PA2-9  Growing Patterns

Goals
Students will identify growing patterns and will describe by how much the patterns grow.

PRIOR KNOWLEDGE REQUIRED
- Understands repeating patterns
- Can add and subtract
- Can count on
- Understands the concept of how many more
- Can find the difference between two numbers by counting on and counting back

MATERIALS
- Pattern blocks or base ten materials

VOCABULARY
- Repeating pattern
- Growing pattern
- Repeat
- Term
- Core
- Next

EXAMPLES:
3 9 2 3 9 2
Clap tap stomp clap tap stomp

Review repeating patterns. Review the meanings of the words term (each item in a pattern) and pattern (anything that you can predict). Write both words on the board. Look at some repeating patterns. Ask students to predict the next term. Emphasize that because the terms repeat, it’s easy to predict what comes next.

Introduce growing patterns. Write on the board: 1, 2, 3, 4, 5. ASK: What number is the next number? (6) And the next number? (7) SAY: These numbers do not repeat. Do you think this is still a pattern even though it doesn’t repeat? Take answers and encourage students to give a reason. Remind them that a pattern is anything that can be predicted.

Draw the picture at left on the board, above the number pattern, and ask how the patterns are related. (The number pattern shows the number of squares in each tower of the shape pattern.)

ASK: What happens to the towers in the pattern? (they become taller, they grow) What happens to the numbers in the pattern? (they get larger) Can we say that they grow too? We can say that both these patterns grow. If patterns that repeat are called repeating patterns, what do you think patterns that grow are called? Write growing patterns on the board.

Review the difference between two numbers (the number you have to add to the first to get the second). Write on the board:

3 5

ASK: How much do you need to add to 3 to get to 5? Demonstrate how to do this by counting up on your fingers as shown in the margin. SAY: Say three with your fist closed. Beginning with your thumb, hold up one finger for each number you count, and stop at five. ASK: How many fingers am I holding up? Then write +2 in the circle. ASK: Why did I write the plus sign? (we are adding to the lower number) Repeat with other pairs. EXAMPLES:
Growing number patterns with the same difference between the terms.
Write on the board:

\[
4 \quad 6, \quad 8 \quad 10, \quad 3 \quad 8, \quad 5 \quad 10
\]

**Bonus** 10, 12; 16, 18; 24, 26; 25, 30; 45, 50.

**ASK:** How much do you need to add to 3 to get to 5? How much do you need to add to 5 to get to 7? Write +2 in each circle. Add another circle and write +2 in it as well. Have volunteers predict the number that comes next.

**SAY:** These numbers don't repeat, but you can still predict the next number.

**ASK:** Do you think this is still a pattern even though it doesn't repeat? What type of pattern is this? (a growing pattern) Why? (each number is larger than the previous one, the numbers grow by two) Repeat with more examples, such as 2, 4, 6 and 10, 15, 20, and leave the patterns on the board. **PROMPT:** In each pattern there is a magic number that each number grows by, and you have to find that magic number.

**Extending growing number patterns.** Ask students to identify the next number in the pattern 3, 5, 7, 9 (above) and to explain their answer. (11, because the magic number is 2 and 11 is 2 more than 9) Encourage students to write the number sentence for the explanation (9 + 2 = 11).

Ask students to continue the other patterns on the board. Then have students combine the steps—find the magic number and then continue the pattern. **EXAMPLES:**

\[
\begin{array}{c}
2 \quad 4 \quad 6 \quad \underline{8} \\
20 \quad 30 \quad \underline{40} \\
7 \quad 9 \quad 11 \quad \underline{13} \\
16 \quad 20 \quad \underline{24}
\end{array}
\]

**Other growing patterns.** Draw a simple growing pattern using shapes or letters such as at left. Have a volunteer extend the pattern. Point out that just as we add 2 to get each next term in the number pattern 3, 5, 7, we add something to get each next term in other growing patterns (in this case, two squares). Repeat with more.

**ACTIVITY**

Give students pattern blocks of the same shape or base ten materials and ask them to create a growing pattern. Have them record their work in their journals and encourage them to explain how the pattern grows. Students can also record the number of blocks used in each figure of the pattern.

