

Solar System to Scale

Mission: Flight Planning is designing a mission to the outer planets. Explore the solar system to scale: how far apart the planets are, how big they are, and how long a spacecraft would travel.

Big question: How big and how spread out is our solar system?

★ Warm-up: Rank it

Rank from smallest to largest. Explain your first choice.

Earth, the Sun, the Moon, Jupiter ✓ **Moon, Earth, Jupiter, Sun.**

A trip to: the Moon, Mars, Neptune ✓ **Moon (days), Mars (months), Neptune (years).**

Key vocabulary

AU (astronomical unit)	Earth's distance from the Sun, about 150 million km.
Inner planets	Mercury, Venus, Earth, Mars: small and rocky.
Outer planets	Jupiter, Saturn, Uranus, Neptune: giant planets.
Scale model	A model where sizes or distances are shrunk by the same amount.

1 Box 1

Crowded or spread out?

On the distance map, where are the four rocky planets?

☐ Bunched up close to the Sun ☐ Spread out evenly ☐ Past Jupiter

✓ **Bunched up close to the Sun**

2 Box 2

How many times farther?

Neptune is 30.1 AU from the Sun and Earth is 1 AU. About how many times farther from the Sun is Neptune than Earth?

Answer: _____ times ✓ **30**

3 Box 3

Size lineup

In the simulator: Switch to **Size lineup** and tap Jupiter.

How many Earths wide is Jupiter?

Answer: _____ Earths ✓ **11.2**

Sort the planets

Sort the planets.

Sort: Mercury · Venus · Earth · Mars · Jupiter · Saturn · Uranus · Neptune

Inner, rocky, small	Outer, giant
Mercury Venus Earth Mars	Jupiter Saturn Uranus Neptune

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Box 4

Plan a trip

In the simulator: Open the **Trip planner** and choose **Saturn** at **17 km/s**.

About how many years would the trip to Saturn take?

Answer: _____ years ✓ **varies: check the student's simulator readout**

Speed it up

In the simulator: Change the speed to **34 km/s** (twice as fast) for the Saturn trip.

What happened to the travel time when the speed doubled?

☐ It was cut in half ☐ It doubled ☐ It stayed the same

✓ **It was cut in half**

5 Box 5

Legend: scale model Legend only

In a playground model, Earth is 1 m from the Sun. How far away should Neptune be?

Answer: _____ m ✓ **30.1**

6 Box 6

Report to Flight Planning

Explain why a trip to Neptune takes much longer than a trip to Mars. Use numbers.

Look for: Compares distances; Connects distance to travel time; a number from the simulator

Exit ticket: answer the big question in your own words

How big and how spread out is our solar system?

Look for: The solar system is mostly empty space. The four rocky inner planets are close to the Sun and small. The gas and ice giants are huge and very far apart; Neptune is 30 times farther from the Sun than Earth. Spacecraft take years to reach the outer planets.

Completion codes

Students see a code like **ABC-13** when they finish. The first part must match below. The letter is the level (E = Explorer, I = Investigator, L = Legend), and the number at the end is how many stars they earned.

Level	Code starts with
 Explorer	1MS-E
 Investigator	1MA-I
 Legend	1ND-L

Watch for these misconceptions

- "Seasons happen because Earth is closer to the Sun in summer." It is the tilt, not the distance.
- "Earth's shadow causes Moon phases." Phases come from our viewing angle of the lit half. Earth's shadow causes lunar eclipses.
- "The Sun moves across the sky." The Sun only appears to move because Earth rotates.