27 m/s$ ✓

Question: A block travels up a 25° incline plane with initial velocity of 14m/s.

a) Find the acceleration of the block

b) Find how far it will go

c) Find the time it takes for the block to stop

Solution:

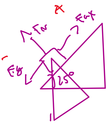
Givens/Unknowns:

$V_i = 14 m/s$

$\theta = 25°$ $\quad V_f = 0 m/s$

$a_x = ?$ $\quad \Delta t = ?$

$\Delta d = ?$



a) $\sum F_x = F_g$

$ma_x = -mg\sin\theta$

$a_x = -g\sin\theta$

$= -9.81\sin 25$

$= -4.14 m/s^2$

b) $V_f^2 = V_i^2 + 2a\Delta d$

$0 = 14^2 + 2(-4.14)\Delta d$

$-14^2 = 2(-4.14)\Delta d$

$\Delta d = \frac{-196}{2(-4.14)}$

$\Delta d = 23.67 m$

c) $V_f = V_i + a\Delta t$

$0 = 14 + (-4.14)(\Delta t)$

$-14 = -4.14\Delta t$

$\Delta t = \frac{-14}{-4.14}$

$\Delta t = 3.385$ ✓