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Page 1 of [#]

# Module 1: The Laws of Physics Governing Orbital Mechanics

Course Owner: School of Warfighter Support  
Course Creator: NRO – CLEON  
Date: October 2017

The overall classification of this module is **UNCLASSIFIED**.

**FOR TRAINING PURPOSES ONLY**

Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Classification/Splash page gives overall classification of entire module

**Objective:** [Objective to which this slide corresponds]

**Sources:** [Where did the content for this page originate?]

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:**

- None

**AUDIO TEXT**

The overall classification of this module is Unclassified.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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UNCLASSIFIED Page 2 of [#]

**Module Objectives**

When you have completed this module, you will be able to:

- Define the term orbit
- Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit
- Summarize Kepler's three Laws of Motion

Click Next to continue.

Extras | Menu | **REPLAY** | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** This page lists the Objectives of the module.

**Objective:** n/a

**Sources:** n/a

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:**

- None

**AUDIO TEXT**

The goal of this module is to explain how and why a satellite stays in orbit.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED Page 3 of [#]

**Satellite Orbit**

Orbit = The path of one body as it revolves around another body.



Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Introduce the term orbit

**Objective:** Define the term orbit

**Sources:** multiple

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:**

- Create animation of satellite revolving around earth.

**AUDIO TEXT**

An orbit is the curved path of a celestial body or spacecraft as it travels around a star, planet, or moon under the influence of gravity. During this course, we will specifically be concerned with man-made satellites revolving around the earth. Each complete orbit of a satellite is called a revolution, or "rev."

**Acronyms & Glossary of Terms:**

Orbit = The path of one body as it revolves around another body.

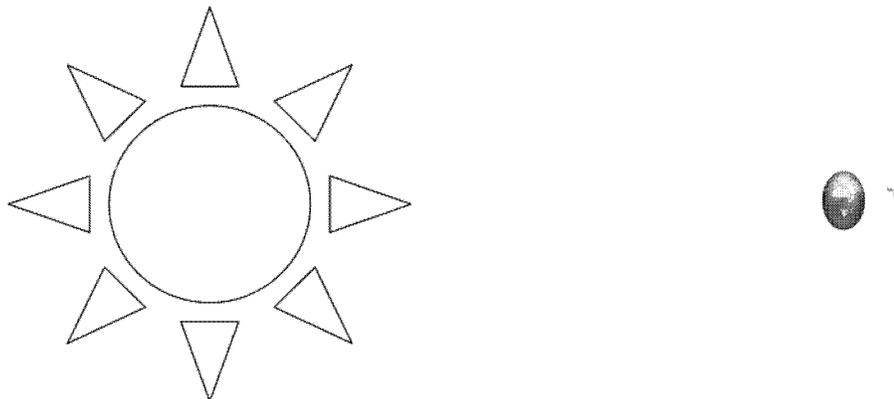
UNCLASSIFIED

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UNCLASSIFIED Page 4 of [#]

**Gravitational Forces**

The gravity of the larger body pulls the satellite inward.



Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain how gravity affects an orbiting body

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:**

- Might be able to animate the earth rotating around sun while the satellite rotates around earth but if not a still picture will get the point across.

**AUDIO TEXT**

The planets in our solar system orbit the Sun, and similarly man-made satellites orbit the earth. In both scenarios, the mass of the central body is overwhelmingly larger than the mass of the orbiting object. This creates gravitational forces that draw the orbiting object toward the central body.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED Page 5 of [#]

**Forces of Velocity**

**NEED A SLIDE HERE TO  
DEFINE/DESCRIBE  
VELOCITY AS IT  
APPLIES TO O.M.**

Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain how velocity affects an orbiting body

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:**

- sdfasdfsdf

**AUDIO TEXT**

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 6a of [#]

### Baseball Experiment

UNCLASSIFIED Audio | Back | Next

**Purpose of screen:** Explain how velocity affects an orbiting body

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:**

- a. Still picture: A regular guy throws the baseball

**AUDIO TEXT**

So, let's consider a common example of those two forces, gravity and velocity, at work.

If you were to throw a baseball, it will go some distance before it falls to the ground. Why does it fall? Because gravity is pulling it towards the center of the earth.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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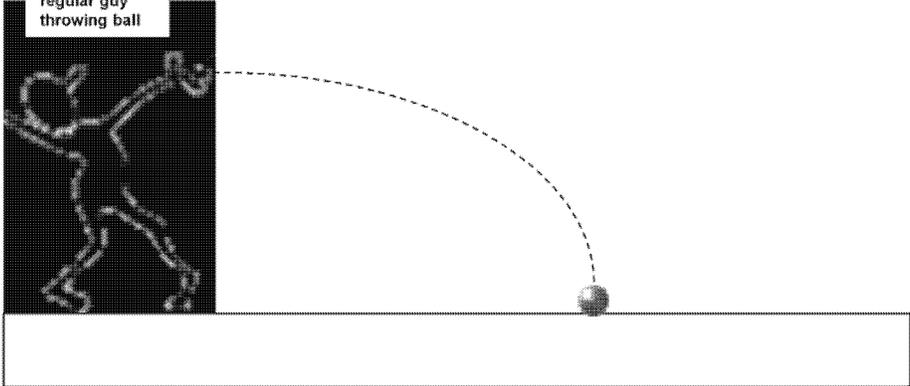
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UNCLASSIFIED Page 6b of [#]

### Baseball Experiment

Increasing the horizontal velocity increases the distance before the ball hits the ground.

First it is just a regular guy throwing ball



The diagram shows a stick figure on the left throwing a ball. A dashed line represents the ball's parabolic trajectory as it moves to the right and then falls back to the ground. A horizontal line represents the ground level.

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Extras | Menu | REPLAY | Audio | Back | Next

**Purpose of screen:** Explain how velocity affects an orbiting body

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:**

b. Still picture: Same regular guy throws the ball further this time. Text box is added.

**AUDIO TEXT**

If you throw it faster, it's going to go farther, but gravity is still going to pull it down.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

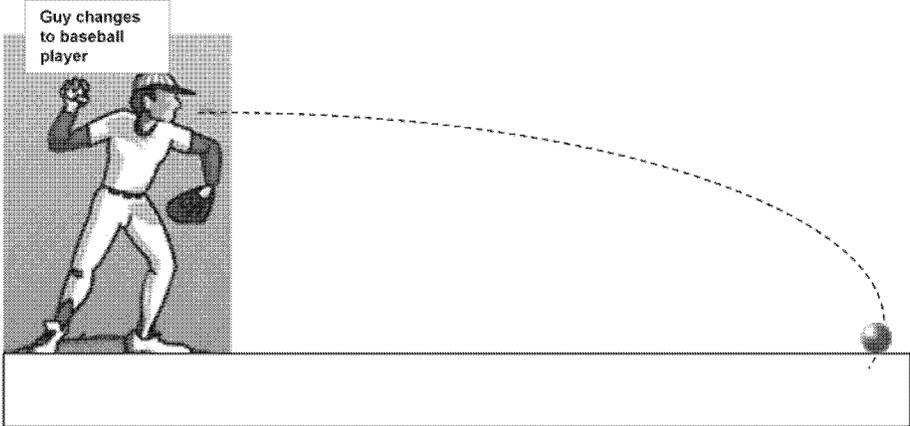
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UNCLASSIFIED

UNCLASSIFIED Page 6c of [#]

### Baseball Experiment

Increasing the horizontal velocity increases the distance before the ball hits the ground.



Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain how velocity affects an orbiting body

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:**

c. Still picture: Guy changes to a baseball player and throws ball much further.

**AUDIO TEXT**

If a professional baseball player throws that same ball, say at 100 miles per hour, it's going to go a lot farther, but it's still going to come to the ground eventually. This seems intuitive when viewed from our "flat earth" perspective, but the earth's surface curves.

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**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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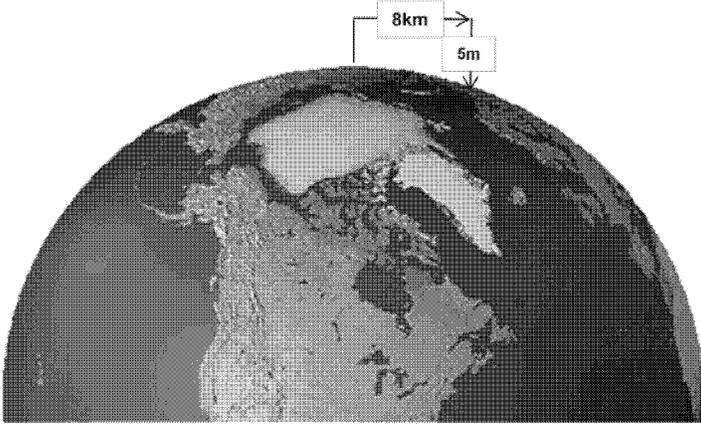
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Page 7a of [#]

### Curvature of the Earth

The surface of the earth curves down about 5m for every 8km.



The diagram shows a cross-section of the Earth's surface. A horizontal line represents the surface at a distance of 8 km from the center. A vertical line from the center to the surface at 8 km is labeled '8km'. A vertical line from the surface at 8 km down to the surface at 0 km is labeled '5m', illustrating the curvature.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain how curvature of the earth affects an orbiting body

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:**

a. Still picture: Picture changes to northern part of earth with first set of arrows and labels.

**AUDIO TEXT**

In fact, the surface of the earth curves down about 5 meters for every 8 kilometers that you travel.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED

UNCLASSIFIED Page 7b of [#]

**Curvature of the Earth**

The surface of the earth curves down about 5m for every 8km.

Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain how curvature of the earth affects an orbiting body

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:**

b. Still picture: Additional sets of arrows cascade in to the right

**AUDIO TEXT**

This means that the ball would have to go a huge distance, at a very high velocity, in order to clear the earth's surface and make it into orbit.

**Acronyms & Glossary of Terms:**

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[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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UNCLASSIFIED Page 8a of [#]

**Another Baseball Experiment**

An object must have a velocity of 17,676 mph (7.9 km/sec) to counter the force of gravity and achieve orbit.

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Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain how velocity affects an orbiting body

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:**

- a. Still picture: Now a superhero throws the ball.

**AUDIO TEXT**

Returning to our baseball example, it would take a superhero to reach that distance and overcome the force of gravity! The ball would need to travel at over 17,000 miles per hour.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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UNCLASSIFIED Page 8b of [#]

### Another Baseball Experiment

If the velocity is over 25,000 mph (11 km/sec), the object will break from Earth's gravity and travel into outer space.

Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain how velocity affects an orbiting body

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:**

b. Still picture: Superhero throws the ball out into space

**AUDIO TEXT**

If our superhero throws the ball even faster, say over 25,000 mph, it will go out of the earth's gravitational pull and into the solar system, like a deep space probe.

**Acronyms & Glossary of Terms:**

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[List any acronyms and terms/definitions that need to go into the glossary.]

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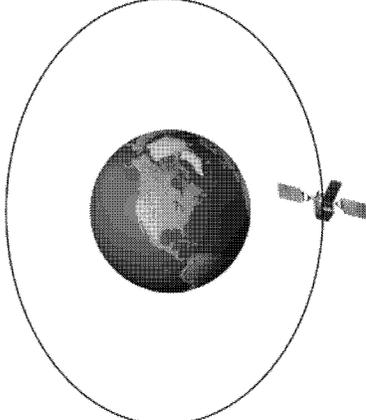
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Page 9a of [#]

### A Delicate Balance

The delicate balance between gravity and velocity enables a satellite to stay in orbit.



The diagram shows a central globe of Earth with a satellite in orbit. The satellite is depicted as a small rectangular object with two solar panels extending from its sides. It is positioned on the right side of a large, vertically-oriented oval that represents the satellite's orbit around the Earth. The Earth is shown with a grid of latitude and longitude lines.

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Extras | Menu | REPLAY | Audio | Back | Next

**Purpose of screen:** Explain balance between Gravity and Velocity

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:**

- a. Animation of satellite rotating the earth.

**AUDIO TEXT**

A satellite in orbit is literally falling around the Earth, but, because of its horizontal velocity, it never impacts the ground. Of course we use rockets, not super heroes, to “throw” satellites into orbit.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 9b of [#]

**A Delicate Balance**

The delicate balance between gravity and velocity enables a satellite to stay in orbit.

Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain balance between Gravity and Velocity

**Objective:** Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:**

b. Add Velocity and Gravity arrows in synch w/ narration.

**AUDIO TEXT**

Then, the satellite stays in orbit from a combination of the velocity it was launched with and the pull of gravity towards the center of the earth. Earth's gravity pulls the satellite towards the earth while the satellite's velocity moves it away.

A precise balance between gravity and velocity keeps a satellite in orbit. Too little velocity and the satellite falls back to Earth; too much velocity and it leaves the Earth for deep space, never to return.

