BRIDGES IN MATHEMATICS 5

GRADE 5 SUPPLEMENT

Set A10 Number & Operations: Integers

Includes

Skills & Concepts

- ★ read, write, compare, and order integers in mathematical and real world situations
- ★ locate points defined by ordered pairs of integers
- ★ write an ordered pair for a point in a coordinate plane with integer coordinates

Published by The MATH LEARNING CENTER *Salem, Oregon*

P201304

Bridges in Mathematics Grade 5 Supplement
Set A10 Number & Operations: Integers

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.
© 2013 by The Math Learning Center
All rights reserved.
Prepared for publication on Macintosh Desktop Publishing system.
Printed in the United States of America.

P201304

The Math Learning Center grants permission to classroom teachers to reproduce blackline masters in appropriate quantities for their classroom use.

Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set A10 ★ Activity 1

ACTIVITY

Introducing Integers

Overview

Students discuss the definitions of counting numbers, whole numbers, and integers. Then the class plays a game designed to help students understand integers by relating them to elevation: above sea level, at sea level, and below sea level.

Skills & Concepts

★ read, write, compare, and order integers in mathematical and real world situations

You'll need

★ Three Useful Definitions (page A10.6, run 1 copy on a transparency)

★ Elevation Bingo (page A10.7, run 1 copy on a transparency, see Advance Preparation)

★ Elevation Bingo Board A (page A10.8, run a half class set on colored copy paper)

★ Elevation Bingo Board B (page A10.9, run a half class set on white copy paper)

★ Word Resource Cards (pages A10.10–A10.12, optional, run 1 copy of each sheet on paper or cardstock)

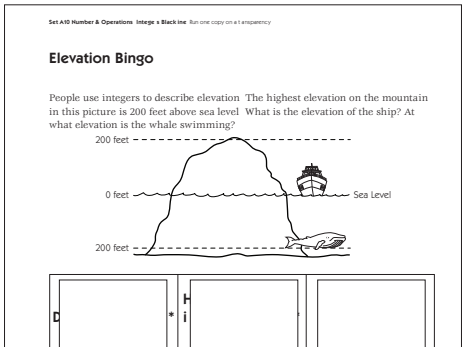
★ 1½" × 2" sticky notes (see Advance Preparation)

★ a piece of paper to mask portions of the overhead

★ red colored pencils (class set)

★ Student Math Journals

Advance Preparation Cover each of the 9 elevations on the Elevation Bingo overhead with 1½" × 2" sticky notes.


Set A10 Number & Operations Integers Blackline Run one copy on a transparency

Elevation Bingo

People use integers to describe elevation The highest elevation on the mountain in this picture is 200 feet above sea level What is the elevation of the ship? At what elevation is the whale swimming?

200 feet

0 feet

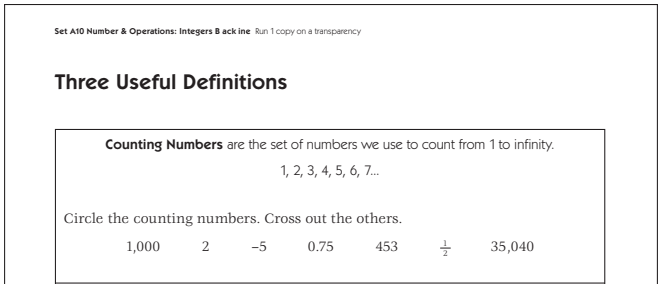
Sea Level

200 feet

Instructions for Introducing Integers

1. Ask students to get out their math journals and pencils. Explain that you are going to give them three mathematical definitions today, which they will need to record in their journals. Then show just the top portion of the Useful Definitions overhead.

Activity 1 Introducing Integers (cont.)



Set A10 Number & Operations: Integers B ack ine Run 1 copy on a transparency

Three Useful Definitions

Counting Numbers are the set of numbers we use to count from 1 to infinity.

1, 2, 3, 4, 5, 6, 7...

Circle the counting numbers. Cross out the others.

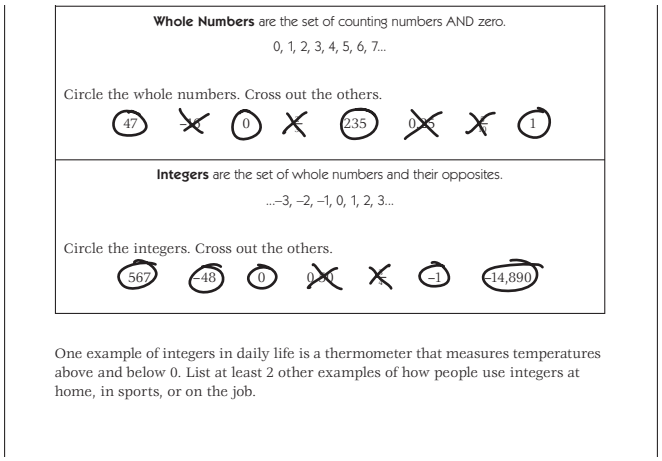
1,000 2 –5 0.75 453 $\frac{1}{2}$ 35,040

2. Read the text with the class, and clarify as needed. Have students copy the definition into their journals. Then ask them to identify the numbers in the bottom line that fit the definition, and record just those numbers in their journals. When most students are finished, ask a volunteer to name one of the numbers he or she recorded. If he or she is correct, circle the number on the overhead.

> ***Teacher*** *Who would like to name one of the numbers from the bottom row they recorded in their journal? Sasha?*
>
> ***Sasha*** *I wrote down 1,000.*
>
> ***Teacher*** *Thumbs up if you agree with Sasha that 1,000 is a counting number. How do you know?*
>
> ***Students*** *Because you land on 1,000 when you're counting.*
> *If you count by 1s, you'll get to 1,000.*
> *It's just a regular number.*

3. Repeat this process until the students have identified, and you have circled, all of the counting numbers: 1000, 2, 453, and 35,040. Ask students to explain why you need to cross out the others in the row. (The counting numbers do not include fractions, decimals, or negative numbers.)

4. Reveal the next section of the overhead and repeat steps 2 and 3. Do the same with the last section. Then give students a few minutes to respond in their journals to the question at the bottom of the overhead.



Whole Numbers are the set of counting numbers AND zero.

0, 1, 2, 3, 4, 5, 6, 7...

