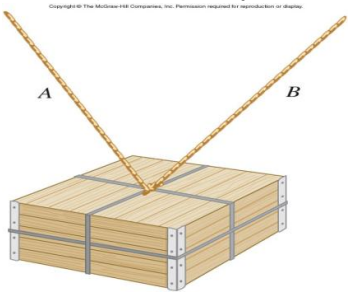
Name:_____

§11.1 Vectors in the Plane

1. Suppose that there are two forces acting on a sky diver: gravity at 180 lb down and air resistance. If the net force is 20 lb down and 20 lb to the left, what is the force of air resistance acting on the sky diver?

2. In the accompanying figure, two ropes are attached to a large crate. Suppose that rope A exerts a force of $\langle -164, 115 \rangle$ lb on the crate and rope B exerts a force of $\langle 177, 177 \rangle$ lb on the crate. If the crate weighs 275 lb, what is the net force acting on the crate? Based on your answer, which way will the crate move?



3. The thrust of an airplane's engines produces a speed of 600 mph in still air. The wind velocity is given by $\langle -30, 60 \rangle$ mph. In what direction should the airplane head to fly due west?

4. A paperboy is riding at 10 ft/s on a bicycle and tosses a paper over his left shoulder at 50 ft/s. If the porch is 50 ft off the road, how far up the street should the paperboy release the paper to hit the porch?

5. The water from a fire hose exerts a force of 200 lb on the person holding the hose. The nozzle of the hose weighs 20 lb. What force is required to hold the hose horizontal? At what angle to the horizontal is this force applied?

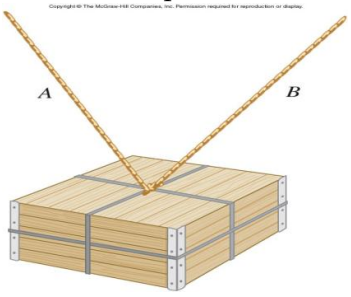
6. A person is paddling a kayak in a river with a current of 1 ft/s. The kayaker is aimed at the far shore, perpendicular to the current. The kayak's speed in still water would be 4 ft/s. Find the kayak's actual speed and the angle between the kayak's direction and the far shore.

§11.2 Vectors in Three Dimensions

7. Find the displacement vectors $\overrightarrow{PQ}$ and $\overrightarrow{QR}$ and determine whether the points $P = (2, 3, 1)$, $Q = (0, 4, 2)$, and $R = (4, 1, 4)$ are collinear.

8. Use vectors to determine whether the points $(0, 1, 1)$, $(2, 4, 2)$, and $(3, 1, 4)$ form an equilateral triangle.

9. In the accompanying figure, two ropes are attached to a 500 lb crate. Rope A exterts a force of $\langle 10, -130, 200\rangle$ lb on the crate, and ropte B exerts a force of $\langle -20, 180, 160\rangle$ lb on the crate. If no further ropes are added, find the net force on the crate and the direction it will move. If a third rope C is added to balance the crate, what force must this rope exert on the crate?



10. For the crate in Exercise 9, suppose that the crate weighs only 300 lb and the goal is to move the crate up and to the right with a constant force of $\langle 0, 30, 20 \rangle$ lb. If a third rope is added to accomplish this, what force must the rope exert on the crate?

11. The thrust of an airplane's engine produces a speed of 600 mph in still air. The plane is aimed in the direction of $\langle 2, 2, 1 \rangle$ and the wind velocity is $\langle 10, -20, 0 \rangle$ mph. Find the velocity vector of the plane with respect to the ground and find the speed.

12. The thrust of an airplane's engine produces a constant speed of 700 mph in still air. The plane is aimed in the direction of $\langle 6, -3, 2 \rangle$ but its velocity with respect to the ground is $\langle 580, -330, 160 \rangle$ mph. Find the wind velocity.