Before assigning the worksheets, ensure that students can identify and count flower petals in pictures like those on page 118 (first and last questions). Draw several examples on the board and show students how to cross out or check the petals that they have already counted so that they count each petal only once.
Shrinking Patterns

Goals
Students will identify shrinking patterns and compare them to repeating and growing patterns.

PRIOR KNOWLEDGE REQUIRED
Understands repeating and growing patterns
Can add and subtract
Can count on
Understands the concept of how many more/fewer
Can find the difference between two numbers by counting on and counting back

Review subtraction by counting backwards. Write on the board: 5 \( \bigcirc \) 3

ASK: How much do you need to subtract from 5 to get to 3? Demonstrate how to do this by counting backwards on your fingers as shown on the margin. Write \(-2\) in the circle. Point out that we include the minus sign to show that we subtract the number. Have students practise finding the number that should be subtracted from the first number to get the second number. EXAMPLES:

\[
\begin{align*}
3 & \bigcirc 1, \\
7 & \bigcirc 5, \\
6 & \bigcirc 3, \\
10 & \bigcirc 5
\end{align*}
\]

Review growing patterns. Write a growing pattern that does not start with the number 1 on the board. Add circles to help students find the difference. EXAMPLE:

\[
\begin{align*}
5 & \bigcirc 7 \bigcirc 9 \bigcirc 11 \bigcirc 13
\end{align*}
\]

ASK: Is this a repeating pattern? (no) What kind of pattern is this? (growing pattern) What is the magic number for it? (2) Do you add it or subtract it? (add) What do we write in the circles? (+2) What would be the next number in the pattern? (15) How do you know? (13 + 2 = 15.) Why do we call this pattern a growing pattern? (because the numbers grow, they become larger)

Shrinking number patterns. Write on the board:

\[
\begin{align*}
30 & \bigcirc 25 \bigcirc 20 \bigcirc 15 \bigcirc 10
\end{align*}
\]

ASK: Is this a repeating pattern? (no) Is this a growing pattern? (no) How do you know? (the numbers are getting smaller) What would you call this pattern? (take answers; students may guess “shrinking pattern”) Explain what the word shrinking means. Write shrinking pattern on the board.

ASK: 30 is how many more than 25? (Count up from 25 to show this.) 25 is how many less than 30? (Count back from 30 to 25 to show this.) What will you do to 30 to get to 25? (subtract 5) Write \(-5\) in the first circle and point out that we write the minus sign to show that we subtract the number 5.
Repeat the same questions for 25 and 20.
Have students practise finding the difference between the terms of various patterns. **EXAMPLES:** 13, 11, 9; 16, 14, 12; 25, 20, 15.

**Shrinking non-numerical patterns.** Draw several such patterns on the board and ask students what the next term in each pattern should be. Then **ASK:** Are these growing patterns? (no) Are these repeating patterns? (no) What do you think these patterns are? (shrinking patterns).

**ACTIVITY**

Give students pattern blocks of the same shape or base ten materials and ask them to create a shrinking pattern. Have them record their work in their journals and encourage them to explain how the pattern shrinks and why it is a pattern at all, that is, how they can predict what comes next. Students can also record the number of blocks used in each figure of the pattern.

**Compare shrinking patterns to growing patterns.** **ASK:** How are shrinking patterns like growing patterns? (The terms change; you can predict what comes next.) How are they different? (The terms become larger in growing patterns and smaller in shrinking patterns. Growing patterns of numbers are made by adding and shrinking patterns are made by subtracting.)

**Reversing a growing pattern makes a shrinking pattern.** Attach to the board three cards with numbers so that they make a growing pattern, such as 3, 5, 7. **SAY:** What type of pattern is this? (growing pattern) I want to change it into a shrinking pattern. Rearrange the cards appropriately. Repeat with another growing pattern of three cards. Then show the pattern 2, 3, 4 and ask a volunteer to rearrange the cards to make a shrinking pattern. Repeat with 4, 6, 8, then with 5, 10, 15, 20. **ASK:** How are you rearranging the cards? Point out that what you do to the cards is like reading the pattern backwards (t-a-c instead of c-a-t). **ASK:** Will reading backwards make any growing pattern a shrinking pattern? Have students use playing cards to create several growing patterns and to reverse the order to make shrinking patterns. **ASK:** What will happen if we take a shrinking pattern and reverse the order? Have students check. What type of pattern did you produce? (repeating pattern)

