Introduction to Slides

For this lesson, a magnetic board with a grid on it (or an overhead projector with a grid drawn on a transparent slide) would be helpful. Let your students practice sliding dots in the form of a small circular magnet right and left, then up and down. Students should be able to identify how far a dot slid in a particular direction and also be able to slide a dot a given distance. If any students have difficulty in distinguishing between right and left, write the letters L and R on the left and right sides of the board.

After students can slide a dot in given direction, show them how to slide a dot in a combination of directions.

You might draw a hockey rink on a magnetic grid and invite volunteers to move a small circular magnet as if they were passing a puck. Sample questions and tasks:

- Pass the puck three units right; five units left; seven units down; two units up.
- Pass the puck two units left and five units up.
- Position several small figures of players on grid intersections in various points of the rink and ask your students such questions as:
  - Player 3 passes the puck 5 units right and two units up. Who receives the pass?
  - Player 5 wants to pass the puck to Player 7. How many units left and how many units down should the puck go?

**Bonus**

Player 4 sent the puck 3 units up. How many units left should Player 7 move to get the pass?

**Assessment**

Slide the dot:

- a) 3 units right; 3 units up
- b) 6 units left; 3 units down
- c) 7 units left; 2 units up
ACTIVITY 1

**Ball Game**
The students are points on the grid, and you give directions such as: “The ball slides three units to the right”; the student with the ball has to throw it to the right place in the grid.

ACTIVITY 2

In the school yard, draw a grid on the ground. Ask your students to move a certain number of units in various combinations of directions by hopping from point to point in the grid.

ACTIVITY 3

**Memory Game**
Students will need a grid and several (1 to 4) small objects (play money of different values or beads of different colours could be used). The objects are placed on the intersections of the grid. Player 1 slides one of the objects while Player 2’s back is turned, and Player 2 then has to guess which object was moved and describe the slide. This game will become much easier when coordinates are placed on the grid and the students are familiar with the coordinate system. When students learn coordinate systems (in section G5-23), they will be able to memorize the coordinates of the objects. They can then compare the coordinates after the objects were moved with the coordinates before the objects were moved to determine exactly which object moved and how.
Tell your students the following story. You might use two actual figures to demonstrate the movements in the story.

Suppose you have a pair of two-dimensional figures and you wish to place one of the figures on top of the other. But the figures are very heavy and very hot sheets of metal. You need to program a robot to move the sheets: to write the program you have to divide the process into very simple steps. It is always possible to move a figure into any position in space by using some combination of the following three movements:

1. You may slide the figure in a straight line (without allowing the object to turn at all):

   Slide

   \[ \text{SLIDE} \]

2. You may turn the figure around some fixed point (usually on the figure):

   Turn or Rotation

   \[ \text{TURN or ROTATION} \]

3. And you may flip the figure over:

   Flip or Reflection

   \[ \text{FLIP or REFLECTION} \]
Two figures are congruent if the figures can be made to coincide by some sequence of flips, slides and turns. For instance, the figures in the picture below can be brought into alignment by rotating the right hand figure counter clockwise a quarter turn around the indicated point, then sliding it to the left.

It is not always possible to align two figure using only slides and turns. To align the figures below you must, at some point, flip one of the figures:

One way to flip a figure is to reflect the figure through a line that passes through an edge or a vertex of the figure. Tell your students that today you are going to teach them about slides.

Show students the following picture and ask them how far the rectangle slid to the right. Ask for several answers and record them on the board. You may even call a vote.

Students might say the shape moved anywhere between one and seven units right. Take a rectangular block and perform the actual slide, counting the units with the students. The correct answer is 4.

Show another picture:
This figure has a dot on its corner. How much did it slide? This time it is easier to describe the slide—just use the benchmark dot on the corner. Check with the block.

Show a third picture.

Is this a slide? The answer is NO, this is a slide together with a rotation. You cannot slide this block from one position to the other, without turning it.

**ACTIVITY**

Give your students a set of pattern blocks or Pentamino pieces and ask them to trace a shape on dot paper so that at least one of the corners of the shape touches a dot. Ask students to slide the shape a given combination of directions. After the slide, trace the pattern block again.
Draw a shape on a grid on the board and perform a slide, say three units right and two units up. Draw a translation arrow as shown on the worksheet. Ask your students if they can describe the slide you’ve made. If they have trouble, suggest that they look at how the vertex of the figure moved (as shown by the transition arrow). To help students describe the slide, you might tell them that the grid lines represent streets and they have to explain to a truck driver how to get from the location at the tail of the arrow to the location at the tip of the arrow. The arrow shows the direction as the crow flies, but the truck has to follow the streets.

