AP PHYSICS
ROTATIONAL and CIRCULAR MOTION TEST

Concepts:

1. Rotation of an object counterclockwise is positive/negative?
2. Rotation of an object clockwise is positive/negative?
3. A revolution is equal to ____________________.
4. All three sides of a Radian are _____________ length
5. The angular speed of an object on a rotating body is equal/different at different radius.
6. The tangential speed of an object on a rotating body is equal/different at different radius.
7. Where does the Centripetal Force vector point?
8. Where does the Centripetal Acceleration vector point?
9. Who was Copernicus?
10. What does Heliocentric mean? Geocentric?
11. Who discovered big G?
12. What are Keplers three laws?
13. If distance was increased between two objects, what happens to the force between them?

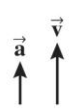
Problems:

1. A carousel—a horizontal rotating platform—of radius r is initially at rest, and then begins to accelerate constantly until it has reached an angular velocity ω after 2 complete revolutions. What is the angular acceleration of the carousel during this time?

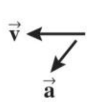
2) Shown below are the velocity and acceleration vectors for an object in several different types of motion. In which case is the object's velocity changing while its speed is not changing?

A)

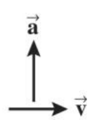

B)




C)




D)




3. If a satellite moves with constant speed in a perfectly circular orbit around the earth, what is the direction of the acceleration of the satellite?
A) in the forward direction
B) in the backward direction
C) outward away from the earth
D) inward toward the earth

E) The acceleration is zero because the speed is constant.

4. You are making a circular turn in your car on a horizontal road when you hit a big patch of ice, causing the force of friction between the tires and the road to become zero. While the car is on the ice, it
A) moves along a straight-line path away from the center of the circle.
B) moves along a straight-line path toward the center of the circle.
C) moves along a straight-line path in its original direction.
D) continues to follow a circular path, but with a radius larger than the original radius.
E) moves along a path that is neither straight nor circular.

5. Two small balls, A and B, attract each other gravitationally with a force of magnitude *F*. If we now double both masses and the separation of the balls, what will now be the magnitude of the attractive force on each one?
A) 16*F*
B) 8*F*
C) 4*F*
D) *F*
E) *F*/4

6. Halley's Comet is in a highly elliptical orbit around the sun. Therefore the orbital speed of Halley's Comet, while traveling around the sun,
A) is constant.
B) increases as it nears the Sun.
C) decreases as it nears the Sun.
D) is zero at two points in the orbit.

7. Corrigan drives at a constant speed of 15 m/s around a circular horizontal curve of diameter 60 m. What are the magnitude and direction of his centripetal acceleration?

8. You need to design a wheel for testing purposes such that its rim will have an acceleration of 1.5 *g* when the rim is moving at 37 m/s while spinning. What should be the diameter of this wheel?

9.Little Stephanie who has a mass 25kg. moves with a speed of 1.80 m/s when 12.4 m from the center of a merry-go-round. Calculate the Centripetal Force exerted upon Stephanie.

10.Levi twirls a yo-yo horizontally around her head (just like you twirled the rubber stopper). The yo-yo has a mass of 0.200 kg and is attached to a string 0.800 m long. If the yo-yo makes one complete revolution in 1.50 s, what force must exist in the string to maintain circular motion?

11.Calculate the centripetal acceleration of the earth ($m_{earth} = 6.00 \times 10^{24}$ kg) in its orbit around the sun and the net force exerted on the earth by the sun. Assume that the earth's orbit is a circle of radius $1.5 \times 10^{11}$ m.

12.Convert 3.5 rev/s to radians/s.

13.A grinding wheel initially at rest with a radius of 0.15 m rotates until it reaches an angular speed of 12.0 rad/s in 4.0 s. What is the wheel's average angular acceleration?

14.Anabelle's bicycle wheel rotates with a constant angular acceleration of 3.0 rad/s$^2$. If the initial angular speed of the wheel is 1.5 rad/s, what is the angular displacement of the wheel after 4.0 s?

14. Evelyn is piloting a helicopter that has 3.0 m long rotor blades that are rotating at an angular speed of 63 rad/s. What is the tangential speed of each blade tip?

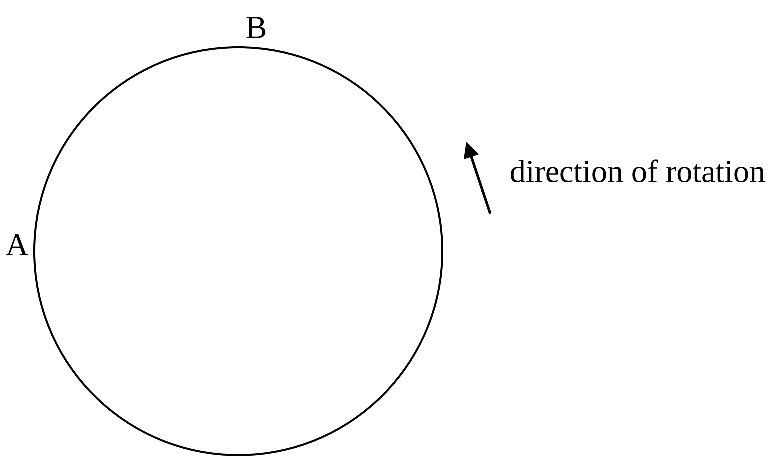

16.If an object is moving in a circular path at a constant speed, it is accelerating. How can that be true?

17.At point A on the circle below, draw:

- ❖ an arrow pointing in the direction of the centripetal force; label it $F_c$.
- ❖ an arrow pointing in the direction of the tangential velocity; label it $v_t$.

At point B on the circle below, draw

- ❖ an arrow showing the path the object would take if the object was on a string (like your rubber stopper lab) and the string broke at point B.




18.Earth rotates 360° every 24 h. What is the angular displacement of a person standing at the equator for 3.0 h?

| | **Radius** | **Mass** |
|---|---|---|
| Neptune | $2.43 \times 10^7$ m | $1.03 \times 10^{26}$ kg |

Use the data above to solve #19.

19. Bryce wouldn't stop talking, so Mrs. Loner decided to launch him in a satellite to orbit Neptune. Assume the satellite ( Bryce included) has a mass of 180 kg and is launched so that it orbits Neptune at an altitude of 12,000 km above the surface of the planet. What is the gravitational force between Neptune and Bryce's satellite?

20. Suppose the gravitational force between two masses is 12 N. If the distance between the two masses is cut in half, what is the gravitational force at the new distance? Show work or explain.