Math Place

Grade 1
British Columbia

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Grade 1 Modules:

- **Number & Operations**
- **Spatial Sense** (Measurement & Geometry)
- **Patterns & Relations / Data & Probability**

Each module includes:
- Teacher's Guide
- Read Aloud Texts
- Big Book (and 8 copies of little book version)
- Math Little Book – Fiction (8 copies)
- Math Little Book – Non-fiction (8 copies)
- Book of Reproducibles
- Teacher's Website
- Overview Guide
- Storage Box

Lead Author for *Math Place* and National Math Consultant

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Diane Stang has been an educator for over 40 years, working in various roles in the public and private sector. She began her career as a classroom and special education teacher in Ontario and British Columbia, and later, as a systems resource coach. Next, she became a student achievement officer for the Ontario Ministry of Education, supporting educators in all subject areas, especially in mathematics. She also developed several math video resources to assist teachers in adopting effective instructional pedagogy and increased math content knowledge. Diane has always advocated for equitable education and has devoted considerable time to supporting students with learning disabilities in math. Diane is now working as National Math Consultant for Scholastic Education.

Number and Operations

Sample Lesson Plans

- **Representing Joining Problems**
- **Joining and Separating Problems**

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SCHOLASTIC EDUCATION

Representing Separating Problems

MATH PLACE BC Grade 1:
Number and Operations
Sample Lesson

Math Learning Standards

Curricular Competencies

- **Reasoning and analyzing:** Use reasoning to explore and make connections; develop mental math strategies and abilities to make sense of quantities; model mathematics in contextualized experiences
- **Understanding and solving:** Visualize to explore mathematical concepts
- **Communicating and representing:** Communicate mathematical thinking in many ways; represent mathematical ideas in concrete, pictorial, and symbolic forms

Content

- **Addition and subtraction to 20 (understanding of operation and process):** Decomposing 20 into parts

Possible Learning Goal

- Represents 'separating' problems by acting them out or using concrete materials

Teacher Look-Fors

- Creates a story problem that involves the action of separation
- Selects an appropriate strategy to solve a separating problem and explains or shows how it works
- Identifies the whole and the parts in the story
- Matches the parts of the equation to the story context
- Explains what the minus sign and equal sign mean

Previous Experience with Concepts:
Students have had experience with addition and have been exposed to separating problems.

