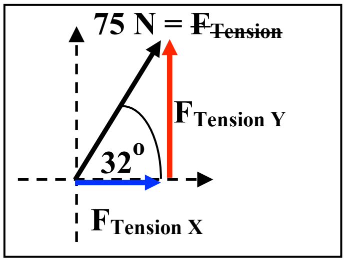
UNIT IV: Worksheet 2 **SOH CAH TOA** **Name KEY #:____**

Determine the x and y components of each of the force vectors below. Show work. Pay attention to when something should be negative. **Make sure your calculator is in degrees.** ***USE PENCIL!!!! Draw in the vectors for Fx and Fy on the diagram.***



Here is an example of what should be written for the equations.

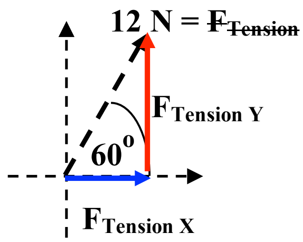
Finding Opposite side of triangle – Sine: Opposite Side = Hypotenuese * Sin (Angle)

$F_{Tension\ Y} = F_{Tension} * \sin\theta$ $F_{Tension\ Y} = 75\ N * \sin(32^o)$ **$F_{Tension\ Y} = 39.7\ N$**

Finding Adjacent side of triangle – Cosine: Adjacent = Hypotenuese * Cos (Angle)

$F_{Tension\ X} = F_{Tension} * \cos\theta$ $F_{Tension\ X} = 75\ N * \cos(32^o)$ **$F_{Tension\ X} = 63.6\ N$**

1.



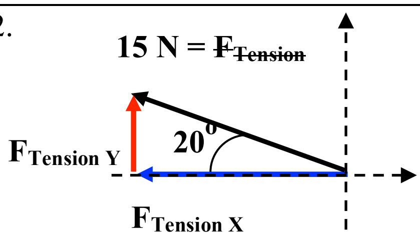
$F_{Tension\ Y} = F_{Tension} * \sin\theta$ $F_{Tension\ Y} = 12\ N * \sin(60^o)$

$F_{Tension\ Y} = 10.4\ N$

$F_{Tension\ X} = F_{Tension} * \cos\theta$ $F_{Tension\ X} = 12\ N * \cos(60^o)$

$F_{Tension\ X} = 6.0\ N$

2.



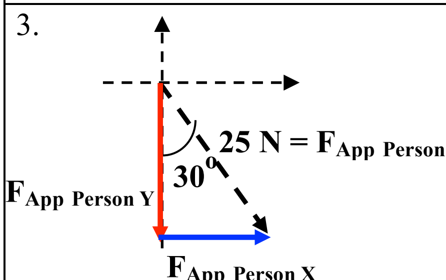
$F_{Tension\ Y} = F_{Tension} * \sin\theta$ $F_{Tension\ Y} = 15\ N * \sin(20^o)$

$F_{Tension\ Y} = 5.13\ N$

$F_{Tension\ X} = F_{Tension} * \cos\theta$ $F_{Tension\ X} = 15\ N * \cos(20^o)$

$F_{Tension\ X} = -14.1\ N$

3.



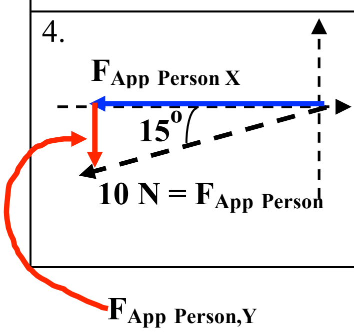
$F_{App\ Person\ Y} = F_{Person,\ Cart} * \cos\theta$ $F_{App\ Person\ Y} = 25\ N * \cos(30^o)$

$F_{App\ Person\ Y} = -21.7\ N$

$F_{App\ Person\ X} = F_{Rope,\ Cart} * \sin$ $F_{App\ Person\ X} = 25\ N * \sin(30^o)$

$F_{App\ Person\ X} = 12.5\ N$

4.



$F_{App\ Person\ Y} = F_{App\ Person} * \sin\theta$ $F_{App\ Person\ Y} = 10\ N * \sin(15^o)$

$F_{App\ Person\ Y} = -2.59\ N$

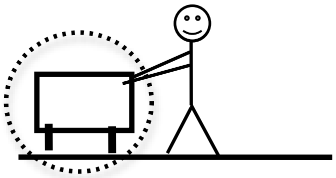
$F_{App\ Person\ X} = F_{A\ Person,\ Cart} * \cos\theta$ $F_{App\ Person\ X} = 12\ N * \cos(15^o)$

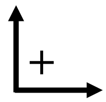
$F_{App\ Person\ X} = -9.66\ N$

Forces from Free-Body Diagram

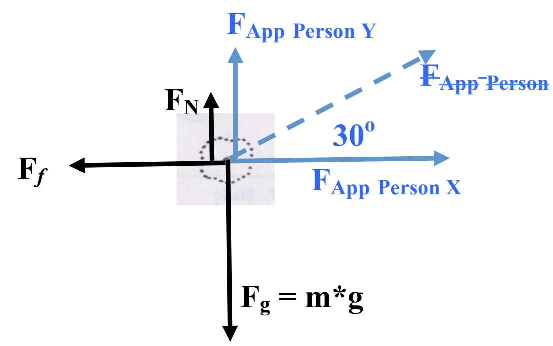
5. Example of a Newton's 2[nd] Law ($F_{rope, box\ X} - F_{surface, box||} = m*a_X$)

