THE FRICTION EQUATION

The Force of Friction depends on two things:
how rough/smooth/sticky the surfaces are and
how hard the surfaces are pressed together.

$$\boxed{F_f = \mu F_N}$$

The Force of friction in Newtons.

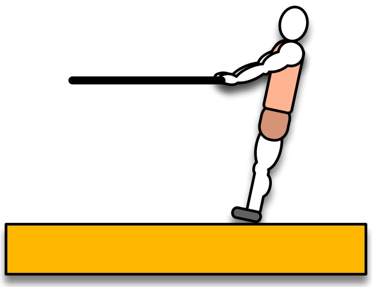
For Kinetic Friction, it's always the same.

For Static Friction, this equation gives the MAX value.

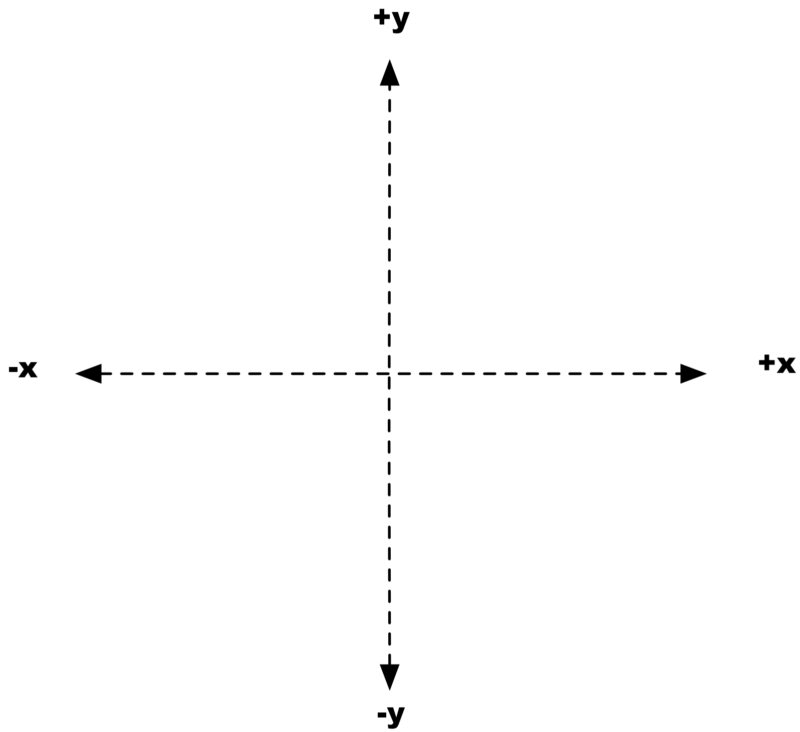
Normal Force in Newtons.
This captures the idea of how hard the surfaces are pressing into one another.

The Coefficient of Friction (Greek letter mu)
It's just a number; it has no units. It captures the idea of how "frictionful" the surfaces are. It can be found by taking the slope of a friction graph, or it can be looked up.

The 100 kg person is at rest. Then the tug-of-war starts and the tension in the rope increases to 600 N. The Coefficient of friction between his shoes and the floor is 0.5



was at rest



x-direction

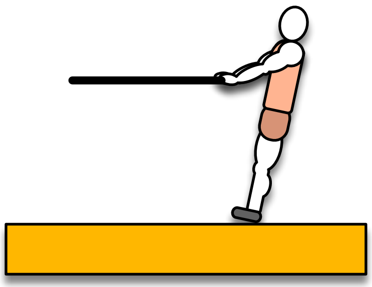
Fnet	direction

☐ He stays at rest.
☐ He gains speed to the right.
☐ He gains speed to the left.