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**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 10 of [#]

**Johannes Kepler**

- Lived 1571-1630
- German mathematician and astronomer
- Analyzed the movement of Mars
- Conclusion: Three universal laws govern planetary motion

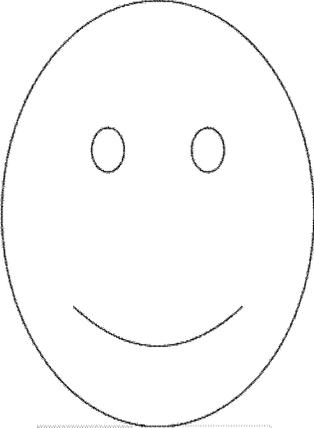


Photo of Johannes Kepler

Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Introduce Kepler and his 3 laws

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next.

**Media Elements:** Photo of Kepler

**AUDIO TEXT**

Johannes Kepler was a German mathematician and astronomer. He analyzed observations of the movement of Mars, as recorded by his mentor Tycho Brahe. From this analysis, he concluded that there are three laws that govern the movements of all planets. Not coincidentally, these laws also apply to the motion of satellites as they orbit Earth.

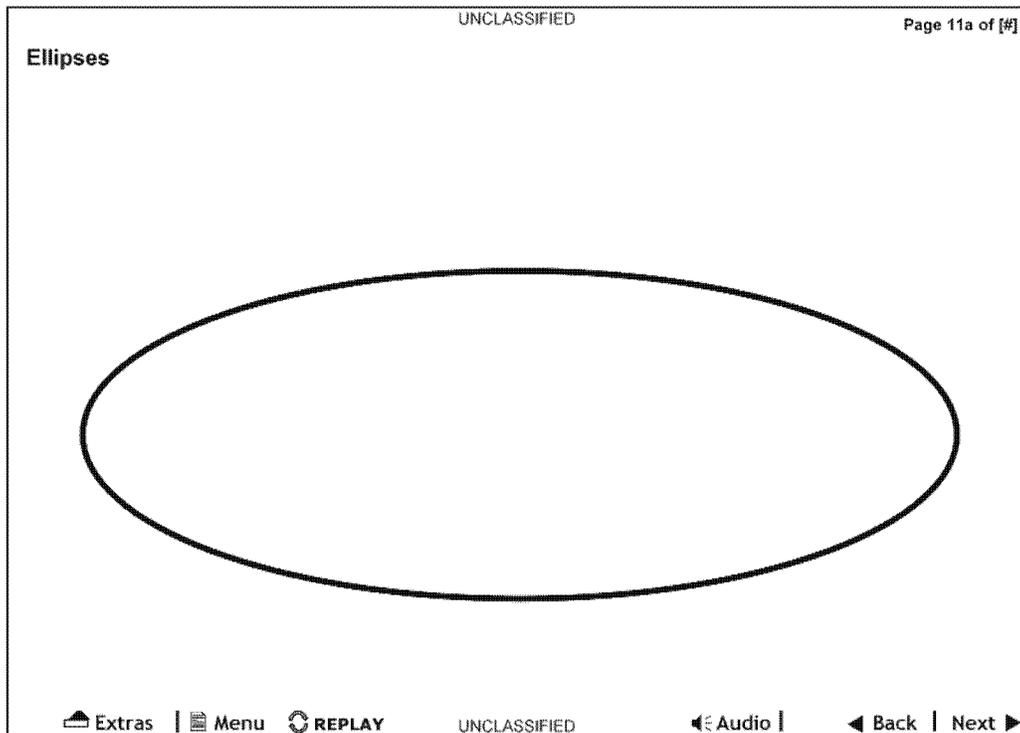
All scientific concepts come with rules, and orbits are no exception. The physics of orbits are necessarily math heavy; however, it is not necessary to memorize the equations in order to understand the concepts.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a quickly changing build of an ellipse and foci:

- a. oval only

**AUDIO TEXT**

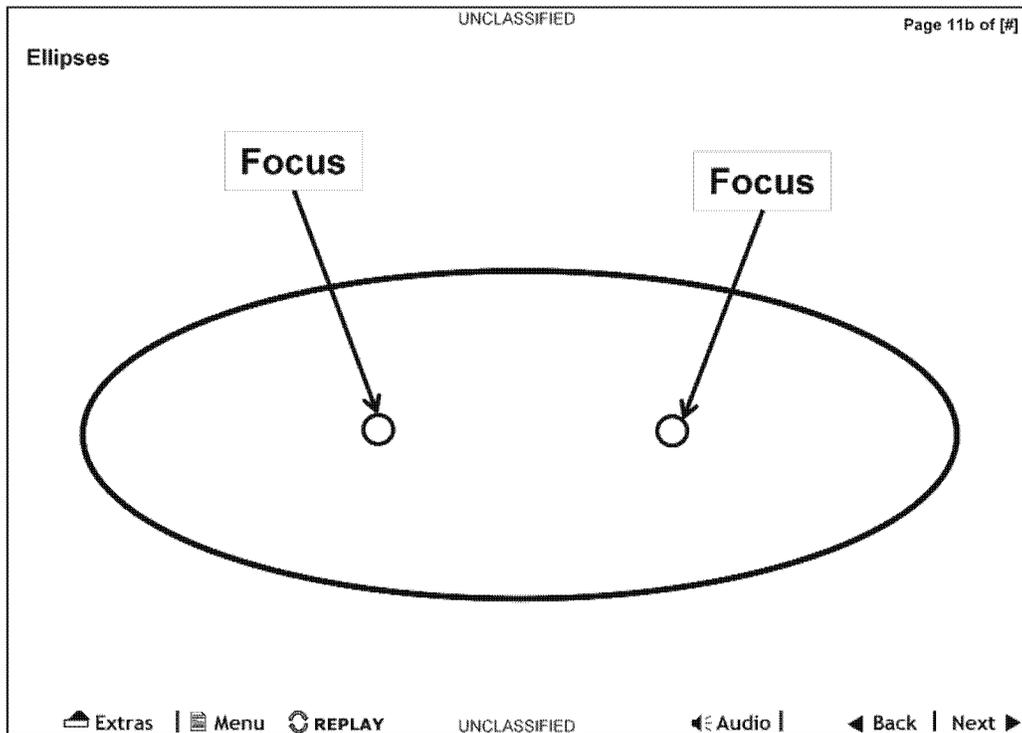
Before we dive into Kepler's laws, we need to define the term ellipse. Simply put, an ellipse is an oval.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a quickly changing build of an ellipse and foci:

b. first add foci and labels' then add formula

**AUDIO TEXT**

All ellipses have two points called foci. The location of each focus is determined by a formula.

**Acronyms & Glossary of Terms:**

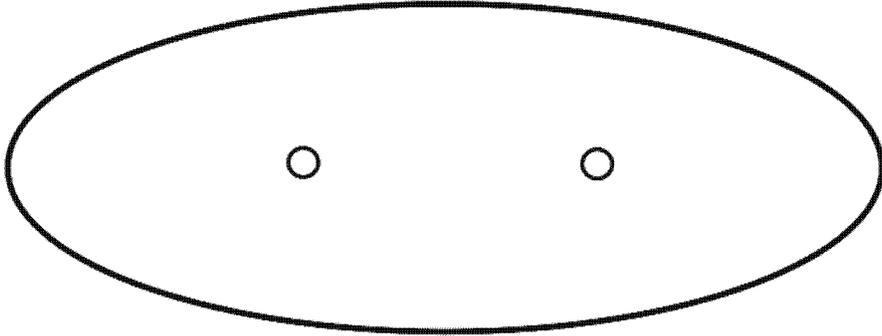
[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED Page 11c of [#]

**Ellipses**



$(D1 + D2) = (D3 + D4)$

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

The diagram shows a large horizontal ellipse with two small circles representing foci inside it. Below the ellipse is the formula  $(D1 + D2) = (D3 + D4)$ . The entire content is within a rectangular frame with a title 'Ellipses' in the top left and navigation controls at the bottom.

**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a quickly changing build of an ellipse and foci:

c. Add formula

**AUDIO TEXT**

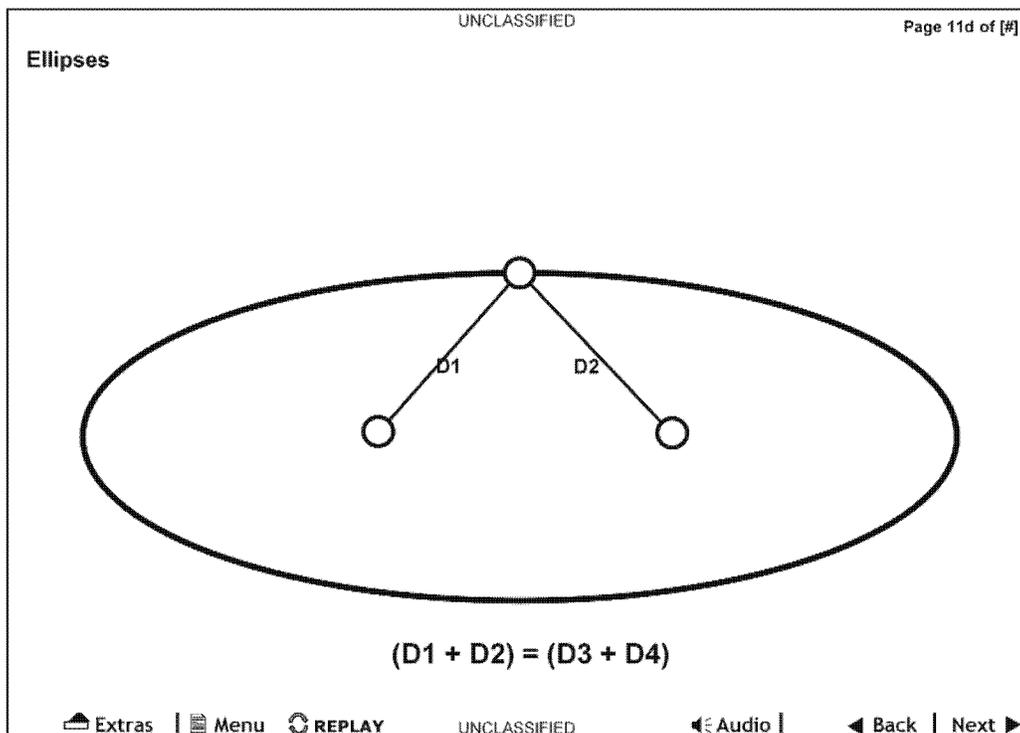
In this formula, D equals distance.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a quickly changing build of an ellipse and foci:

d. Add purple point, then lines, and then labels D1 and D2 (in synch w/ naration)

**AUDIO TEXT**

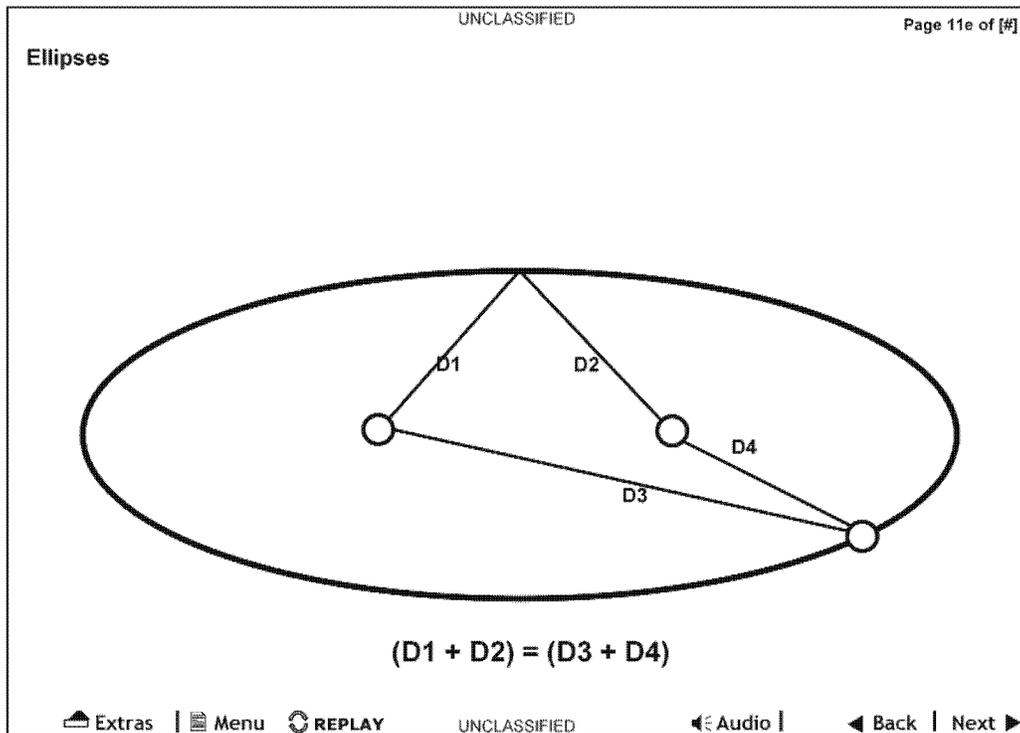
We start by measuring the distance from any point around the ellipse to each of the foci. Those are D1 and D2.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a quickly changing build of an ellipse and foci:

e. move purple point, then add lines and then labels D3 and D4 (in synch w/ narration)

