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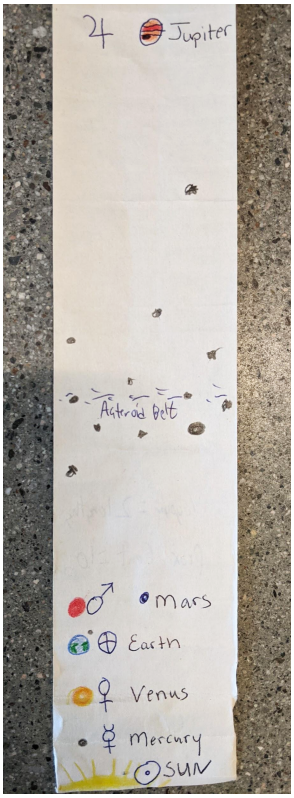


Solar System Scale

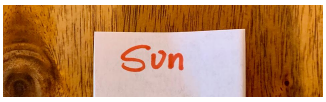
The Solar System is big. It took the *Voyager 2* spacecraft *12 years* to travel almost 3 billion miles to Neptune—even at an average cruising speed of 42,000 miles per hour! Create a scale model of our Solar System to get an idea of just how mind-bogglingly far the distances between planets really are.

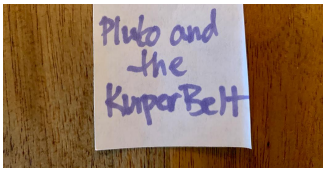
Materials

A long strip of paper, at least 3 feet long (like register or receipt paper)
Alternative: 3 feet of string or rope and masking tape
Pencil or pen
Scissors

Directions

1. **Cut** the ends of the paper to make straight edges.
2. **Label** one end of the paper "Sun" and the other end "Pluto and the Kuiper Belt."
3. **Fold** the paper in half, crease it, open it up again and **mark** at the halfway point with your pencil. **Label** the mark "Uranus."
4. **Fold** the paper back in half, then in half again. **Unfold** and lay it flat.
    a. **Mark** the fold between Pluto and Uranus with your pencil and **label** it "Neptune."
    b. **Mark** the fold in between the Sun and Uranus and **label** it "Saturn."





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5. **Fold** the Sun end of the paper up to meet the Saturn mark and flatten to crease it. **Unfold** and lay flat again. **Mark** at the fold between the Sun and Saturn and **label** it "Jupiter."

6. **Fold** the Sun end of the paper up to meet the Jupiter mark. **Mark** at the fold between the Sun and Jupiter and **label** it "Asteroid Belt."

7. **Fold** the Sun end of the paper up to meet the Asteroid Belt mark and crease it. **Mark** the fold between the Sun and the Asteroid Belt and **label** it "Mars."

8. From here, folding to get precise distances may be challenging and planets are closer together. **Fold** the Sun end of the paper up to meet the Mars mark. *Leave it folded* and **fold** that section in half again. **Unfold** the tape, leaving three creases:

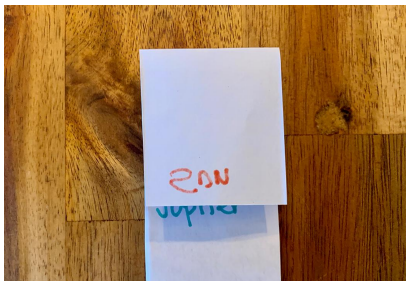
    a. **Mark** the crease nearest Mars and **label** it "Earth"

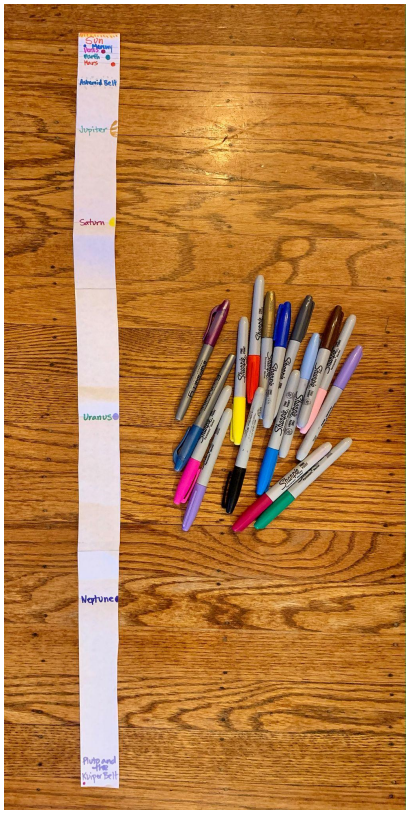
    b. **Mark** the crease in the middle and **label** it "Venus"

    c. **Mark** the crease closest to the Sun and **label** it "Mercury."

9. **Smooth** out your scale model and admire your work. If you want to, **decorate** your scale by drawing the planets next to their labels.

10. **Alternative method:** If you cannot find a piece of paper at least three feet long, you can also do this activity with a rope or string of the same length. Instead of marking distances with a pencil, see if a marker will be visible on your string or stick a thin piece of masking tape on the string and label it. Then follow steps 2–8.





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Thought experiments

1. The farthest humans have gone into the Solar System is to Earth's Moon. Find Earth on your model: The distance between the Earth and the Moon on your model is about the same width of the pen or pencil mark you used to indicate Earth's position. For a more precise way to show how small a distance it would be from Earth to the Moon, you would have to divide the distance from Earth to the Sun into almost 400 pieces!

2. Unmanned spacecraft take about four months to travel from Earth to Mars, while a hypothetical manned spacecraft would take at least six. (Spacecraft with humans on board travel a little slower for the astronauts' protection.) On your paper scale, locate the distance between Earth and Mars. If it takes humans six months just to travel from Earth to Mars, imagine how long it would take to reach Saturn, or even Neptune!

3. One big difference between your paper scale model and the Solar System itself is that the planets are never in a perfectly straight line like they appear here; each planet travels around the Sun at its own speed. From time to time, a few planets might appear to be in a straight line with respect to Earth or the Sun, but since the planets go at different speeds and often travel above or below the plane of the solar system, they will never line up perfectly "straight." Your paper scale model shows an approximation of their average distance from the Sun: Some planets travel a little closer or a little farther at different points in their orbit.