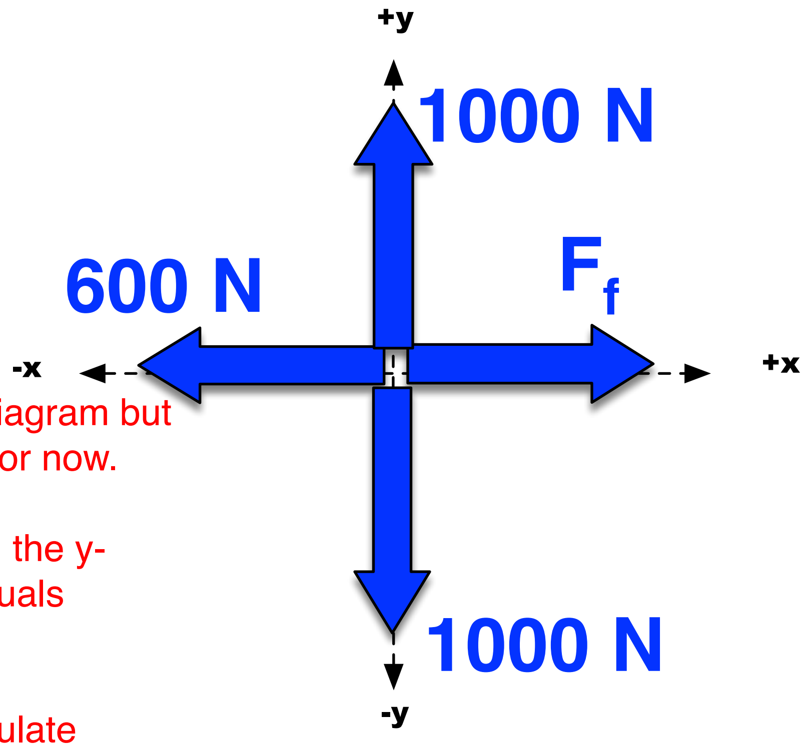
y-direction

Fnet	direction

The 100 kg person is at rest. Then the tug-of-war starts and the tension in the rope increases to 600 N. The Coefficient of friction between his shoes and the floor is 0.5



was at rest



1. Put Tension and Friction on diagram but leave friction without a number for now.

2. Nothing weird is happening in the y-direction, so assume Normal equals weight.

3. Use the Normal Force to calculate friction:

$$F_f = \mu F_N$$

$$F_f = (0.5)(1000\text{ N})$$

$$F_f = 500\text{ N}$$

x-direction

Fnet	direction

- ☐ He stays at rest.
- ☐ He gains speed to the right.
- ☐ He gains speed to the left.

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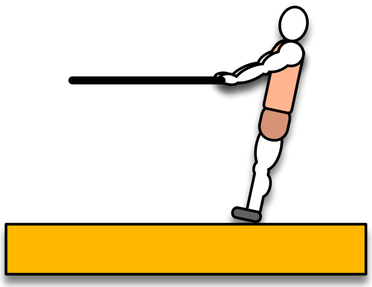
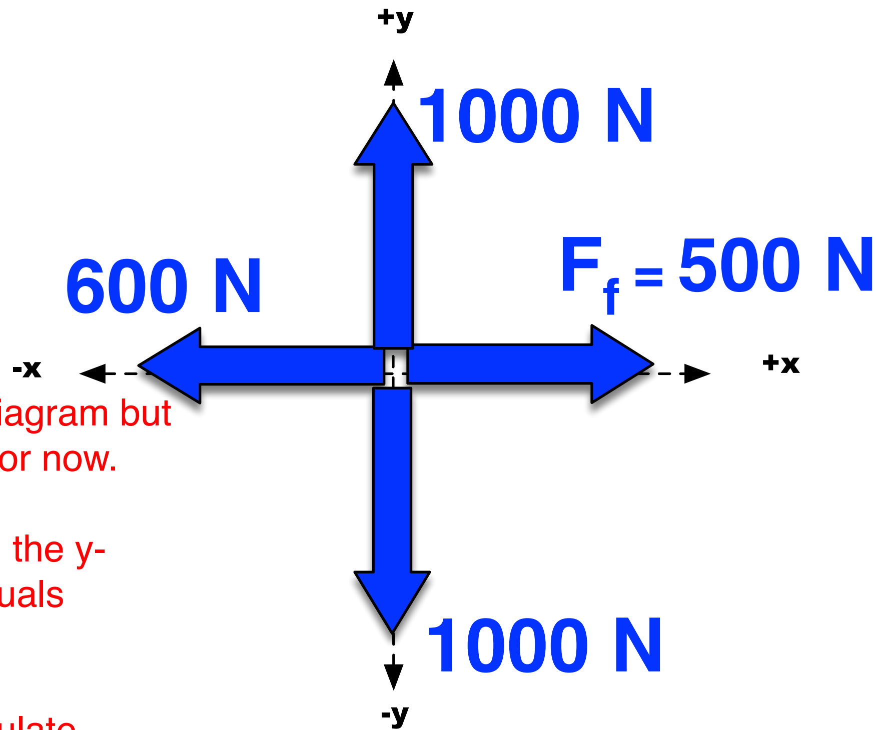
y-direction