**AUDIO TEXT**

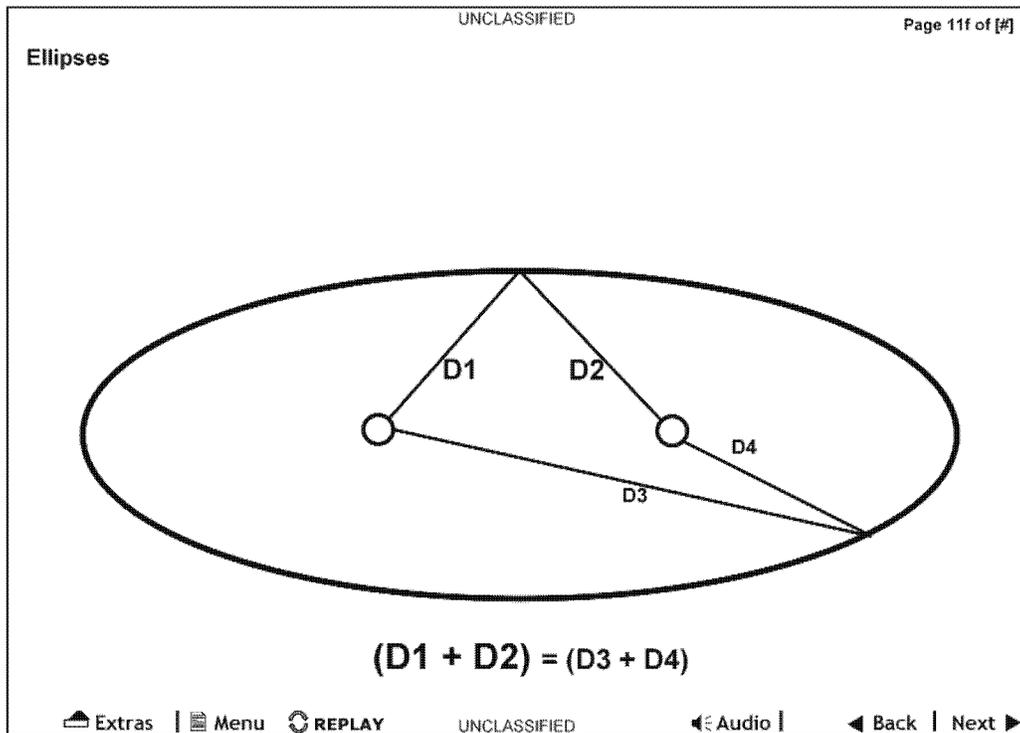
Next, measure from both foci to any other point anywhere around the ellipse. Those are D3 and D4.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a quickly changing build of an ellipse and foci:

f. remove purple point; first  $(D1 + D2)$  gets highlighted (red/bold maybe?) in the formula along with the D1 and D2 lines.

**AUDIO TEXT**

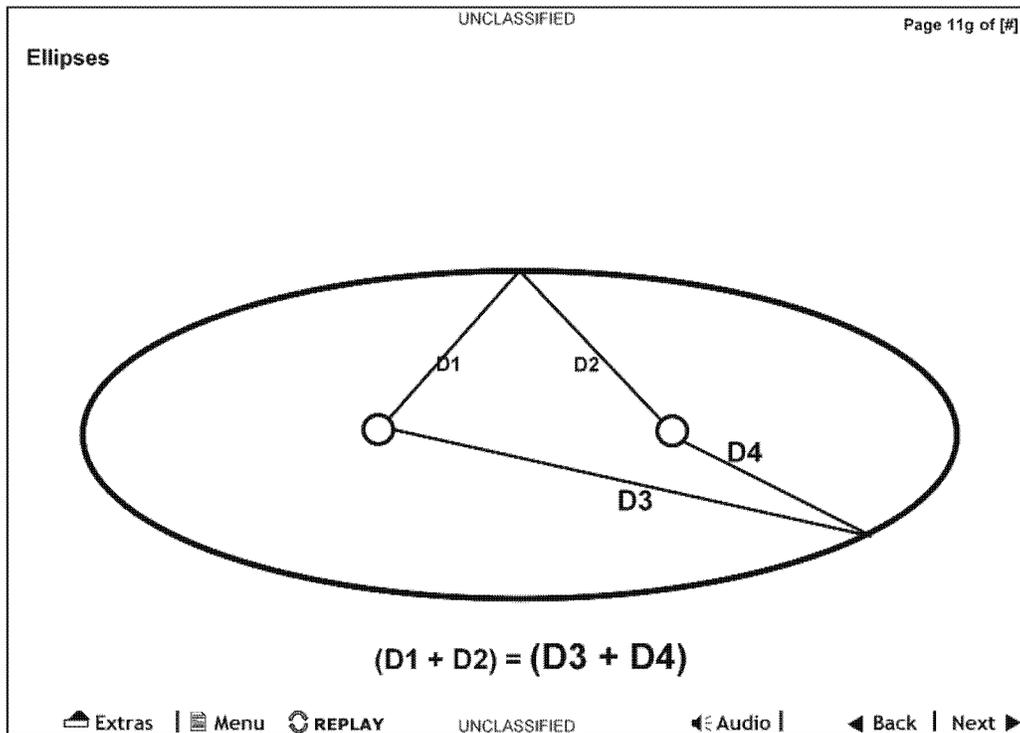
The sum of D1 and D2 . . .

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED



**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a quickly changing build of an ellipse and foci:

g. Then  $(D3 + D4)$  in formula gets highlighted along with D3 and D4 lines.

**AUDIO TEXT**

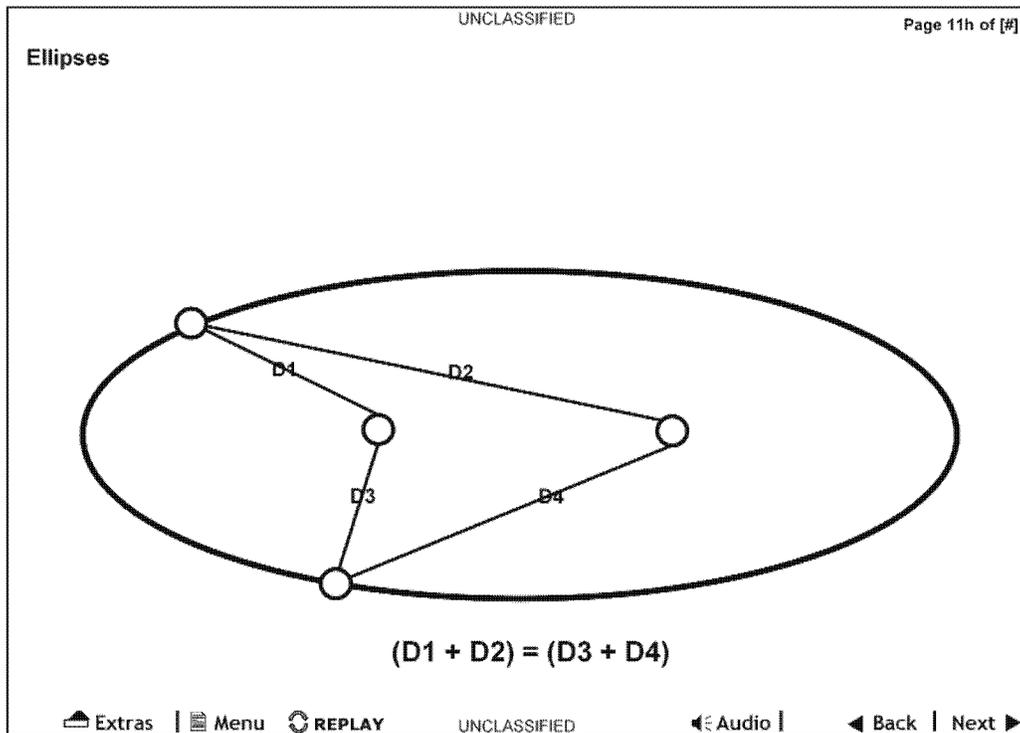
... will always equal the sum of D3 and D4.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a quickly changing build of an ellipse and foci:

h. relocate all of the lines and the 2 purple points

**AUDIO TEXT**

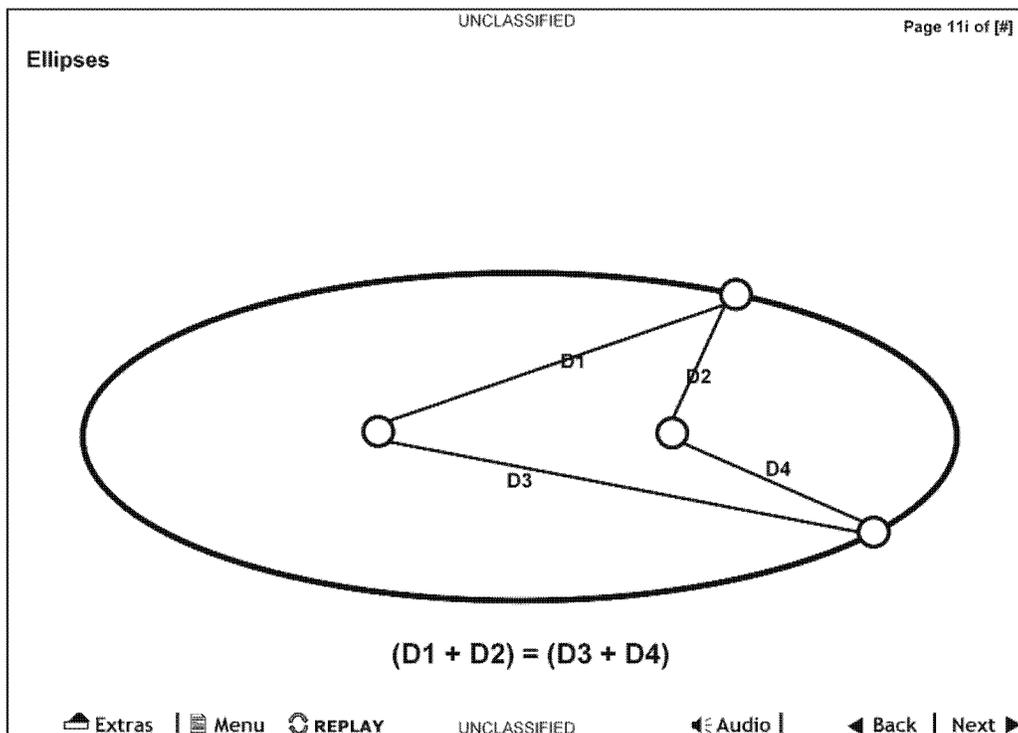
It doesn't matter which two points on the ellipse you choose.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a quickly changing build of an ellipse and foci:

i. relocate all of the lines and the 2 purple points AGAIN

**AUDIO TEXT**

D1 plus D2 will always equal D3 plus D4.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED

UNCLASSIFIED Page 11j of [#]

**Ellipses**

An ellipse is a regular oval shape, traced by a point moving in a plane so that the sum of its distances (D) from two other points (the foci) is constant.

$(D1 + D2) = (D3 + D4)$

Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define ellipse

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next

**Media Elements:** a quickly changing build of an ellipse and foci:

j. Back to same graphic as 11e; add text box.

**AUDIO TEXT**

So, to get more technical, an ellipse is a regular oval shape, whereby the sum of the distances from any point to both of the foci is constant no matter where on the oval the point is located.

All this really means is that the location of the foci determine the size and shape of the oval. This is important in understanding Kepler's three laws.

**Acronyms & Glossary of Terms:**

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[List any acronyms and terms/definitions that need to go into the glossary.]

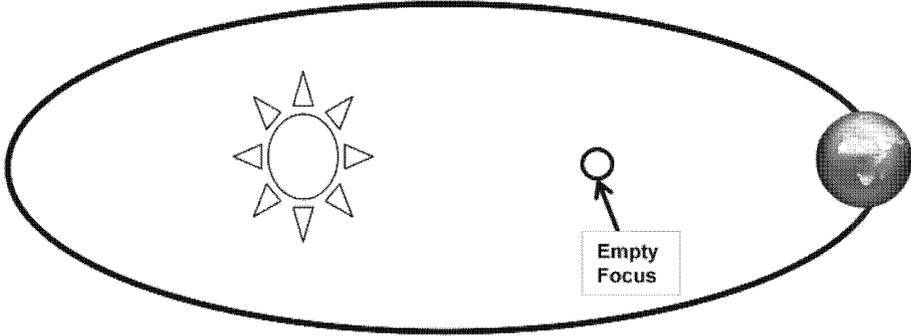
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UNCLASSIFIED Page 12a of [#]

**Kepler's First Law of Planetary Motion**

Kepler's 1<sup>st</sup> Law of Motion:  
 "The orbit of every **Planet** is an ellipse with the **Sun** at one of the foci."