Circle the whole numbers. Cross out the others.

47 –16 0 $\frac{1}{2}$ 235 0.25 $\frac{1}{4}$ 1

Integers are the set of whole numbers and their opposites.

...–3, –2, –1, 0, 1, 2, 3...

Circle the integers. Cross out the others.

567 –48 0 0.5 $\frac{1}{4}$ –1 –14,890

One example of integers in daily life is a thermometer that measures temperatures above and below 0. List at least 2 other examples of how people use integers at home, in sports, or on the job.

5. Have students pair-share their responses to the question, and then call on volunteers to share their ideas with the class.

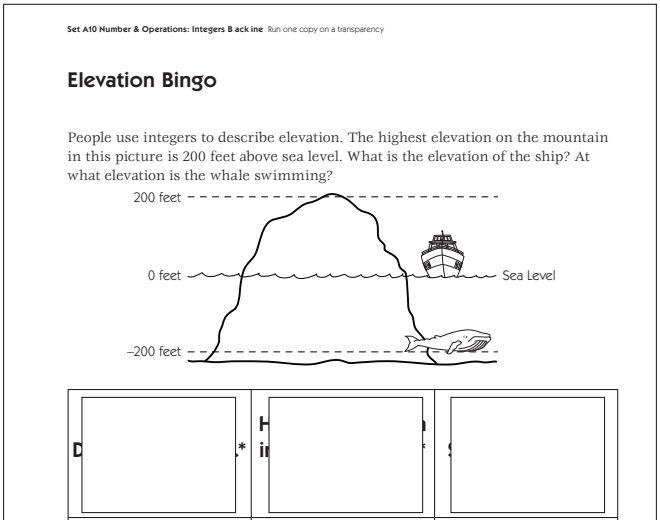
© The Math Learning Center

Activity 1 Introducing Integers (cont.)

Students *In golf, you can get a score that's below par. If it usually takes 3 strokes to get the ball into the hole, and you do it in 2 strokes, you get a score of minus 1.*
Penalties in football are like negative numbers.
The thermometer at our house goes all the way up to 120° and all the way down to negative 60°.
There are lots of integers in my big sister's math book.
With money, you can have some, like 5 dollars, or you can have none, that's zero. Or if you owe someone money, it's kind of like a negative number.

6. Let the students know that you are going to spend several days investigating integers together. Today, you are going to play a game that involves integers. Divide the class into 2 teams. Give each of the students on Team 1 a copy of Elevation Bingo Board A, and each of the students on Team 2 a copy of Elevation Bingo Board B. Tell them that they will need a red colored pencil to play the game.

7. Place the Elevation Bingo overhead on display. Give students a few moments to examine the display quietly. Then read the text with the class, and ask students to identify the elevation of the ship and the whale in the illustration.


Set A10 Number & Operations: Integers B ack ine Run one copy on a transparency

Elevation Bingo

People use integers to describe elevation. The highest elevation on the mountain in this picture is 200 feet above sea level. What is the elevation of the ship? At what elevation is the whale swimming?

8. Then explain that there is an elevation recorded under each sticky note. You will let teams take turns telling you which sticky notes to remove. If either or both teams have that elevation on their board, they get to circle it and mark the elevation line to show its position. The first team to mark 3 boxes in a vertical, horizontal, or diagonal row wins.

9. Call on a student from one of the teams to tell you which sticky note to remove from the overhead.

Maya *Please take off the one in the middle of the middle row.*

Students *Okay, the elevation of Imperial, California is 59 feet below sea level.*
How could a place on land be below sea level?
It could be in a valley, or a really low place.

Teacher *If you have 59 feet below sea level on your board, circle it. Then find negative 59 on the elevation line, mark it, and label it.*

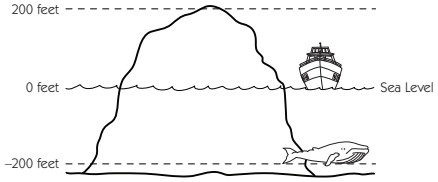
Activity 1 Introducing Integers (cont.)

Students *Where's 59 on this line?*
We need to mark negative 59, not positive 59.
It goes 0, negative 100, and negative 200. Each of the marks in between must be 50.
I'm going to make a mark just a little bit below the negative 50 mark.
59 feet below sea level is like negative 59, right?

Set A10 Number & Operations: Integers Blackline Run one copy on a transparency

Elevation Bingo

People use integers to describe elevation. The highest elevation on the mountain in this picture is 200 feet above sea level. What is the elevation of the ship? At what elevation is the whale swimming?



	Elevation of Imperial, CA.* –59 feet	

* Wikipedia@http //en wikipedia org/wiki/List of places on land w th elevations below sea level
** US Geological Survey@http //egsc usgs gov/isb/pubs/booklets/elvadist/elvadist html

Set A10 Number & Operations: Integers Blackline Run a ha f class set on colored copy paper

NAME Alyssa DATE March 15

Elevations Bingo Board A

200 feet below sea level	59 feet below sea level	30 feet above sea level
125 feet below sea level	72 feet below sea level	at sea level
83 feet above sea level	8 feet below sea level	195 feet above sea level

Each cell shows a vertical number line with 200′, 100′, 0′, –100′, –200′. The 59 feet below sea level cell has –59 marked.

10. Call on a student from the other team to tell you which sticky note to remove, and repeat the process described above. Continue until one of the teams has marked 3 boxes in a horizontal, vertical, or diagonal row.

11. When one of the teams has won, remove all of the sticky notes from the overhead. Discuss the set of elevations with the class. Here are some questions and prompts you might pose:

- Which elevation on the overhead is the lowest? Which is the highest?
- List the elevations in order from lowest to highest in your journal. When you are finished, we will list them together on the board so you can check your work.
- How do you know that 72 feet below sea level is lower than 59 feet below sea level?
- How do you know that 125 feet below sea level is lower than 83 feet above sea level? A second grader might be confused because 125 is greater than 83. How would you explain this to a younger student?)
- What is the difference, in feet, between 8 feet below sea level and 30 feet above sea level? Use one of the elevation lines on your sheet to help determine the answer.
- What is the difference, in feet, between 72 feet below sea level and 83 feet above sea level? Use one of the elevation lines on your sheet to help determine the answer.

© The Math Learning Center

Activity 1 Introducing Integers (cont.)

