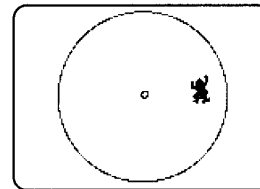


# 20 Frog on a Turntable

The concept investigated in this simulation is circular motion.



## Situation A

A frog is resting on an old-fashioned record-playing turntable when the turntable begins rotating. The friction force between the frog's feet and the turntable must provide the centripetal force needed to keep the frog in place.

### Make a Prediction

1. As the turntable rotates, the frog must strain to keep from being thrown off. Predict where it will be easiest for the frog to hold on to the turntable. Place a check next to your prediction.
  - a.  At the turntable's outer edge.
  - b.  At the turntable's center.
  - c.  At any point on the turntable. Location does not matter.



**Run Simulation** Set *Rotational speed* to 60.00 rpm. Set *Distance from center* to 6.00 cm. Click the *Run* button and observe the simulation. Note the *Centripetal force* and record it in Table 1. Click the *Reset* button. Set *Distance from center* to 12.00 cm. Click the *Run* button and observe the simulation. Note the *Centripetal force* and record it in Table 1.

Table 1 Effect of Distance from Center on Centripetal Force

	Distance from center (cm)	
	6.00	12.00
Centripetal force (N)		

2. Was your original prediction correct? Using data from Table 1, explain how the frog's distance from the center affects how hard it is to stay on the turntable.

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Complete Table 2 by running the simulation as directed below.



**Run Simulation** Click the *Reset* button. Set *Rotational speed* and *Distance from center* to the values in the first line of Table 2. Click the *Run* button and observe the simulation. Note the *Centripetal force* and *Linear speed* and record them on the first line in Table 2. Click the *Reset* button. Complete the rest of Table 2 by running the simulation for each set of values given for *Rotational speed* and *Distance from center*. Remember to click the *Reset* button before changing any values.

**Table 2 Effect of Rotational Speed and Distance from Center on Linear Speed and Centripetal Force**

Rotational speed (rpm)	Distance from center (cm)	Linear speed (m/s)	Centripetal force (N)
40.00	4.00		
40.00	8.00		
80.00	4.00		
80.00	8.00		

Questions 3–4 refer to the results in Table 2.

3. How is the linear speed related to the frog's distance from the center? Assume the rotational speed is constant.

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4. If the rotational speed doubles, what would the frog have to do to maintain a constant linear speed?

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5. If the rotational speed of the turntable is constant, is the linear speed of the frog at any fixed position constant? Explain.

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6. When the rotational speed of the turntable is constant, the frog's linear speed is also constant. Is the frog undergoing acceleration? Explain.

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