Worksheet for Exploration 11.2: Nonuniform Circular Motion

Time: 3.12 Force: Attraction

EXTERNAL FORCE OFF!

vx (m/s)	vy (m/s)	|L| (Js)	KE (J)
+8.22	-8.67	+23.89	+14.27
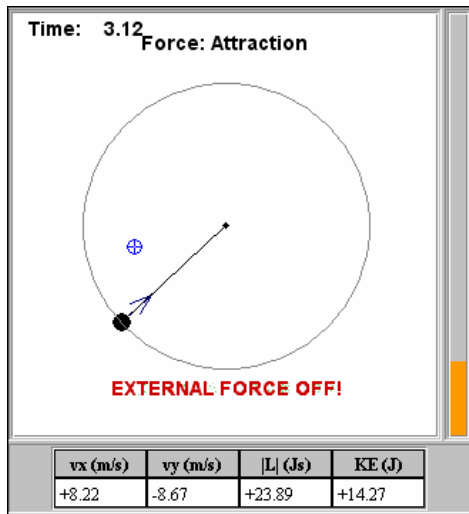
In this Exploration you are looking down at a black ball on a table top. Drag the crosshair cursor **(position is given in meters and time is given in seconds)** to within 5 m of the 0.2-kg black ball. The cursor will then exert a constant force on the black ball. You may choose either an attractive 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 kinetic energy in joules. Restart.

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

a. At the beginning of the animation (after you press "play" but before you move the cursor), in what direction does the net force point?
   i. Note that the net force includes the force due to the circular wire.

b. With this force, does the black ball move? Why or why not?

c. Where must you apply the force in order to make the ball acquire a tangential velocity?
   i. Try placing the crosshair and leaving it in a position, and then push play.
   ii. If you have not done so, consider where to place the crosshairs to make the ball not acquire a tangential velocity, then answer c.
   iii. You may want to sketch your results.

d. Describe the direction of the force that makes the ball acquire the maximum tangential velocity for the force applied.
   i. Consider what happens as time passes. How should you position the crosshair to keep increasing the tangential velocity?

e. How does the magnitude of the torque relate to the force applied?

f. How does the direction of the torque relate to the force applied?
   i. Sketch a sample picture including the appropriate angle, F and r. (Torque on the black ball).