Extensions

- Use pages A10.10–A10.12 to create Word Resource Cards for counting numbers, whole numbers, and integers. Post these cards in a prominent location in the classroom for students' reference.
- The Los Angeles County Office of Education has a web site that introduces integers and operations with integers at http://mathstar.lacoe.edu/lessonlinks/integers/integers_main.html. If you have access to the Internet and the necessary projection equipment, you might consider sharing the first two activities in the Introducing Integers section with your students. Integer Challenge helps students understand integers by linking them to extreme temperatures and elevations around the world. Sets of Numbers reviews the definitions of counting numbers, whole numbers, and integers, and uses effective animations to show how the three sets are related. Students who are especially interested in math and/or science might be interested in exploring these interactive computer activities on their own if you don't have time to pursue them with the class.

© The Math Learning Center

Three Useful Definitions

Counting Numbers are the set of numbers we use to count from 1 to infinity.

1, 2, 3, 4, 5, 6, 7...

Circle the counting numbers. Cross out the others.

1,000 2 –5 0.75 453 $\frac{1}{2}$ 35,040

Whole Numbers are the set of counting numbers AND zero.

0, 1, 2, 3, 4, 5, 6, 7...

Circle the whole numbers. Cross out the others.

47 –16 0 $\frac{2}{3}$ 235 0.25 $\frac{5}{10}$ 1

Integers are the set of whole numbers and their opposites.

...–3, –2, –1, 0, 1, 2, 3...

Circle the integers. Cross out the others.

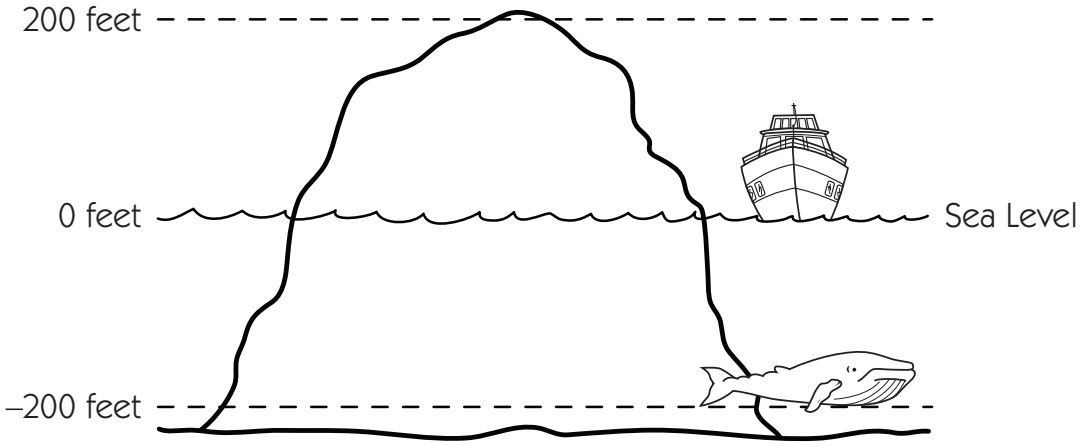
567 –48 0 0.50 $\frac{3}{4}$ –1 –14,890

One example of integers in daily life is a thermometer that measures temperatures above and below 0. List at least 2 other examples of how people use integers at home, in sports, or on the job.

© The Math Learning Center

Elevation Bingo

People use integers to describe elevation. The highest elevation on the mountain in this picture is 200 feet above sea level. What is the elevation of the ship? At what elevation is the whale swimming?



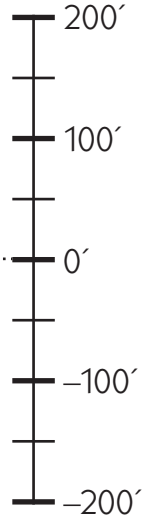
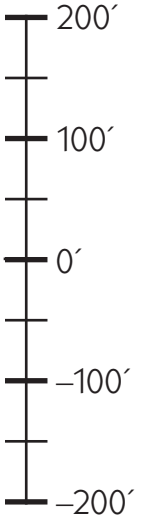
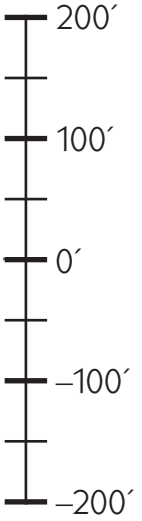
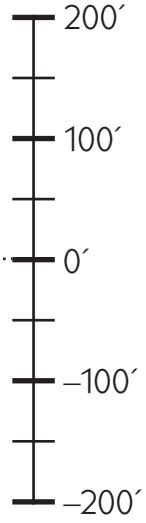
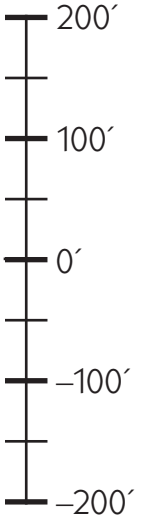
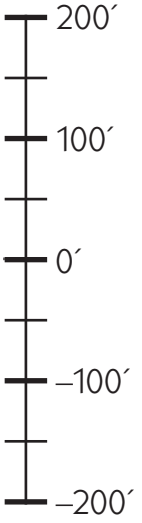
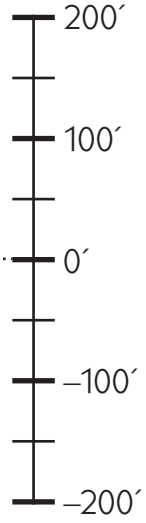
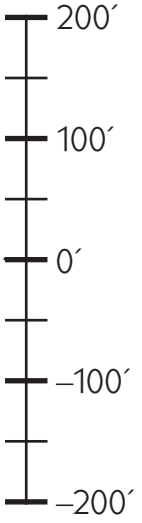
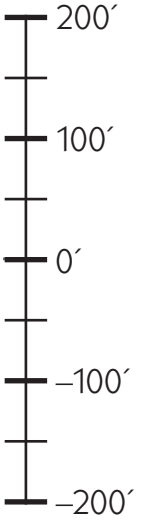
Elevation of Desert Shores, CA.* **–200 feet**	**Highest Elevation in Houston, TX.**** **83 feet**	**Elevation of Salton City, CA.*** **–125 feet**
Lowest Elevation in New Orleans, LA.** **–8 feet**	**Elevation of Imperial, CA.*** **–59 feet**	**Lowest Elevation in Memphis, TN**** **195 feet**
Elevation of Coachella, CA.* **–72 feet**	**Lowest Elevation in Portland, OR**** **Sea Level**	**Highest Elevation in Miami, FL**** **30 feet**