**Shrinking patterns in life.** Discuss where shrinking patterns might be found in life experiences. **EXAMPLE 1:** Nora has 10 cherries to share with friends. She gives 2 cherries to each friend. How many cherries does she have left after each sharing? **EXAMPLE 2:** Simon has a pencil that is 20 cm long. Each time he sharpens his pencil, it is 1 cm shorter. How short will it be after each sharpening? **ASK:** Can you think of examples of shrinking patterns? How about growing patterns?

**Extension**

BLM Extending Shrinking Patterns (p I-17)
**PA2-11 Describing Patterns**

**Pages 123–126**

**CURRICULUM EXPECTATIONS**
Ontario: 2m1, 2m5, 2m7, 2m61, 2m65, 2m67
WNCP: 2PR2 [C, CN, R], 3PR1, 3PR2

**Goals**
Students will describe growing and shrinking patterns by identifying where they start and how much is added or subtracted each time. When given a pattern rule, students will write out the pattern.

**VOCABULARY**
pattern
grow
term
add/subtract
repeat
shrink
start

**NOTE:** If you are following the WNCP curriculum, limit the lesson to growing patterns only. Use only Workbook page 123 and use BLM Pattern Rules (in place of Workbook page 126).

**PRIOR KNOWLEDGE REQUIRED**
- Can describe repeating patterns
- Can add and subtract
- Can count on
- Understands the concept of how many more/fewer
- Can find the difference between two numbers by counting on and counting back

**MATERIALS**
- coins or spinners (see Activity)
- toothpicks
- BLM Pattern Rules (p 1-18)
- BLM Star Patterns (p 1-19)
- BLM Patterns on a Number Line (p 1-20)

**Review repeating patterns.** Draw the following repeating patterns on the board and **ASK:** How would you describe these patterns?
- \(\text{O} \circ \text{O} > (\text{O} \circ \text{O} >, \text{then repeat}) + 3 + 3 + 3 \ (\text{+, 3, then repeat})
- 1, 2, 4, 2, 1, 2, 4, 2, 1, 2, 4, 2 (1, 2, 4, 2, then repeat)
- **SAY:** You have just described some pattern rules. (Write pattern rule on the board.) A pattern rule describes a pattern so well that someone could draw or write the same pattern when given the rule, without seeing the pattern itself.

**Rules for growing patterns.** Start with patterns that are created by adding the same number, such as 3, 5, 7, 9, .... Include circles for the differences between the terms. **First ASK:** What number was added each time? Have students write several terms of the pattern. Then **SAY:** Find the number the pattern grows by. Use both phrases: “grows by” and “add ___ each time.” Repeat with pattern 2, 4, 6, 8. **Then ASK:** How are the patterns the same? (they both grow by 2) How are they different? (the numbers are all different; they start with different numbers) What could we do to describe the patterns so that it would be clear which is which? Would it be necessary to say all the numbers in the beginning of the pattern? How many numbers would be enough? Finally, write the description for both patterns: “start at 3, add 2 each time” and “start at 2, add 2 each time.” Write several growing patterns on the board (include circles for the difference) and have students identify the pattern rules. **Bonus**

| 25, 27, 29, 31 | 25, 50, 75 | 25, 35, 45, 55 |

**Writing growing patterns from rules.** Now invite some volunteers to give rules for growing patterns, and have students write the patterns according to these rules. For students who struggle, suggest that they first draw a pattern of spaces and circles, as on Workbook page 126, and write the number that should be added in each circle. Where does the number that we start with go? (into the first blank)
**Examples:**
10, 8, 6, 4  11, 10, 9, 8
11, 9, 7, 5  35, 30, 25, 20
60, 50, 40, 30

**Bonus**
25, 23, 21, 19  75, 50, 25, 0
100, 90, 80, 70  95, 85, 75, 65

**Extra Practice:**
BLM Star Patterns

**Rules for shrinking patterns.** Ask students to predict the proper way to describe a shrinking pattern. They can use patterns like the ones at left to check their predictions. Encourage them to state the rule in this form: Start at ___, subtract ___ each time. Have volunteers make rules for shrinking patterns and ask students to write patterns according to these rules.

