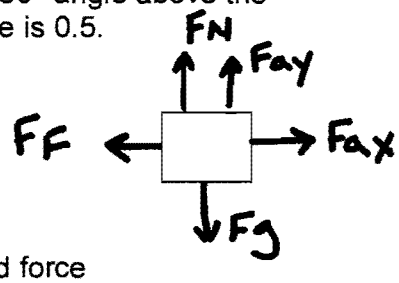
PHRICTION PHUN - DON'T LET THIS SLOW YOU DOWN

A 20 kg box is pulled up and to the right with a 200 N force (Fa) at a 30° angle above the horizontal. The coefficient of friction between the box and the surface is 0.5.

1. Draw a FBD in the using the box to the right. Make sure you label all your forces with proper names.



2. Determine the horizontal and vertical components of your applied force

Fa_x = $200\cos(30) = 173N$ Fa_y = $200\sin(30) = 100N$

3. Determine the weight (force of gravity) of your box.

$F_g = mg = 20(9.8)$ $196\,N$

4. Write $F_y$net equation here (you have 3 forces): $F_y$net, = $F_N + Fa_y - F_g$ = 0
5. Now, using your $F_y$net equation, calculate the normal force: $F_N = F_g - Fa_y$

$F_N = 196 - 100$ $96\,N$

6. Now, calculate the force of friction acting on the box:

$F_F = \mu F_N = 0.5(96)$ $48\,N$

7. Write your $F_x$net equation here (you have 2 forces): $F_x$net, = $Fax - F_F$ = ma

9. Calculate the acceleration of the box: $Fax - F_F = 173 - 48 = 125N$

$a = \frac{F}{m} = \frac{125}{20}$ $6.25\,m/s^2$

10. If the box starts from rest, determine the velocity of the box after 4 seconds.

$V_f = V_i + at = 6.25(4) = 25\,m/s$

$25\,m/s$

11. Determine the distance traveled in those 4 seconds

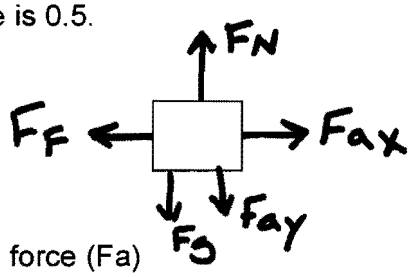
$d = \frac{1}{2}at^2$

$= \frac{1}{2}(6.25)(4)^2$ $50\,m$

PHRICTION PHUN - PART 2

A 20 kg box is pushed down and to the right with a 200 N force (Fa) at a 30° angle below the horizontal. The coefficient of friction between the box and the surface is 0.5.

1. Draw a FBD in the using the box to the right. Make sure you label all your forces with proper names.



2. Determine the horizontal and vertical components of your applied force (Fa)

Fa_x = $200\cos(30) = 173$ Fa_y = $200\sin(30) = 100N$

3. Determine the weight (force of gravity) of your box.

$F_g = mg = 20(9.8)$ 196 N

4. Write $F_y$net here (you have 3 forces): $F_y$net, = $F_N - Fay - Fg$ = 0

5. Now, calculate the normal force: $F_N = F_g + Fay$

$F_N = 196 + 100$ 296 N

6. Now, calculate the force of friction acting on the box:

$F_F = \mu F_N = 0.5(296) =$ 148 N

7. Write your $F_x$net, here (you have 2 forces): $F_x$net, = $Fax - F_F$ = ma

8. Calculate $F_x$net, :

$F_{X\,NET} = 173 - 148 =$ 25 N

9. Calculate the acceleration of the box:

$F_{Net} = ma \quad a = \frac{F_{NET}}{m} = \frac{25}{20} =$ 1.25 m/s²

10. If the box starts from rest, determine the velocity of the box after 4 seconds.

$V_f = at = 1.25(4)$ 5.0 m/s

11. Determine the distance traveled in those 4 seconds

$d = \frac{1}{2} a t^2 = \frac{1}{2}(1.25)4^2$ 10.0 m

12. Were your forces of friction different in the two problems? Why does this happen?

YES