Empty Focus

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define Kepler's first law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a build of an ellipse with changing objects orbiting around it

a. Opens w/ earth in orbit around sun

**AUDIO TEXT**

Kepler's First law of Planetary Motion states that "The orbit of every planet is an ellipse with the Sun at one of the foci." In this scenario, the second focus of the ellipse is empty.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

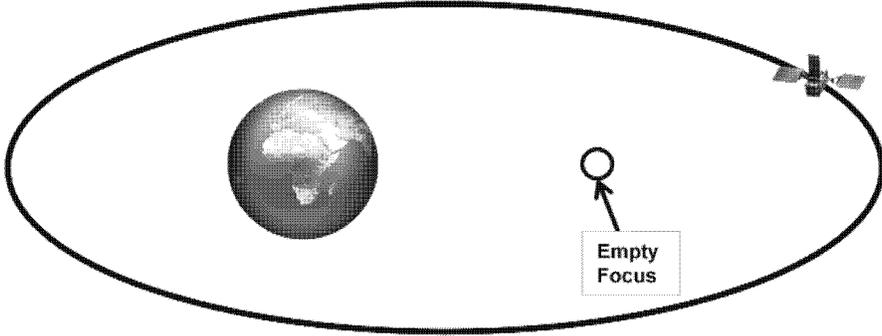
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UNCLASSIFIED

UNCLASSIFIED Page 12b of [8]

**Kepler's First Law of Planetary Motion**

Kepler's 1<sup>st</sup> Law of Motion: (Adapted to Earth Satellites)  
 "The orbit of every **Satellite** is an ellipse with the **Earth** at one of the foci."



Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define Kepler's first law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next

**Media Elements:** a build of an ellipse with changing objects orbiting around it

b. Text at top changes; now a satellite is orbiting around earth

**AUDIO TEXT**

This can easily be adapted to earth-orbiting satellites. Now the Earth is one of the foci.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED

UNCLASSIFIED Page 13 of [#]

Kepler's First Law Interpreted

Need a slide here  
interpreting and explaining  
why we care.

Click Next to continue.

Extras | Menu | REPLAY UNCLASSIFIED Audio | Back | Next

**Purpose of screen:** explain Kepler's first law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next

**Media Elements:** asdfasdf

asdfasdfasdf

**AUDIO TEXT**

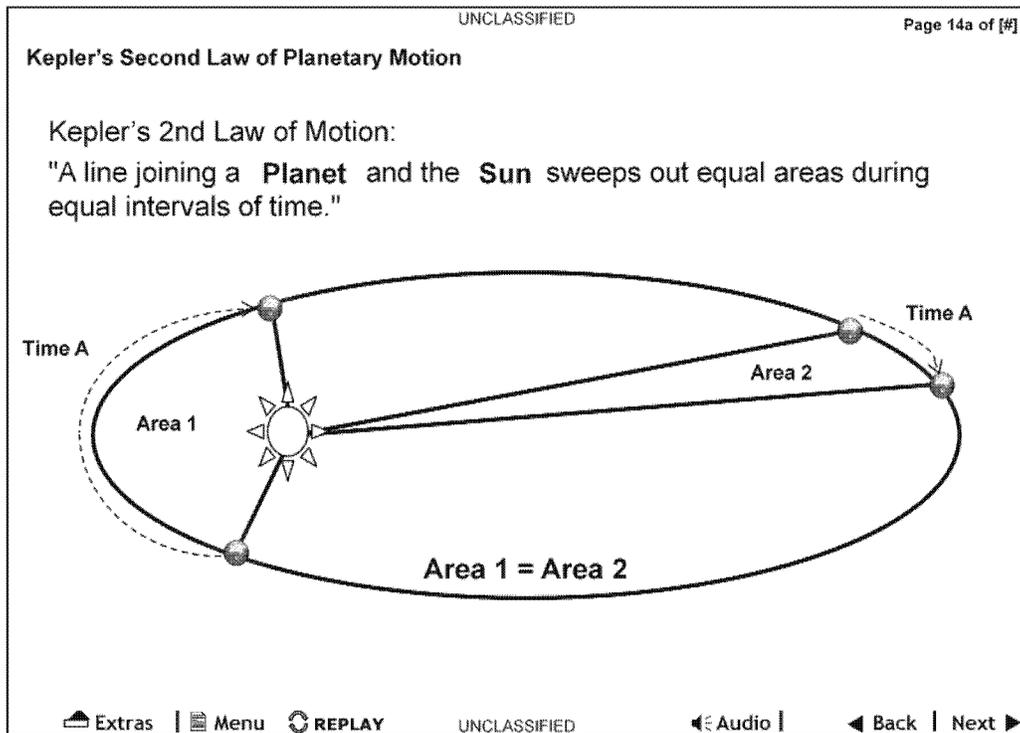
asdfasfsdf

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

UNCLASSIFIED



**Purpose of screen:** Define Kepler's 2<sup>nd</sup> law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a build of an ellipse with changing objects orbiting around it

a. Opens w/ earth in orbit around sun

**AUDIO TEXT**

Kepler's Second Law of Planetary Motion states that "A line joining a planet and the Sun sweeps out equal areas during equal intervals of time."

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

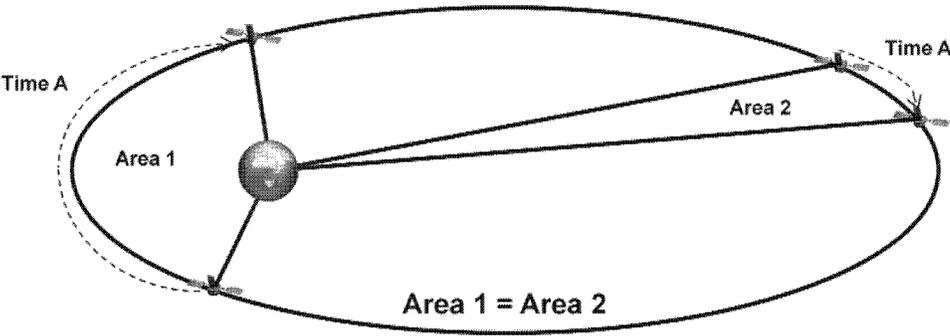
UNCLASSIFIED

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UNCLASSIFIED Page 14b of [9]

### Kepler's Second Law of Planetary Motion

Kepler's 2nd Law of Motion: (Adapted to Earth Satellites)  
 "A line joining a **Satellite** and the **Earth** sweeps out equal areas during equal intervals of time."



Area 1 = Area 2

Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define Kepler's 2<sup>nd</sup> law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next

**Media Elements:** a build of an ellipse with changing objects orbiting around it  
 b. Text at top changes; now a satellite is orbiting around earth

**AUDIO TEXT**

Again, this can readily be applied to man-made satellites orbiting the earth.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

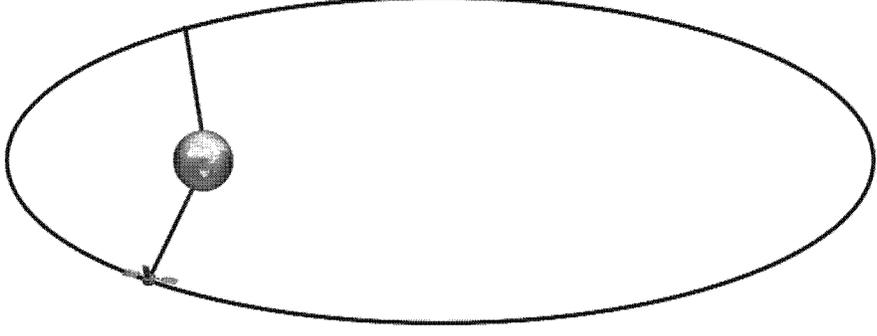
UNCLASSIFIED

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UNCLASSIFIED Page 15a of [#]

**Kepler's Second Law Interpreted**

In a certain amount of time, a satellite covers a certain distance around its orbit and covers a certain area of space.



The diagram shows an elliptical orbit with a central body (represented by a shaded sphere). A satellite is shown at the leftmost point of the orbit. A line segment connects the central body to the satellite, and another line segment connects the central body to a point further along the orbit. The region between these two line segments and the arc of the orbit is shaded, representing the area swept out by the satellite as it moves from the first point to the second.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define Kepler's 2nd law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Animation of satellite on left moving from first point around to 2<sup>nd</sup> point. The "area" builds with it. Finally the labels and green arrow appear.

**AUDIO TEXT**

But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

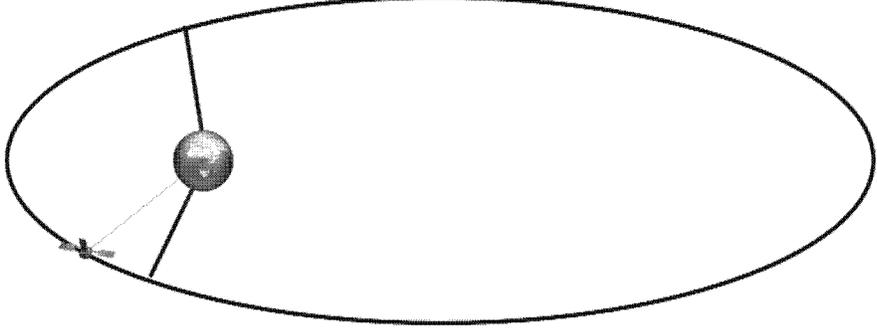
UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 15b of [9]

**Kepler's Second Law Interpreted**

In a certain amount of time, a satellite covers a certain distance around its orbit and covers a certain area of space.



Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define Kepler's 2nd law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Animation of satellite on left moving from first point around to 2<sup>nd</sup> point. The "area" builds with it. Finally the labels and green arrow appear.

**AUDIO TEXT**

But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

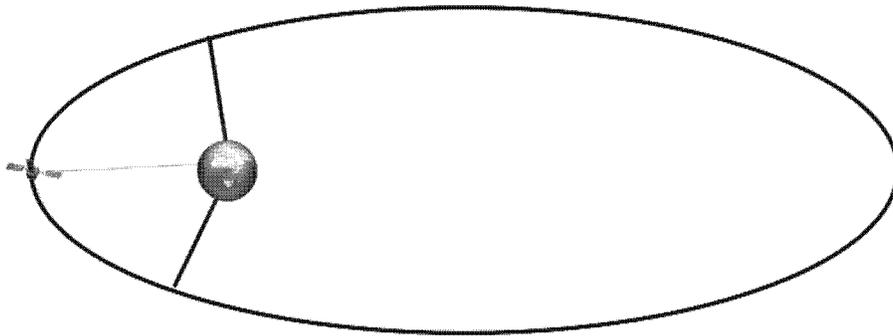
UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 15c of [#]

**Kepler's Second Law Interpreted**

In a certain amount of time, a satellite covers a certain distance around its orbit and covers a certain area of space.



Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define Kepler's 2nd law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Animation of satellite on left moving from first point around to 2<sup>nd</sup> point. The "area" builds with it. Finally the labels and green arrow appear.

**AUDIO TEXT**

But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

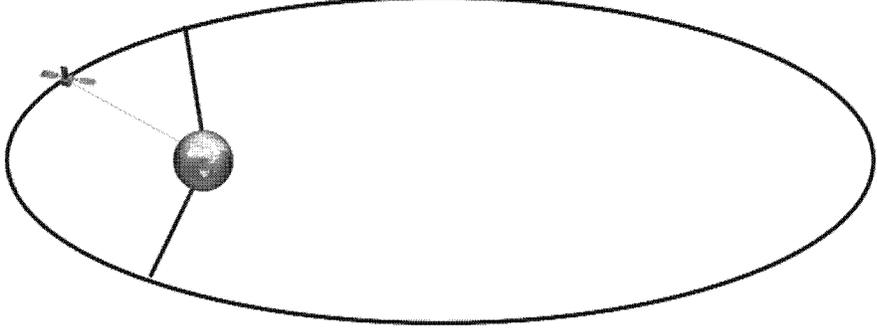
UNCLASSIFIED

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UNCLASSIFIED Page 15d of [9]

### Kepler's Second Law Interpreted

In a certain amount of time, a satellite covers a certain distance around its orbit and covers a certain area of space.



Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define Kepler's 2nd law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Animation of satellite on left moving from first point around to 2<sup>nd</sup> point. The "area" builds with it. Finally the labels and green arrow appear.

