

Constructing Task: Earth Day Project

In this activity, students consider a real-world situation involving a set of data. Using the data, students determine the pattern formed by the numbers in the data set. Then they extend the pattern and use the pattern to make predictions.

STANDARDS FOR MATHEMATICAL CONTENT

MCC4.OA.5 Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself.

STANDARDS FOR MATHEMATICAL PRACTICE TO BE EMPHASIZED

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.

BACKGROUND KNOWLEDGE

Students should have had prior experiences working with and extending patterns. Also, students should be able to graph points easily. After points are graphed, ask students if it is appropriate to connect the points. (In this situation it is not appropriate because students collect cans just once a day and they do not (typically) collect a fraction of a can. However, students may want to line up the points along the edge of a ruler or sheet of paper to make predictions using the graph.

ESSENTIAL QUESTIONS

- How can we determine the relationships between numbers?
- How can we use patterns to solve problems?
- How can we describe a pattern?

MATERIALS

- “Earth Day Project” student recording sheet, 3 pages
- Blocks to use to build the pattern (for those students who wish to use them)

GROUPING

Individual/Partner Task

NUMBER TALKS

This task allows kids to review several number talks strategies. Revisit chapter 8 and explore whatever strategy is most appropriate for you class. As well as any addition and subtraction strategies that seem applicable and appropriate. (Number Talks, 2010, Sherry Parrish)

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

In this activity, students consider a real-world situation involving a set of data. Using the data, students determine the pattern formed by the numbers in the data set. Then they extend the pattern and use the pattern to make predictions.

Comments

This activity may be used as an assessment, as a learning task, or as an independent follow-up activity for reinforcement or review, depending on the instruction that occurred prior to this task.

For Teacher information only:

Teachers should give some thought to this pattern before presenting this problem to their students. Start by looking at the relationship of the numbers in the two columns. Teachers should try to express this relationship in words. See the examples below.

Some students may think about the pattern in this way:

- Day 1 shows a column of 4 and 1 more.
- Day 2 shows 2 columns of 4 and 1 more.
- Day 3 shows 3 columns of 4 and 1 more
- Day 4 will show 4 columns of 4 and 1 more.

Therefore the pattern is generated by $4 \times$ number of the day presents the

While it is not expected that students will be able to generalize this pattern to an expression (except possibly as an extension for some students), asking students to talk about what they see changing/growing in the pattern is important to help them develop an awareness of the structure of a pattern.

Keep in mind some students may see the pattern differently. For example, it is possible for students to describe it as follows:

- Day 1 shows a 2×4 rectangle with 3 missing.
- Day 2 shows a 3×4 rectangle with 3 missing.
- Day 3 shows a 4×4 rectangle with 3 missing.
- Day 4 will show a 5×4 rectangle with 3 missing.

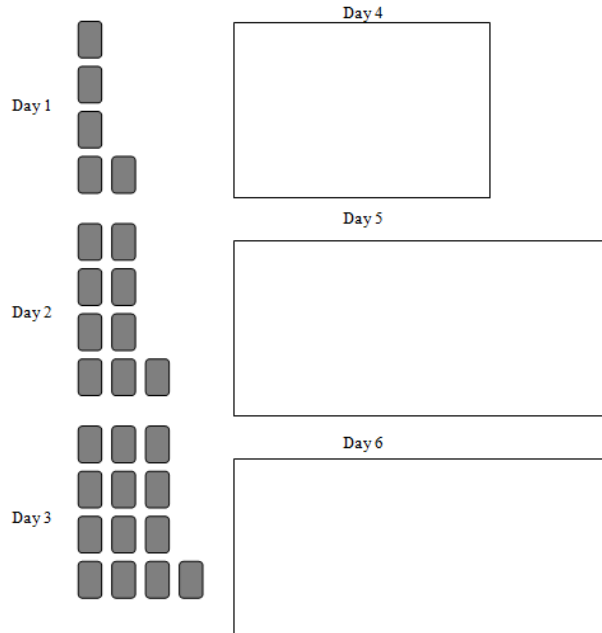
Of course, this can be written as $(\text{input} + 1) \times 4$ with the representing the number of the day. Using the distributive property gives you $4 \times \text{input} + 4$, which is the same as $4 \times \text{input} + 4$. Asking students to describe the relationship of the numbers in the two columns.

Task Directions

Students will follow the directions below from the “Earth Day Project” student recording sheet.

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Common Core Georgia Performance Standards Framework Teacher Edition
Fourth Grade Mathematics
Unit 2

Fourth graders in Ms. Smith's class have decided to start a recycling project for Earth Day. They put a bin in the cafeteria to collect used aluminum cans. At the end of each school day, they take the bin back to their classroom and count the cans collected for the day. Ms. Smith's class is keeping notes about how many cans are being collected. It seems that the number of cans collected each day follows a pattern. If the pattern continues, sketch the number of cans collected on days 4-6 in the boxes below.