A person pulls on a 50. kg desk with a 200. N force acting at 30.0° angle above the horizontal. The desk does not budge. **Draw a force diagram for the desk.**





V = 0
a = 0
ΣF = 0



a. Write the equation ($F_{net\ X} = ma_x$) that describes the forces that act in the x-direction. (*Hint: Write all the forces in the x-direction on the left-side of equation equal to m*a_x*)

$$\Sigma F_X = m*a_X \qquad + F_{App\ Person\ X} - F_f = m*\cancel{a_X}^{\,0}$$

b. Write the equation ($F_{net\ Y} = ma_y$), that describes the forces, which act in the y-direction. (*Hint: Write all the forces in the y-direction on the left-side of equation equal to m*a_x*)

$$\Sigma F_Y = m*a_Y \qquad + F_N + F_{App\ Person\ Y} - F_g = m*\cancel{a_Y}^{\,0}$$

c. Determine the x and y components of the force of person on the desk. (*Hint: Sine & Cosine will be used.*)

$$F_{App\ Person\ X} = F_{App\ Person} * \cos(\theta) \qquad F_{App\ Person\ X} = 200.\ N * \cos(30.0^o)$$

$$\boxed{F_{App\ Person\ X} = 173.2\ N}$$

$$F_{App\ Person\ Y} = F_{Person,\ Desk} * \sin(\theta) \qquad F_{App\ Person\ Y} = 200.\ N * \sin(30.0^o)$$

$$\boxed{F_{App\ Person\ Y} = 100.\ N}$$

d. Determine the value of the frictional force. Do the same for the normal force. (*Hint: Part A, B, & C are used here.*)

$F_{App\ Person\ X} - F_f = m*\cancel{a_x}^{\,0}$ $\qquad F_{App\ Person\ X} = F_f$ $\qquad F_f = 173.2\ N$ **Friction Force**

$F_N + F_{App\ Person\ Y} - F_g = m*\cancel{a_Y}^{\,0}$ $\qquad$ **Force of Earth** $F_g = m*g$ $\qquad g = 10\ N/kg = 10\ m/s^2$

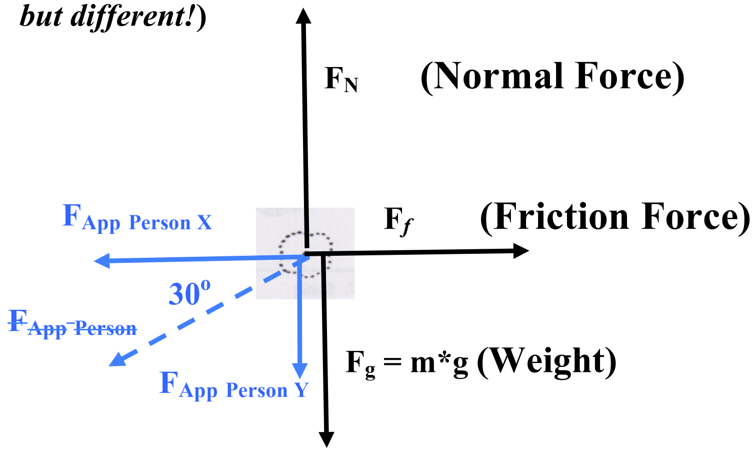
F_N (← **Normal Force**) $= m*g - F_{App\ Person\ Y}$

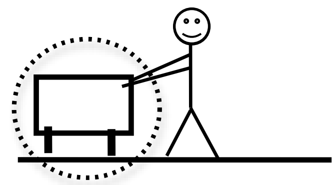
$F_N = 50.0\ kg * 10.\ N/kg - 100.\ N$

$F_N = 500\ N - 100.\ N$

$F_N = 400.\ N$

6. Suppose in the diagram above, the person were *pushing* down at a 30° angle with 200 N of force. The desk still does not move. **Draw a force diagram for the desk.** (***Hint: This is the same as problem #5 but different!***)





a. Write the equation (**F**$_{net}$ = **ma**$_x$) that describes the forces that act in the x-direction.

$$\Sigma F_X = m*a_x \qquad F_{App\ Person\ X} - F_f = m*a_x$$

b. Write the equation (**F**$_{net}$ = **ma**$_y$) that describes the forces that act in the y-direction.

$$\Sigma F_Y = m*a_Y \qquad F_N - F_{App\ Person\ Y} - F_g = m*a_Y$$

c. Determine the value of the frictional force. Do the same for the normal force.

$$F_{App\ Person\ X} - F_f = m*a_x \qquad F_{App\ Person\ X} = F_f$$

$$F_f = 173.2\ N$$

$$F_N - F_{App\ Person\ Y} - F_g = m*a_Y$$

$$F_N = m*g + F_{App\ Person\ Y}$$

$$F_N = 50.0\ kg * 10.\ N/kg + 100.\ N$$

$$F_N = 500\ N + 100.\ N$$

$$F_N = 600.\ N$$