INTD290: Number Systems in pre-Columbian Context

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1 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 thestar and planet.
2. Activate the path and grid options at right.
3. Click the play button and allow the planet to rotate through 360 degrees, all the way around the star. You canspeed up or slow down the motion, which is just governed by gravity, with the controls.
4. Use the yellow measuring tape tool at right to measure two distances: (a) the distance from the star to the pathof 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?- **No, the distance to the right is shorter (91308) than the distance to the left of the star(94600)**
5. What would be true of the numbers if the orbit was perfectly circular?

   The numbers would be the same, since the radius of the circle stays the same

5 Gravity

Instructions:

1. Using the controls at right, display the direction of the force of gravity.
2. What happens to the path of the planet if you deactivate gravity?

   The planet is no longer attracted to the star and does not move in circular motion

3. What happens to the force of gravity if you leave it activated, but click and drag the planet farther from thestar?

   The force of gravity becomes weaker and the planet takes a longer path around the sun, the diameter of the rotation increases

4. Display the velocity with the control at right. Reveal what happens if you let the planet follow one orbit, andthen 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).

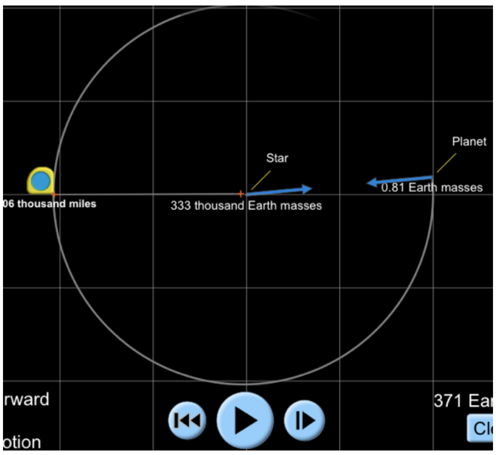
   When I changed the velocity and made it lower, the planet took a shorter path around the sun. When I increased the velocity, the planet took a wider path around the sun. It must have to do with the speed of the planet, since it increases, the diameter of the rotation increases, and as the speed of the planet decreases, the diameter decreases as well.

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 anorbit 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).

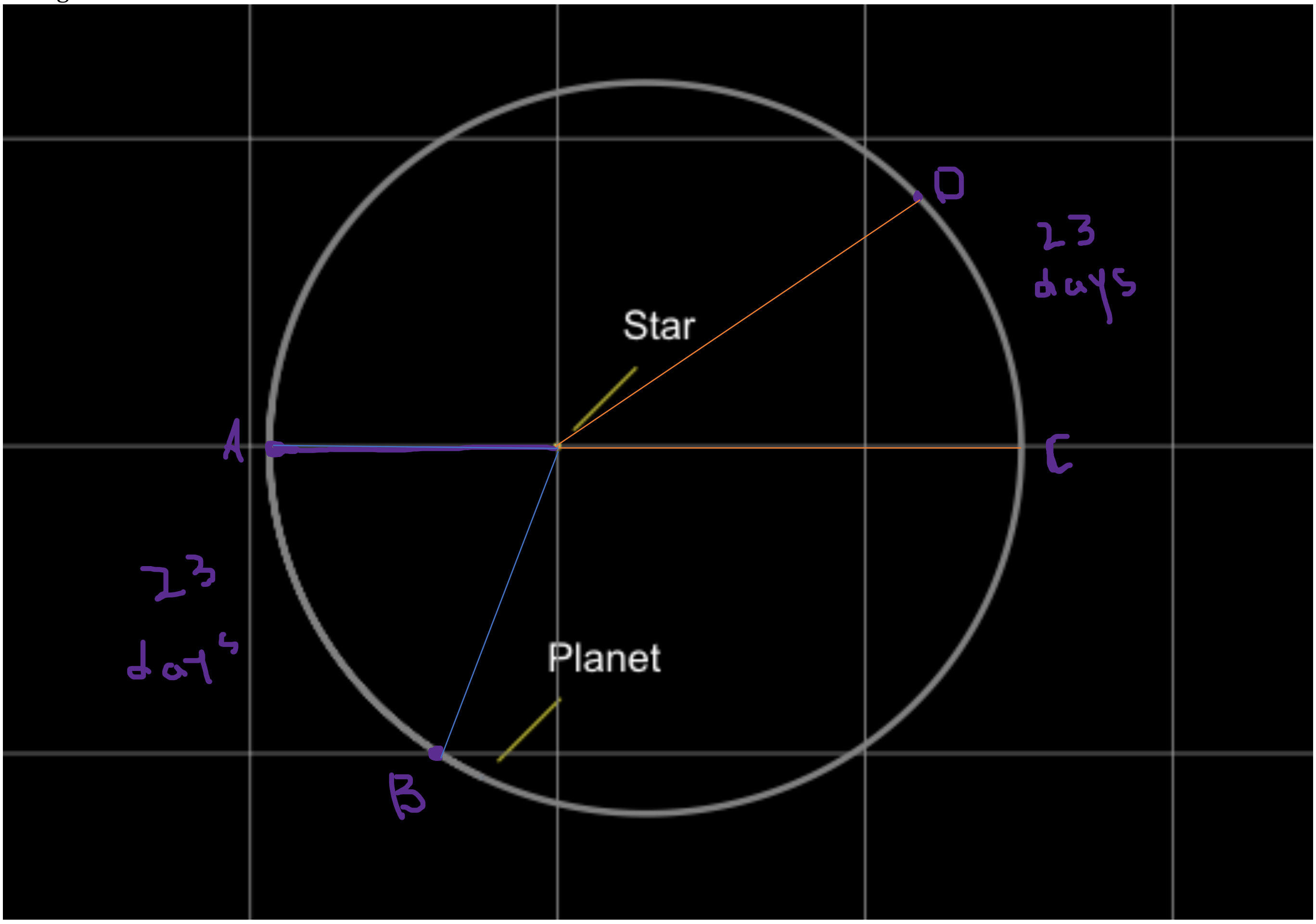
To make the planet move in more or less circular movement, I found the mass of the venus, this planet has the most circular rotation due it it's small eccentricity that corresponds to gravitational pull between the planet and the sun and has to do with it's mass.



2. For your circular orbit, determine what happens if you change the mass of the planet (controls at right). Answerthis question: does the rate at which something accelerates downward due to gravity here on Earth depend on its mass? Is it different for planets?

   The more the mass of the object=the more gravity it has. It works differently for other planets since they have different gravitational pull

3. Finally, tweak your orbit so that it is elliptical. Using the ruler and grid, find the area of a triangle swept outby 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



Keplers 2nd law states that planet passes from point A to point B at the same rate that it passes from B to C. A radius vector joining any planet to the sun sweeps out equal areas in equal lengths in time, therefore the areas are the same.