INTD-290: Number Systems in pre-Columbian Context

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How to Submit this Assignment

Once you answer the questions, take a picture of your work and convert it to a PDF. Submit the PDF to the assignment link on Moodle.

2 Introduction

For this asynchronous assignment, we will be using something called a Physics Educational Technology simulation, or PhET simulation. For an introduction to this tool, please follow this link to a tutorial video by one of my colleagues:

https://youtu.be/m6e2y4fef1I

3 The Simulation

To find this simulation, which teaches us how gravity and planetary orbits work, follow this link:

https://phet.colorado.edu/en/simulation/gravity-and-orbits

4 The Basics: circular and elliptical orbits

Instructions:

1. Starting with the link above, press the “to scale” option at the bottom of the screen. Chose the option with the star and planet.

   Check

2. Activate the path and grid options at right.

   Check

3. Click the play button and allow the planet to rotate through 360 degrees, all the way around the star. You can speed up or slow down the motion, which is just governed by gravity, with the controls.

   Check

4. Use the yellow measuring tape tool at right to measure two distances: (a) the distance from the star to the path of the planet on the right, and (b) the distance from the star to the path of the planet on the left. Are they the same number?
    - a) 90860 thousand miles from the star
    - b)94477 thousand miles from the star at 180 days, 94898 at exactly half the same rotation.
    - They are not the same number,
5. What would be true of the numbers if the orbit was perfectly circular?

    The numbers would be exactly the same.

Gravity

Instructions:

1. Using the controls at right, display the direction of the force of gravity.
    - The force of gravity goes anti parallel to one another of the earth and the sun.
2. What happens to the path of the planet if you deactivate gravity?
    - The path of the planet shoots upward
3. What happens to the force of gravity if you leave it activated, but click and drag the planet farther from the star?
    - The vector of gravity or the strength of the magnitude of the sun upon the planet decreases
4. Display the velocity with the control at right. Reveal what happens if you let the planet follow one orbit, and then pause, and then change the length of the velocity arrow. This corresponds to changing the speed of the planet. (Changing the direction of the arrow changes the direction of the velocity).
    - Upon this action of changing the velocity of the planet, the orbit or path alters as a result.

6 Kepler's Laws

Instructions:

1. Now that you can see how to control the system using velocity, force, and distance from star, try to make an orbit that is nearly circular. Show that the radius of the orbit is almost the same when measured at different places (it should be the same number all the way around for a circle, but this might be challenging).

    -I achieved a similar radial orbit of 91433 by lowering the velocity ever so slightly and used the grid to create a perfect circle.

2. For your circular orbit, determine what happens if you change the mass of the planet (controls at right). Answer this question: does the rate at which something accelerates downward due to gravity here on Earth depend on its mass? Is it different for planets?
    - No, the rate at which something accelerates downward does not depend on the mass but on gravity (9.81N) constant that is due to the earths pull. This is different from planets

because as you increase the mass of a planet or even the sun the force of attraction or even gravity force will increase.

3. Finally, tweak your orbit so that it is elliptical. Using the ruler and grid, find the area of a triangle swept out by the orbit when it is going faster (nearer to the star). The planet needs some number of days to sweep out this area. Find a different triangle on the other side of the orbit that requires the same number of days. Can you show that these triangles have the same area? This is Kepler's 2nd Law.

- I found that both of my triangles had an almost same area off by a factor of a thousand-ish that's probably due to humanistic error and is interesting considering I've never been aware of this law and seeing it first hand is quite remarkable.