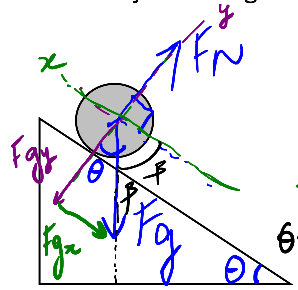
Name: ________________________________ Phys 12

3.2 Inclines (part 1)

We've mostly dealt with forces acting horizontally and vertically. What happens if we have objects moving at an angle?

Consider an object sitting on an incline and compare this to an object sitting on a flat surface.

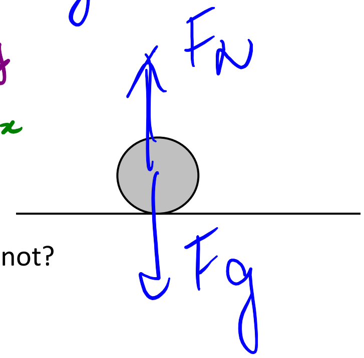
Draw the free-body diagram of these two objects.



is $F_N = F_g$?

$F_N = F_{gy}$

$F_{net_x} = F_{gx}$



Why will the object on the incline move? Use the free-body diagram to explain.

Imbalance of forces

F_{net} along the ramp $\neq 0$

Will this object accelerate down the incline at the acceleration due to gravity? Why or why not?

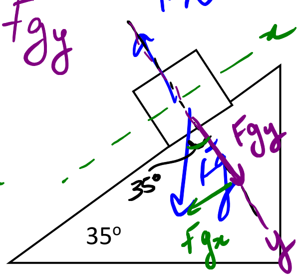
No

$$F_{net_x} = F_{gx} = F_g \sin\theta = ma$$

*Key point: Since the motion is on a diagonal axis, we must resolve our vectors into their components **relative** to this new set of diagonal axis in our calculations.*

Ex 1

An 8.0 kg block slides down the frictionless inclined plane shown. What is its acceleration?



y: $F_N = F_{gy}$

x: $F_{net} = ma$

$= F_{gx}$

$= F_g \sin 35$

$ma = mg\sin 35$

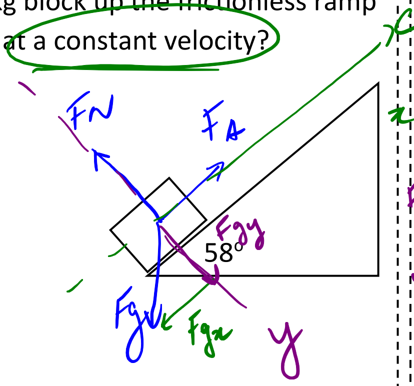
$a = g\sin 35$

$= 9.8\sin 35$

$= 5.6\ m/s^2$ down the incline

Ex 2

How much force is required to push an 11 kg block up the frictionless ramp shown at a constant velocity?



x: $a = 0$, $F_{net_x} = 0$

$F_A - F_{gx} = 0$

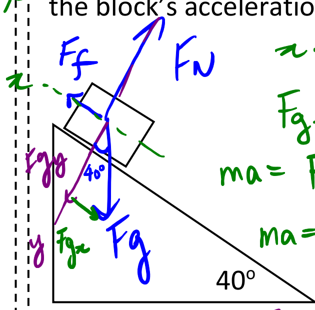
$F_A = F_{gx} = mg\sin 58$

$= 11(9.8)\sin 58$

$= 91\ N$

Ex 3

A 15 kg block sits on an inclined ramp whose coefficient of friction is 0.21. Find the block's acceleration.



x: $F_{net} = ma = F_{gx} - F_f$

$F_f = \mu F_N$

$ma = F_{gx} - F_f$

$ma = mg\sin 40 - \mu F_N$

y: $F_N = F_{gy} = mg\cos 40$

$\therefore ma = mg\sin 40 - \mu(mg\cos 40)$

$a = 9.8\sin 40 - 0.21(9.8)\cos 40$

$= 4.7\ m/s^2$

HW: Worksheet 3.2 ALL