Make sure your students know that a slide is also called a “translation”. Students should also understand that a shape and its image under a translation are congruent.

**Extensions**

1. Slide the figures however you want, and then describe the slide:

2. Describe a move made by a chess knight as a slide. Describe some typical moves of other pieces such as a pawn or a rook (castle).
**G5-23**

**Grids and Maps**

Assign a letter to each row of desks in your class and a number to each column. Ask your students to give the coordinates of their desks. Then play “postman”—a student writes a short message to another student and writes the student’s “address” in coordinates. A volunteer postman then delivers the letter. The postman has to describe how the letter moved (two to the front and one to the left, for example).

Place a slide with a map of Saskatchewan on the overhead projector (see the **BLM**). Ask volunteers to find the cities on the map and to answer the questions:

- What are the coordinates of Saskatoon?
- What are the coordinates of Regina?
- What are the coordinates of Uranium City?
- What are the coordinates of Prince Albert?
- What can you find in the square A4? D5? D1?

**GOALS**

Students will describe and perform a slide on a grid, and find a point given by coordinates on a map.

**PRIOR KNOWLEDGE REQUIRED**

Slides
Coordinate systems

**VOCABULARY**

<table>
<thead>
<tr>
<th>slide</th>
<th>translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>row</td>
<td>column</td>
</tr>
<tr>
<td>coordinates</td>
<td></td>
</tr>
</tbody>
</table>

**Battleship Game**

This game may be either played in pairs or a teacher can play against the whole class, when the class is guessing the teacher’s ships. You might also give some tips—when a player hits something, where can the other squares of the ship be? When the ship is sunk, where there are no ships?

**Sample Placement:**

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  8 7 6 5 4 3 2 1
A B C D E F G H
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Let your students draw their own map, possibly based on a book they are reading. Ask them to make their own questions of the same kind as on the worksheet and ask their partners to answer them.

**ACTIVITY 2**

Give your students an assortment of Pentamino pieces. Ask them to trace each piece on grid paper, draw a mirror line through a side of the piece and then draw the reflection of the piece in the mirror line. Students could check if they have drawn the image correctly by flipping the grouping of Pentamino pieces over the mirror line and seeing if it matches the image. Let your students know that a “flip” is also called a “reflection.” Students should notice that each vertex on the original shape is the same distance from the mirror line as the corresponding vertex of the image. Let your students practice reflecting shapes with partners: Each student draws a shape of no more than 10 squares, and chooses the mirror line. The partner has to reflect the shape over the given mirror line.

**Advanced game:** One student draws two shapes of no more than 10 squares so that the shapes are symmetric in a line but one square is misplaced. The partner has to correct the mistake.

Draw four points as shown and explain that two of these points are reflections of the other two. Challenge students to draw the mirror line. How do they know that the line they have drawn is the mirror line? Which point is reflection of which?

**GOALS**

Students will perform reflections of points and shapes through a line.

**PRIOR KNOWLEDGE REQUIRED**

Symmetry

**VOCABULARY**

reflection  mirror line
symmetry  symmetry line

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**ACTIVITY**

Player 1 and Player 2 each draw a grid as shown. Each player shades:

- 1 battleship
- 2 cruisers
- 2 destroyers
- 1 submarine

(See grid for an example: no square of a ship may be adjacent to a square of another ship, including diagonally.)

Players try to sink all their partner’s battleships by guessing their coordinates. If a player’s ship is in a square that is called out, the player must say “hit.” Otherwise they say “miss.”

Each player should keep track of the squares they have guessed on a blank grid by marking hits with X’s and misses with ✓’s. The game ends when all of one player’s ships are sunk. A ship is sunk when all its squares are hit, and the owner of the ship must indicate that to the partner.

(Continued from previous page.)

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**G5-24**

**Reflections**

Give your students an assortment of Pentamino pieces. Ask them to trace each piece on grid paper, draw a mirror line through a side of the piece and then draw the reflection of the piece in the mirror line. Students could check if they have drawn the image correctly by flipping the grouping of Pentamino pieces over the mirror line and seeing if it matches the image. Let your students know that a “flip” is also called a “reflection.” Students should notice that each vertex on the original shape is the same distance from the mirror line as the corresponding vertex of the image. Let your students practice reflecting shapes with partners: Each student draws a shape of no more than 10 squares, and chooses the mirror line. The partner has to reflect the shape over the given mirror line.

**Advanced game:** One student draws two shapes of no more than 10 squares so that the shapes are symmetric in a line but one square is misplaced. The partner has to correct the mistake.