Math Vocabulary:
subtract, minus, minus sign, take away, add, plus, plus sign, equal, equal sign, join, equation, matching equation
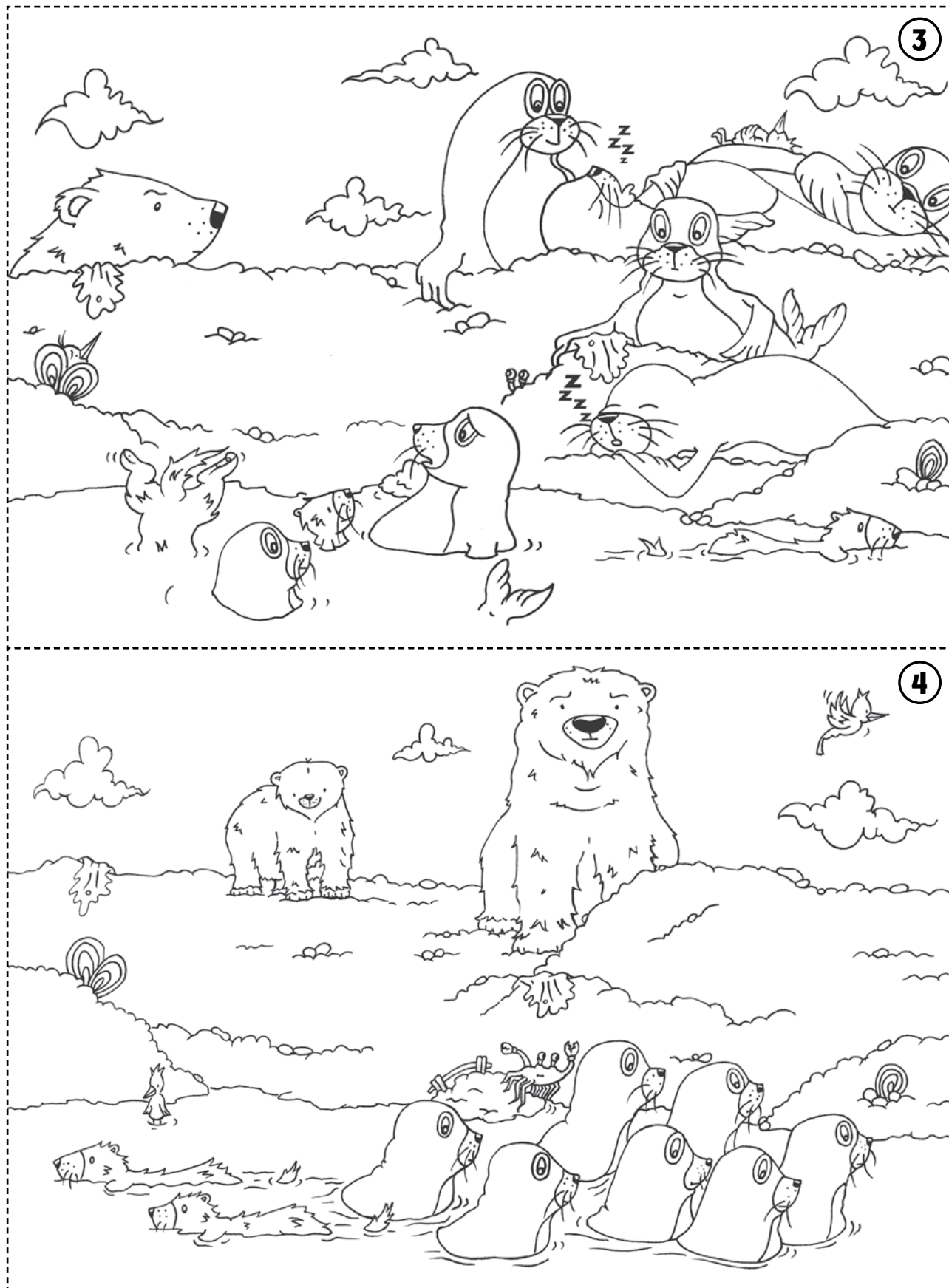
About the Math

Addition and subtraction are inverse operations. As Marian Small points out, since they "undo" each other, "any addition situation can also be viewed as a subtraction one, and vice versa" (Small, 2009, p. 107). Alex Lawson adds that while some curricula introduce subtraction well after addition, this does not benefit students. She stresses that "children who have a solid sense of cardinality and who have begun to develop an understanding of the part-whole relationship should be able to learn to subtract" (Lawson, 2016, p. 23). This is especially true when students use a 'think addition' or counting up strategy to solve problems, rather than a subtraction strategy.

BLM 2: Blank Ten Frames

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④

Minds On (15 minutes)

- Propose the following problem, but change the names and the context so it connects to the experiences of your students: 7 children were playing in the park. 5 had to go home. How many children were left?
- Have students turn and talk with a partner and visualize the problem. Discuss their visualizations. Have some students act out the problem according to the instructions of the class. Ask how this problem is different from the other problems that they have acted out in the past. (e.g., People are leaving rather than joining the group; they end up with less people rather than more people.)
- Introduce the minus sign as representing 'removing or taking away' as you create an equation that matches the scenario. Explain that the whole is being broken up into two parts. Have students identify the whole and the two parts in terms of the context.
- Offer another problem to act out if students are still uncertain about the 'removing' action.

Working On It (15 minutes)

- Have students work in pairs. Have them create two or three story problems that involve the action of separating the whole. They can choose how they want to represent their problems (e.g., act it out, use concrete materials). Encourage students to be creative and to use materials from around the classroom to help tell their stories. Tell them that they can choose to create a matching equation for their story or wait until later to do so.

Differentiation

- Some students may have difficulty transitioning from 'joining' to 'separating' problems presented in a context, not because of the math, but due to the language used in the stories. Offer a familiar but simplistic context using real objects (e.g., books placed on and off of a shelf) to enact an addition problem (e.g., 3 books on a shelf, 2 more added), and then enact a subtraction problem with the same materials (e.g., 3 books on a shelf, 2 taken away). Pair the language (e.g., adding, joining, subtracting, taking away) with the actions. Using the same context, describe a similar problem with different numbers and have them act it out. It is important to simplify the language, but not the math, since students who need support with the language can capably learn with their peers when the language is no longer an obstacle to learning.

