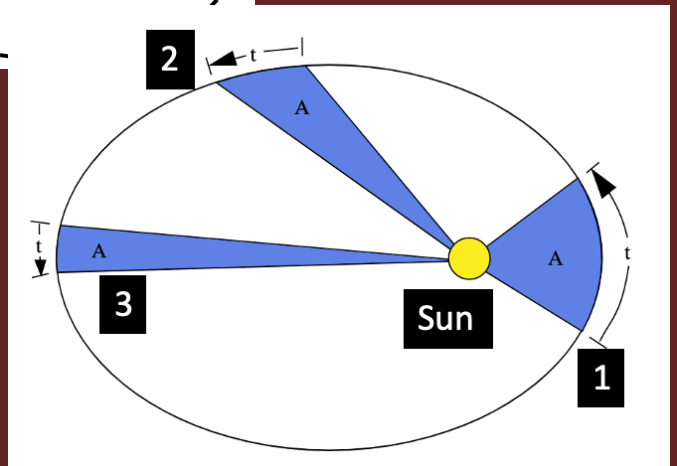
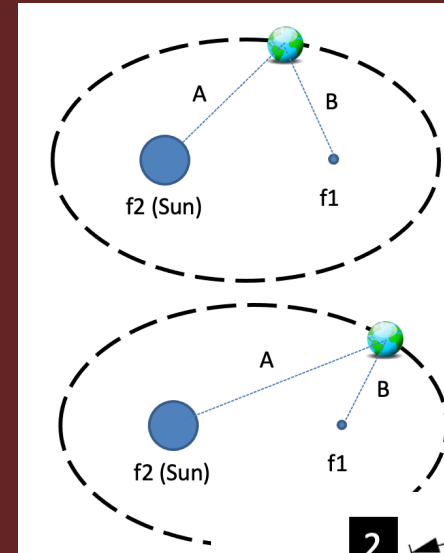


Gravitational Fields, Orbits and Kepler's Laws

- Gravitational Fields
- Calculating the Gravitational Field Strength
- Kepler's Three Laws of Planetary Motion
- The Constant of Proportionality - C



Preview File

Please enjoy this preview of your Student Version of the presentation. Please note within this sample file:

- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
- Other slides may have on them, this represents writing that has been removed on this sample

**The paid full version of your resource includes
both Google Slides and PowerPoint and is
Google Classroom Ready**



Gravitational Fields

- A gravitational field exists in the space surrounding an object in which the force of gravity is exerted on other objects
- If we are speaking in terms of the gravitational field surrounding a celestial body (i.e., a planet, etc.),

$$F_G = \frac{Gm_1m_2}{r^2}$$

$$F_g = F_G$$

- $F_g = mg$, therefore $m_2g = \frac{Gm_1m_2}{r^2} \rightarrow g = \frac{Gm_1}{r^2}$
- m_1 = larger object, m_2 = smaller

Check Your Understanding

- a) Calculate the magnitude of the gravitational field strength on the surface of Mars.

$$G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2 \quad r = 3.40 \times 10^6 \text{ m}$$

$$M = 6.37 \times 10^{23} \text{ kg} \quad g = ?$$

- b) What is the ratio of the magnitude of the gravitational field strength on the surface of Mars to that on the surface of Earth?

$$g = \frac{Gm_1}{r^2}$$

**This Slide Has Been
Removed**

Check Your Understanding

Determine the speed of Venus around the Sun.

