

Just in Time Quick Check

Standard of Learning 4.PFA.1

Strand: Patterns, Functions, and Algebra

Standard of Learning 4.PFA.1

The student will identify, describe, extend, and create increasing and decreasing patterns (limited to addition, subtraction, and multiplication of whole numbers), including those in context, using various representations.

Students will demonstrate the following Knowledge and Skills:

- a) Identify, describe, extend, and create increasing and decreasing patterns using various representations (e.g., objects, pictures, numbers, number lines, input/output tables, and function machines).
- b) Analyze an increasing or decreasing single-operation numerical pattern found in lists, input/output tables, or function machines and generalize the change to identify the rule, extend the pattern, or identify missing terms.
- c) Given a rule, create increasing and decreasing patterns using numbers and input/output tables (including function machines).
- d) Solve contextual problems that involve identifying, describing, and extending increasing and decreasing patterns using single-operation input and output rules.

Just in Time Quick Check

Just in Time Quick Check Teacher Notes

Supporting and Prerequisite SOL: 4.CE.1, 4.CE.2, 4.MG.2, 3.PFA.1

Just in Time Quick Check 4.PFA.1

1. This list of numbers follows a pattern.

1, 4, 16, 64, 256

The pattern will continue to increase in the same way. What will be the next number in this pattern?

2. The first three figures in a pattern of candies are shown. The pattern of candies will continue to grow in the same way.



- a) Describe the rule to determine the increasing pattern of the candies.

- b) How many candies will be in Figure 5 of this pattern?

3. Ashley owns a dog training business. This table shows the number of dog treats Ashley has at the end of each week.

Week	1	2	3	4	5
Number of Dog Treats	270	225	180	135	?

If the pattern shown in this table continues the same way, how many dog treats will Ashley have at the end of week 5?

4. The same rule is used on each input number in this table to create each output number.

Input	Output
2	12
5	30
?	42
9	54
12	72

What is the input number when the output number is 42?

4.PFA.1 Just in Time Quick Check Teacher Notes

Common Errors/Misconceptions and their Possible Indications

1. This list of numbers follows a pattern.

1, 4, 16, 64, 256

The pattern will continue to increase in the same way. What will be the next number in this pattern?

Some students may have the misconception that this pattern is adding three since $1 + 3 = 4$, and some students may think the rule is $+192$ since $64 + 192 = 256$. Other students may have difficulty understanding what a “rule” is. If students struggle with how to approach the problem, teachers may wish to have students think about what is happening with the numbers. Example questions: “Are the numbers increasing or decreasing?” “What mathematical operation(s) could make this (increasing/decreasing) occur with numbers?” Once students make the connection that increasing numbers are a result of addition or multiplication, students can progress to analyzing the pattern. Ask students, “How is the pattern changing?” “How do you move from 1 to 4? 4 to 16? What operation can we apply so the move is the same between every number?” Students may benefit from the use of manipulatives to model how the pattern is changing. Exposure to a variety of patterns using different objects, pictures, and numbers would be helpful to students.

2. The first three figures in a pattern of candies are shown. The pattern of candies will continue to grow in the same way.



- a) Describe the rule to determine the increasing pattern of the candies.
- b) How many candies will be in Figure 5 of this pattern?

Some students may have trouble describing the rule in their own words. Encourage students to look at the initial section of the pattern and then focus on the section of the pattern that is changing. Students can then look at the next figure to see if the pattern continues. Encourage students to use a strategy such as sentence frames to structure their thinking as they describe the rule.

Some students may have difficulty determining the pattern when represented as a picture. Students may benefit from using manipulatives to replicate the pattern. Replicating the pattern with concrete materials will help students make the connection to a numerical representation. Students should be encouraged to write the number of candies for each set of triangles

underneath the picture. This will help students think about the pattern numerically and aid them in extending the pattern.

Some students will recognize the pattern is increasing by one triangle each time, and these students may think the answer is 5 because there will be 5 triangles in the fifth figure. Encourage students to think about what information has been provided about the problem. The focus in this problem is on the increasing pattern of the candies and how many candies will be in Figure 5.

3. Ashley owns a dog training business. This table shows the number of dog treats Ashley has at the end of each week.

Week	1	2	3	4	5
Number of Dog Treats	270	225	180	135	?

If the pattern shown in this table continues the same way, how many dog treats will Ashley have at the end of week 5?

A common error students may make is to assume that all patterns are increasing. Students with this misconception may incorrectly add on to the Week 4 amount rather than subtracting from it. Encourage students to look at the numbers and focus on whether they are increasing or decreasing. Once students determine that the numbers are decreasing, encourage them to think about which operations might cause the numbers to decrease.

Another common error is assuming that the rule is based on the smallest number in the pattern which would result in students subtracting and determining that Week 5 is 0. Students would benefit from practicing how to find a rule and checking multiple spots in the table to determine if the rule applies to every change in the table. These students may struggle to understand that the rule in a pattern should apply to every iteration of the pattern.

Lead students to discuss what is happening to the numbers in the table and make the connection that decreasing number of dog treats means that the operation/rule must be subtraction or division. Providing concrete examples with context for students to think about will help them come to this conclusion. If students have difficulty analyzing and determining whether the pattern is increasing or decreasing, this may indicate that students need to develop a conceptual understanding of increasing and decreasing using operations and then make this connection to tables.

4. The same rule is used on each input number in this table to create each output number.

Input	Output
2	12
5	30
?	42
9	54
12	72

What is the input number when the output number is 42?

A common error is focusing on the numbers in the output column and predicting the next output. Students with this misconception might add on to the last output without considering the input column. Encourage students to look for the relationship between each input and output number to help them find the rule for this input-output table. Having students write out the number sentence for each row, emphasizing the rule as part of the number sentence, may help students see the relationship between the input column and the output column (e.g., $2 \times 6 = 12$; $5 \times 6 = 30$; $9 \times 6 = 54$).

Another common error is incorrectly applying the rule for the input-output table. As students look at the relationship between the input and output columns, they may correctly determine the rule but then forget that they are looking for the input number. Students with this misconception may apply the rule to the output number rather than using inverse relationships to determine the input number. Encourage students to look at the inverse relationships demonstrated in the table. For example, if the rule involves a multiplication rule for the input number, students could also explore applying a division rule to the output number and discussing the inverse relationships of those number sentences.