**Distinguishing between growing and shrinking patterns.** Write several patterns on the board, some growing and some shrinking. For each pattern, **ASK:** Is it a growing or a shrinking pattern? Do you add or subtract to create the pattern? Have students describe the patterns.

**Activity**
Pairs will need a spinner as shown. Player 1 spins the spinner and creates a number pattern of the type given by the spinner. Player 2 identifies the rule used to create the pattern. Students then switch roles. Players can write the rules for their patterns, exchange the rules with a different pair of students, and recreate each others’ patterns from the given rules.

Advanced variation: Player 2 does not see what the spinner shows, so has to identify also whether the pattern is growing or shrinking.

**Patterns on number lines.** Review adding and subtracting on a number line. Draw a number line on the board and ask students to use it with these calculations: 5 + 2, 7 + 2, 5 – 2, 3 – 2. For each calculation, students should hold up the number of fingers that show where they would start and how many steps they would take, and point in the direction they will go to perform the calculations. Repeat with more examples until all students can confidently show the answer. Then draw the picture at left and **ASK:** What pattern does this picture show? (3, 5, 7, 9) How can you tell from the picture what the rule for the pattern is? Is it easier to tell the rule from the number pattern or from the picture? Ask students to explain their reasoning. Draw several patterns on number lines and have students write the rule for the patterns. Then reverse the task: write the rule and have students draw the arrows.

**Extensions**

1. BLM Bananas and Cherries  (p 1-21)

2. Have students explore repeating, growing, and shrinking patterns using a calculator and given a rule. To explore repeating patterns, have students start at 7, add 1, subtract 1, add 1, subtract 1, etc. **ASK:** What repeating pattern do you get? Repeat with similar examples. Then **SAY:** Start at 4, add 1, add 1, subtract 2, add 1, add 1, subtract 2, and so on. **ASK:** Now what repeating pattern do you get? Then challenge students to make their own repeating pattern by adding and subtracting different amounts. Let them discover the requirement for creating a repeating pattern: the sum of the numbers they add needs to equal the sum of the numbers they subtract. When all students see this, give them time to create more patterns, so that even students who did not discover the requirement can use it to create interesting repeating patterns.
PA2-12 Identifying Patterns

Pages 127–129

CURRICULUM EXPECTATIONS
Ontario: 2m1, 2m5, 2m7, 2m61, 2m62, 2m67
WNCP: optional [C, CN, R], 3PR1, 3PR2

VOCABULARY
pattern
repeating
growing
shrinking
term

Goals
Students will identify growing, shrinking, and repeating patterns.

PRIOR KNOWLEDGE REQUIRED
Understands repeating, growing, and shrinking patterns
Can add and subtract
Can count on
Understands the concept of how many more/fewer
Can find the difference between two numbers by counting on and counting back

MATERIALS
BLM Add or Subtract? (p. 1-22)
BLM Adding and Subtracting Patterns (p. 1-23)
BLM Match Patterns with Descriptions (p. 1-24)
BLM What Kind of Pattern? (p. 1-25)

Should I add or subtract to get the next number? Write on the board pairs of numbers with a circle between them and have students show thumbs up if they have to add to get the second number from the first and thumbs down if they have to subtract. Also ASK: How much do you add or subtract? If necessary, practise finding the difference by counting on or counting backwards. Struggling students can use BLM Add or Subtract? for extra practice.

Identifying growing and shrinking patterns. Write one growing and one shrinking pattern on the board: 1, 3, 5, 7, 9 and 7, 5, 3, 1, 3. SAY: One of these patterns was made with addition and the other with subtraction. ASK: Can you tell which is growing? Shrinking? How do you know? SAY: I know a pattern was made by addition. What kind of pattern is it: growing, shrinking, or repeating? (growing) Is that true for any pattern made by addition? (yes) Why? (because when you add, the numbers become larger) Repeat with a pattern made by subtraction.

