Name _____Answer Key_____ Date _____

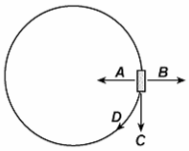
Honors Physics Gravity/Circles/Kepler WS #4H

Period _____ Mrs. Nadworny

# Centripetal Acceleration & Force

**Directions** – Read textbook pages 257 – 262. Solve the following problems using the GUESS method and correct significant figures. Be sure to show ALL work!

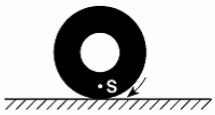
1. In the diagram below, a cart travels clockwise at a constant speed in a horizontal circle.



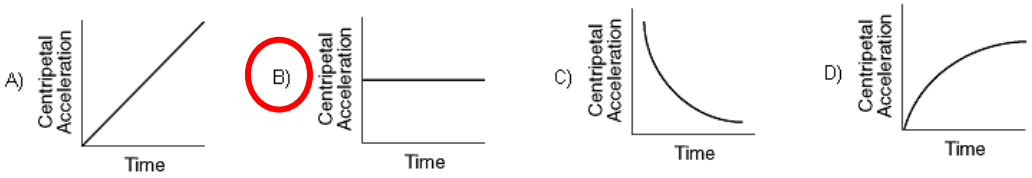

At the position shown in the diagram, which arrow indicates the direction of the centripetal acceleration of the cart?

A) A B) B C) C D) D

2. In the diagram below, S is a point on a car tire rotating at a constant rate.




Which graph best represents the magnitude of the centripetal acceleration of point S as a function of time?




3. A 2.7 kg object is being swung in a circle of radius 3.6 meters with a constant acceleration of 6.4 m/s$^2$.
   a. Calculate the speed of the object.

$$v = \sqrt{a_c \cdot r} = \sqrt{(6.4\,\tfrac{m}{s^2})(3.6m)} = 4.8\,\tfrac{m}{s}$$

   b. Calculate the force necessary to keep the object moving in a circle.

$$F_c = ma_c = 2.7kg(6.4\,\tfrac{m}{s^2}) = 17N \text{ inward}$$

Continued on next page

4. Sid E. Leitz is practicing his lasso skills for the big summer rodeo. He ties a 35 kg mass to the end of a rope and is swinging it at a constant speed of 12 m/s. The tension in the rope is 2500 N. Calculate the radius of the circle.

$$r = \frac{mv^2}{F_c} = \frac{35kg\,(12\,\frac{m}{s})^2}{2500N} = 2.0m$$

5. An object of mass *m* is moving in a circle of radius *r* at a speed *v*.
   a. What happens to the centripetal force if mass is doubled?

$$F_c = \frac{mv^2}{r} = \frac{(2)(1)^2}{1} = 2$$ Doubled

   b. What happens to the centripetal force if speed is doubled?

$$F_c = \frac{mv^2}{r} = \frac{(1)(2)^2}{1} = 4$$ Quadrupled

   c. What happens to the centripetal force if the radius is cut in half?

$$F_c = \frac{mv^2}{r} = \frac{(1)(1)^2}{1/2} = 2$$ Doubled

   d. What happens to the centripetal acceleration if the mass is quadrupled?

$$a_c = \frac{v^2}{r} = \frac{1^2}{1} = 1$$ Nothing because mass has no effect on acceleration

   e. What happens to the centripetal acceleration if the radius is tripled?

$$a_c = \frac{v^2}{r} = \frac{(1)^2}{3} = 1/3$$ 1/3 as big

Answers in size order: 0 or 1, 1/3, 2, 2, 2.0, 4, 4.8, 17