Communicate About Transformations

Goal
Describe translations, rotations, and reflections.

Prerequisite Skills/Concepts
• Identify transformations, including reflections, translations, and rotations, using concrete materials and drawings.
• Describe location and movements on a grid.

Expectations
4m77 use mathematical language to describe geometric ideas
4m81 demonstrate an understanding of translations, reflections, and rotations

Assessment for Feedback
<table>
<thead>
<tr>
<th>What You Will See Students Doing…</th>
<th>When Students Understand</th>
<th>If Students Misunderstand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• use math language when describing geometric transformations</td>
<td>• Students use terms such as translation, rotation, reflection, line of reflection, and centre of rotation correctly.</td>
<td>• Students use imprecise language to describe transformations. Review the definitions for translation, rotation, and reflection and ask students to use each in a sentence.</td>
</tr>
<tr>
<td>• use the criteria of the Communication Checklist to self-assess the quality of their descriptions and to make improvements</td>
<td>• Students include written detail and diagrams to explain their ideas about transformations.</td>
<td>• Students identify transformations with no explanation. Provide specific ways to improve their description, such as including more detail and labelled diagrams.</td>
</tr>
</tbody>
</table>

Preparation and Planning

Meeting Individual Needs

Extra Challenge
• Students can be challenged to write directions for creating a quilt block to exchange with a partner. Each student can then create the quilt block, following the instructions. Afterwards, they can suggest improvements to each other’s instructions based on the criteria listed in the Communication Checklist.

Extra Support
• Read the Communication Checklist together with those students who are having difficulty writing clear instructions, and help them evaluate their instructions according to each criterion in the Checklist.
1. Introduction (Small Groups) ♦ 5–10 min

Organize students into small groups. Have them take turns acting out reflections, rotations, and translations using body movements. As each student takes a turn, the others can identify the transformation and then describe how to demonstrate the transformation.

Sample Discourse
“How do the reflections, rotations, and translations feel different?”
• Translations are like stepping to the side; my feet and body are still facing the same direction, though.
• Rotations are like spinning. If I do it too much, I get dizzy.
• Reflections are like a 180° rotation, either clockwise or counterclockwise.

Tell students that they are going to write instructions for how to make a transformation.

2. Teaching and Learning (Whole Class/Small Groups) ♦ 20–25 min

Draw attention to the sentences at the top of Student Book page 392, and then together read Carmen’s Instructions. Have students follow Carmen’s instructions as they make the Yankee Puzzle quilt block. Draw attention to the central question and discuss the ways in which Carmen’s instructions make sense and the ways in which they are not clear. Draw attention to the criteria from the Communication Checklist to help guide the discussion.

Students can work through prompts A and B, then create their own set of instructions for creating the Yankee Puzzle quilt block, improving on Carmen’s as they do so.

Sample Discourse
“What shapes make up the Yankee Puzzle quilt block?”
• triangles and trapezoids

“Why do you think that Carmen chose to use only triangles in her instructions?”
• It’s easier to explain a pattern when it has only one shape. Since the 2 triangles make 1 trapezoid, it was easier to explain the pattern as if it only had triangles.

Reflecting
Use these questions to ensure that students understand how to write instructions that are clear and easy to follow, as well as why it is important for instructions to be clear. Discuss the questions, encouraging varied responses and examples.

Sample Discourse
1. a) • If the steps are out of order, then you can’t solve the problem.
   • If you try to follow instructions and you do Step 2 before Step 1, it won’t make sense and you’ll get confused.

b) • You need enough detail so you know exactly what to do.
   • If the instructions don’t have enough detail, you might not know everything you need to do for each step.

c) • Using math language helps other people understand exactly what you mean.
   • You should use math language to explain the steps because it’s shorter than not using it.

2. • If I read my instructions aloud to someone else, and they can follow each step, I know that I’ve included everything I need.
   • Reading my instructions aloud helps me think through each step as I read it.
**Answers**

A. For example, Carmen showed all the steps in the right order and she used mathematical language and diagrams.

B. In Step 2, Carmen didn’t say what direction to rotate the triangle. Rey rotated the triangle counterclockwise when it should have been rotated clockwise. Carmen also didn’t say what direction to reflect the triangle in Step 4.

1. a) For example, the order of steps is important when each step must be completed before you can start the next.
   
   b) For example, the details about each step tell you exactly what to do.
   
   c) For example, mathematical language explains exactly how to move the shapes. “Translate a shape” explains better how to move the shape than if it just said “move the shape” because I know what translate means.