Assessment Opportunities

Observations: Observe whether there are students who continue to make joining problems and do not grasp the separating action.

Conversations: If students created a joining problem, ask them to explain what is happening. (e.g., There are 3 students. 2 students sit with them and now there are 5 students.) Ask how many they are starting with in their story and whether they end up with more or less after the story is done. Ask how they could change their story so they end up with less at the end. (e.g., There are 3 students. 1 student leaves. How many students are left?) Reinforce how the action differs.
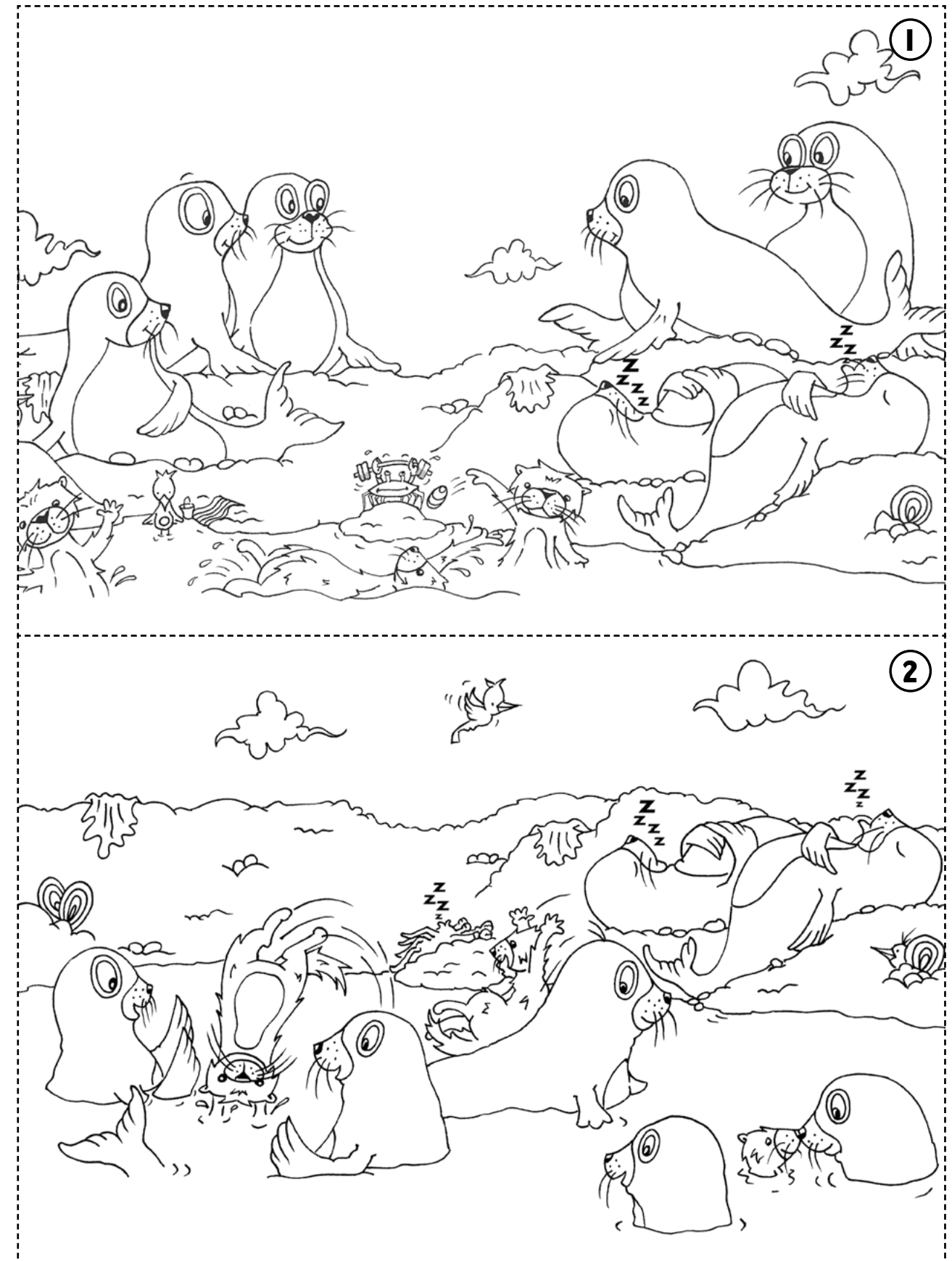
Consolidation (15–20 minutes – 5–10 minutes for meeting with another pair and 10 minutes for whole-class discussion)

- Have each pair of students meet with another pair. They take turns proposing their word problems to the other students, who then solve it by acting it out or using concrete materials.