On the board, write “G = growing” and “S = shrinking” as a key for the next exercise. SAY: G represents growing and S represents shrinking. Ask students write either G or S beside various patterns that you draw on the board. EXAMPLES:

3, 5, 7, 9 (G) 12, 9, 6, 3 (S) 15, 20, 25, 30, 35 (G)

/////\\\\\\\\\\\\\\\\\redd\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\n

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Distinguishing between repeating, growing, and shrinking patterns.
Remind students of repeating patterns, such as 1, 2, 1, 2, 1, 2. Add “R = repeating” to your key. SAY: Now you have three types of patterns to choose from. Continue having students identify patterns, this time including repeating patterns along with growing and shrinking patterns. **EXAMPLES:**

$1, 3, 1, 3, 1, 3 (R)$  $25, 20, 15, 10 (S)$  $2, 12, 22, 32, 42 (G)$

**Identifying patterns in addition and subtraction sentences.** Write the following sums on the board:

\[
\begin{array}{cccc}
4 & 4 & 4 & 4 \\
+1 & +2 & +3 & +4 \\
\end{array}
\]

Have volunteers complete the addition sentences. Once the answers are written on the board, have students identify the patterns in each row. (First row (R); second row (G); answers 5, 6, 7, 8 (G).) Continue with more examples, using first addition and then subtraction. Use four volunteers for each question: one to complete the addition or subtraction sentences and three to identify the type of pattern in the rows. Keep your key for the labels S, R, and G on the board. **EXAMPLES:**

<table>
<thead>
<tr>
<th>Pattern Type</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLM Adding and Subtracting Patterns</td>
<td>4 4 4 4 (S) 7 8 9 10 (G)</td>
</tr>
<tr>
<td>BLM Match Patterns with Descriptions</td>
<td>5 5 5 5 (R) 6 6 6 6 (G)</td>
</tr>
<tr>
<td>BLM What Kind of Pattern?</td>
<td>5 6 7 8 (G) 2 3 4 5 (G)</td>
</tr>
<tr>
<td></td>
<td>+5 +6 +7 +8 (G) 2 2 2 2 (R)</td>
</tr>
<tr>
<td></td>
<td>10 12 14 16 (G) 0 1 2 3 (G)</td>
</tr>
</tbody>
</table>

**Extension**

Patterns in music. Ask students to listen for patterns in favourite songs or other pieces of music. Patterns can appear in the music, in the lyrics, in the volume, or in the instrumentation. For example, songs with a refrain will have a repeating pattern: verse, refrain, verse, refrain, and so on. A song like “Five Little Speckled Frogs” has both a repeating pattern (you sing the same melody for each verse) and a shrinking pattern (the number of frogs on the log decreases by one each time). You can also create patterns with any song. Ask students for ideas, or ask them to sing a song different ways and then identify the pattern they created. **EXAMPLES:** ask students to start singing very softly and gradually get louder (and vice versa); have three students sing the first verse and have three more students join in with each new verse.
PA2-13 Patterns in Hundreds Chart
Pages 130–131

CURRICULUM EXPECTATIONS
Ontario: 2m2, 2m3, 2m7, 2m61, 2m62, 2m67
WNCP: 2PR2 [C, R]

VOCABULARY
pattern
repeat
grow
shrink
term
diagonal

Goals
Students will find patterns in a hundreds chart and explain the rules for
patterns found.

PRIOR KNOWLEDGE REQUIRED
Understands repeating and growing patterns
Recognizes numbers to 200
Can count on
Understands the concept of how many more/fewer
Can find the difference between two numbers by counting on and counting back
Can skip count by 10
Can describe a pattern

MATERIALS
hundreds charts
BLM Two Hundreds Chart (p I-26)
magnetic letters (if available)
BLM Every 5th Square (p I-27)

---

Introduce the terms row and column. Ensure that all students can
identify a row and a column in a hundreds chart or calendar. Write “row”
and “column” on the board and label a row and column accordingly. As a
memory aid, have students create the words “row” and “column” with letter
cards or magnetic letters. Then rearrange the letters in “column” so that it
reads downwards, in a column. Have students read the word in the new
position. ASK: Which letter appears in both words? Put the words together
as shown. Keep them on the board for future reference.