2. For example, then I can see if the instructions make sense to someone who hasn’t tried the problem before. If someone has trouble following the instructions, then the instructions probably aren’t clear enough, but if someone can easily follow the instructions, then the instructions work.

3. a) For example, to get to shape B, move shape A 4 spaces right and 1 space down or move A 1 space down and 4 spaces right.

4. a) For example:

   Step 1: Draw an 8-by-8 grid and colour it yellow.
   
   Step 2: Draw a purple triangle in the top left square. Reflect it across the vertical line of reflection. The 2 triangles now make 1 large triangle.
   
   Step 3: Translate the large triangle 1 space down.
   
   Step 4: Rotate both triangles 90° clockwise.
   
   Step 5: Repeat Step 4 two times.

   b) For example, I used mathematical language such as translate and rotate and I included the angle and direction of rotation.

**3. Consolidation ➤ 15–25 min**

**Checking (Pairs)**

For intervention strategies, refer to the Meeting Individual Needs box and the Assessment for Feedback chart.

3. Discuss with students the parts of the description that make sense and the parts that are missing.

**Practising (Individual)**

4. a) Ask the students to identify the shapes that make up the quilt block.
   
   b) & c) Refer the students to the Communication Checklist.

**Related Question to Ask**

<table>
<thead>
<tr>
<th>Ask</th>
<th>Possible Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>About Question 3:</strong></td>
<td>• I asked myself each question in the Checklist and then looked at each step in my instructions. Then I decided what to do to improve the description of the step.</td>
</tr>
</tbody>
</table>

**Closing (Whole Class)**

Have students summarize their learning by asking, “What makes your math instructions clear and precise?”

• I show the steps to my solution in the right order.
• I have detail to explain my thinking.
• I use math terms like translation.
• I use a diagram to show what I mean.
**Assessment of Learning**—What to Look for in Student Work…

**Assessment Strategy:** written question

**Communication**

**Key Assessment Question 4**
- a) Write instructions for making this quilt block. Have someone test your instructions.
- b) Identify the strengths of your instructions.
- c) How could you improve your instructions?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>provides incomplete or inaccurate instructions</td>
<td>provides partial instructions that exhibit some clarity and logical thought</td>
<td>provides complete, clear, and logical instructions</td>
<td>provides thorough, clear, and insightful instructions</td>
</tr>
<tr>
<td></td>
<td>organization is minimal and seriously impedes communication</td>
<td>organization is limited but does not seriously impede communication</td>
<td>organization is sufficient to support communication</td>
<td>organization is effective and aids communication</td>
</tr>
<tr>
<td></td>
<td>uses diagrams that exhibit minimal clarity and accuracy, and are ineffective in communicating</td>
<td>uses diagrams that lack clarity and accuracy, though not sufficiently to impede communication</td>
<td>uses diagrams that are sufficiently clear and accurate to communicate</td>
<td>uses diagrams that are clear, precise, and effective in communicating</td>
</tr>
<tr>
<td></td>
<td>uses very little mathematical language</td>
<td>uses some mathematical language correctly</td>
<td>uses correct mathematical language</td>
<td>uses precise mathematical language</td>
</tr>
</tbody>
</table>

**Extra Practice and Extension**
- You might assign any of the questions related to this lesson, which are cross-referenced in the chart below.

<table>
<thead>
<tr>
<th>Problem Bank</th>
<th>Chapter Review</th>
<th>Workbook</th>
<th>Nelson Web Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Book p. 401, Question 4</td>
<td>Student Book p. 403, Question 6</td>
<td>p. 128, all questions</td>
<td>Visit <a href="http://www.mathk8.nelson.com">www.mathk8.nelson.com</a> and follow the links to <em>Nelson Mathematics 4</em>, Chapter 14.</td>
</tr>
</tbody>
</table>

**Math Background**

Many students can follow instructions with accuracy when asked to perform each transformation, but have difficulty when asked to articulate instructions for another person to follow. It is important that students have plenty of opportunity to practise explaining their thinking in a clear, precise, and logical order. You should model answers for students that contain math words. Encourage students to add detail to their answers, to modify their answers to clarify any misinformation, and to use the Communication Checklist on Student Book page 393 to see if they included sufficient detail. Students, especially those who benefit from visual reinforcement, should write their explanations on paper in an organized step-by-step format, as shown on Student Book page 392. They should then follow the instructions to see if the steps are accurate and make sense.

**At Home**
- Students can write directions for finding an object in their bedroom and give them to a family member to follow. They can instruct the family member to start at the door to the bedroom. The directions should include translations, reflections, and rotations.

2 cm Grid Paper, Masters Booklet p. 24

**Extra Support:**
- Scaffolding Master p. 68