



Get the Data

Visit EOSS <http://1.usa.gov/GTgyyT> to recreate this exact scene. Recommended operating system: MS Vista or later; Browser: MS Internet Explorer 8 or later.

Step 1 – Click on the ‘Visual Controls’ tab and make sure that the following items are selected with a ‘white spot’: stars, planetary bodies, labels, orbit lines, and metric.

Step 2 - Activate the Distance Measuring tool and measure the distance from the sun to Jupiter. Round the answer to the nearest 10 million kilometers to obtain a value of 740 million kilometers.

Step 3 – Repeat this measuring step on the same day and month for the next 12 years.

Answering Questions

The orbits of the planets are not perfect circles, so that their mean, median and mode distances are identical, but have the shapes of ellipses with varying distances from the sun.

Problem 1 – What is the mean distance to Jupiter from the sun to the nearest 10 million kilometers?

Problem 2 – What is the median and mode of the orbit distance to Jupiter to the nearest 10 million km?

Math Challenge

Suppose that we rounded the distances to the nearest 100 million kilometers. Explain why the distance to Jupiter is no longer multi-modal.

Answer Key

| Year | Measured Distance (million km) | Rounded Distance (million km) |
|------|-----------------------------------|----------------------------------|
| 2012 | 743 | 740 |
| 2013 | 757 | 760 |
| 2014 | 776 | 780 |
| 2015 | 795 | 800 |
| 2016 | 809 | 810 |
| 2017 | 815 | 820 |
| 2018 | 812 | 810 |
| 2019 | 800 | 800 |
| 2020 | 781 | 780 |
| 2021 | 762 | 760 |
| 2022 | 746 | 750 |
| 2023 | 740 | 740 |
| 2024 | 745 | 750 |

Problem 1 — What is the mean distance to Jupiter from the sun to the nearest 10 million kilometers? Answer: Mean = (Sum of column 3) / 13 = 10100/13 = 776.9 million km, or **780 million kilometers**.

Problem 2 – What is the median and mode of the orbit distance Jupiter to to the nearest 10 million km? Answer: Median of 13 values is the entry for value number 7 or **780 million kilometers**. The mode is the most frequent number in the list. Because the most frequent numbers in the list are 740, 750, 760, 780, 800 and 810 which occur exactly twice for each value, this sample is considered multi-modal.

Suppose that we rounded the distances to the nearest 100 million kilometers. Explain why the distance to Jupiter is no longer multi-modal.

Answer: The mode is now '7' or 700 million kilometers. At this level of accuracy, the orbital distance of Jupiter no longer varies and so it must be found at a definite distance from the sun (a single mode) and not at several different distances (multi-modal).