Fnet	direction

The 100 kg person is at rest. Then the tug-of-war starts and the tension in the rope increases to 600 N. The Coefficient of friction between his shoes and the floor is 0.5



was at rest



1. Put Tension and Friction on diagram but leave friction without a number for now.

2. Nothing weird is happening in the y-direction, so assume Normal equals weight.

3. Use the Normal Force to calculate friction: $F_f = \mu F_N$

$$F_f = (0.5)(1000\text{ N})$$

$$F_f = 500\text{ N}$$

4. So now you can put in the force of friction and find net force.

x-direction

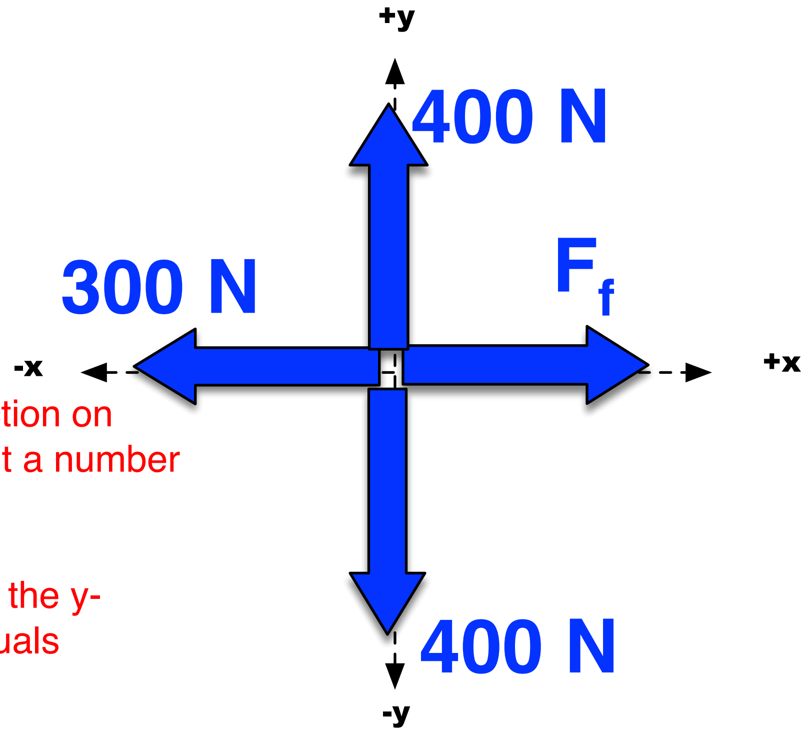
Fnet	direction
100 N	L

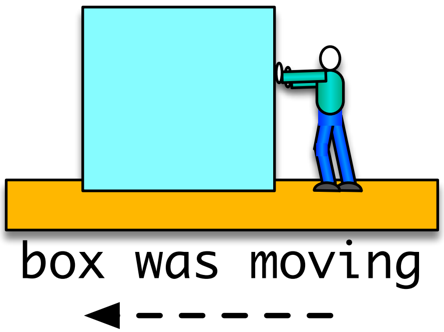
- ☐ He stays at rest.
- ☐ He gains speed to the right.
- X He gains speed to the left.

y-direction

Fnet	direction
0 N	

The 40 kg box was already moving to the left. The person applies a force of 300 N to the box. The coefficient of friction between the box and the floor is 0.25





1. Put the person's push and friction on diagram but leave friction without a number for now.

2. Nothing weird is happening in the y-direction, so assume Normal equals weight.

3. Use the Normal Force to calculate friction:

$$F_f = \mu F_N$$

$$F_f = (0.25)(400\ \text{N})$$

$$F_f = 100\ \text{N}$$

x-direction

Fnet	direction

- ☐ The box is slowing down.
- ☐ The box is speeding up.
- ☐ The box is maintaining constant speed.

