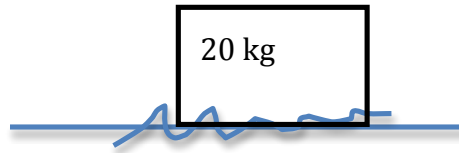# F = ma

1. A boy pushes on a 20 kg box with a force of 100 N. 4 sec later it is moving at 8 m/s. Find the force of friction.

20 kg

2. A 0.1 kg arrow is pushed   with a force of 100 N through a distance of 40 cm.
   a. Find the speed of the arrow as it leaves the bow.
   b. How high would the arrow go if shot straight up?

3. A boy (m=50 kg) pulls the wagon by pulling forward with a force of 280 N.
   a. Find how far the system moves in 2 sec.
   b. Find the tension in the rope.

20 kg
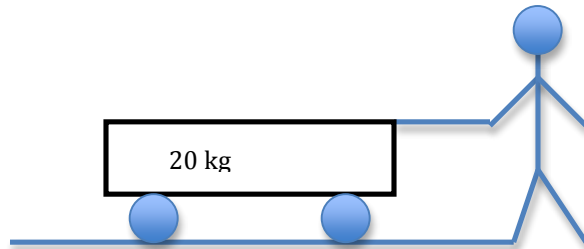
4. Now in #3 there is 80 N of friction between the ground and the wagon.
   a. Find how far the system moves in 2 sec.
   b. Find the tension in the rope.

5. The train pulls with a force of 10,000 N. The engine has a mass of 1000 kg and each car is 500 kg. Find a, T_1, T_2, and T_3.

T_1 T_2 T_3

1000   500   500   500
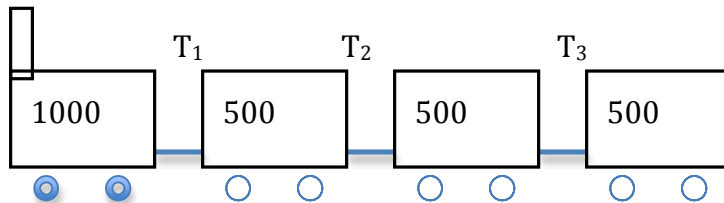
6. A boy pushes up on a box whose mass is 20 kg with a force of 250 N. Find the magnitude and direction of a.

7. In #6, how hard should the boy push upward to produce an acceleration of
   a. 1 m/s^s upward
   b. 1 m/s^s downward