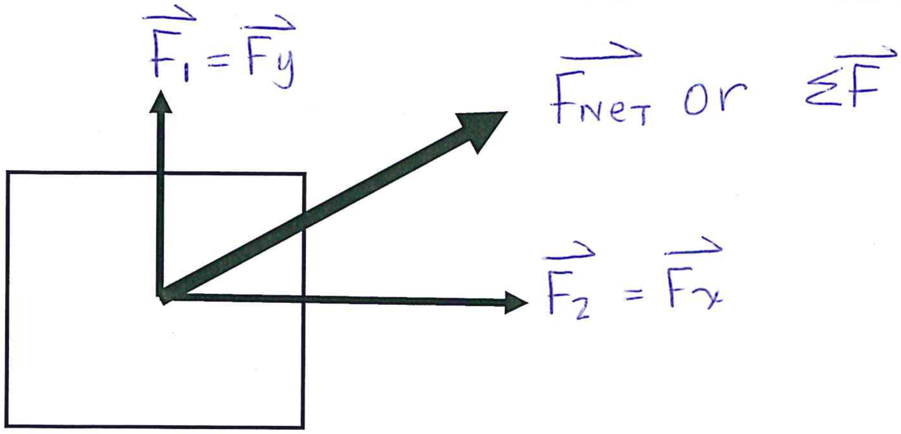
NAME: answers

U2:L6 VECTORS + INCLINED PLANES

TWO APPLIED FORCES AT 90°

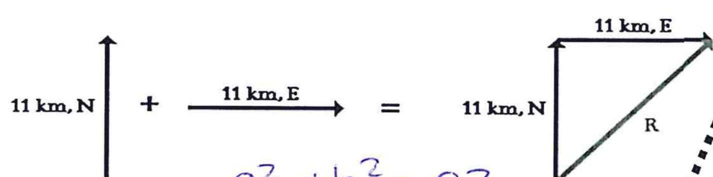


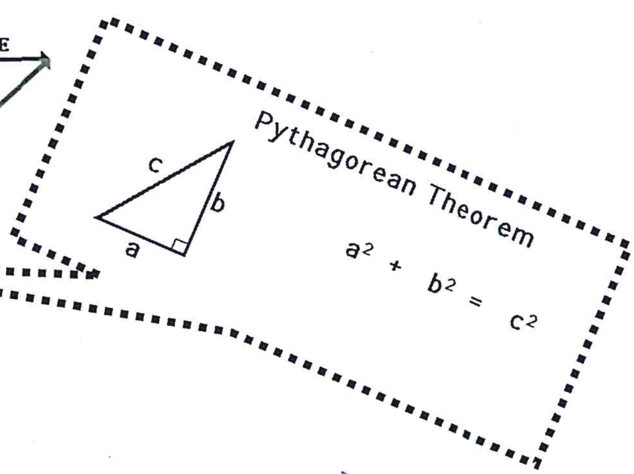
Top OR Side view

TIP TO TAIL METHOD:

When adding vectors, we can use the "Tip to Tail Method" where you "pick up" the second vector and connect its tail to the first vector's tip. This will give you a resultant vector.

The resultant vector, is therefore: the NET force.





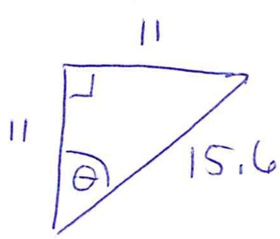
$a^2 + b^2 = c^2$

$11^2 + 11^2 = R^2$

$242 = R^2$

$15.6 = R$

what angle?



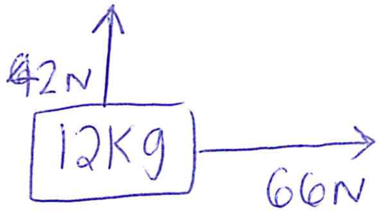
$\sin\theta = \frac{11}{15.6}$

$\sin\theta = 0.705$

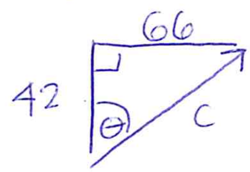
$\theta = 44.8°$ ≈ 45°

∴ $\vec{\Sigma F} = 15.6\text{N}$ [N45°E]

EXAMPLE #1: Two forces of 66.0 N [E] and 42.0 N [N] act on a 12.00 kg block. Draw an FBD of the situation, find the net force acting on the block, and find its acceleration (remember to include magnitude AND direction)



Tip → Tail



$c^2 = a^2 + b^2$

$c^2 = 42^2 + 66^2$

$c^2 = 1764 + 4356$

$\sqrt{c^2 = 6120}$

$c = 78.2N$

$\sin\theta = \frac{66}{78.2} = 0.844$

$\theta \approx 57.56°$

$\Sigma \vec{F} = 78.2N$ [N 58° E]

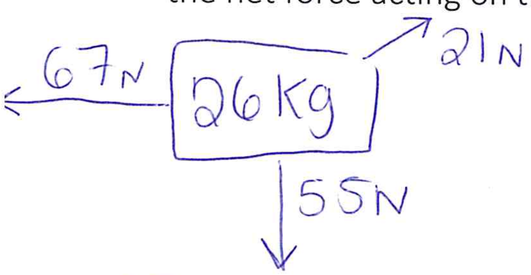
$\vec{F} = ma$

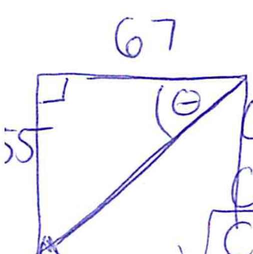
$a = \vec{F}/m$

$a = 78.2/12$

$\vec{a} = 6.5 m/s^2$ [N 58° E]

EXAMPLE #2: A block (26 kg) is experiencing two applied forces on a rough surface. The block experiences a force of 55 N [S] and 67 N [W]. The block also experiences a frictional force of 21 N. Draw an FBD of the situation and then find the net force acting on the block, as well as its acceleration.