**AUDIO TEXT**

But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

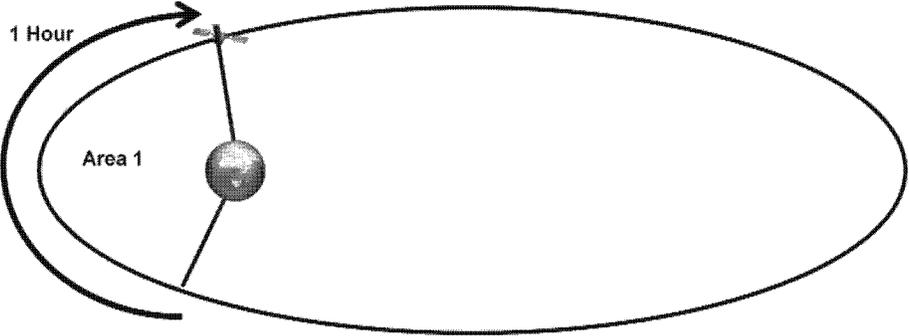
UNCLASSIFIED

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UNCLASSIFIED Page 15e of [#]

### Kepler's Second Law Interpreted

In a certain amount of time, a satellite covers a certain distance around its orbit and covers a certain area of space.



Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define Kepler's 2<sup>nd</sup> law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Animation of satellite on left moving from first point around to 2<sup>nd</sup> point. The "area" builds with it. Finally the labels and green arrow appear.

**AUDIO TEXT**

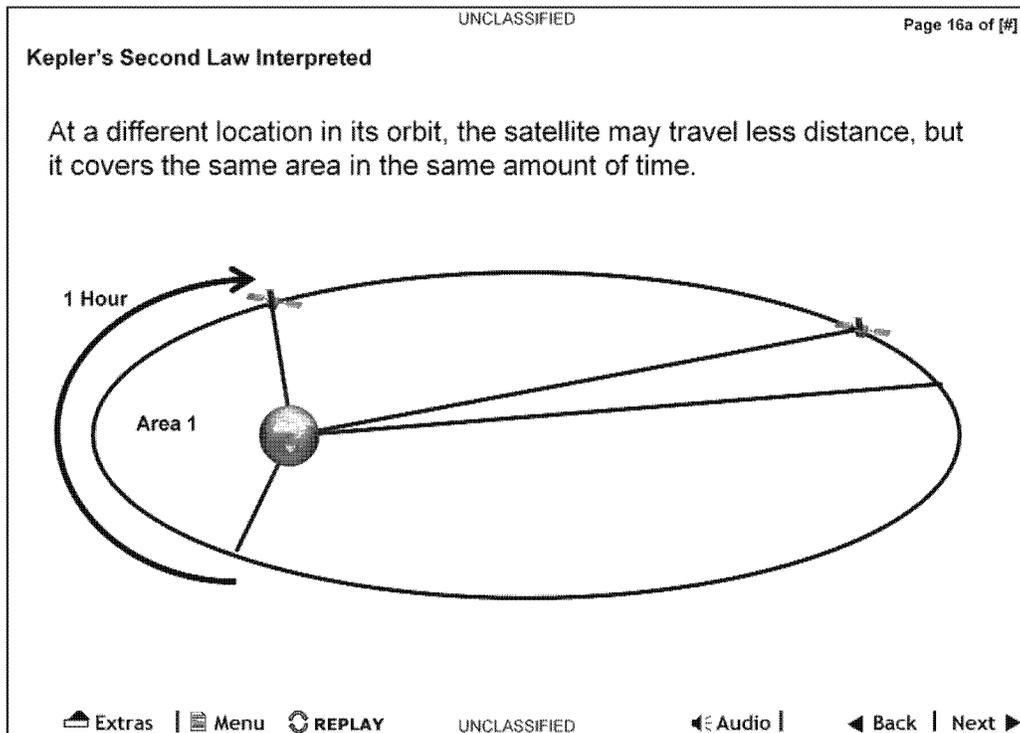
But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Explain Kepler's 2<sup>nd</sup> law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Animation of satellite on right moving from first point around to 2<sup>nd</sup> point. The "area" builds with it. Finally the labels and green arrow appear.

**AUDIO TEXT**

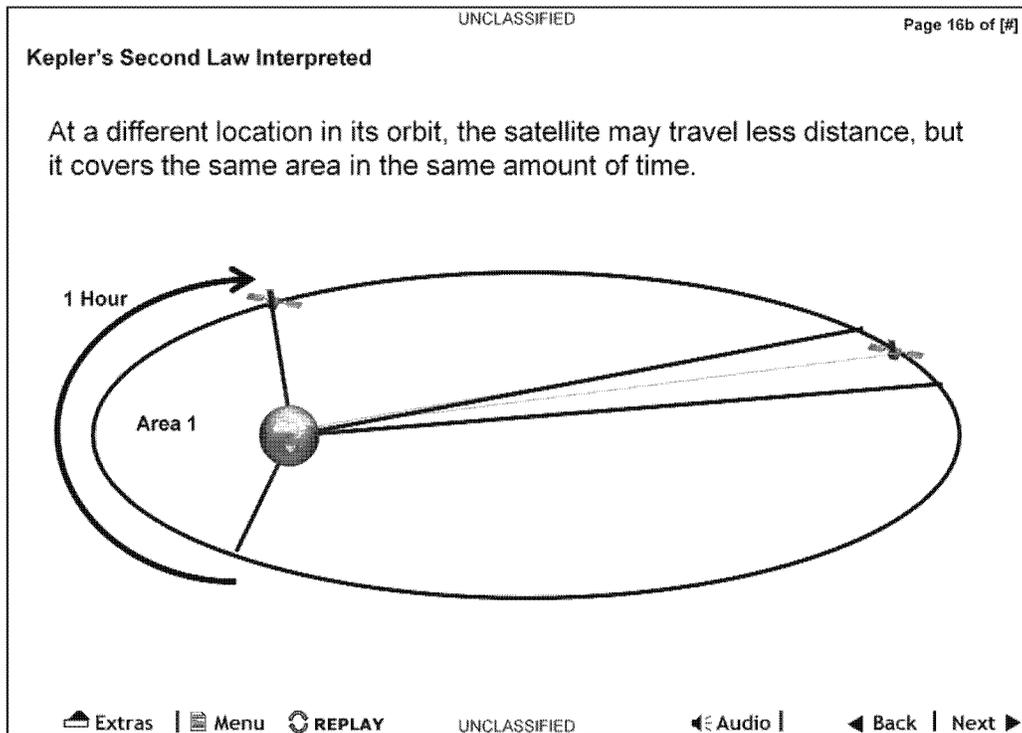
Later, the same satellite is in a different portion of its orbit, further away from the earth. In the same time period, it travels a much shorter distance. However, the area of space that it "sweeps out" is equal to that of the first area.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Explain Kepler's 2<sup>nd</sup> law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Animation of satellite on left moving from first point around to 2<sup>nd</sup> point. The "area" builds with it. Finally the labels appear.

**AUDIO TEXT**

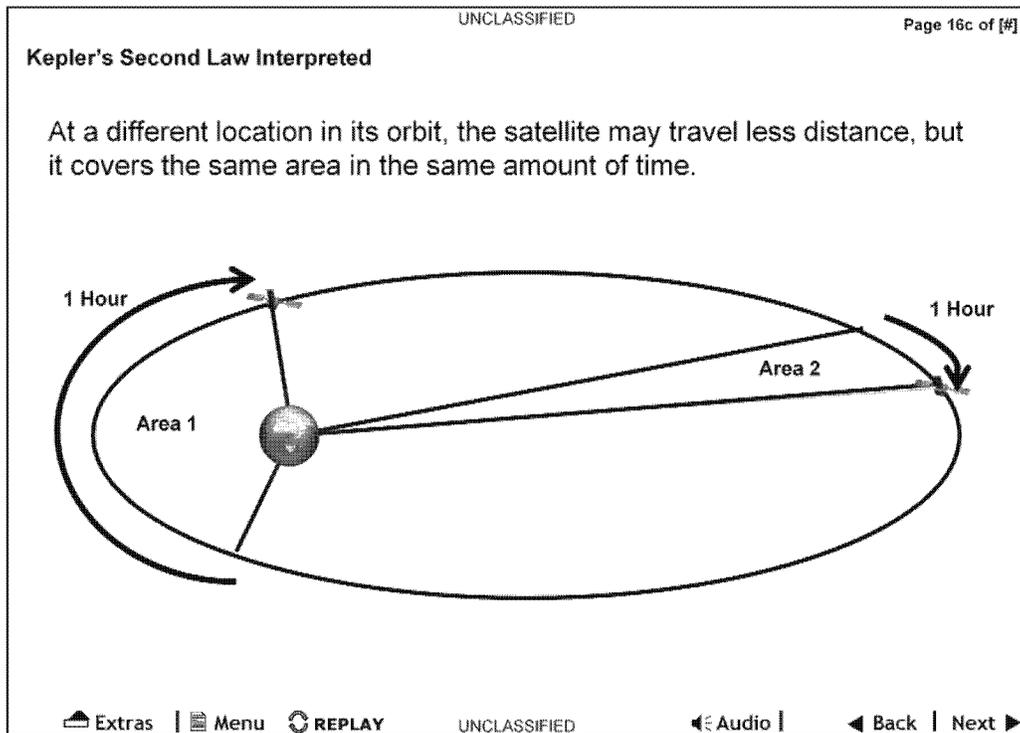
Later, the same satellite is in a different portion of its orbit, further away from the earth. In the same time period, it travels a much shorter distance. However, the area of space that it "sweeps out" is equal to that of the first area.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Explain Kepler's 2<sup>nd</sup> law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Animation of satellite on left moving from first point around to 2<sup>nd</sup> point. The "area" builds with it. Finally the labels appear.

**AUDIO TEXT**

Later, the same satellite is in a different portion of its orbit, further away from the earth. In the same time period, it travels a much shorter distance. However, the area of space that it "sweeps out" is equal to that of the first area.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED Page 16d of [X]

### Kepler's Second Law Interpreted

At a different location in its orbit, the satellite may travel less distance, but it covers the same area in the same amount of time.

Area 1 = Area 2

Click Next to continue.

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's 2<sup>nd</sup> law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Animation of satellite on left moving from first point around to 2<sup>nd</sup> point. The "area" builds with it. Finally the labels appear.

**AUDIO TEXT**

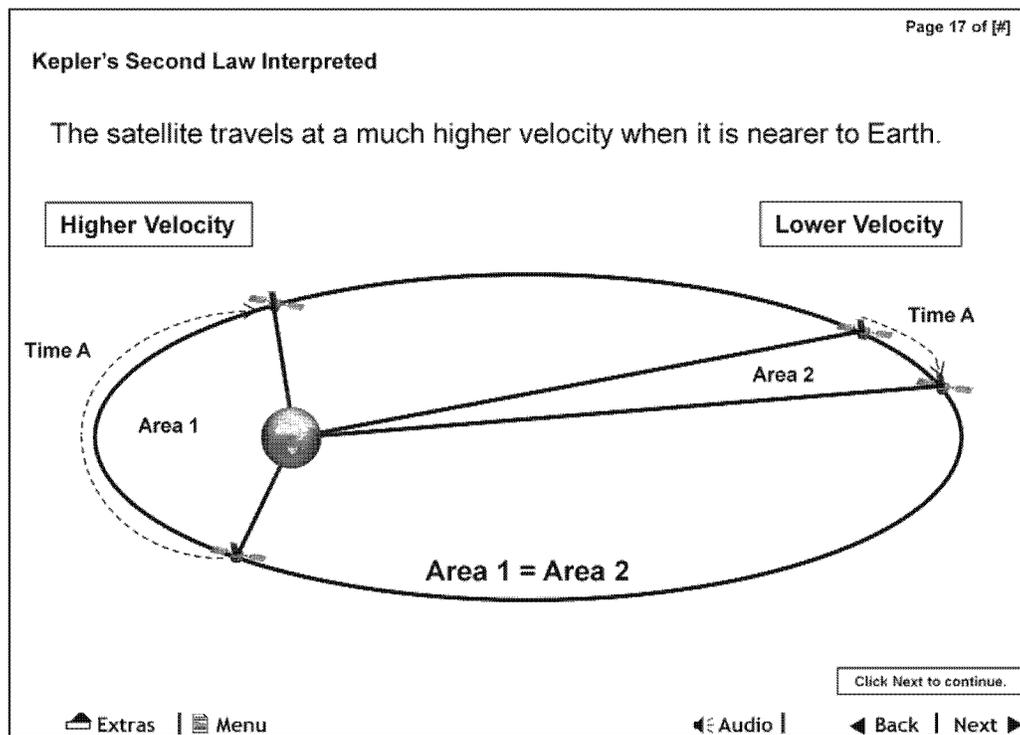
Later, the same satellite is in a different portion of its orbit, further away from the earth. In the same time period, it travels a much shorter distance. However, the area of space that it "sweeps out" is equal to that of the first area.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Explain Kepler's 2<sup>nd</sup> law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next

**Media Elements:** Back to same still graphic as page 14b. Add Higher Velocity and Lower Velocity labels in synch w/ narration.