* Wikipedia@http://en.wikipedia.org/wiki/List_of_places_on_land_with_elevations_below_sea_level
** US Geological Survey@http://egsc.usgs.gov/isb/pubs/booklets/elvadist/elvadist.html

© The Math Learning Center

NAME _____ **DATE** _____

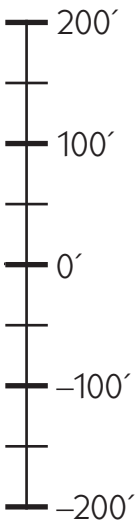
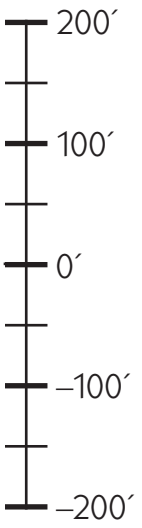
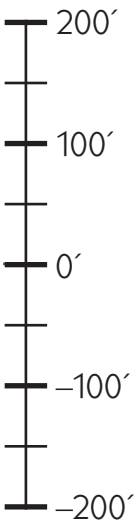
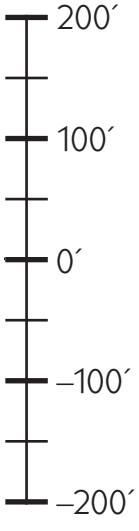
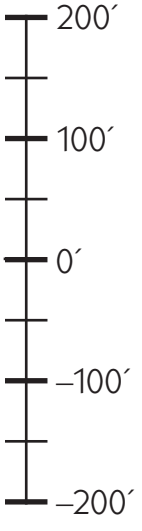
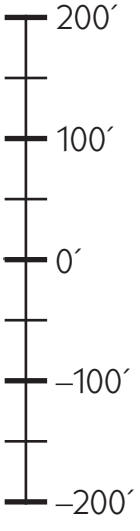
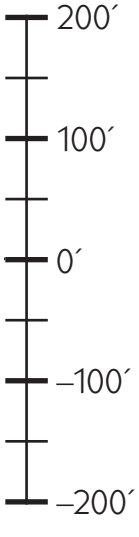
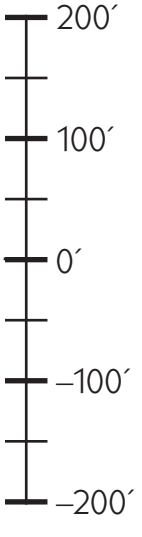
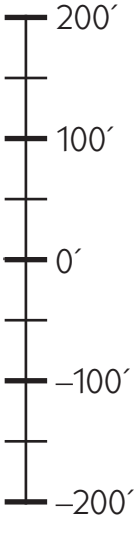
Elevations Bingo Board A

200 feet below sea level 	**59 feet below sea level** 	**30 feet above sea level** 
125 feet below sea level 	**72 feet below sea level** 	**At sea level** 
83 feet above sea level 	**8 feet below sea level** 	**195 feet above sea level** 

© The Math Learning Center

NAME _____ **DATE** _____

Elevations Bingo Board B

72 feet below sea level 	**At sea level** 	**195 feet above sea level** 
8 feet below sea level 	**83 feet above sea level** 	**125 feet below sea level** 
200 feet below sea level 	**59 feet below sea level** 	**30 feet above sea level** 

© The Math Learning Center

Counting Numbers

1, 2, 3, 4, 5, 6...

Counting Numbers:

also called natural numbers, this is the set of numbers used to count from 1 to infinity

© The Math Learning Center

© The Math Learning Center

Whole Numbers

1, 2, 3, 4, 5, 6...

Whole Numbers:

the set of counting numbers AND zero

Integers

...–3, –2, –1, 0, 1, 2, 3...

Integers:

the set of whole numbers and their opposites

© The Math Learning Center

Set A10 ★ Activity 2

ACTIVITY

Integer Tug O' War

Overview

Among the real world situations in which negative numbers appear are games such as Jeopardy and Hearts, where players score both positive and negative points, and football, where teams move in positive and negative directions with respect to their own goal line. Integer Tug O' War is a board game that bears a slight resemblance to football, in that two teams race to be the first to their own goal line, rolling positive and negative numbers to determine their moves. The teacher introduces Integer Tug O' War to the whole class, and then students play the game in pairs.

Skills & Concepts

★ read, write, compare, and order integers in mathematical and real world situations

You'll need

★ Introducing Integer Tug O' War (page A10.18, run 1 copy on a transparency)

★ Integer Tug O' War Team 1 Game Board (page A10.19, half class set on colored copy paper)

★ Integer Tug O' War Team 2 Game Board (page A10.20, half class set on white copy paper)

★ dice numbered 1–6 and 4–9 (1 of each per student pair)

★ positive and negative dice (1 per student pair, see Advance Preparation)

★ black and red linear pieces (4 of each color per student pair)

★ transparent spinner overlays (optional, half class set, see Advance Preparation)

★ Student Math Journals

Advance Preparation If you have blank dice or wood cubes, make a half class set of positive and negative dice by marking 3 sides of each die with a plus sign and 3 sides with a minus sign. Although dice are much better than spinners for this game, you can use page A10.21 to make positive and negative spinners if you don't have access to blank dice or cubes. (If you make spinners instead of dice, each pair of students will need a transparent spinner overlay.)

Note We strongly recommend that you read the rules and play Integer Tug O' War by yourself or with a partner before you teach this lesson. While the rules may seem complex at first glance, the game is simple but rich in strategic possibilities.