$c^2 = 55^2 + 67^2$

$c^2 = 3025 + 4489$

$\sqrt{c^2 = 7514}$

$c = 86.68N$

$\sin\theta = \frac{55}{86.68} = 0.635$

$\theta \approx 39.4°$

$\Sigma \vec{F}$ in dir. of motion is

$\Sigma \vec{F}_{APP} - \vec{F}_f$

$\Sigma \vec{F} = 86.68N - 21N$

$\Sigma \vec{F} = 65.68N$ [W 39° S]

$\Sigma \vec{F} = m\vec{a}$

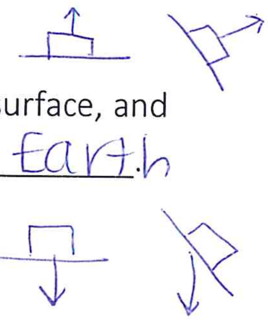
$\vec{a} = \vec{F}/m = \frac{65.68}{26}$

$\vec{a} = 2.52 m/s^2$ [W 39° S]

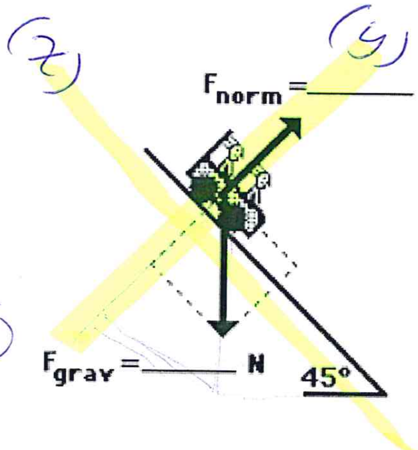
OBJECTS ON AN INCLINE

When an object lies on an incline, vector components need to be considered, and calculated separately.

Remember… normal forces are always drawn PERDENICULAR to the surface, and gravitational force is always towards center of earth.



Find the net force and acceleration of the following situation:



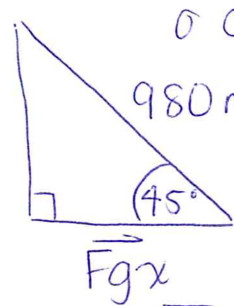
m=1000 kg

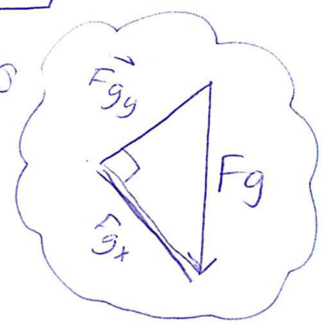
$\vec{F_g} = m \times g$

$\vec{F_g} = 1000 \times 9.8\ m/s^2$

$\vec{F_g} = 9800N$

Shift / tilt perspective of x and y





motion $= \Sigma \vec{F}$

$\vec{F_{gy}} = \vec{F_N}$

$\cos 45°(980) = \Sigma \vec{F}$

$692.96 = \Sigma \vec{F}$

$\sin 45°(980N) = \vec{F_{gy}} = \vec{F_N}$

$692.96N = \vec{F_N}$

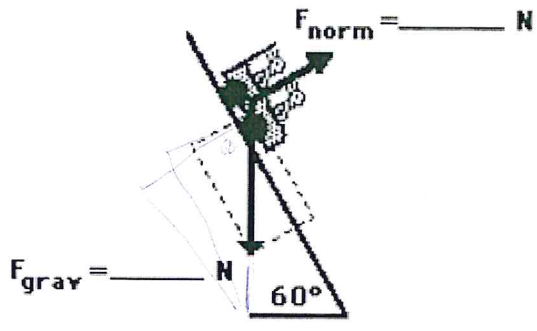
$\Sigma \vec{F} = m \times \vec{a}$

$\vec{a} = \frac{\Sigma F}{m} = \frac{692.96N}{1000kg}$

$\vec{a} =$ ~~[scribbled out]~~

$6.9 m/s^2$

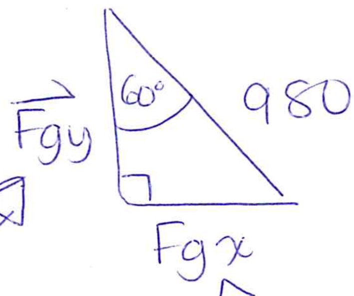
Find the net force and acceleration of the following situation:



m=1000 kg

$\vec{F_g} = 1000 \times 9.8$

$\vec{F_g} = 980\,N$



$\cos 60°(980) = \vec{F_{gy}} = \vec{F_N}$

$\boxed{490_N = \vec{F_N}}$

$\sin 60°(980) = \vec{F_{gx}}$

$848.7\,N = \vec{F_{gx}} = \Sigma \vec{F}$

$\Sigma \vec{F} = m \times \vec{a}$

$\vec{a} = \frac{\Sigma \vec{F}}{m} = \frac{848.7\,N}{1000\,kg}$

$\boxed{\vec{a} = 0.849\,m/s^2}$