**AUDIO TEXT**

The takeaway for Kepler's second law is that an orbiting satellite travels much faster when it is close to the Earth than when it is further away. This allows the satellite to "sweep out" equal areas although it is covering different distances at different times.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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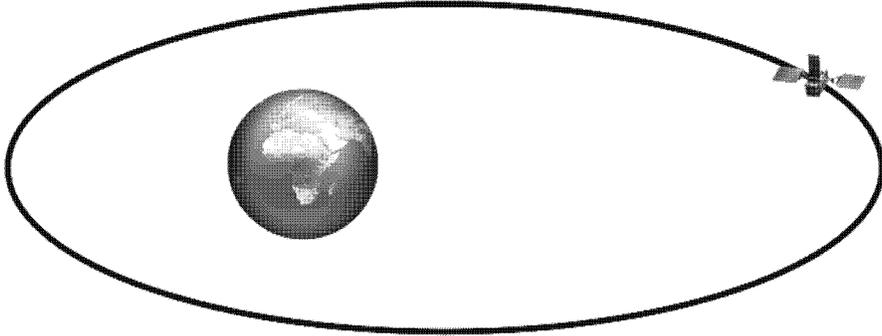
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Page 18 of [#]

**Orbital Period**

Orbital period is the time it takes for one revolution around the earth.

- As low as 90 minutes
- As high as 24 hours



Click Next to continue.

Extras | Menu | Audio | Back | Next

**Purpose of screen:** Define Orbital Period

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:** Click Next

**Media Elements:** animation of satellite going around Earth

**AUDIO TEXT**

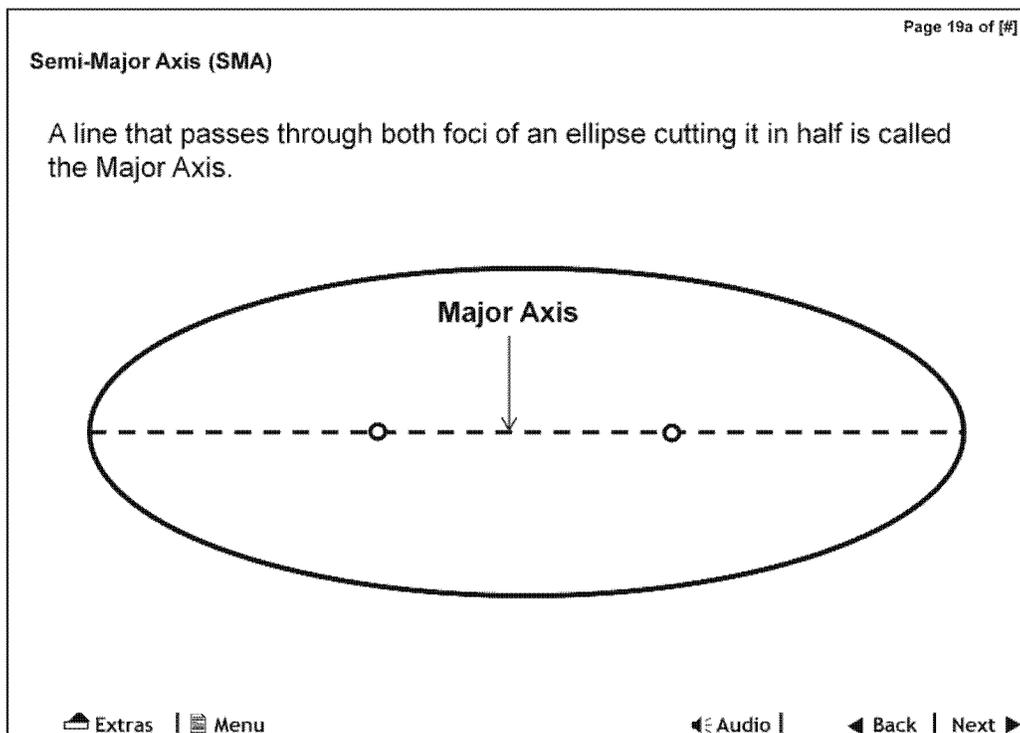
Before we move on to Kepler's Third law, we need to define some more terms. Orbital period is the time it takes for a satellite to make one revolution around the earth. The orbital period determines how many revolutions the satellite will complete each day. Additionally, orbital period has a direct effect on the amount of time that the satellite has access to any given target. This is referred to as dwell time.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Define Semi-Major Axis

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Build of ellipse with varying lines and labels

**AUDIO TEXT**

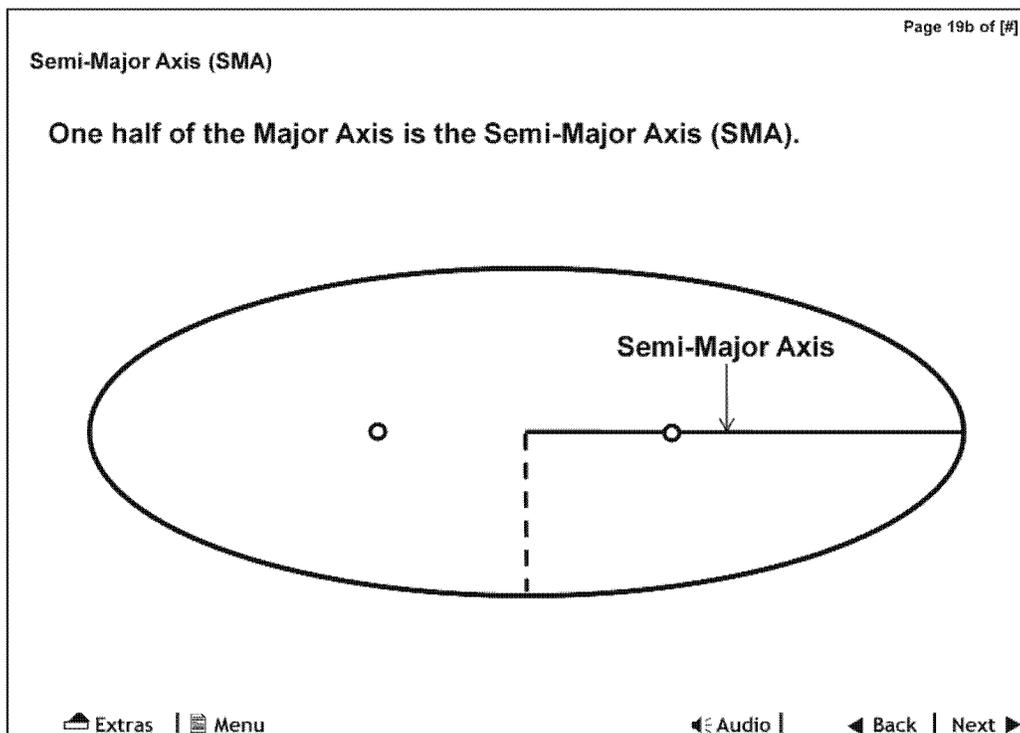
The overall length of an ellipse is referred to as the Major Axis.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Define Semi-Major Axis

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Build of ellipse with varying lines and labels

**AUDIO TEXT**

Half of the Major Axis is the Semi-Major Axis. The semi-major axis determines the size of the orbit. The bigger the semi-major axis, and the corresponding orbit, the longer the orbital period.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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UNCLASSIFIED Page 20a of [#]

**Kepler's Third Law of Planetary Motion**

Kepler's 3<sup>rd</sup> Law of Motion:  
 "The squares of the orbital periods of **Planets** are directly proportional to the cubes of the axes of the orbits."

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Extras | Menu | REPLAY | Audio | Back | Next

**Purpose of screen:** Define Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a build of an ellipse with changing objects orbiting around it

a. Opens w/ earth in orbit around sun in 2 different ellipses (orbits)

**AUDIO TEXT**

Kepler's third Law of Planetary Motion states that "The squares of the orbital periods of planets are directly proportional to the cubes of the axes of the orbits."

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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UNCLASSIFIED Page 20b of [ # ]

### Kepler's Third Law of Planetary Motion

Kepler's 3<sup>rd</sup> Law of Motion: (Adapted to Earth Satellites)  
 "The squares of the orbital periods of **Satellites** are directly proportional to the cubes of the axes of the orbits."

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Define Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** a build of an ellipse with changing objects orbiting around it  
 b. Now satellites are in orbit around earth in 2 different ellipses (orbits)

**AUDIO TEXT**

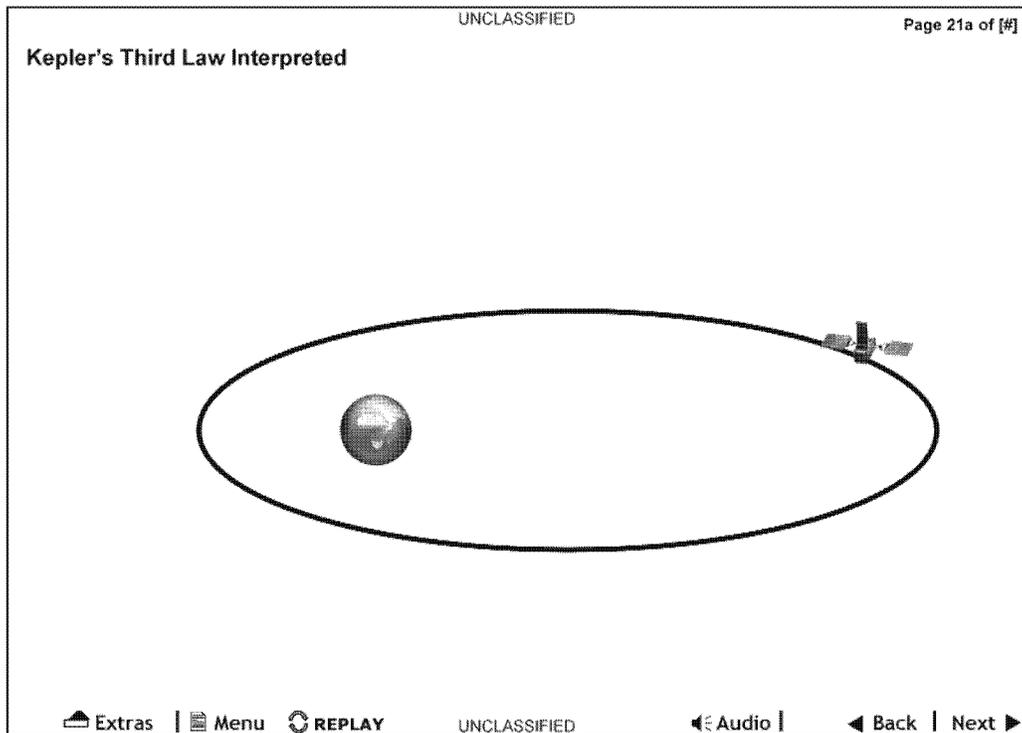
Once again, we can adapt this to Earth-orbiting satellites. But what does it mean?

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels as shown and in synch w/ narration  
a. single satellite in orbit

**AUDIO TEXT**

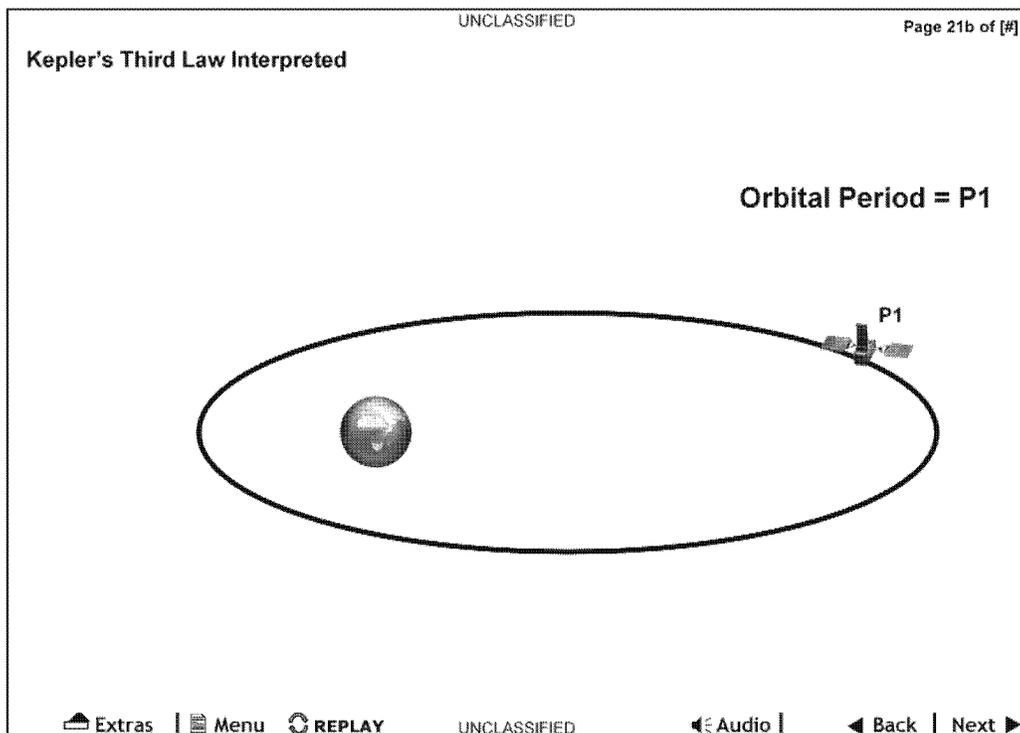
Let's break that down into smaller chunks so that we can explain it.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels as shown and in synch w/ narration

b. Add big red and little orange P1 labels

**AUDIO TEXT**

Remember, the Orbital Period is the length of time it takes for the satellite to make one revolution. Let's label that  $P_1$ .