$$G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$$

$$M_{\text{sun}} = 1.99 \times 10^{30} \text{ kg}$$

$$r_V = 1.08 \times 10^{11} \text{ m}$$

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

Kepler's Laws

1. _____

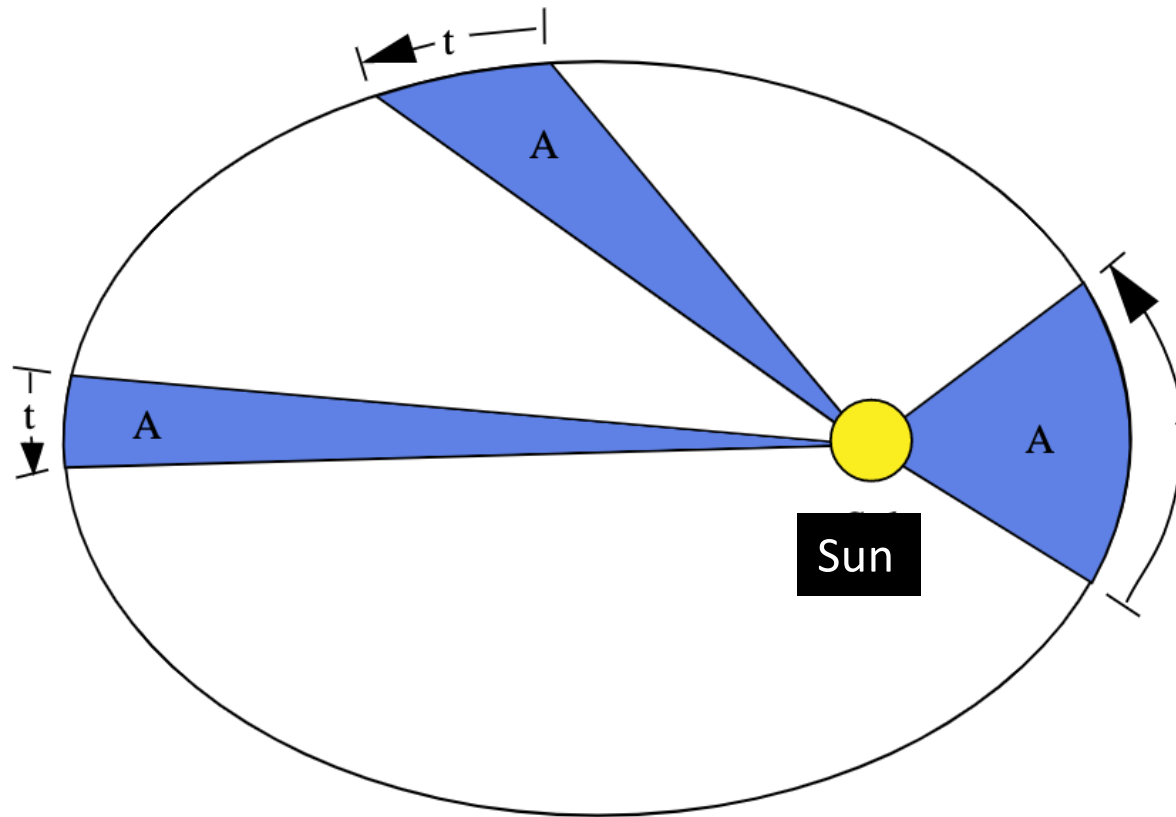
2. _____

3. _____

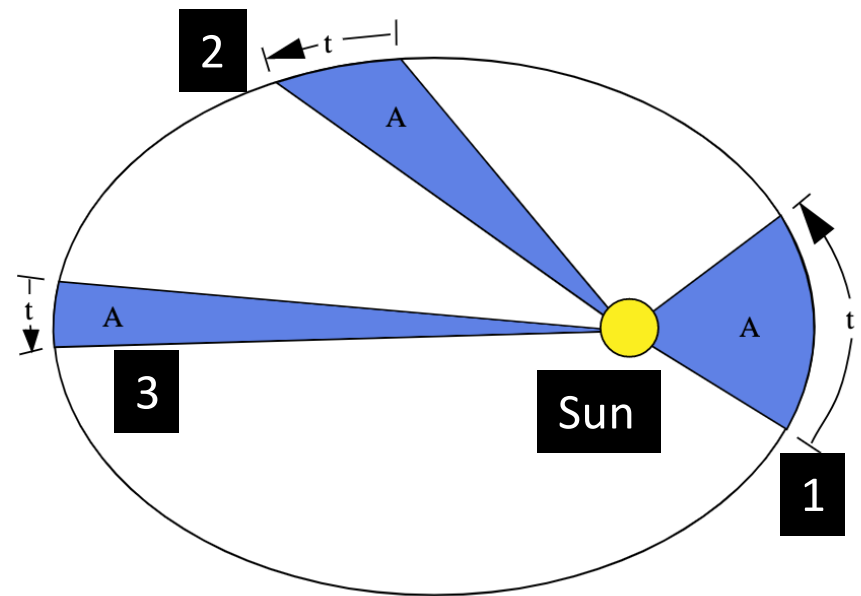
**This Slide Has Been
Removed**

Kepler's Second Law

A line joining a planet and the Sun sweeps out equal areas during equal intervals of time.



- If the planet is closer to the Sun (1), it needs to move farther around the orbit to create an area equal to when it is at a greater distance (2,3)



To cover the same area over the same amount of time, the planet at location 1 will have to move faster than location 2 which will move faster than location 3.

**This Slide Has Been
Removed**

Check Your Understanding

The average radius of Earth's orbit above the Sun is 1.495×10^8 km.
The period of revolution is 365.26 days.

- a) Determine the constant C_S to four significant digits.
- b) An asteroid has a period of revolution around the Sun of 8.1×10^7 s. What is the average radius of its orbit?

$$r^3 = C_S T^2$$

One More Thing

The constant of proportionality, C , will typically be given but it can also be calculated.

$$C = \frac{GM}{4\pi^2} = \frac{r^3}{T^2}$$