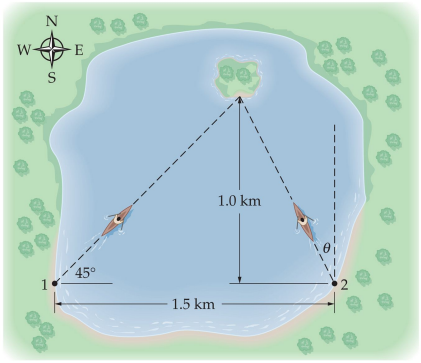
NAME _____ **PERIOD** ____

UNIT 5 PRACTICE PROBLEMS **AP PHYSICS**

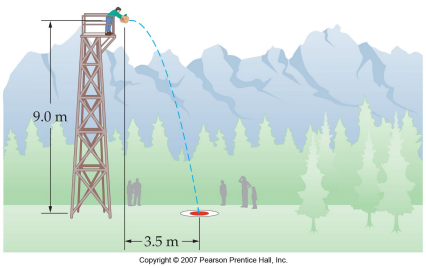
5.1 TWO DIMENSIONAL MOTION

1. A boat moves with a constant speed of 3.2 m/s in a direction 42° north of west. How far **(a)** west and **(b)** north has the sailboat traveled in 25 min?
2. As you walk to class with a constant speed of 1.60 m/s, you are moving in a direction that is 15.0° north of east. How much time does it take to change your displacement by **(a)** 20.0 m east or **(b)** 30.0 m north?
3. Starting from rest, a car accelerates at 2.0 m/s^2 up a hill that is inclined 5.5° above the horizontal. How far **(a)** horizontally and **(b)** vertically has the car traveled in 12 s?
4. Two canoeists start paddling at the same time and head toward a small island in a lake, as shown in **Figure 4–15**. Canoeist 1 paddles with a speed of 1.35 m/s at an angle of 45° north of east. Canoeist 2 starts on the opposite shore of the lake, a distance of 1.5 km due east of canoeist 1. **(a)** In what direction relative to north must canoeist 2 paddle to reach the island? **(b)** What speed must canoeist **2** have if the two canoes are to arrive at the island at the same time?



5.2 ZERO LAUNCH ANGLE PROJECTILES

5. An archer shoots an arrow horizontally at a target 15 m away. The arrow is aimed directly at the center of the target, but it hits 52 cm lower. What was the initial speed of the arrow?
6. An astronaut on the planet Zircon tosses a rock horizontally with a speed of 6.95 m/s. The rock falls through a vertical distance of 1.40 m and lands a horizontal distance of 8.75 m from the astronaut. What is the acceleration of gravity on Zircon?
7. In Denver, children bring their old jack-o-lanterns to the top of a tower and compete for accuracy in hitting a target on the ground. Suppose that the tower is 9.0 m high and that the bull's-eye is a horizontal distance of 3.5 m from the launch point. If the pumpkin is thrown horizontally, what is the launch speed needed to hit the bull's-eye?



8. On August 25, 1894, Chicago catcher William Schriver caught a baseball thrown from the top of the Washington Monument (555 ft, 898 steps). **(a)** If the ball was thrown horizontally with a speed of 5.00 m/s, where did it land? **(b)** What was the ball's speed and direction of motion when caught?

9. A ball rolls off a table and falls 0.75 m to the floor, landing with a speed of 4.0 m/s. **(a)** What is the acceleration of the ball just before it strikes the ground? **(b)** What was the initial speed of the ball? **(c)** What initial speed must the ball have if it is to land with a speed of 5.0 m/s?

5.3 GENERAL LAUNCH ANGLE PROJECTILES

10. A soccer ball is kicked with a speed of 9.50 m/s at an angle of 25.0° above the horizontal. If the ball lands at the same level from which it was kicked, how long was it in the air?
11. The “hang time” of a punt is measured to be 4.50 s. If the ball was kicked at an angle of 63.0° above the horizontal and was caught at the same level from which it was kicked, what was its initial speed?
12. In Sussex County, Delaware, a post-Halloween tradition is “Punkin Chunkin,” in which contestants build cannons, catapults, trebuchets, and other devices to launch pumpkins and compete for the greatest distance. Though hard to believe, pumpkins have been projected a distance of 4086 feet in this contest. What is the minimum initial speed needed for such a shot?
13. Babe Didrikson holds the world record for the longest baseball throw (296 ft) by a woman. For the following questions, assume that the ball was thrown at an angle of 45.0° above the horizontal, that it traveled a horizontal distance of 296 ft, and was caught at the same level from which it was thrown. **(a)** What was the ball's initial speed? **(b)** How long was the ball in the air?
14. A rock is thrown from a 50.0-m-high cliff with an initial velocity of 7.0 m/s at an angle of 53.0° above the horizontal. Find the velocity vector for when it hits the ground below.