Introduce the diagonal on a hundreds chart. Explain that on a hundreds
chart we call the string of squares whose opposite corners touch diagonals.
Write “diagonal” on the board and draw the first two pictures in the margin
to illustrate its meaning. Then draw the third picture and ASK: Is this a
diagonal? (yes) Invite volunteers to shade several diagonals with different
colours on a hundreds chart.

Identify patterns on a hundreds chart. Display a large hundreds chart on
the board or with an overhead projector, or use a pocket chart. Shade or
highlight in any way a row on the chart. ASK: What numbers have I shaded?
Do they form a pattern? Are they in a row, a column, or on a diagonal? Which
row is that? Repeat with a column and a diagonal. After that have students
choose a column, a row, and a diagonal and describe the patterns they see.
Have them record their patterns and the description in their journals.

Review the term digit. Write the number 2 on the board, then write the
word “digit” and ASK: How many digits does this number have? Repeat
for the number 24, then ASK: Which digit is the ones digit? (4) Which is
the tens digit? (2) Repeat for the number 246, adding a question about the
hundreds digit. ASK: What is the difference between a digit and a number?
(a digit is a figure from 0 to 9; a number can have one digit or several digits)
Point out that digits work in numbers the same way letters work in words.

**Find patterns in rows.** Refer to the hundreds chart again. Highlight part of any row—but don’t include the number in the tenth column—and ask students to write out the pattern created that way (e.g. 33, 34, 35, 36, 37). Have students circle the ones digits of the numbers in the pattern, then ask them to write the pattern of the ones digits in red (3, 4, 5, 6, 7) and the pattern of the tens digit in blue (3, 3, 3, 3, 3). Ask students to describe both patterns. Repeat with another row (e.g., 62, 63, 64, 65, 66), keeping the same colours for the ones digits and the tens digits. **SAY:** Look at the red patterns—the ones digits. How are these patterns the same? How are they different? Repeat with the patterns in the tens digits. **ASK:** Do you think the numbers in any row of the hundreds chart will produce similar patterns? Have students check their predictions with a row of their choice.

**Find patterns in columns.** Repeat the exercise above with numbers in two columns of the hundreds charts.

**Bonus** Shade a row, a column, and a diagonal in the bottom hundreds chart on **BLM Two Hundreds Chart** and describe the patterns in the ones digits, the tens digits, and the numbers themselves.

**Practise finding patterns in ones and tens digits.** Have students skip count by 10s starting at 3 and mark the numbers on a hundreds chart. Ask them to find the patterns in the ones and the tens digits of these numbers.

**Bonus** Start at 11 and skip count by 11s. What do you notice about the numbers on the hundreds chart? What patterns do you see in the ones and the tens digits?

Hide the hundreds chart and ask students to say whether these numbers are in the same row or column: 45, 46, 47, 48. (Students can show the answer with their hands, so that you can assess the class at a glance.) Uncover the chart to check the answers. Repeat with 23, 33, 43, 53. Then hide the chart again and write this pattern on the board: 42, 53, 64, 75, 86. **SAY:** John sees that the pattern in the ones digits is 2, 3, 4, 5, 6. This is like the pattern in a row, so he thinks all these numbers are in a row on the hundreds chart. Is he correct? Discuss John’s mistake. Then say that Jill thinks that because the pattern in the tens digit is “start at 4, add 1 each time,” just as in any column, the numbers should all be in a column. Is she correct? Discuss Jill’s mistake. Finally, have students find the numbers on a hundreds chart and identify their position as diagonal.

**Extension**

**BLM Patterns in Addition Tables** (pp 1-28–1-29). The second page of this BLM asks students to find the “how many” pattern: how many sums are 0 (just one: 0 + 0); how many sums are 1 (two: 1 + 0 and 0 + 1); how many sums are 2 (three: 2 + 0, 1 + 1, and 0 + 2); and so on. Students should see that the pattern starts at 1 and grows by one. It may be helpful to see the pattern if you have students first colour the 0 sums in green, the 1 sums in yellow, the 2 sums in blue, and the 3 sums in red.
Extending Shrinking Patterns

makes patterns by subtracting the same number.