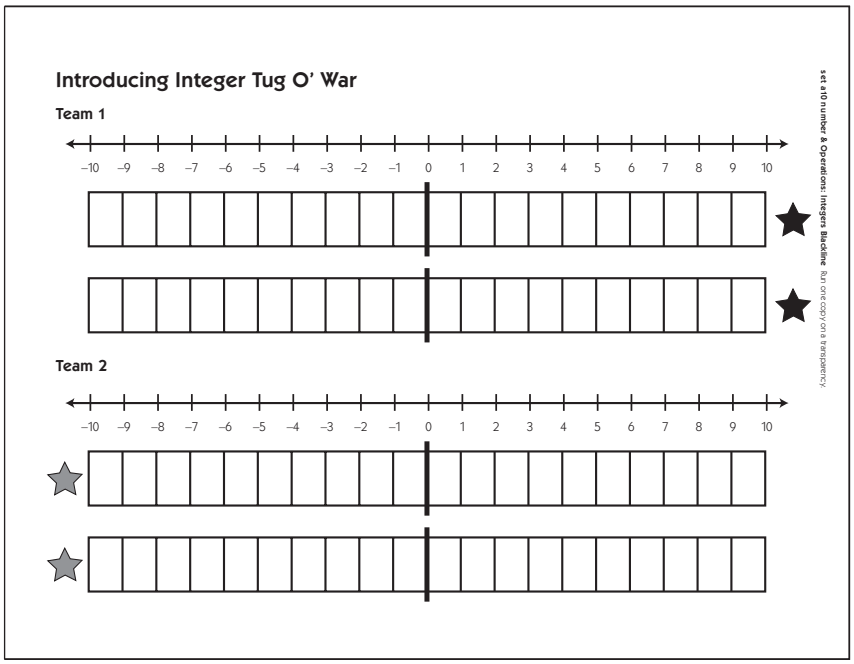
Background for the Teacher: Helping Students Understand Integers *In* Elementary and Middle School Mathematics: Teaching Developmentally, *John Van de Walle writes that the number line is one of the two models most commonly used for teaching integers in middle school. He says that the number line can be confusing, and that games such as football can provide students with an intuitive sense of how the model*

Activity 2 Integer Tug O' War (cont.)

works. He writes, "It is important to remember that signed values are directed distances *and not points on a line." Integer Tug O' War is designed to provide early experiences with this concept. For example, positive and negative 5 can be spotted on the number line in this game, but students also come to understand that integers are actually measured distances from 0. If your marker is sitting on negative 2 and you roll positive 5, you will move 5 spaces to the right, landing on positive 3. If your marker is on positive 3 and you roll negative 6, you will move 6 spaces to the left, landing on negative 3. While not intended to teach operations with integers, Integer Tug O' War helps students develop the understandings they will need to do in middle school.*

Instructions for Integer Tug O' War

1. Place the Introducing Tug O' War overhead on display. Ask students to examine it quietly for a few moments, and then have them pair-share observations. After a minute or so, call on volunteers to share their observations with the class.



Students *It's a board for a game with 2 teams.*
Team 1 has stars on the right side; Team 2 has stars on the left.
There are positive and negative numbers on the lines.
They go up to positive 10 and down to negative 10.
The lines are kind of like the elevation lines from yesterday, but they're sideways instead of up and down.

2. Let students know that this is, a game board. Today, you are going to teach the class a new game called Integer Tug O' War, that will help them learn more about integers and how they work. Review the definition of *integers* (the set of whole numbers and their opposites), and note with students that the members of each number pair (–1 and 1, –2 and 2, –3 and 3, etc.) are the same distance from zero in the opposite direction, while zero is neither positive nor negative.

3. Explain that Integer Tug O' War is a little bit like football, in that each team tries to get their markers to their own goal line. Team 1's goal lines are set at positive 10; Team 2's are set at negative 10. At the be-

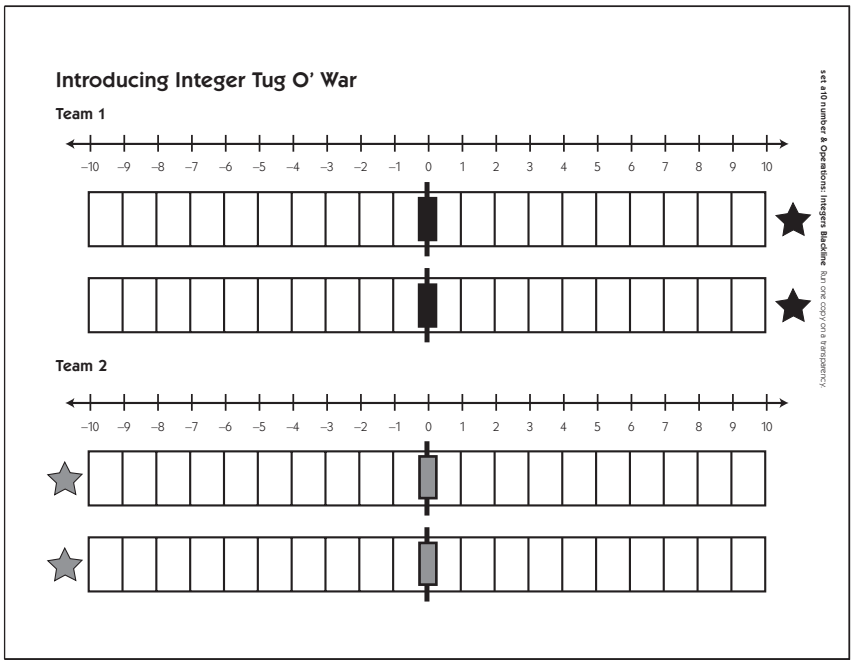
 © The Math Learning Center

Activity 2 Integer Tug O' War (cont.)

ginning of the game, each team places their markers at 0. The teams take turns rolling 2 dice and moving the designated number of spaces. One of the dice is numbered; the other is marked with positive and negative signs. A negative roll results in a move to the left; a positive roll results in a move to the right.

4. Ask students to pair up. Number off so that one student in each pair is assigned the number 1, and the other is assigned the number 2. Explain that all the 1s will play for Team 1, and all the 2s will play for Team 2. Then give each pair a Team 1 and a Team 2 game board, while a student helper places a small handful of black and red linear pieces at each table or cluster of desks. Let students know that you are going to play a demonstration game with the whole class that uses only 2 of the tracks for each team. When everyone understands how the game works, they will play with their partners, and use all 4 of the tracks on their boards.

5. Explain that Team 1 will use black linear pieces as game markers, and Team 2 will use red linear pieces. Have students place their markers at zero on the first 2 tracks on their boards while you set up the overhead game board. Then ask a student from each team to roll the 2 dice and report the results. The team with the greater number gets to start first.



