2nd Law of Motion

The rate of speed change (acceleration)
is given by the ratio of force to mass.

$$a = \frac{F_{net}}{m}$$

acceleration (m/s every second) = $\frac{\textbf{Net Force (N)}}{\textbf{mass (kg)}}$

So a Newton is the force required to accelerate 1 kg at a rate of 1 m/s every second.

That means a Newton is a kgm/s every second

Speed up and slow down EX1

Dino pushes Gina on an old pair of roller skates (her mass is 40 kg) with a force of 140 N. There is 20 N of friction due to the squeeky old wheels of the skates. They start from rest.

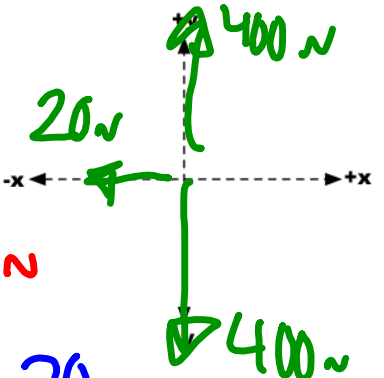
a) Put the forces on the diagram & find the net force.
b) Calculate the speed change factor.
c) Fill in the table below up tp 3 s.

$F_{net} = 140N - 20N = +120N$

$a = \frac{F_{net}}{m} = \frac{+120N}{40kg} = +3\frac{m}{s^2}$ away

Then after t = 3 s, Dino stops pushing, and Gina continues with only the friction force in the x-direction.

a) Put the forces on the diagram & find the net force.
b) Calculate the speed change factor.
c) Fill in the rest of the table.



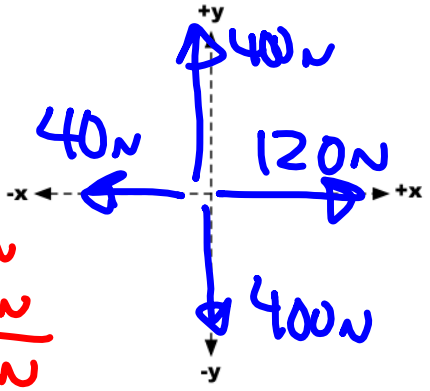
$F_{net} = -20N$

$a = \frac{F_{net}}{m} = \frac{-20N}{40kg} = -0.5\frac{m}{s^2}$

Speed at t = 0	Speed at t = 1 s	Speed at t = 2 s	Speed at t = 3 s	Speed at t = 4 s	Speed at t = 5 s	Speed at t = 6 s	Speed at t = 7 s	Speed at t = 8 s
0 m/s	+3 m/s	+6 m/s	9 m/s	8.5 m/s	8 m/s	7.5 m/s	7 m/s	6.5 m/s

Dino pushes Gina on an old pair of roller skates (her mass is 40 kg) with a force of 120 N. There is 40 N of friction due to the squeeky old wheels of the skates. They start from rest.

a) Put the forces on the diagram & find the net force.
b) Calculate the speed change factor.
c) Fill in the table below up to 4 s.

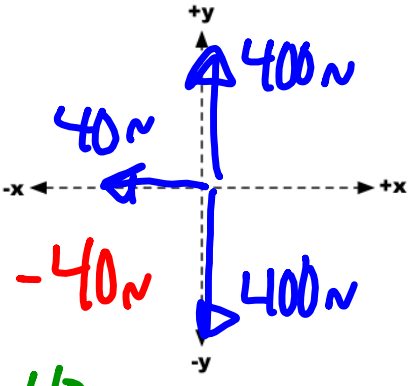


$F_{net} = 120\text{ N} - 40\text{ N} = +80\text{ N}$

$a = \frac{F_{net}}{m} = \frac{+80\text{ N}}{40\text{ kg}} = +2\ \frac{\text{m/s}}{\text{every sec.}}$

Then after t = 4 s, Dino stops pushing, and Gina continues with only the friction force in the x-direction.

a) Put the forces on the diagram & find the net force.
b) Calculate the speed change factor.
c) Fill in the rest of the table.



$F_{net} = -40\text{ N}$

$a = \frac{-40\text{ N}}{40\text{ kg}} = -1\ \frac{\text{m/s}}{\text{every sec.}}$

Speed at t = 0	Speed at t = 1 s	Speed at t = 2 s	Speed at t = 3 s	Speed at t = 4 s	Speed at t = 5 s	Speed at t = 6 s	Speed at t = 7 s	Speed at t = 8 s
0 m/s	2 m/s	4 m/s	6 m/s	8 m/s	7 m/s	6 m/s	5 m/s	4 m/s