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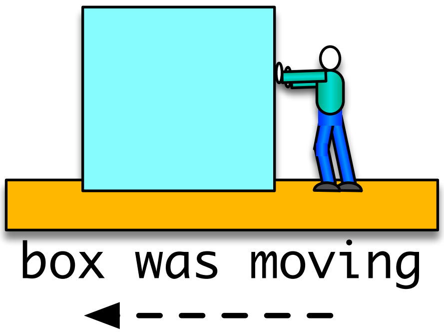
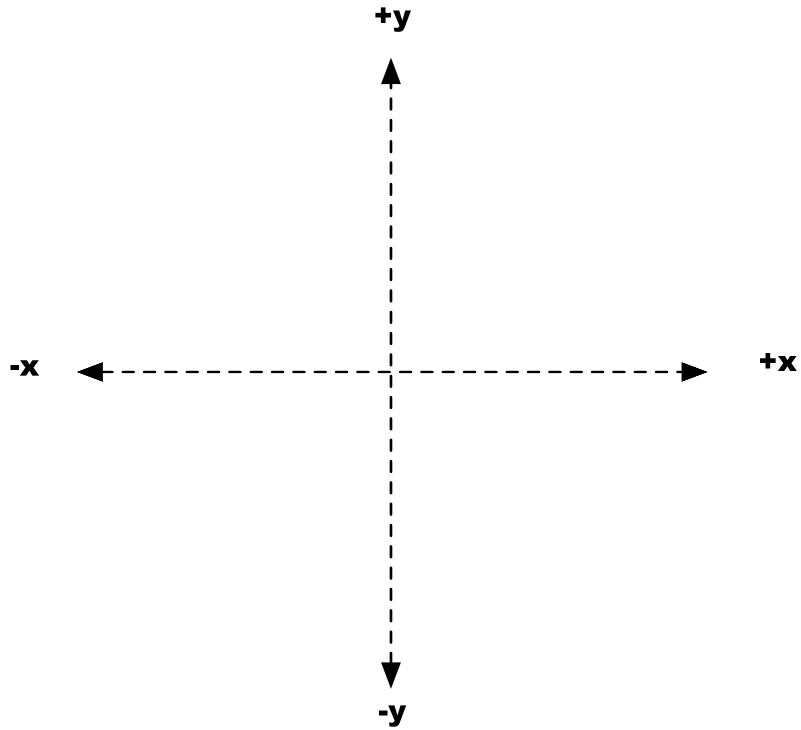
y-direction

Fnet	direction

The 40 kg box was already moving to the left. The person applies a force of 300 N to the box. The coefficient of friction between the box and the floor is 0.25





x-direction

Fnet	direction

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y-direction

Fnet	direction

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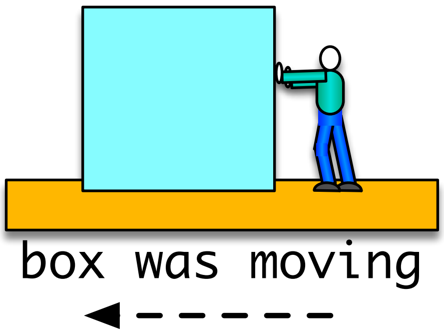

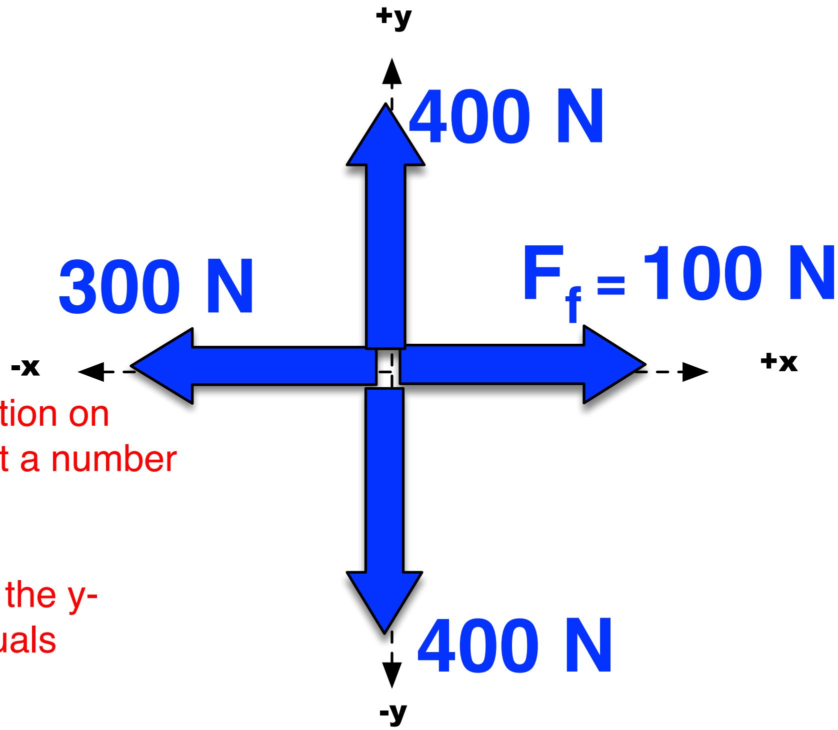

1. Put the person's push and friction on diagram but leave friction without a number for now.

2. Nothing weird is happening in the y-direction, so assume Normal equals weight.

3. Use the Normal Force to calculate friction:

$$F_f = \mu\, F_N$$

$$F_f = (0.25)(400\text{ N})$$

$$F_f = 100\text{ N}$$

4. Now fill in friction and calculate net force.

x-direction

Fnet	direction
100 N	L

- ☐ The box is slowing down.
- X The box is speeding up.
- ☐ The box is maintaining constant speed.

y-direction

Fnet	direction
0 N	