Students *We got a positive 2 and you guys got negative 3. We get to start.*
What do you mean? 3 is higher than 2.
But positive 2 is more than 0, and negative 3 is less than 0. If you count it on the line, 2 is actually 5 more than negative 3!

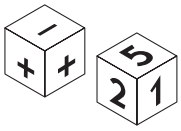
6. Once the starting team has been identified, call a representative up from that team to roll the dice and move one of the markers at the overhead, as the members of that team do the same on their game boards. If there is any confusion about which direction to move, explain that rolling a positive number always results in a move to the right, no matter where you are on the line. Likewise, rolling a negative number always results in a move to the left.

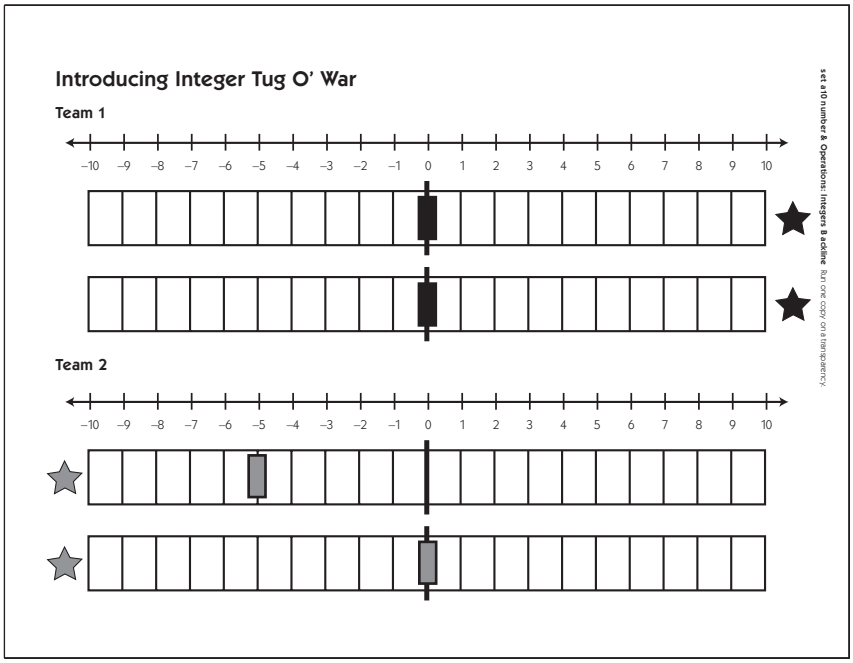
© The Math Learning Center

Activity 2 Integer Tug O' War (cont.)

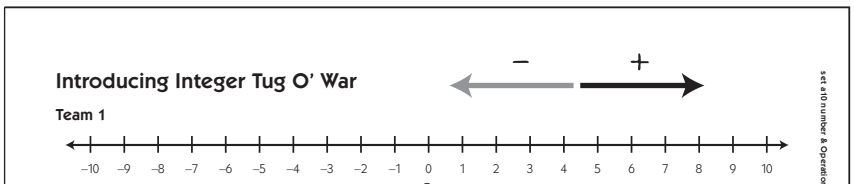
Jasmine *I rolled negative 5. That means we have to move backwards, kind of like taking 5 away?*

Sergio *That's good, though. We want to go that way. Our goal line is down on negative 10. We want to roll negative numbers!*





7. Now have a representative from the other team come up to roll and move a marker at the overhead as members of that team do so on their own game boards. Then have the two teams take turns rolling and moving until one team gets both the markers to their own goal line. If students become confused about which direction to move, draw a black arrow pointing to the right and a red arrow pointing to the left to help them remember that a positive roll always means a move to the right, and a negative roll always means a move to the left.



Here are some additional rules to introduce as the game proceeds:

- A team can split a roll between its 2 markers. If a team rolls positive 5, for instance, it can move one of its markers 3 spaces to the right, and the other marker 2 spaces to the right.
- The student who is rolling for a team and moving the marker(s) at the overhead on any given turn is in charge of that move for the whole team. (This is important because there will be more than one way to handle the roll in many cases. There may be some discussion, but the student at the overhead gets to make the final decision.)
- If one of a team's markers lands on the other team's goal line, the players get to move that marker back to 0. If, for instance, Team 1 has gotten enough negative rolls to have forced one of their markers down to negative 10, they get to move that marker back to 0 before their next turn. (This is the redemption rule, providing a team down on its luck with new hope of winning the game.)

 © The Math Learning Center

Activity 2 Integer Tug O' War (cont.)

- In order to win, a team has to land on its own goal line exactly. For example, if Team 2 has one of its markers positioned on -9, the players will have to roll a -1 to win. If they roll a -2 or -3, they can split the roll between their two markers. If one of their markers is already at their goal line, they lose a turn and must wait for their next roll.
- Even after a team has gotten one of its markers to its own goal line, that marker is still in play and can still be moved if necessary.
- A team cannot move its markers off the track. If a move is not possible, the players lose that turn and must wait for the next one.

8. Play the game until one team has won. Then ask students to share some thoughts about the game. What are some strategies they might use to win when they play again with their partner?

> ***Students*** *Sometimes it's good to split up the roll.*
> *Yeah, like if one of your markers is almost to the goal line, and the other one isn't, you can take part of the roll to get the first marker to the line, and then use the rest for the other marker.*
> *If you're getting a lot of bad rolls, it's good to just let one of your markers land on the other team's goal line. Then you can move it back to 0.*
> *Yeah, the 0 rule is good. It makes you feel like you still have a chance to win.*

