Physics 20
Chapter 2 Worksheet

Answer the following questions on a separate sheet. Make sure to follow all rules for setting up a question, sig digs, and scientific notation when appropriate. Answers are in brackets and italics after each question.

1. **Explain** what a "vector" is, and give specifics of how it is drawn.

2. You are pushing on a lawnmower so that the handle makes a 40° angle with the ground. The force you are exerting is 150 N.
   a) **Determine** the components of the force horizontally and vertically. *(Horz = 1.1e2N, Vert = 96N)*
   b) You are thinking about changing the handle position so that it makes an angle of 30° to the ground. **Prove** that this will help you move the mower more efficiently. *(Horz = 1.3e2 N, so more force being used to actually push forward.)*

3. You are taking an introductory course in aircraft so that you can eventually take flying lessons. In the course they are showing you how a helicopter can be blown off course if the pilot does not take the wind speed into account. The foolish pilot in the example is trying to fly West to a town that is 220 km away. He is flying helicopter that can move at 85 km/h in still air. He is flying due West, without taking into account that there is a 28 km/h [N] wind.
   a) **Determine** the pilot's resultant velocity. *(89 km/h [W18ºN])*
   b) **Determine** how long the pilot *thinks* he should be in the air to reach his destination. *(2.6h)*
   c) After the time he believes he should be in the air for, he lands. **Determine** how far North from his target he is when he lands. *(72 km [N])*

4. The airspeed of a small plane is 200 km/h. The wind speed is 50.0 km/h [E]. **Determine** the velocity of the plane relative to the ground if the pilot keeps the plane pointing in each of the following directions.
   a) East *(250 km/h [E])*
   b) West *(150 km/h [W])*
   c) North *(206 km/h [N14.0°E])*
   d) North 40° East *(2.4e2 km/h [E41°N])*
   e) West 16° South

5. A swimmer can swim at a speed of 1.80 m/s in still water. If the current in a river 200 m wide is 1.00m/s [E], and the swimmer starts on the south bank and swims so that she is always pointing directly across the river, **determine** each of the following.
   a) The swimmer's resultant velocity, relative to the river bank. *(2.06 m/s [N29°E])*
   b) How long she will take to reach the north shore. *(111s)*
   c) How far downstream she will land (from the point opposite her starting point). *(111 m [E])*

6. A swimmer on the south shore of a river wishes to swim to a dock directly north of her starting point. Her maximum swimming speed in still water is 4.0 km/h and there is a current in the river flowing 2.5km/h towards the west.
   a) **Determine** the direction in which she must swim so she goes straight north across the river. *([N39°E])*
   b) If the river is 2.0 km wide, **determine** how long it takes her to cross. *(0.65 h or 39 min)*

7. A pilot wishes to make a flight of 300 km [NE] in 45 minutes. When he checks with the meteorological office he finds out there will be a wind of 80 km/h [N] the whole way. **Determine** the heading and airspeed he should use for the flight. *(348 km/h [E36°N])*

8. An insurance company has asked you to visit an accident scene in the river valley. A car went over an 8.85m high cliff and fell so that it hit the ground 11.2 m from the base of the cliff. The driver was lucky to only receive a few small cuts and bruises. He claims that he was not driving over the posted speed limit of 35 km/h. **Determine** if you will tell the insurance company that he is lying or telling the truth. *(He's not lying; he was traveling at 30.0km/h)*

9. The school football team has asked you for advice. During kickoffs the ball is not going far enough. The team's kicker shows you his kicks, and you figure out that he consistently kicks the ball so that it leaves his foot moving at 72 km/h.
   a) **Predict** the best angle for him to try to kick the ball so that it will go as far as possible. *(45º)*
   b) If he does kick it at that angle, **determine** how far it will travel. *(41m)*
   c) The team is also concerned that it will travel low to the ground and hit them in the back of the heads! **Determine** the maximum height it will reach. *(10m)*