Draw four points as shown and explain that two of these points are reflections of the other two. Challenge students to draw the mirror line. How do they know that the line they have drawn is the mirror line? Which point is reflection of which?
Write several words, such as MOODY CAT IN A WOODEN BOX, on a transparency sheet and project it onto the board in an incorrect way (flipped horizontally or vertically). Ask your students if they can read the text. Which words are still readable? Which letters look normal? Which transformation should be performed to make the text look completely normal? (A reflection.) Ask your students to draw the mirror line. Show them that a reflection in a mirror and a flip of the transparency sheet both achieve the goal.

**Bonus**

1. Students could try to copy and reflect a shape in a slant line, for example:

2. Sort all the capital letters of the alphabet into a Venn diagram:
   1. Letters that look the same after a reflection in a horizontal line.
   2. Letters that look the same after a reflection in a vertical line.

**Extensions**

1. Which letters of the alphabet look different after a horizontal or vertical reflection, but look the same after two reflections? **EXAMPLE:** If you reflect the letter E or L through a vertical line, the image faces backwards. If you reflect the image through a second vertical line, you produce the original letter. What happens if you reflect a letter first through a horizontal line, then through a vertical line?

2. Draw an equilateral triangle. If you reflect it through one of the sides and look at two shapes together, what shape will you get? Write down your prediction and check it. Is the result different for the other sides? Repeat with an isosceles triangle and a triangle with a right angle. Are the results different for different sides? Check all sides.

The following five extensions answer the demands of The Atlantic Curriculum for Grade 5.

3. Cyril experiments with a mirror and a straight line. He draws a straight line and puts the mirror across it. He looks at the angle between the line he drew and the mirror and at the angle between the reflection of the line and the mirror. He thinks that these angles are the same. Is he correct?

Cyril turns the mirror and looks at the angle between the line he drew and its reflection in the mirror. The angle between the line and the mirror is 20°. How large is the angle between the line and its reflection? Cyril wants to put a mirror so that it is at a right angle with the line. What is the degree measure of a right angle? How large is the angle between the line and its reflection be when the mirror is at a right angle to the line? What does Cyril see in the mirror?
4. Boris experiments with a Mira and an angle. He draws an angle and places the Mira so that it touches the vertex on his angle and divides the angle in two. He rotates the Mira around the vertex until the angle on one side of the Mira and its reflection are the same. Using the mirror as a ruler he draws a line through the angle (starting at the vertex of the angle). He says that the line cuts the angle into two equal parts. Is he correct? The line that divides an angle into two equal parts is called a bisector.

5. Which of the points on the line L is closest to the point A? Estimate, then measure the distances between the points to check your prediction. Connect the points on the line with the point A. Measure the angles between the lines you drew and the line L. What is the angle at the point that is nearest to A?

![Diagram of points A, B, C, D, E, F on line L]

Angela measures the acute angles. She says: The further the point from A, the less the angle between the line I drew from the point to A and the line L. Is she correct? Can you draw a point on L that is nearer to A than D? The distance from a point A to a line is the shortest among the distances from A to the points on the line. What is the distance from A to L?

**CHALLENGING:** How can you use Cyril’s method to find a point on a line that is nearest to a given point? **ANSWER:** Put a mirror across the line so that it touches the given point (which we will call point A). Turn the mirror (around the point A) until you see that the reflection of the line continues the line itself. At that point you know that the mirror is perpendicular (i.e., at a right angle) to the line. Draw a line through A using the mirror as a ruler. The point where your line meets the given line is the point nearest to A.

6. Gleb wants to find the midpoint of a line segment AB using symmetry. He knows that a point and its image in a mirror are the same distance from the mirror. He puts a Mira across the segment AB and looks at the point A’ (the mirror image of the point A). He also sees the point B through the Mira. He makes sure that the mirror is perpendicular to the line and he moves the mirror between the points A and B. What does he see in the Mira when it is in the middle of the line segment? Why does this happen exactly at the midpoint of the segment?

**ANSWER:** When the Mira is at the midpoint of the segment, Gleb sees that the points A and B coincide. This happens because the distance between the mirror and the point A (which is the same as the distance between the mirror and A’) is now the same as the distance between the Mira and the point B.

7. A line that is both perpendicular to the given segment and passes through its middle is called a perpendicular bisector of a segment. How can Gleb use Mira to draw a perpendicular bisector of a segment? (**HINT:** Gleb and Cyril are friends.)
Map of Saskatchewan

- Uranium City
- Clearwater River Provincial Park
- Wollaston Lake
- Prince Albert
- Saskatoon
- Swift Current
- Moose Jaw
- Regina
- Maple Creek
- Weyburn