Name _____

GRAVITY HOLDS SOLAR SYSTEM TOGETHER

1. What stretches the fabric?

2. If we imagine the mass at the center of the table is the sun (M_{Sun}), then write an equation for the force that the object (M_{Object}) experiences at any location away from the center of the sun (r) because of the depression in spacetime.

3. If the object is released from rest, explain the motion of the object, and write the equation for the object's acceleration.

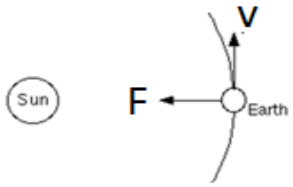
4. If we imagine that the marble is thrown tangentially to the earth, explain the motion of the earth and write the equation for the earth's acceleration.

5. Since the acceleration of the earth is centripetal, show an equation to find the speed of the earth as during the orbit assuming the orbit is circular.

Name _____

6. Use this speed to find the time that it takes the earth to orbit the sun.

7. Show the work for the derivation again and calculate the gravitational force of the sun on the earth, the average speed of the earth in the orbit around the sun, and the time in days that it takes for the earth to orbit the sun. Answers will vary from reality since the true orbit is not a perfect circle.



($Mass_{Sun}$ = 1.99 x 10^{30} kg, $Mass_{Earth}$ = 6 x 10^{24} kg, $r_{Earth\ to\ Sun}$ = 1.5 x 10^{11} m)

8. Show the work for the derivation again and calculate the gravitational force of the sun on Mercury, the average speed of Mercury in the orbit around the sun, and the time in seconds that it takes for Mercury to orbit the sun. Answers will vary from reality since the true orbit is not a perfect circle.
($Mass_{Sun}$ = 1.99 x 10^{30} kg, $Mass_{Mercury}$ = 3.28 x 10^{23} kg, $r_{Mercury\ to\ Sun}$ = 5.8 x 10^{10} m)

9. Explain why the orbit of Mercury is so much shorter than the orbit of the earth.