WORKSHEET – NEWTON'S 2ND LAW OF MOTION AND KINEMATIC EQUATIONS

1. Liam is pushing a car down a level road at 2.0 m/s with a force of 243 N.
   a. Draw an FBD.
   b. What is the total force acting on the car in the opposite direction, including road friction and air resistance? *243N... why?*

2. Physicists can be, well, kinda fruity. What net force would be required, in each case, to accelerate a 500 g grapefruit at:
   a. 4.0 m/s^2 b. 12 m/s^2 *2 N, 6 N*

3. What acceleration would an unbalanced force of 84 N produce on each of the following masses?
   a. 4.2 kg b. 8.4 kg 20 m/s, 10 m/s

4. A 1200 kg car travelling at 50 km/h experiences an air resistance of 5000 N and road friction of 7500 N.
   a. What is the car's speed in m/s?
   b. If the wheels push forward with a force of 17500 N, what is the car's acceleration? *4.17 m/s^2*
   c. What is the car's speed, in km/h, if the acceleration was maintained over a distance of 1000 m? *332 km/h*

5. An 1100 kg car accelerates at 3.40 m/s^2.
   a. What is the net force acting on the car? *3740 N*
   b. If the car accelerates from rest for 30 s, what is its resulting velocity?
   c. If the wheels exert a force of 5600 N [fwd], what is the magnitude of the resisting force? *-1860 N*
   d. How long would it take for the car to come to rest assuming that only the resisting force is acting on it? An FBD will help.

6. What change in velocity would be produced by an unbalanced force of 2.0 x 10^4 N acting for 6.0 s on a 2000 kg dragster? *60 m/s*

7. A 4000 kg truck changes speed from 22.0 m/s [N] to 8.0 m/s [N] in 3.50 s. Determine the net force acting on the truck during this time. *-16000 N*

8. How long does it take a 50 kg rider on a 10 kg bicycle to accelerate from rest to 4.0 m/s [E] if the net force acting on the system is 48 N [E]? *5.0 s*

9. What is the net force that accelerates a 5.0 kg cannonball from rest to 150 m/s [W] if the force acts for 0.050 s? *15000 N*

10. A 500 g model rocket accelerates from 20 m/s [up] to 45 m/s [up] in 0.70 s.
    a. What is the net force acting on the rocket? *17.86 N*
    b. Assuming that the change in mass of the rocket is negligible (very little fuel used up), determine the magnitude of the thrust force that propels the rocket upward. *22.76 N*

11. Two ropes are attached to the front of an object. Rope 1 acts E30°N with a force of 120 N. Rope 2 acts E50°S with a force of 100 N. The ropes are parallel to the ground. If the object has a mass of 100 kg, determine the acceleration of the object assuming no friction.

12. An 80 kg box sitting on a floor is pushed with a force of 100 N [R]. The push encounters a resistance of 20 N [L]. Determine:
    a. The velocity of the object 8.5 s after the push was initiated, assuming that the object was already moving with a speed of 2m/s [R] prior to the push being initiated.
    b. Determine the distance the object would travel once the 100 N force was removed.