**Acronyms & Glossary of Terms:**

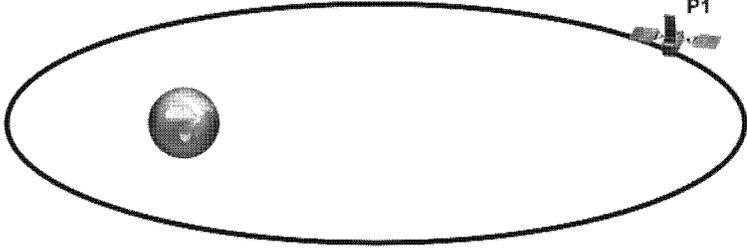
[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED Page 21c of [#]

**Kepler's Third Law Interpreted**



Orbital Period = P1  
**P1 X P1 = P1<sup>2</sup>**

Extras | Menu | **REPLAY** | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels as shown and in synch w/ narration  
c. Add big red formula

**AUDIO TEXT**

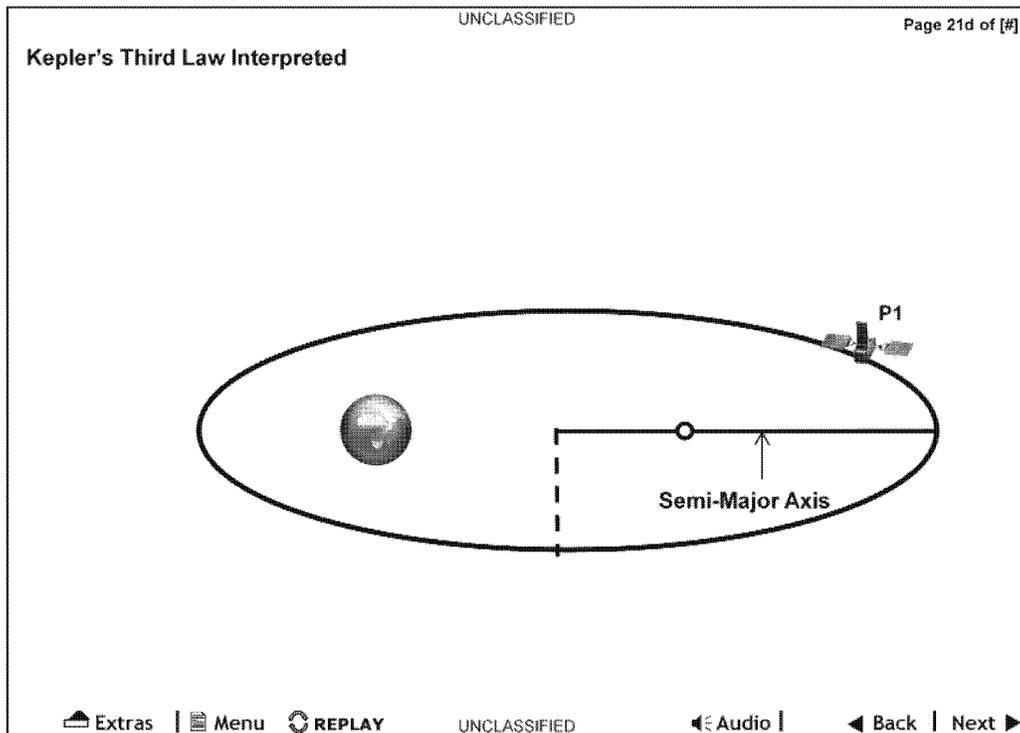
If you were to multiply it by itself, you have P1 squared. Now we have Kepler's "square of the orbital period."

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED



**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels as shown and in synch w/ narration

d. Remove upper labels and add label for SMA

**AUDIO TEXT**

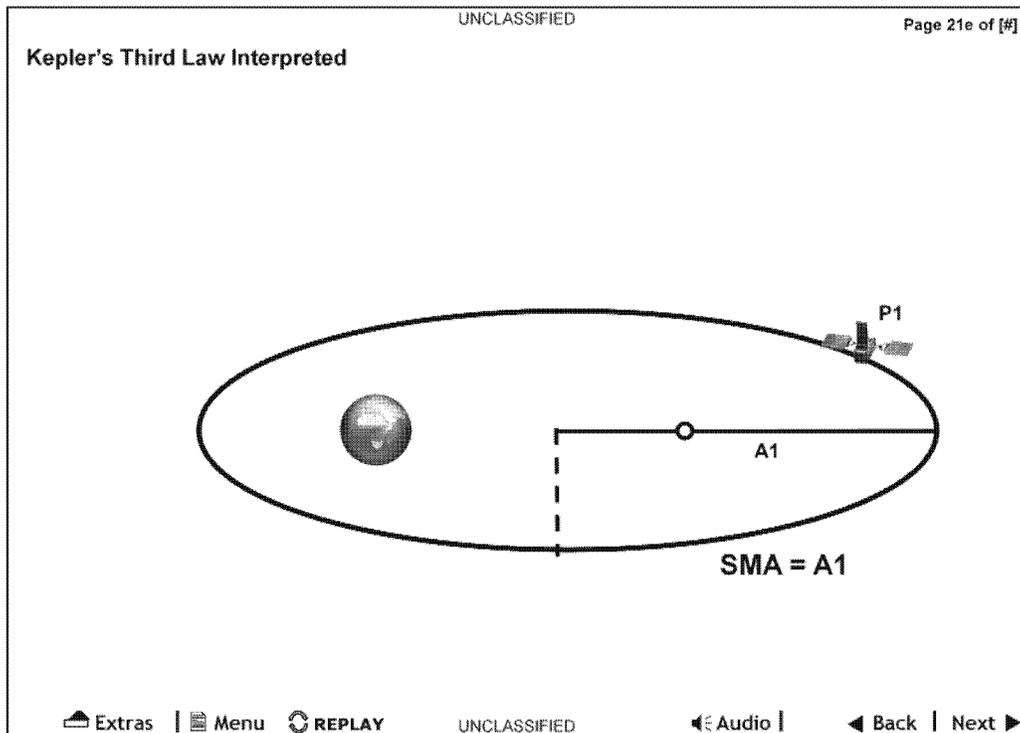
Also remember, the Semi-Major Axis is half of the length of the ellipse.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels as shown and in synch w/ narration  
e. Remove SMA label. Add big red and little orange A1 labels.

**AUDIO TEXT**

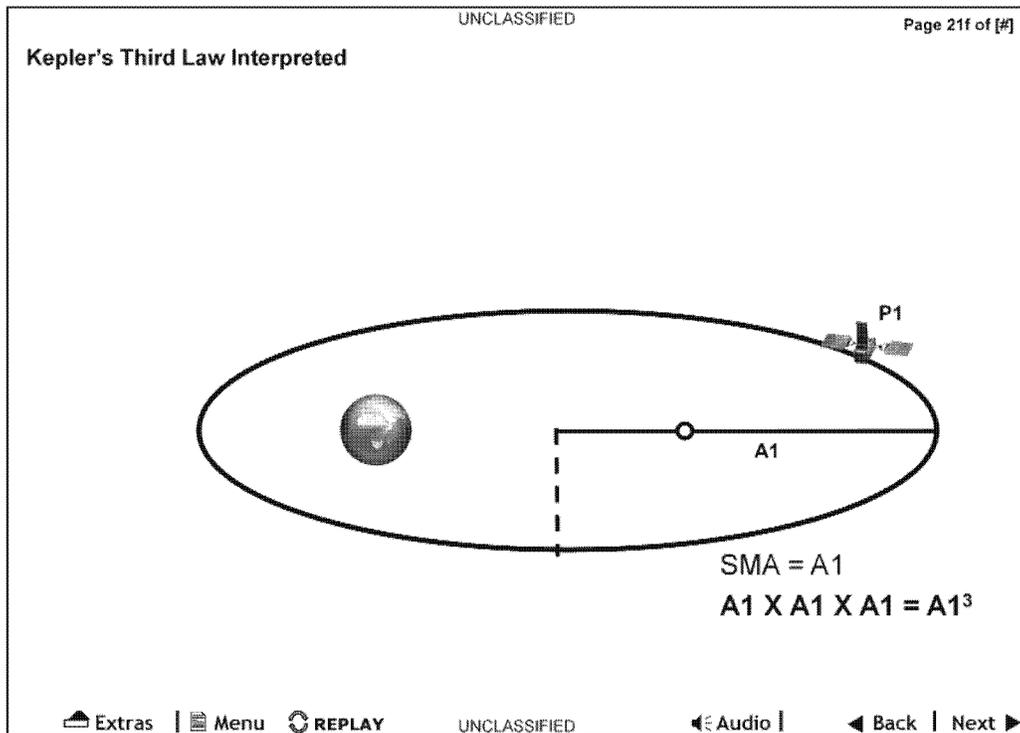
We will label that A1.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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UNCLASSIFIED



**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels as shown and in synch w/ narration

f. Add big red formula

**AUDIO TEXT**

If you were to multiply it by itself and then by itself once again, that is A1 cubed. Now, we have identified Kepler's "cube of the axis of the orbits."

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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UNCLASSIFIED Page 22a of [#]

**Kepler's Third Law Interpreted**

$P^2$  is proportional to  $A^3$

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

- a. larger orbit

**AUDIO TEXT**

So, let's put all of those pieces together now into one complete thought.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

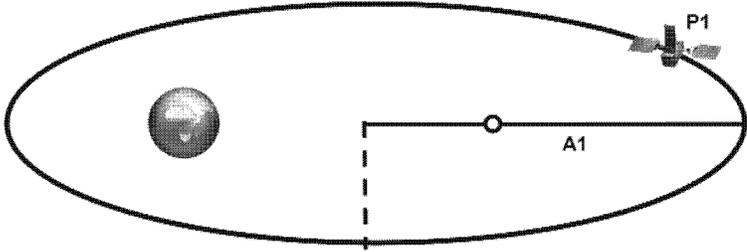
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UNCLASSIFIED

UNCLASSIFIED Page 22b of [ # ]

**Kepler's Third Law Interpreted**

**$P^2$**  is proportional to  $A^3$



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Extras | Menu | REPLAY | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

b. Bold  $P^2$

**AUDIO TEXT**

In simple terms, Kepler's third law states that the **square of the orbital period** of a satellite has a proportional relationship to the cube of the Semi-Major Axis.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

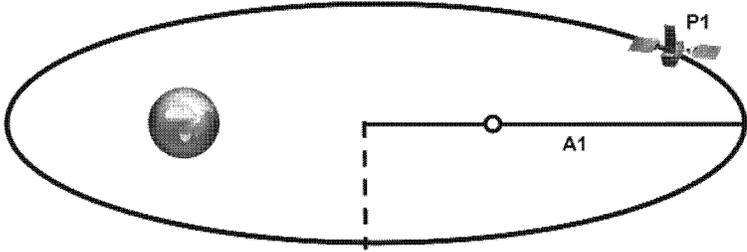
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UNCLASSIFIED Page 22c of [#]

**Kepler's Third Law Interpreted**

P12 is **proportional** to  $A1^3$



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Extras | Menu | REPLAY | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

c. Bold proportional

**AUDIO TEXT**

In simple terms, Kepler's third law states that the square of the orbital period of a satellite has a **proportional relationship** to the cube of the Semi-Major Axis.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

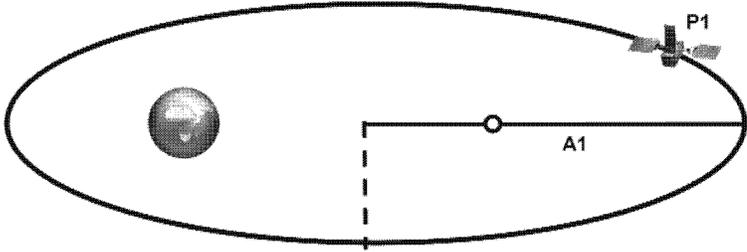
UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 22d of [ # ]

**Kepler's Third Law Interpreted**

$P^2$  is proportional to  **$A^3$**



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Extras | Menu | REPLAY | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

d. Bold  $A^3$

**AUDIO TEXT**

In simple terms, Kepler's third law states that the square of the orbital period of a satellite has a proportional relationship to the **cube of the Semi-Major Axis**.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

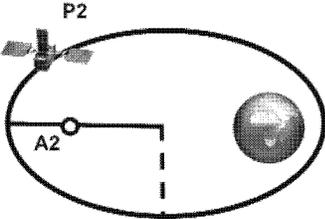
UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 22e of [#]

**Kepler's Third Law Interpreted**

$P^2$  is proportional to  $A^2$



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Extras | Menu | REPLAY | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

- e. Changes to small ellipse and new formula

**AUDIO TEXT**

This rule applies no matter the size of the orbit. The same proportional relationship is always maintained.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

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UNCLASSIFIED Page 23a of [#]

**Kepler's Third Law Interpreted**

$$\frac{P1^2}{P2^2} = \frac{A1^3}{A2^3}$$

UNCLASSIFIED

Extras | Menu | REPLAY | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top

**AUDIO TEXT**

Kepler described this relationship using a complex formula.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 23b of [#]

**Kepler's Third Law Interpreted**

$$\frac{P1^2}{P2^2} = \frac{A1^3}{A2^3}$$

## The Law of Harmonies

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top

b. Add text box.