Continue the pattern.

\[
\begin{array}{ccc}
5 & -1 & 4 \\
7 & -2 & 5 \\
9 & -1 & 8 \\
6 & -2 & 4 \\
25 & -5 & 20 \\
6 & -3 & 3 \\
\end{array}
\]

Find the number \(\Box\) subtracts and continue the pattern.

\[
\begin{array}{ccc}
7 & \Box & 5 \\
42 & \Box & 32 \\
17 & \Box & 15 \\
10 & \Box & 8 \\
90 & \Box & 80 \\
\end{array}
\]
Continue the pattern.

- Start at 1. Add 2 each time.
  
  1 \[+2\] 3 \[+2\] 5 \[+2\] 7 \[+2\] 9

- Start at 5. Add 1 each time.
  
  5 \[+1\] 6 \[+1\] ___ \[+1\] ___ \[+1\] ___

- Start at 10. Add 2 each time.
  
  10 \[+2\] ___ \[+2\] ___ ___ ___

- Start at 3. Add 10 each time.
  
  ___ ___ ___ ___ ___ ___

- Start at 10. Add 5 each time.
  
  ___ ___ ___ ___ ___ ___

Make your own rule and continue the pattern.

- Start at ____. Add ____ each time.
  
  ___ ___ ___ ___ ___ ___
Star Patterns

☐ Write how many stars in each row.
☐ Describe the pattern.
Patterns on a Number Line

☐ Describe the pattern.

Start at 1. Add 2 each time.

Start at 4. Add 2 each time.

Start at 12. Subtract 1 each time.
Bananas and Cherries

1 banana weighs 10 cherries.
2 bananas weigh 20 cherries.
3 bananas weigh ___ cherries.
4 bananas weigh ___ cherries.
___ bananas weigh 50 cherries.
___ bananas weigh 60 cherries.
7 bananas weigh ___ cherries.
___ bananas weigh 80 cherries.

Describe the growing patterns.

Start at ____.

Start at ____.
Add or Subtract?

□ Write the number you add or subtract in the circle.

3 +2 5
5 -1 4
3 6
5 3

7 9
7 5
6 4
6 11

5 10
5 8
6 9
9 5

20 10
30 25
3 10
10 9

15 20 25
15 10 5

2 5 8
8 7 6
### Adding and Subtracting Patterns

- Add or subtract.
- Does the pattern repeat, grow, or shrink?
  - Write R, G, or S beside each pattern.

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Blackline Master — Patterns and Algebra — Teacher’s Guide for Workbook 2.2
Match Patterns with Descriptions

☐ Match the patterns with the descriptions.

- [ ] 1 3 5 7 9
  - Start at 6.
  - Grow by 2.

- [ ] 6 5 4 3 2 1
  - Start at 1.
  - Grow by 2.

- [ ] 6 8 10 12 14 16
  - Start at 16.
  - Shrink by 4.

- [ ] 9 6 3 0
  - Start at 6.
  - Shrink by 1.

- [ ] 16 12 8 4 0
  - Start at 0.
  - Grow by 4.

- [ ] 0 4 8 12 16
  - Start at 9.
  - Shrink by 3.
What Kind of Pattern?

Is the pattern repeating, growing, or shrinking?

10¢   20¢   30¢   40¢   50¢

repeating   growing   shrinking

repeating   growing   shrinking

repeating   growing   shrinking

repeating   growing   shrinking
## Two Hundreds Charts

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Every 5th Square

☐ Shade every 5th square. Use the reading pattern.

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☐ Write the ones digit from each shaded square.

5, __, __, __, __, __, __.

☐ Write the next 4 ones digits.

__, __, __, __.

☐ Describe the pattern in the ones digits.

☐ Copy the pattern you shaded.

5, 10, __, __, __, __, __.

☐ What number do you add every time? __

☐ Describe the pattern.

☐ The shaded squares are in two columns / rows.

☐ says 1347 will be shaded. Is she correct? Explain.
Describe the pattern in the shaded squares.

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**Start at 0.**

**Add 2 each time.**

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**4, then repeat.**

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Patterns in Addition Tables (2)

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Describe the pattern.

Describe the pattern.

How many sums are...

0? 1 1? 2 2? ___ 3? ___ 4? ___ 5? ___

Describe the “how many” pattern.