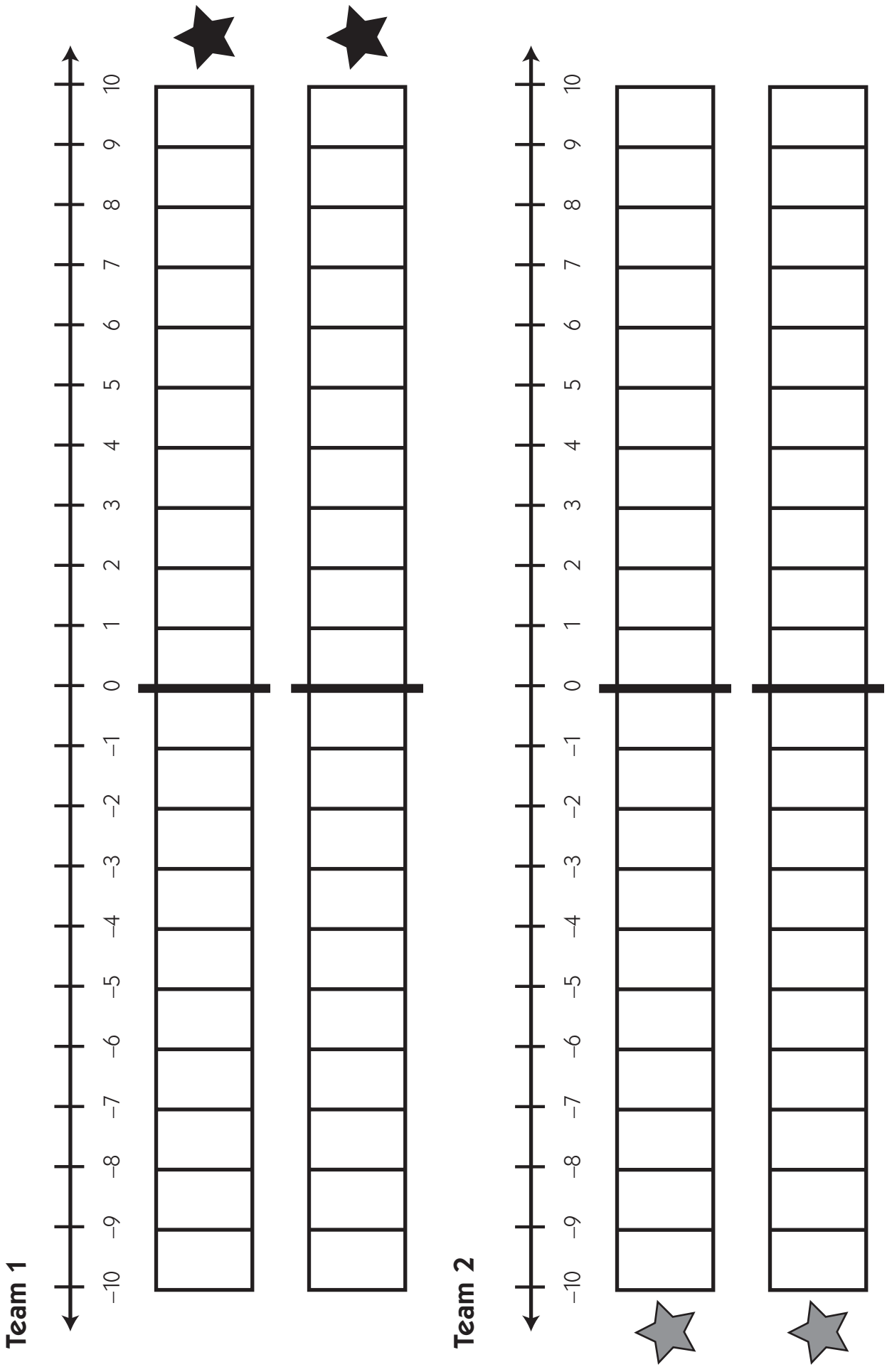
9. Then give each student pair a signed die and numbered die, and allow them to use the rest of the instructional period to play the game in pairs. Let them know that they can use 2, 3, or even all 4 of the tracks on their board. Put the 4–9 dice in a place that is easily accessible to all the students, and let them know that they can use a 4–9 die in place of the 1–6 die if they want. Furthermore, they can switch back and forth between the 1–6 and 4–9 dice whenever they want during the game, but they cannot use both at once. Circulate to observe and give assistance as needed. Depending on the needs of your students, you may want to pull a small group together to play the game with you. If more than a few of your students run into difficulties, reconvene the group to work through the problem(s) together using the overhead board. Encourage students to play the game more than once if time allows. If they only used 2 tracks the first time, challenge them to use 3 or 4 the next. The more tracks they use, the more options they will have when it comes to dealing with problematic rolls.

Extensions

- Allow students to revisit the game during free time. The more they play Integer Tug O' War, the more they will be able to refine their strategies. Playing the game multiple times also strengthens students' understandings of signed numbers as directed distances, providing the foundation they need to add and subtract integers in middle school.
- Ask students to write about their experiences playing Integer Tug O' War. Some prompts might include:
  - Do you think this is a fair game? Why or why not?
  - Does it make any difference whether you are on the positive or the negative team?
  - Here's what I like about this game.
  - Here's what frustrates me about this game.
  - Here's what I would do to make this a better game.

