Teacher Guide

Going the Distance

Key idea: Distances in our solar system are vast.

Time: 30 minutes

Objective

Students use the Earth-Sun distance to calculate distances between planets in our solar system. Then they calculate how long it would take for messages to travel at the speed of light between planets.

Do the activity

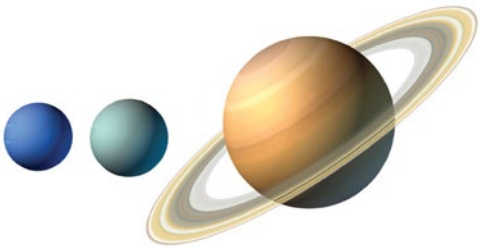
Give students the *Going the Distance* Student Handout and have them read "How far apart are the planets?" Then have them use the information in that section and in the table to answer the questions. Remind students to show their calculations.

STANDARDS ALIGNMENT

NGSS **MS-ESS1.A.1:** The Universe and Its Stars: Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.

MS-ESS1.B.1: Earth and the Solar System: The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.

CCSS **M.7.EE:** Solve real-life and mathematical problems using numerical and algebraic expressions and equations.



Answer Key

Use the information above and in the table to answer the questions. Be sure to show your work.

Planet	Average distance from Sun compared to Earth
Mercury	0.4
Venus	0.7
Earth	1
Mars	1.5
Jupiter	5
Saturn	10
Uranus	19
Neptune	30

1. How would you use the information in the table to calculate the average distance from Earth to each of the other planets? *[To find the average distance from Earth to any one of the other planets, first use the table to look up the distance from Earth to the Sun and the distance from the other planet to the Sun. Then subtract the smaller of the two distances from the other. For example, to find the average distance from Earth to Mercury, subtract Mercury's average distance from the Sun from Earth's average distance from the Sun, or 1 – 0.4 = 0.6. To express that distance in kilometers (miles), multiply 0.6 by the Earth-Sun distance, or 149,597,870 kilometers (93 million miles).]*
2. Calculate the average distance between Mars and Earth. *[To find the average distance from Earth to Mars, subtract the average Earth-Sun distance from the average Mars-Sun distance, or 1.5 – 1 = 0.5. The average Earth-Mars distance is 0.5 times the average Earth-Sun distance. To express that distance in kilometers (miles), multiply 0.5 by the average Earth-Sun distance, or 149,597,870 kilometers (93 million miles), which is 74,798,935 kilometers (46 million miles).]*
3. Calculate the average distance between Jupiter and Earth. *[To find the average distance from Earth to Jupiter, subtract the average Earth-Sun distance from the average Jupiter-Sun distance, or 5 – 1 = 4. So the average Earth-Jupiter distance is 4 times the average Earth-Sun distance. To express that distance in kilometers (miles), multiply 4 by the average Earth-Sun distance, or 149,597,870 kilometers (93 million miles), which is 598,391,480 kilometers (372 million miles).]*

4. How many times farther is Jupiter from Earth than Mars is from Earth? *[We already know the average Earth-Jupiter distance is 4 times larger than the average Earth-Sun distance and the average Earth-Mars distance is 0.5 times as large. To calculate how many times farther from Earth Jupiter is than Mars, divide Jupiter's average distance from Earth by Mars' average distance from Earth, or 4 ÷ 0.5 = 8. On average, Jupiter is 8 times farther from Earth than Mars is from Earth.]*

5. How many minutes would it take on average for a command to travel at the speed of light from Earth to a spacecraft on Mars? *[We already know it takes about 8 minutes for a command to travel the average Earth-Sun distance at the speed of light. To calculate how long it would take a command to travel the average Earth-Mars distance, multiply that distance by the number of minutes required to travel the average Earth-Sun distance, or 0.5 x 8 = 4. So it would take 4 minutes to travel that distance.]*

6. How many minutes would it take on average for a command to travel at the speed of light from Earth to Jupiter? *[For Jupiter, multiply the average Earth-Jupiter distance by the number of minutes required to travel the average Earth-Sun distance, or 4 x 8 = 32. So on average, a command would take 32 minutes to travel that distance.]*