STE Pretest 4.1

1. On earth gravitational acceleration is 9.8 m/s^2. On Neptune it is 11.2 m/s^2.
   a) Find the mass(in kg) and weight(in N) of a 250 g can of mango juice on earth.
   b) Find the mass(in kg) and weight(in N) of a 250 g can of mango juice on Neptune.

a) Earth: mass = 0.250 kg
Weight = mg = 0.250*9.8 = 2.45 N
b) Neptune mass = 0.250 kg
Weight = mg = 0.250*11.2 = 2.8 N

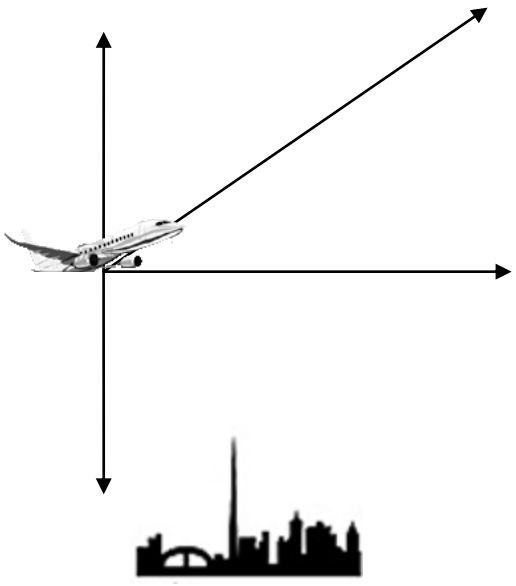
2. Find the net force acting on a box if it's being pulled on by a boy with a 29N force and in the opposite direction by another boy exerting 33 N.

33 N – 29 N = 4 N in the direction of the 33N boy.

3. At takeoff, the combined actions of engines and wings on a plane produce a force of 90,000 N at an angle of $60°$above the horizontal. The plane rises at a constant velocity in the vertical direction while continuing to accelerate in the horizontal direction.

   a. Balance the weight with the vertical force to find the mass of the plane.

   b. Use the horizontal force to find the horizontal acceleration.



A) F= mg = 90000sin60 This is balancing the weight perfectly, which is why the plane is no longer accelerating upward. (was not the case at takeoff!)
m = 90000sin60/9.8 = 7953 kg
B) $F_{horizontal}$ = 90 000*cos60
F = ma
90 000*cos60 = ma
90 000*cos60 = 7953 a
a = 90 000*cos60/ 7953 = 5.7 m/s^2

4. How much work is done to push a 22 kg mass up a 37^{o} inclined plane for a distance of 3.0 m?

$W = F_{effective} * d$
$= mg\sin\theta * d$
$= 22(9.8)\sin 37 * 3.0$
$= 389$ J

5. A 0.50 kg mass is dropped from a height of 60.0 m. How fast will it be travelling when it hits a worker (has safety helmet) who is 2.0 m tall? Use the conservation of mechanical energy approach.

At the beginning :
total energy = P.E. + K.E
= mgh + 0(not moving)
=0.50(9.8)(60) = 294 J

At height of 2.0 m:
total energy = P.E. + K.E
$= 294\text{ J} = mgh + 0.5mv^2$
$294\text{ J} = 0.50(9.8)(2.0) + 0.5(0.50)\,v^2$
v = 33.7 m/s (safety helmet won't save him, unless air resistance plays a major role.) Try solving this problem with a different mass; the answer won't change.