

**Phy131 First Homework Assignment**  
**Due Monday January 11**

**Question 1.**

Two forces act on a small object:

Force  $\vec{A}$ : The magnitude is 50 units in a direction  $30^\circ$  South of East

Force  $\vec{B}$ : The magnitude is 80 units in a direction  $50^\circ$  South of West

- a) Express these two forces as vectors using the unit vectors  $\hat{i}$  and  $\hat{j}$ .
- b) What is the net force acting on the object? Express your answer in terms of the unit vectors and also in terms of the magnitude and direction.
- c) If one wants to add a third force, such that the net force on the object is zero, what force (direction and magnitude) would you add?

**Question 2**

Katrina, Katya, and Katie are playing a game of three-way tug of war. There are three ropes attached to a circular ring, and each player pulls on a rope. Katrina pulls directly **North** with a force of 100 units. Katya pulls directly **West** with a force of 150 units. Katie pulls with a force of 150 units in a direction  $30^\circ$  **South of East**.

What is the net force (direction and magnitude) on the ring?

**Question 3**

There are two forces on an object. The net force on the object is 50 units to the north. If one force is 30 units to the west, what is the other force (direction and magnitude)?

**Question 4**

Lt. Charlotte's boat is at anchor. A lighthouse is located 200 meters due east of her boat. A bouy is located 300 meters from her in a direction  $60^\circ$  North of West. What is the location, Distance and Direction, of the bouy from an observer at the

lighthouse?

**Question 5**

The length of a bicycle pedal arm is 6 inches. A downward force of 100 pounds is applied to the pedal arm. Find the torque about the axis (pivot point) when the arm makes an angle of: a)  $30^\circ$ , b)  $90^\circ$ , and c)  $180^\circ$  with the vertical.

**Question 6**

Weak Willie and Strong Sammy have to carry a heavy 200 pound rock. To do this, they will put the rock on a 20 pound plank and each lift upward at the ends of the plank. The plank is 6 feet long. Weak Willie can only lift a maximum of 50 pounds. Strong Sammy can lift a maximum of 180 pounds.

- a) How close to Weak Willie's end of the plank can the rock be placed so they can both lift it (plus the plank)?
- b) How far from Weak Willie's end of the plank can the rock be placed so they can both lift it (plus the plank)?

**Question 7**

Timmy, Tommy, and Tammy are sitting on a teeter-totter. Timmy (120 pounds) sits 6 feet to the left of the pivot point, Tommy (100 pounds) sits 3 feet to the right of the pivot point, and Tammy sits 6 feet to the right of the pivot point. The teeter-totter is in equilibrium. What is Tammy's weight?