- Meet as a class. Since the possible learning goal is about representing separating problems, make connections between students' representations by acting them out or using concrete materials. Select two or three pairs of students to present their problem to the whole class and explain how they represented it. Ask students how each of the problems can be represented using an equation. Record each equation as students give their explanation, pausing to show how each part relates to the context. Check for understanding by asking what each part represents. Save this list of equations for the next lesson.

- Ask why we might use numbers and symbols to represent problems, rather than words.

- **Building Growth Mindsets:** Students are sometimes overwhelmed when they are first introduced to a new concept. They may get quiet and feel embarrassed if they make mistakes or feel confused. Discuss how subtracting or 'separating' is a really new concept to understand and they have lots of time in grades one, two, three, and beyond to understand it. Reinforce the message that making mistakes actually helps our brain to grow so we can do things better.

- You can also raise students' curiosity by asking what they wonder about subtracting stories. Encourage wondering since that is what makes mathematicians explore new ideas.

Further Practice

- **Independent Problem Solving in Math Journals:** Verbally pose one of the following prompts:
    - Draw a picture that shows adding or joining. Draw a picture that shows subtracting or taking away. Write a matching equation for each.
    - **Extending Understanding:** Draw pictures to match 4 + 3 and 4 – 3. Show how they are the same and how they are different.

BLM 1: What's the Story?

- *But you said the whole is at the beginning of the story. How can you be left with the whole?* (e.g., You are working backwards.) Show the two ways on your circle drawing.
- *How are the two ways the same?* (e.g., They both have the same parts and wholes.) *How are they different?* (e.g., One starts with the whole and one ends with the whole, so they are opposite of each other.)
- *How are adding and subtracting different?* (e.g., They are opposite actions.)
- Students will need several experiences with these strategies throughout the year before they see how they are connected.

Partner Investigation

- Give each pair an arithmetic rack. Have them pose subtracting problems to each other to solve. Encourage them to solve them in many ways.

Follow-Up Talk

- After the investigation, create an anchor chart of strategies or add them to the chart if it was previously started.

Sample Lesson

Joining and Separating Problems

Math Learning Standards

Curricular Competencies

- **Reasoning and analyzing:** Model mathematics in contextualized experiences
- **Understanding and solving:** Visualize to explore mathematical concepts; develop and use multiple strategies to engage in problem solving
- **Communicating and representing:** Communicate mathematical thinking in many ways

Content

- **Addition and subtraction to 20** (understanding of operation and process): Decomposing 20 into parts; mental math strategies; addition and subtraction are related

Possible Learning Goal

- Creates and solves joining and separating problems using concrete materials and drawings

Teacher Look-Fors

Previous Experience with Concepts:
Students have solved joining and separating problems with numbers to 10, using concrete materials.

- Creates a context for joining or separating problems, based on a visual
- Identifies action taking place within a given story context
- Explains or shows the difference between joining and separating problems
- Represents action of joining or separating and solves problems, using concrete materials
- With assistance, explains how an accompanying number sentence matches the story context, including what the signs and numbers represent

Math Vocabulary:
add, subtract, plus, minus, join, take away, equal, the same as, number story

About the Math

There are different meanings for addition and subtraction, including joining, separating, part-part-whole, and comparing types of problems. Students need exposure to all of them to fully understand the operations of addition and subtraction. See the Introduction to the Addition and Subtraction Units for full explanations about the various types of addition and subtraction problems.

About the Lesson

Students solved several joining and separating problems in Unit 2: Addition and Subtraction to 10, using concrete materials. This lesson reviews these meanings of addition and subtraction by presenting problems in a story context. It also reinforces how the stories can be represented in concrete, pictorial, and symbolic forms.

The four pictures on the big book spread tell a fictional story but there are no words to explain exactly what happens from frame to frame. Students create their own interpretations and then represent the action with concrete materials or drawings. Students are also exposed to the way numerical expressions and/or equations can be used to record their stories. Throughout the process, students learn that the numbers can take on a different meaning, depending on the story being told.

