<u>Physics 200</u> **Name: ________________________________**

Mid-Term Review: Circular Motion and Gravitation

1. A wheel with a radius of 0.50 m makes one-half of a rotation. How far does the wheel move forward?
   - A. 1.57 m B. 3.14 m C. 6.28 m D. 90.0 m

2. A ball of mass m attached to a string is moving in a circle of radius r with a uniform speed of v. The tension in the string (i.e. the force needed to keep the ball moving in a circle) is F_T. If the velocity of the ball triples to 3v (i.e. 3 times its original velocity), what is the new tension in the string?
   - A. $F_T/9$ B. $F_T/3$ C. F_T D. $3F_T$ E. $9F_T$

3. A ball of mass m attached to a string is moving in a circle of radius r with a uniform speed of v. The tension in the string (i.e. the force needed to keep the ball moving in a circle) is F_T. If the mass of the ball increases to 5m (i.e. 5 times its original mass), what is the new tension in the string?
   - A. $F_T/25$ B. $F_T/5$ C. F_T D. $5F_T$ E. $25F_T$

5. If the distance bdetween two masses (measured from center to the center) is cut in half, then the force of gravitational attraction between the two masses
   - A. quadruples. B. doubles. C. stays the same.
   - D. is cut in half. E. is divided by four.

6. The orbital speed of a planet in our solar system does not depend upon
   - A. Newton's gravitational constant G. B. the planet's mass.
   - C. the Sun's mass. D. the planet's orbital radius

7. For an object in free fall near the surface of a planet (e.g. in our classroom), the value of the acceleration due to gravity, g, does not depend upon
   - A. the planet's mass. B. the object's mass. C. the planet's radius.

8. If the mass of a planet is doubled and the radius remains the same, what happens to g, the acceleration due to gravity, at the surface of the planet?
   - A. "g" remains the same B. "g" is halved
   - C. "g" is doubled D. "g" is quadrupled

11. A satellite is moving around the Earth in a circular orbit with a speed v. If the gravitational force of the Earth were to suddenly disappear, then the satellite would
   - A. move radially outwards (i.e. directly away from Earth) with a speed v.
   - B. move in a straight line tangential to its former orbit with a speed v.
   - C. spiral away from the Earth. D. fall towards the surface of the Earth.

12. Kepler's 2^{nd} Law implies that:
   - A. each planet moves with a constant speed in its elliptical orbit.
   - B. a planet moves fastest when it is closest to the Sun.
   - C. a planet moves fastest when it is furthest from the Sun.

13. An object weighs 100 N on Earth's surface. When it is moved to a point one Earth radius above Earth's surface, the force of gravity on the object will be

A. 25 N B. 50 N C. 100 N D. 400 N

14. Derive the formula for the speed of a stable orbit around Earth, using the Universal Law of Gravitation and centripetal force.

15. Explain or show the difference between a satellite's orbital radius and its altitude.

16. A 20kg aardvark is traveling in perfect 3m radius circles at a constant speed of 2m/s._ As the aardvark travels in these circles, rain is pushing the aardvark downward with a force of 3N, and crows are exerting an upward force on the creature. Describe the magnitude and direction of the **net force** acting on the aardvark.

17. Two bowling balls of mass 7.0 kg each have a radius of 10.0 **cm**. If they are placed next to each other so they are touching, calculate the gravitational force between them. (5 pts)

18. Find the orbital period of Mars, in Earth years. Mars' orbital radius is $2.278X10^{11}$m, and Earth's orbital radius is $1.4957x10^{11}$m.

Answers/Solutions:

1. A	2. E	3. D	~~4. D~~	5. A
6. B	7. B	8. C	~~9. D~~	~~10. D~~
11. B	12. B	13. A		

14. $v = \sqrt{\frac{GM}{r}}$

15. Orbital radius = distance from center of satellite to center of orbited planet or star. Altitude = distance from satellite to surface of orbited planet or star.

16. 26.7N toward the center of the circle

17. 8.17×10^{-8}N

18. 1.88 Earth Years