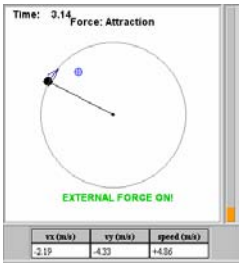
Worksheet for Exploration 5.2: Force an Object Around a Circle



In this Exploration you are looking down at a black ball on a table top. Drag the crosshair cursor **(position is given in meters and time is given in seconds)** to **within 5 m** of the 0.2-kg ball. The cursor will then exert a constant force on the black ball. You may choose either an attractive or a repulsive force. In addition, the black ball is constrained to move in a circle by a very long wire. The blue arrow represents the net force acting on the mass, while the bar graph displays its speed in meters/second. Restart.

For both attraction and repulsion, drag the cursor around to see how the net force varies.

a. At the beginning of the animation (before you move the cursor), in what direction does the net force point?

i. Make a sketch showing the force the wire exerts (F_{wire}), the external force (F_{ext}), the net force (F_{net}) if appropriate.

b. With this force, does the ball move?

c. What type of applied force makes the ball acquire a tangential velocity?

i. For each of the forces discussed in a. i , you should consider what the directions are. First what direction can F_{wire} have? Show on a sketch.

ii. Can this force (F_{wire}) contribute to the acquisition of tangential velocity?

iii. What specific property must the F_{ext} have in order to generate a tangential velocity?

d. Describe the direction of the force that makes the ball acquire the maximum tangential velocity for the force applied.

i. Is the direction constant?

ii. Is the net force in the same direction? Discuss.

e. When the ball has a tangential velocity, in which direction does the net force point when the cursor is nearby? In what direction does the acceleration point?

i. Describe both the tangential and radial components of the net force vector.

f. With the object moving, drag the cursor far away from the ball. In what direction is the net force now? What is the direction of the acceleration? Why?

i. Describe both the tangential and radial components of the net force vector.