The problem types of joining and separating are further reinforced in a series of related math talks. The talks also reintroduce and reinforce the part-part-whole and comparing problem types that were introduced in Addition and Subtraction to 10.

Materials:

"What's the Story?" (pages 18–19 in the *Number Sense* big book and little books), BLM 1: *What's the Story?*, concrete materials, chart paper, markers

Time: 60 minutes
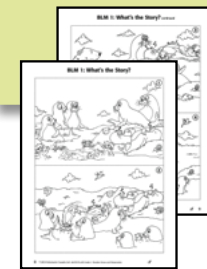
Minds On (20 minutes)

- Show the "What's the Story?" spread in the *Number Sense* big book, covering all but picture #1 (top left of spread).
- Draw attention to picture #1. Ask students where they think the story takes place (e.g., in the Arctic, by the ocean). Ask what animals are in the story and whether they think the drawings show what they look like in real life (e.g., they are cartoons, the animals are smiling, real seals don't sleep like that). Ask what type of story is being told in the pictures. (e.g., fiction)
- Tell students that, since there are no words, they can create their own stories to match the pictures. Give them the following example of what may have happened before this picture:
  - Imagine that there were only 2 seals fast asleep on the shore (point to the seals) and no other animals in sight. 2 other seals just finished fishing and waddled up on shore to join them. How many seals are there now?
- Discuss students' answers. Ask what action is taking place. Ask how they could show this scenario using concrete materials. Ask how they could show this story using numbers (e.g., 2 + 2 = 4). Review what all parts of the equation mean in relation to the picture.
- Have students turn and talk to a partner about what might happen after the proposed scenario. Have them act it out with concrete materials. Discuss some of their responses and how they showed their solution (e.g., 3 more seals join the 4 seals, and now there are 7 seals; then 3 otters swim along, so now there are 10 animals). Ask how numbers could show each of the stories (e.g., 3 + 4, 7 + 3). Clarify that we need to know the story to understand the numbers.

- *What do you visualize? What action is happening?* (e.g., Butterflies are going away.) *Do you think there will more or less butterflies in the garden? Why?* (e.g., There will be less because butterflies are leaving.)
- *With your partner, show the problem on ten-frames in at least one way.*
- Possible solutions to further probe:
  - (Removal, counting 3 times) Shows 17 on two ten-frames, counting by 1's. Removes 8 counters, one at a time counting 1, 2, 3…, 8. Counts the remaining 9 counters, 1, 2, 3…, 9.
  - (Removal, conceptually subitizing various amounts) Shows 17 on two ten-frames. Removes the 7 counters on the partially filled frame (subitizing) and then 1 more on the filled frame, counting on from 7…, 8. Then subitizes the 9 remaining counters.
  - (Adding on) Puts 8 red counters on one ten-frame. Adds 2 yellow counters to fill the frame, saying 10, then adds more yellow counters to the second ten frame, counting on from 10 as 11, 12…, 17. Counts the yellow counters as 1, 2, 3…, 9.
  - (Comparing) Builds 17 on two ten-frames that are side by side. Builds 8 on another ten-frame, which is underneath. Matches the counters that are the same on the top and bottom representations (8 of them). Removes the matching counters from top and bottom, and counts the remaining counters as 1, 2, 3…, 9.
- Discuss some of the strategies that students share. Below are some prompts for connecting the removal and the adding on strategy.
- *With the butterfly problem, what is the whole?* (e.g., the whole is all of the 17 butterflies when they are together) Draw 17 circles on chart paper. *When does this happen in the story?* (e.g., at the beginning) *What are the two parts and when do they happen in the story?* (e.g., the 8 butterflies that fly away after they are together, and the 9 butterflies that stay) *Show me the parts on my drawing.* Circle the parts that students show.
- *What are you showing when you start by putting 17 counters on your ten-frames?* (e.g., the whole) *And what are you showing when you remove 8 of the counters?* (e.g., one part – butterflies going away) *What do the remaining counters represent?* (e.g., the other part – butterflies that are still in the garden)
- *When you show 8 counters to start off your problem, what are you showing?* (e.g., one part – the butterflies that flew away) *What are you showing when you add more counters?* (e.g., the other part – the butterflies that are left) *How do you know when to stop adding counters?* (e.g., when I count 17) *And what are you left with?* (e.g., the whole)
- *So in the first way, you are starting with the whole, taking away a part and are left with the other part, so you are subtracting. How is the second strategy different?* (e.g., you are starting with the part, adding a part, and getting the whole)

Let's Talk (15–20 minutes)

Select the prompts that best meet the needs of your students.

