

## **Constructing Task: Earth Day Project**

### **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:**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning

### **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

### **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 into 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  $4 \times \square + 1$ , where  $\square$  represents the number of the day. 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  $2 \times 4$  rectangle with 3 missing.

Day 2 shows a  $3 \times 4$  rectangle with 3 missing.

Day 3 shows a  $4 \times 4$  rectangle with 3 missing.

Day 4 will show a  $5 \times 4$  rectangle with 3 missing.

Of course, this can be written as  $(\square + 1) \times 4 - 3$ , with the  $\square$  representing the number of the day. Using the distributive property gives you  $4 \times \square + 4 - 3$ , which is the same as  $4 \times \square + 1$ . Asking students about their thinking is a good way to understand how students see the relationship of the numbers in the two columns.

## Task Directions

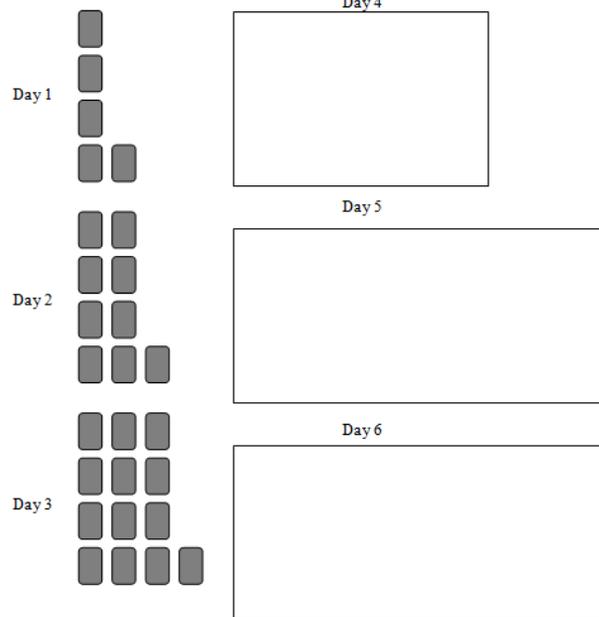
Students will follow the directions below from the “Earth Day Project” student recording sheet.

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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Fourth Grade Mathematics • Unit 1



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 25<sup>th</sup> 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**

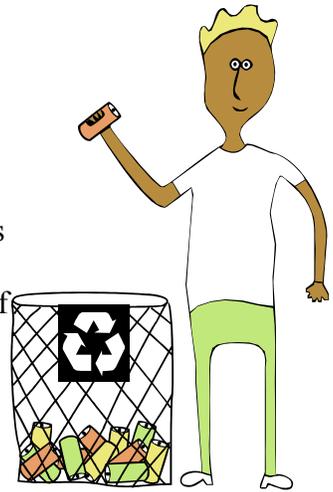
- Some students will benefit by using manipulatives to help them demonstrate the problem with concrete objects prior to drawing a model or attempting to extend the pattern.

Name \_\_\_\_\_ Date \_\_\_\_\_

## Earth Day Project

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.



Day 1

Day 4

Day 2

Day 5

Day 3

Day 6

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?

- 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.

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

- How many days will it take the class to collect enough cans for the field trip? Show all work and explain your thinking.

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

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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. 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 25<sup>th</sup> day.

