

Just in Time Quick Check

Standard of Learning 3.PFA.1

Strand: Patterns, Functions, and Algebra

Standard of Learning 3.PFA.1

3.PFA.1 The student will identify, describe, extend, and create increasing and decreasing patterns (limited to addition and subtraction of whole numbers), including those in context, using various representations.

Students will demonstrate the following Knowledge and Skills:

- a) Identify and describe increasing and decreasing patterns using various representations (e.g., objects, pictures, numbers, number lines).
- b) Analyze an increasing or decreasing pattern and generalize the change to extend the pattern or identify missing terms using various representations.
- c) Solve contextual problems that involve identifying, describing, and extending patterns.
- d) Create increasing and decreasing patterns using objects, pictures, numbers, and number lines.
- e) Investigate and explain the connection between two different representations of the same increasing or decreasing pattern.

Just in Time Quick Check

Just in Time Quick Check Teacher Notes

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

Just in Time Quick Check 3.PFA.1

1. Carson made this number pattern.

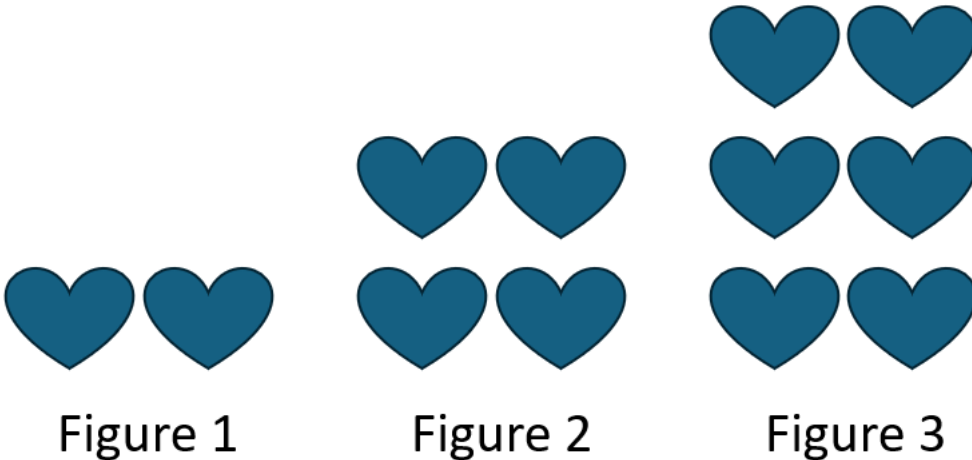
1, 5, 9, 13, 17, 21 ...

If the pattern continues, what will the ninth number be? _____

2. Create a pattern that shows +6 on the number line below.



3. Look at the pattern. Then answer the questions below.



- a) How does the pattern increase from one figure to the next?
- b) If the pattern continues, how many hearts will be in Figure 5?

4. What is the next number in this pattern? Explain how you know.

57, 51, 45, 39, _____

5. Natalie counted all her Halloween candy and then started eating the same amount of candy each week. This table shows the number of pieces of candy Natalie had at the end of each week.

Week	1	2	3	4	5
Number of Pieces of Halloween Candy	54	45	36	27	18

If the pattern shown in this table continues the same way, how many total weeks will it take Natalie to eat all her Halloween candy?

6. Ms. Carey put the following pattern on the board:

5, 10, 15, 20, 25...

Ms. Carey then asked students to show a different representation of this same increasing pattern. The patterns of two students, Anna and Zeke, are shown below. Which student created a correct representation of the same increasing pattern as above? Explain how you know.

Anna's Pattern 5, 15, 25, 35, 45...	Zeke's Pattern 12, 17, 22, 27, 32...
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3.PFA.1 Just in Time Quick Check Teacher Notes

Common Errors/Misconceptions and their Possible Indications

1. Carson made this number pattern.

1, 5, 9, 13, 17, 21 ...

If the pattern continues, what will the ninth number be? _____

Some students may write 22, the number that follows 21. Some students may write 25 because they understood the pattern but wrote the next number rather than the ninth number. These students would benefit from more experience analyzing patterns to see how they are changing and then extending the pattern beyond the next number.

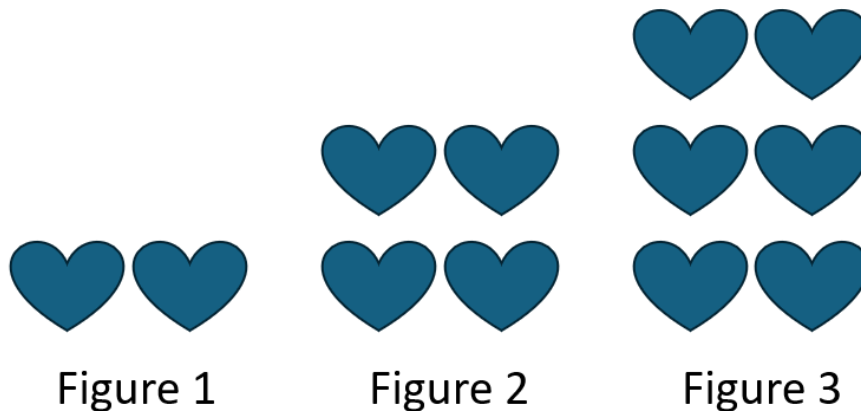
2. Create a pattern that shows +6 on the number line below.



Students may have difficulty demonstrating a pattern given a blank number line. They may place a single point on the number 6 or they may jump forward by ones from zero to six (creating a pattern of +1 instead of +6), or they may start at 0 and then jump to 5 (which may indicate that students counted 0 as the first number). Teachers can support student learning by modeling addition (and subtraction) on a number line and emphasize that this pattern shows repeated addition, not just points on the number line. It may also help students to draw tick marks on the number line and label the numbers 0-20, then create the jumps of 6 to represent the pattern.