- *We have been telling the story about the animals in the picture. We have one more picture to finish our story. Look closely at the differences between picture #3 and picture #4. If the answer is 2, what could the stories and actions be? Turn and talk to your partner, and put your thumb up when you think you have a story.* (e.g., 1 polar bear joins 1 polar bear; 3 otters minus 1 otter) *How are the stories different, even though they both equal 2?* (e.g., the actions, the animals involved) *How can we show the difference in the actions in numbers stories?* (e.g., 1 + 1 = 2 and 3 − 1 = 2)

- *What might the story be if the answer is 0? What does it mean to have an answer of 0?* (e.g., It means that nothing is left.) *What might be a story with an answer of 0?* (e.g., 5 seals on the shore, 5 seals jump into the water, now there are 0 seals on the shore) *What would this look like in a number sentence?* (5 − 5 = 0)

- *Think of stories that would describe the number of seals on the shore from picture #1 to picture #2 to picture #3 to picture #4.* (e.g., There are 7 seals, then 5 jump in the water, so now there are 2 on the shore. Then 3 seals climb back to shore, and now there are 5. All 5 leave so now there are 0.) *What would these look like as number stories?* (e.g., picture #1 to picture #2: 7 − 5 = 2; picture #2 to picture #3: 2 + 3 = 5; picture #3 to picture #4: 5 − 5 = 0) *How are the actions shown in the number stories?*

Partner Investigation

- *What might these number stories describe from picture to picture (3 + 5, 8 − 3, 5 − 1 + 5)?*

- *Find more differences between picture #3 and picture #4 or from picture to picture. Tell the story and show it with concrete materials.*

Follow-Up Talk

- *What have you learned about how the actions in the story are related to adding and subtracting?*

Math Talk:

Math Focus:
- Representing separating problems as whole-part-part relationships
- Exploring various mental strategies (e.g., counting back, counting up)

Let's Talk (15–20 minutes)

Select the prompts that best meet the needs of your students.

- *Visualize the following problem:*
    - *There are 17 butterflies in the garden. 8 fly away. How many butterflies are left?*

- Show students picture #2 (bottom left of spread) and have them compare it to picture #1. Ask what action might have taken place between the first and second picture. Give the example:
    - There is a group 4 seals on this side of the shore (point to the seals on the right in picture #1). 2 of those seals jumped into the water. How many seals are left in the group now?

- Discuss what action is taking place (e.g., removing, taking away). Ask how the story can be shown with numbers. (e.g., 4 − 2 = 2) Highlight how the numbers and symbols match the story.

Working On It (15 minutes)

- Have students work in groups of two or three. Give each group one of the little versions of the big book, a copy of BLM 1, and some concrete materials. Ask students to create a story of what might have happened between the first and second pictures. They can model it with their concrete materials and then record it with a matching drawing or a number sentence on chart paper. After thinking of two or three scenarios, have each group circle their favourite story and then annotate the action on the BLM.

Differentiation

- Some students may find it difficult to describe the stories in words. Let them indicate the change while you model the language. Pose the following prompts:
    - Point to what is different from this picture to that picture. (e.g., student points to 7 seals on the shore and then only 2 seals on the shore)
    - Point to where the other seals went. (e.g., student points to the water) How many seals in the water? (e.g., says or shows 5). So there are 7 seals and then 5 swim away and 2 seals are left (pointing to each part). 7 take away 5 equals 2.

- Once you model this procedure, have other students in the group describe the differences that the student points out.

Assessment Opportunities

Observations: Since this is an open task, students may have difficulty getting started.

Conversations:
- What did you see that was different in the two pictures? (e.g., There were 4 seals on that side and now there are only 2.) What action happened? (e.g., 2 jumped into the water.) So are we adding or taking away seals on the shore? (e.g., taking away and then there are less) How can you say that as a number story? (e.g., 4 seals take away 2 seals equals 2 seals left on the shore.)

