Warm Up

1. What is the radius of a cylinder that as it rotates at 4.5 m/s generates 1.3 m/s^2 of acceleration?
2. What is the mass of an object that rotated at 4.55 m/s around a radius of 88 cm and experienced 130 N of force?

Target

- I can explain what universal gravitation is and how to solve for it.

Gravitation

- Johannes Kepler was an astronomer who used data collected from his mentor to describe the behavior of planets around the sun.
- Kepler’s first law states planets move in ellipses around the sun.

- Kepler’s second law states planets move faster the closer they are the sun and slower the further from the sun.
- Kepler’s third law states a math relationships between the periods of any two planets and the distance from the sun.

- Newton took this information and explained it using the concept of gravitational force.
- Gravitational force is the attractions of any two objects due to the masses of each object.

- The gravitational force describe the attraction of any objects with mass in the universe and is called universal gravitation.
- $F = Gm_1m_2/r^2$

- The larger the mass, the stronger the force.
- The further the masses are from each other, the weaker the force is.
- Universal gravitation is used today to determine the velocity a satellite needs to be in order to orbit the Earth.

Practice

- Oliver, whose mass is 65 kg, and Olivia, whose mass is 45 kg, sit 2.0 m apart in their physics classroom. What is the force of gravitational attraction between Oliver and Olivia?
- Answer: 4.9×10^{-8} N

Practice

- Mr. Cree, whose mass is 60.0 kg, is doing a physics demonstration in the front of the classroom. How much gravitational force does he exert on 55.0 kg Martha in the front row, 1.50 m away? How does this compare to what he exerts on 65.0 kg Lester, 4.00 m away in the back row?
- Answer: 9.78×10^{-8} N
- Answer: 1.63×10^{-8} N

- Einstein show how gravity acts on an object.
- General Relativity describes gravity as a dip in the fabric of space called space-time.
- Object orbit and move by gravity because gravity creates a dip in this fabric causing a change in the motion of the object.

Summary

- Newton explained how gravity worked and expressed it using universal gravitation.
- Einstein explained the behavior of gravity as a an effect on space-time.

Assignment

- Work on Universal Gravitation Worksheet

Assignment

- Click on the link and try to get the highest score in the class.
- Questions to think about during the game:
- How is the sun affected as more objects are added?
- Which objects have the greatest effect on gravity?
- What effect does gravity on each object?