



## DAWN ACTIVITY LEADER GUIDE

### PATTERNS IN THE SKY!

#### Goal:

Learn about the gap in our solar system - that helped discover Ceres.

#### Estimated time:

30 minutes

#### Who to do it with:

Ages: 12-Adult

Numbers: 6 or more!

#### What you need:

- A large enough area to take 100 steps.
- Labels for learners that identify the planets they represent: Sun-0 steps, Mercury-4 steps, Venus-7 steps, Earth-10 steps, Jupiter-52 steps, Saturn-100 steps.
- Labels that identify the predicted locations of Mars-13 steps, Jupiter-16 steps, and Saturn-19 steps.

#### How to do it:

1. Designate one learner to be the Sun.
2. Have the learners who represent Mercury, Venus, and Earth start at the Sun and take the number of steps shown on their label to represent their planet's distance from the Sun.
3. Ask all learners:
  - a. "Do you see a pattern developing here?"
  - b. "Do you think that this pattern continues for the remainder of the planets?" [Accept their answers.]
    - You may place learners or some other marker to show where the pattern would predict the planets to be located: Mars-13 steps, Jupiter-16 steps, and Saturn-19 steps.
4. Have the learner who actually represents
  - a. Mars take 16 steps from the Sun;
  - b. Jupiter take 52 steps from the Sun; and
  - c. Saturn take 100 steps from the Sun.
5. Ask all learners:
  - a. "Was our original pattern correct?" [No]
  - b. "Why do think it was not correct?" [Not enough information]
  - c. "Now do you see a pattern?" [Yes]

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6. Encourage all learners to, "Describe the pattern that you see."

a. "Do you need a hint? Try this:

Planet	Steps from the Sun	Broken into a repeating mathematical pattern, you get:
Mercury	4	$4 + 0 = 4$
Venus	7	$4 + 3 = 7$
Earth	10	$4 + 6 = 10$
Mars	16	$4 + 12 = 16$
		$4 + 24 = 30$
Jupiter	52	$4 + 48 = 52$
Saturn	100	$4 + 96 = 100$

7. But, wait! This pattern predicts a planet at 30 steps from the Sun. Did we have a planet there? No.

8. The pattern you just saw is called the Titius-Bode rule. This "rule" correctly predicted the distance and presence of the planet Uranus (discovered in 1791 by William Herschel). Because this "rule" predicted a "missing" planet between Mars and Jupiter, many astronomers engaged in a "celestial police" hunt for the missing planet in 1800.

### Optional:

9. A great next activity is "In Search Of ..."

### Why do it:

The Titius-Bode Law led to the search for a "missing planet" in between the orbits of Mars and Jupiter. Because of the search, Ceres was discovered in 1801, very near where the missing planet was predicted! The Dawn Mission will first investigate asteroid Vesta and then move to study asteroid Ceres.