

Title: Celestial Review

Author: Janet Moore

Subject(s): Mathematics, Science

Topic(s): Astronomy, Celestial Objects, Functions, Graphing, Space Science, Earth Science

Grade/Level: 7-8

Objective:

By the end of this lesson, students will be able to:

- identify celestial objects from descriptions and definitions.
- perform mathematical function operations and graphing.

Summary of Lesson: Students will become NEO (near-Earth object) hunters in this math and space science review game.

Time Allotment: 1-2 45-minute class periods

Procedures/Instructions:

Students should have learned about functions, prior to this activity. Also, students should be learning about various celestial objects, such as stars, planets, asteroids, meteoroids, comets, supernova, etc.

1. DAY BEFORE: Have students prepare the clue cards. Approximately 50 of the index half-cards should remain blank. The rest should have a clue written on one side of them. This clue should be a creative description, definition, example, or picture of a celestial object (see words above). Having students create the clues gives them a stake in the review game and provides a good pre-review activity.
2. BEFORE CLASS: Create a 10x10 coordinate grid on the chalkboard. Label the x-axis and y-axis from 0 to 10. Tape one clue card at each intersection (there will be about 121 intersections) of the grid, clue-side down. (About half of the cards will not have a clue.)
3. BEFORE CLASS: Use a marker to write function "rules" on the outside of your "function machine" boxes. Write 1 function "rule" on each box (or write the function rules on strips of paper and tape one to each box so that they can be interchanged during the game):
 - a. $Y = x + 2$
 - b. $Y = x$



© Challenger Center for Space Science Education, 2006. Funded in part by a grant from the Toyota USA Foundation. No portion of this module may be reproduced without written permission.



- c. $Y = 2x$
- d. $Y = x - 4$
- e. $Y = 10 - x$
- f. $Y = 11 - x$
- g. $Y = 9 - x$
- h. $Y = 8 - x$
- i. $Y = 13 - x$
- j. $Y = 2(x - 3)$
- k. $Y = 1(x - 2)$
- l. $Y = 1$
- m. $Y = 9$
- n. $Y = 2(x+1)$
- o. $Y = 2x + 6$
- p. $Y = 17 - x$
- q. $Y = 11 - 3x$
- r. $Y = 0$
- s. $Y = 7 - 2x$
- t. $Y = 15 - x$
- u. $Y = 7 - x$

4. BEFORE CLASS: Only display SOME of the functions at the beginning of the game. During the game, you (teacher) can randomly change to new functions on the function machines.
5. DURING CLASS: Divide students up into 5-6 teams. Deal 7 cards to each team. Hand out 1 Student Sheet to each player in case they would like to keep track of the board throughout the game. Players may also need scratch paper and pencils for their calculations.
6. Explain to the class that NASA has detected several near-Earth objects (NEO's) in one portion of our sky. Unfortunately, at this particular time, several near and far objects are cluttered in that particular area. So NASA needs teams of astronomers (the students) to study that region of the sky with their telescopes. The team that can identify the most objects (near or far) will win a substantial cash prize from NASA.
7. Teams will take turns using the "telescope computer." To use the computer, students must enter a number card into one of the available "function machines." The number card gives the x-coordinate where the telescope will point. The function gives the y-coordinate where the telescope will point. (The students should do the function calculation.)
8. When a team is ready to take a turn, they will present their number card and tell which function they are entering it into. They will also state the resulting x- and y-coordinates from the function. You (teacher) will go to the board and pull the card from those coordinates.
 - a. If the card is blank, there is nothing in that region of the sky. The card goes in a "discard" pile and the next team gets a turn.

- b. If the card has a clue on it, you (teacher) should read the clue to the team.
 - i. If the team can identify what type of celestial object is described, they win 1 point and get to keep the card. Then the next team gets a turn.
 - ii. If the team cannot identify the celestial object on their first guess, the card goes back on the board at the same location so that future teams can try to identify it. Then the next team gets a turn.
9. At the end of each turn, the team should draw another card.
10. NOTE: Aces are worth an x-value of 1; 2-10 are worth their numerical value; Jacks, Queens, and Kings are wild, meaning that they can represent any numerical x-value to be entered into a function.
11. The team with the most identified objects at the end of the hour wins the game.

Alternative: An alternative to having students use the Internet to complete the function machine activity is to have a cardboard box and index cards with numbers on them. Leave the back of the cardboard box open and cut a slot on each side of the box. Choose a "rule" for the "function machine" to follow (for example $y = x + 2$). Do not tell the students the rule. Then, put a number in one side of the box. From the back of the box, you (teacher) should then push another number out of the other side of the box, following the rule. (If the rule is $y = x + 2$, and if you put a 3 in one side of the box, you should push a 5 out of the other side of the box.) Repeat with different numbers, but using the same "rule". Have students try to guess the rule. When they guess the rule, "reprogram" the function machine with a different rule and repeat the process.

Instructional Materials:

- Chalkboard or markerboard
- 60 Index Cards, cut in half (100 total half-cards)
- Tape
- 10-20 Cardboard boxes with slots cut in them (function machines)
- Marker
- 1 or 2 Decks of playing cards
- [Student Sheet](#)

Additional Resources:

Function machine activity

www.shodor.org/interactivate/activities/fm/index.html

National Science or Mathematics Standards:

Science

Earth and Space Science

CONTENT STANDARD D:

As a result of activities in grades 5-8, all students should develop an understanding of

- Earth in the solar system

Science and Technology

CONTENT STANDARD E:

As a result of activities in grades 5-8, all students should develop

- Understandings about science and technology

History and Nature of Science

CONTENT STANDARD G:

As a result of activities in grades 5-8, all students should develop understanding of

- Science as a human endeavor
- Nature of science

Mathematics

Number and Operations Standard

Instructional programs from pre-kindergarten through grade 12 should enable all students to—

- Understand numbers, ways of representing numbers, relationships among numbers, and number systems
- Understand meanings of operations and how they relate to one another. Compute fluently and make reasonable estimates
- Understand patterns, relations, and functions

Algebra Standard

Instructional programs from pre-kindergarten through grade 12 should enable all students to—

- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships

Geometry Standard

Instructional programs from pre-kindergarten through grade 12 should enable all students to—

- Specify locations and describe spatial relationships using coordinate geometry and other representational systems

Assessment Plan:

Students will be assessed based upon their ability to make the function calculations and coordinate identification as well as their ability to identify the celestial objects that are described to them.