- Look at the two pictures. What do you notice that is different from picture #1 to picture #2? (e.g., There are 3 seals here and now there are none.) What actions may have happened? (e.g., They jumped into the water.) How can you describe that as a number story? (e.g., There are 3 seals, and 3 seals jump into the water, and now there are none.) How could we write that with numbers?

Consolidation (The next day: 25 minutes – 10 minutes to meet with another group and 15 minutes to meet with the whole class)

- Students meet with another group. They take turns showing their circled drawing or number sentence and the other group tries to guess what the matching word story would be. They can then show their annotated BLM to explain their story.
- Strategically select two or three of the stories to share. You can either have students show the number sentence and the class guess what the story would be, or have students describe the story and have the class create the matching number sentence.
- Discuss the different actions in the story (e.g., joining, addition; taking away, subtraction) and how they are different and represented differently in number sentences. Find the relevant words on the Math Word Wall and review their meanings.
- Clarify that the number sentence needs a story to understand what the numbers mean.
- **Building Growth Mindsets:** Tell students that if they didn't understand everything in the lesson today, they don't need to worry since they will have more time to explore in the days ahead. Explain that they will be continuing to create stories about the seals and the otters, and that it will get easier to create and solve the problems with more practice and hard work. Ask whether they enjoyed making up their own stories. Highlight how math can also involve using their imaginations and it can be fun.

Materials:

"What's the Story?" (pages 18–19 in the *Number Sense* big book and little books), concrete materials

Math Talk:

Math Focus:
- Representing joining and separating problems in concrete, pictorial, and numerical forms
- Make connections between the operations of addition and subtraction

Let's Talk (15–20 minutes)

Following are some possible prompts to uncover the stories students find and how to connect the mathematical concepts that emerge. It is important to have students' responses drive the dialogue. Select the prompts that best meet the needs of your students.

Teaching Tip

Integrate the math talk moves (see Guide front matter) throughout Math Talks to maximize student participation and active listening.

- Show the pictures in "What's the Story?" *What is a joining problem that we discovered the other day? Why is it a joining problem? What is a separating or 'taking away' problem? How is the action different in the two problems?*
- *Look at picture #3 and study it closely. What action may have taken place between the second and third pictures? Turn and talk to your partner. Show the action with some concrete materials and think how you could describe it in words and as a number story.*
- Discuss students' responses. (e.g., There were 5 seals in the water, 3 seals climbed out, now there are only 2 seals in the water.) *What action took place?* (e.g., leaving the water) *How did you show that with your materials?* (e.g., We showed 5 cubes and then took 3 away and then we had 2 left, so we said 5 take away 3 equals 2.) *So how would we write this with numbers and symbols?* (5 – 3 = 2) *Put your thumb up if you found this story.*
- *Did anyone have a different story using the numbers 5, 3, and 2?* (e.g., We had 2 seals on land and then 3 more seals from the water joined them, so now there are 5 seals on the shore.) *How could they have shown this story?* (e.g., 2 cubes, and 3 cubes, push them together, and count them up, which equals 5 seals on the shore) *How would this look with numbers?* (e.g., 2 + 3 = 5) *How is this story different from the subtraction story?* (e.g., the action; one is putting together groups, and the other is taking away groups)
- *If the answer is 5, what might be another story? Turn and talk to your partner and act it out with your materials.* (e.g., There were 8 animals in the water in picture #2 and 3 animals leave, so now there are 5 animals in the water.) *What action took place and how could we write it as a number story?*
- *How many animals are on the shore in picture #3?* (6) *How can you describe the action to get from picture #2 to picture #3? How would this look in a number sentence?*

Partner Investigation

- Pose the following prompt: *If the answer is 6, what might be the story? How can you show it with materials and numbers?* (e.g., 2 seals on the shore, 3 seals join them from the water, and then 1 polar bear joins them too; 2 + 3 + 1 = 6)

Follow-Up Talk

- Conclude with discussing how knowing the full story in words is important for understanding the number stories.

Materials:

"What's the Story?" (pages 18–19 in the *Number Sense* big book and little books), concrete materials

Math Talk:

Math Focus:
- Representing joining and separating problems in concrete, pictorial, and numerical forms
- Make connections between the operations of addition and subtraction