While students will likely respond to this problem by jumping from 0 to 6, then 6 to 12, etc., there are other possible correct responses if students start at another number and jump forward six (e.g., starting at 5, then jumping to 11, then jumping to 17, etc.). It may be helpful for students who started at a number other than 0 to share their explanations and number lines with other students. This will support understanding of the concept that patterns do not always have to start at 0.

3. Look at the pattern. Then answer the questions below.



a) How does the pattern increase from one figure to the next?

Students may have difficulty explaining how the pattern increases from one figure to the next. If students only look at Figures 1 and 2, they may state that the pattern is doubling, because it goes from two hearts to four hearts. Most students will recognize that the pattern increases by two each time. Teachers should encourage students to provide additional information in their explanations by asking students, “How do you know it increases by two hearts each time?” Students may say that each figure adds an additional row of two hearts on top, or they may say that each of the two columns increases by one heart each time (thus, increasing the pattern by a total of two hearts). Additionally, it may be helpful to connect this pattern to arrays and multiplication. For example, Figure 2 shows two rows of two (i.e., an array to represent 2×2), and Figure 3 shows three rows of two (i.e., an array to represent 3×2).

b) If the pattern continues, how many hearts will be in Figure 5?

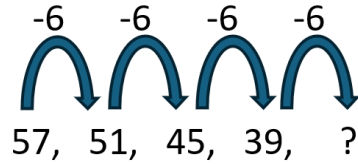
The most common error is for students to state that there are eight hearts in Figure 5. This likely indicates that students determined the number of hearts that would be in Figure 4 rather than extending the pattern to Figure 5. It may be helpful for students to circle the phrase “Figure 5” in the question, as it will draw their attention to how far they need to extend the pattern. It may also be helpful for students to draw the next two figures in the pattern, labeling each one as Figure 4 and Figure 5.

4. What is the next number in this pattern? Explain how you know.

57, 51, 45, 39, _____

In this problem, students may have difficulty identifying the rule of the pattern, especially because the pattern is decreasing, which may be more difficult for some students. Some students may not recognize this pattern as decreasing and may instead try to add to determine the next number. Other students may recognize that the pattern decreases, but may subtract incorrectly, believing that the rule is -5 or -7, leading to an incorrect next number in the pattern.

Teachers should encourage students to determine the difference between each pair of numbers (e.g., 57 to 51, 51 to 45, 45 to 39), and label that the pattern decreases by six each time, as in the image below. It may also help students to verbalize the rule (i.e., “subtract six each time”) prior to determining the next number in the pattern.



5. Natalie counted all her Halloween candy and then started eating the same amount of candy each week. This table shows the number of pieces of candy Natalie had at the end of each week.

Week	1	2	3	4	5
Number of Pieces of Halloween Candy	54	45	36	27	18

If the pattern shown in this table continues the same way, how many total weeks will it take Natalie to eat all her Halloween candy?

Students may be unsure of what the problem is asking and may respond with a number that is already listed in the chart (e.g., five weeks). Some students may not understand that “eating all of her Halloween candy” means that they must extend the pattern until there are zero pieces of candy left. Other students may understand the context but respond that it will take Natalie two weeks to eat all her Halloween candy. This error indicates that students were able to extend the pattern two additional weeks, but they did not recognize that this would result in Natalie taking a total of seven weeks to eat all the candy.

It is also common for students to make computation errors when determining the rule of the pattern, especially when the pattern is decreasing and students must use subtraction. It may be helpful to connect the numbers in this pattern to multiplication/division and to the multiples of 9. Students can see this as a repeated subtraction pattern ($54 - 9 = 45$, $45 - 9 = 36$, etc.) and use this knowledge to extend the pattern two more weeks ($18 - 9 = 9$, $9 - 9 = 0$), resulting in a total of seven weeks.

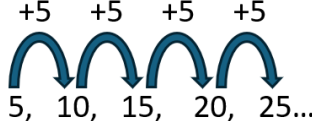
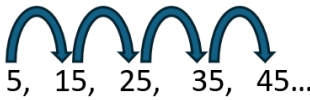

6. Ms. Carey put the following pattern on the board:

5, 10, 15, 20, 25...

Ms. Carey then asked students to show a different representation of this same increasing pattern. The patterns of two students, Anna and Zeke, are shown below. Which student created a correct representation of the same increasing pattern as above? Explain how you know.

Anna's Pattern	Zeke's Pattern
5, 15, 25, 35, 45...	12, 17, 22, 27, 32...

A common error is for students to say that Anna's pattern shows a different representation of Ms. Carey's increasing pattern. This may indicate that students only looked at the first number in each pattern (5) and determined that they must represent the same increasing pattern. Other students may look beyond the first number but still choose Anna's pattern as correct because her pattern uses some of the same numbers as Ms. Carey's pattern (i.e., 5, 15, 25). It would be helpful for students to show the difference between each pair of numbers in all three numbers, as shown below. This will allow students to see that although Anna's pattern uses some of the same numbers as Ms. Carey's pattern, Anna's pattern does not represent the same increasing pattern as Ms. Carey's pattern.

<p style="text-align: center;">Ms. Carey's Pattern</p> <p style="text-align: center;">+5 +5 +5 +5</p>  <p style="text-align: center;">5, 10, 15, 20, 25...</p>	
<p style="text-align: center;">Anna's Pattern</p> <p style="text-align: center;">+10 +10 +10 +10</p>  <p style="text-align: center;">5, 15, 25, 35, 45...</p>	<p style="text-align: center;">Zeke's Pattern</p> <p style="text-align: center;">+5 +5 +5 +5</p>  <p style="text-align: center;">12, 17, 22, 27, 32...</p>