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The students recorded the number of cans they collected each day in the t-table below. When they collect one hundred cans, the students can turn them in to the recycling center and earn money to be used for an upcoming field trip. If the pattern continues how many days will it take to collect at least 100 cans?

1. Use what you know about the cans collected in the first five days to make a prediction about how many days it will take to collect at least 100 cans. Show your work and explain in words why you predicted the number of days that you chose.
2. Continue the pattern in the t-table. Fill in the missing values.
3. Explain how you found the missing values in the t-table.
4. How many days will it take the class to collect enough cans for the field trip. Show all work and explain your thinking.
5. On the graph paper below, label the horizontal axis "Number of Days," label the vertical axis "Number of Cans." Label the horizontal axis 1-25 by 1s; label the vertical axis 1-100 by 5s. Make sure you start at zero. Plot the number of cans collected each day for days 1 - 5.

If the pattern continues, use the graph to predict the number of cans the students will collect on the 25th day.

Day	Cans
1	5
2	9
3	13
4	17
5	21
6	_____
7	_____
8	_____
9	_____
10	_____
⋮	
⋮	
20	_____
⋮	
⋮	
100	_____

FORMATIVE ASSESSMENT QUESTIONS

- What is changing each day in the pattern?
- How many cans will be collected on day 4? How do you know? How will the pattern look?
- How did you complete the chart? How do you know you are correct?
- What do you notice about the numbers in each column? What do you notice about how the numbers in each row are related?
- How did you find the number of cans collected on day 20? On day 100? How do you know your answers are correct?
- How do you plot points on a coordinate plane?

DIFFERENTIATION

Extension

- Asks students to write in words what is happening in the pattern (i.e. each day the number of cans increases by 4; the number of cans each day can be found by multiplying the day number by 4 and adding 1 or the expression $4 \times \square + 1$ where \square is the day number.). Also, ask students to make other predictions based on the graph and check their predictions using the expression $4 \times \square + 1$.

Intervention

- Some students will benefit by using manipulatives to help them demonstrate the problem with concrete objects prior to drawing a model or attempting to extend the pattern.

TECHNOLOGY

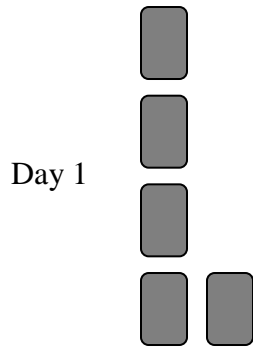
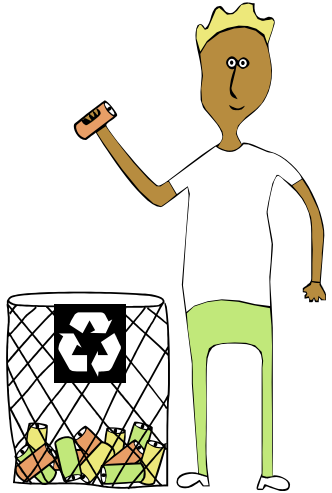
- <http://illuminations.nctm.org/LessonDetail.aspx?ID=L305> This lesson requires students to analyze numeric patterns. It can be used for additional practice, remediation or extending understanding of the concept.
- <http://illuminations.nctm.org/LessonDetail.aspx?ID=L327> This interactive lesson has students find patterns in the multiplication tables. IT can be used for additional practice, remediation or extending understanding.
- <http://www.prometheanplanet.com/en-us/Resources/Item/74887/function-machines> This activity can be used to assess basic knowledge of function machines following a lesson.

Name _____ Date _____

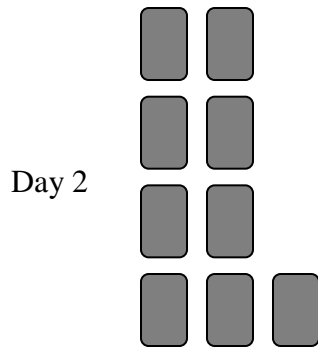
Earth Day Project

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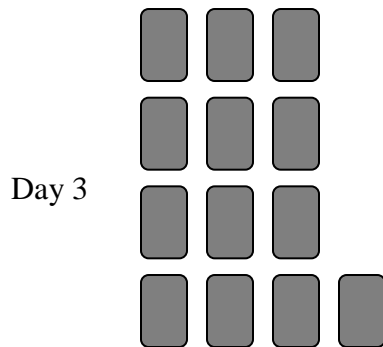
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Day 4



Day 5



Day 6

MATHEMATICS GE

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•	_____
100	_____

- Continue the pattern in the t-table. Fill in the missing values.
- Explain how you found the missing values in the t-table.

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5. On the graph paper below, label the horizontal axis “Number of Days,” label the vertical axis “Number of Cans.” Label the horizontal axis 1-25 by 1s; label the vertical axis 1-100 by 5s. Make sure you start at zero. Create a bar graph of the number of cans collected each day for days 1 - 5. If the pattern continues, use the graph to predict the number of cans the students will collect on the 25th day.