**AUDIO TEXT**

Since this law applies to all orbits, planetary or man-made, Kepler referred to his 3<sup>rd</sup> law as "The Law of Harmonies."

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 23c of [#]

### Kepler's Third Law Interpreted

# The Law of Harmonies

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top  
b. Add text box.

**AUDIO TEXT**

So what the Law of Harmonies mean to us humans trying to launch satellites into orbit?

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

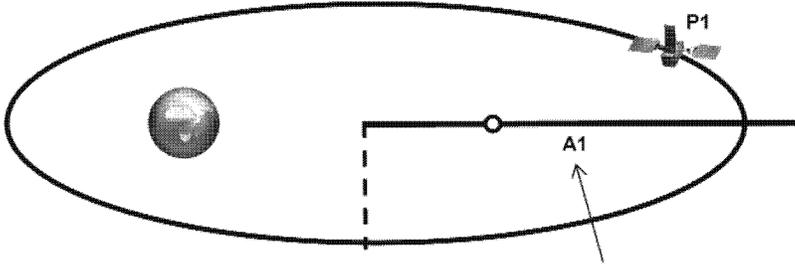
UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED Page 23c of [x]

**Kepler's Third Law Interpreted**

If SMA increases, overall size of orbital path increases.



**SMA Increases**

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top

b. Add text box.

**AUDIO TEXT**

If the semi-major axis increases, the overall orbital path must increase. This causes the orbital period to increase. If the orbital period increases, the velocity of the satellite decreases. So, the key takeaway for Kepler's Third Law is that satellites in smaller orbits travel faster than satellites in larger orbits. This happens because the further away from Earth a satellite gets, the lower the gravitational pull and the lower the velocity required to counter that pull.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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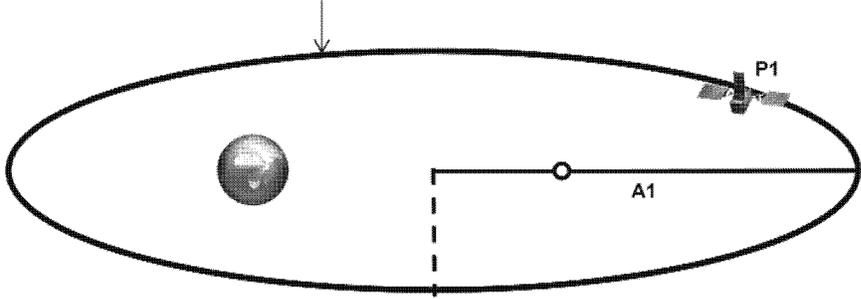
UNCLASSIFIED

UNCLASSIFIED Page 23c of [#]

**Kepler's Third Law Interpreted**

If SMA increases, overall size of orbital path increases.

**Orbital path Increases**



Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top

b. Add text box.

**AUDIO TEXT**

If the semi-major axis increases, the overall orbital path must increase. This causes the orbital period to increase. If the orbital period increases, the velocity of the satellite decreases. So, the key takeaway for Kepler's Third Law is that satellites in smaller orbits travel faster than satellites in larger orbits. This happens because the further away from Earth a satellite gets, the lower the gravitational pull and the lower the velocity required to counter that pull.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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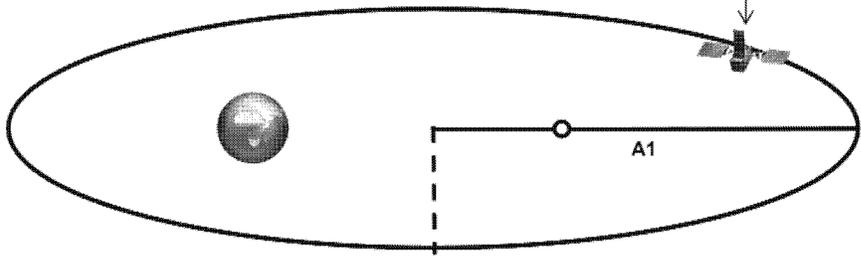
UNCLASSIFIED

UNCLASSIFIED Page 23c of [#]

**Kepler's Third Law Interpreted**

Therefore, the Orbital Period increases.

**Orbital Period Increases**



Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top

b. Add text box.

**AUDIO TEXT**

If the semi-major axis increases, the overall orbital path must increase. This causes the orbital period to increase. If the orbital period increases, the velocity of the satellite decreases. So, the key takeaway for Kepler's Third Law is that satellites in smaller orbits travel faster than satellites in larger orbits. This happens because the further away from Earth a satellite gets, the lower the gravitational pull and the lower the velocity required to counter that pull.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

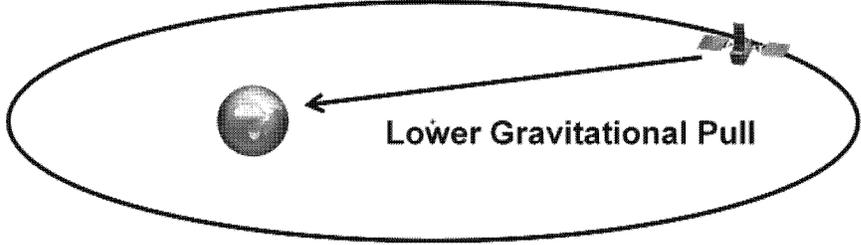
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UNCLASSIFIED

UNCLASSIFIED Page 23c of [#]

**Kepler's Third Law Interpreted**

Lower gravitational pull requires lower velocity to maintain orbit.



Lower Gravitational Pull

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top

b. Add text box.

**AUDIO TEXT**

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**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

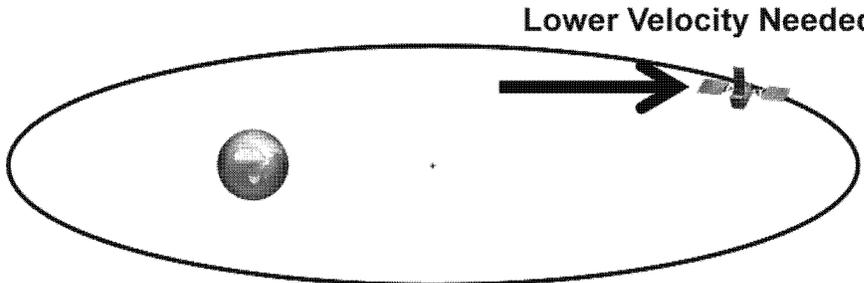
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UNCLASSIFIED

UNCLASSIFIED Page 23c of [#]

**Kepler's Third Law Interpreted**

Lower gravitational pull requires lower velocity to maintain orbit.



**Lower Velocity Needed**

Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top

b. Add text box.

**AUDIO TEXT**

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**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

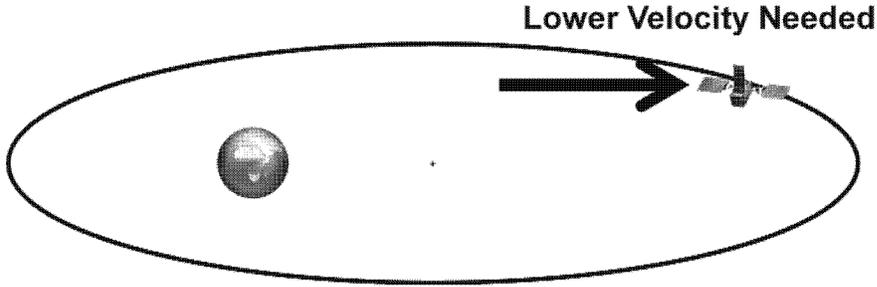
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UNCLASSIFIED Page 23c of [#]

**Kepler's Third Law Interpreted**

Lower gravitational pull requires lower velocity to maintain orbit.



The diagram shows an elliptical orbit around a central Earth. A satellite is positioned on the right side of the orbit. A large black arrow points from the text 'Lower Velocity Needed' towards the satellite, indicating that at this distance from Earth, a lower orbital velocity is required to maintain the orbit.

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Extras | Menu | REPLAY | UNCLASSIFIED | Audio | Back | Next

**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top  
b. Add text box.

**AUDIO TEXT**

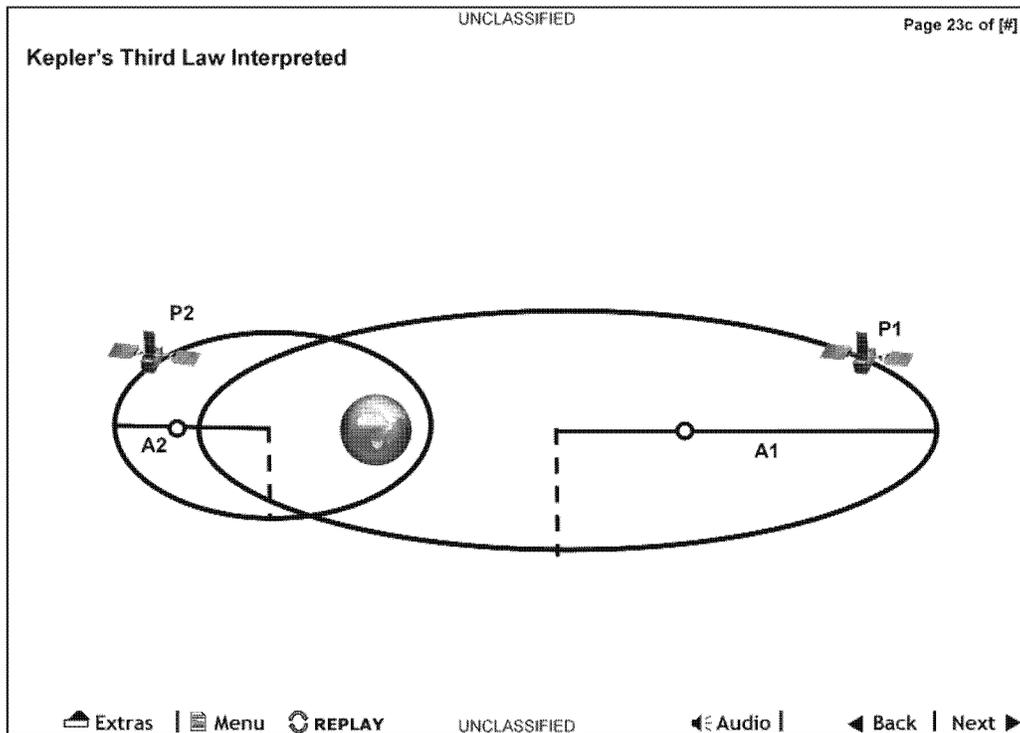
Back to the delicate balance of Vel and Gravity.

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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**Purpose of screen:** Explain Kepler's third law of motion

**Objective:** Summarize Kepler's three Laws of Motion

**Sources:** SME

**DEVELOPER NOTES:**

**User Instruction:**

**Media Elements:** Back to same graphic from 20b. Add formula at top

b. Add text box.

**AUDIO TEXT**

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**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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<b>[MODULE TITLE]</b>	//CLASSIFICATION	Page [#] of [#]
<b>(U) [Module] Summary</b>		
(U) You have completed the <b>[Module Title]</b> module.		
(U) In this module, you learned		
<ul style="list-style-type: none"> <li>• [Type Module/enabling objective.]</li> <li>• [Type Module/enabling objective.]</li> <li>• [Type Module/enabling objective.]</li> </ul>		
(U) To continue, click on the [ _____ ] link in the left frame.		
		Click the _____ link on the left.
 Extras	 Menu	 REPLAY
//CLASSIFICATION	 Audio	 Back    Next

**Purpose of screen:** Summarized and closes the module.

**Objective:** [Objective to which this slide corresponds]

**Sources:** [Where did the content for this page originate?]

**DEVELOPER NOTES:**

**User Instruction:** To continue. Click on the [     ] link in the left frame.

**Media Elements:**

- None

**AUDIO TEXT**

//CLASSIFICATION

[(U) Type audio script here.]

[(U) Be sure to begin each paragraph with the proper portion-marking and fill in the header/footer.]

//CLASSIFICATION

**Acronyms & Glossary of Terms:**

[List any acronyms and terms/definitions that need to go into the glossary.]

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Defining the term orbit  
Gravity and Velocity  
What keeps a satellite in orbit?

 Extras |  Menu |  REPLAY | UNCLASSIFIED |  Audio |  Back | Next 

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