© The Math Learning Center

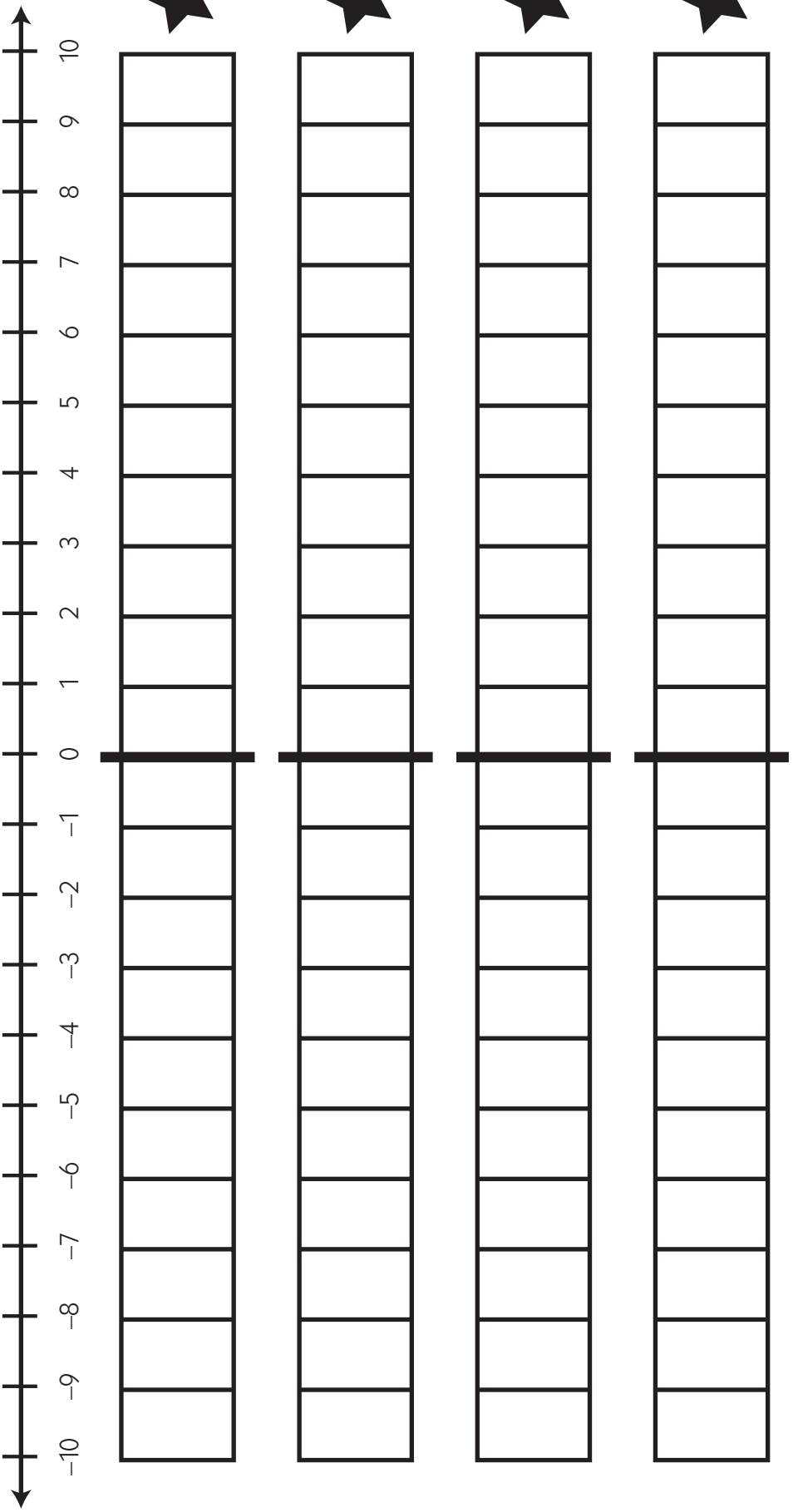
Introducing Integer Tug O' War



© The Math Learning Center

NAME _____ DATE _____

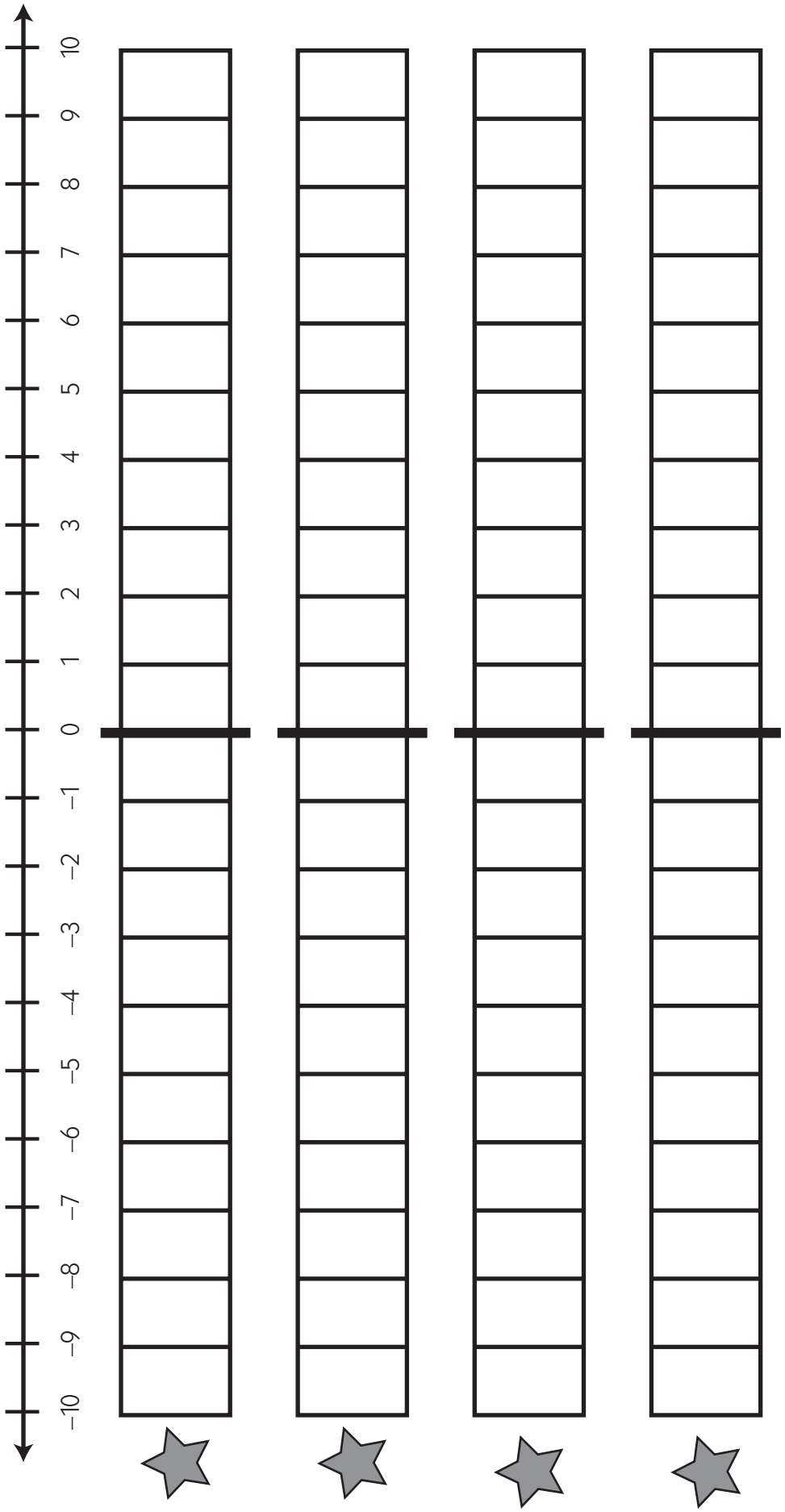
Integer Tug O' War Team 1 Game Board



© The Math Learning Center

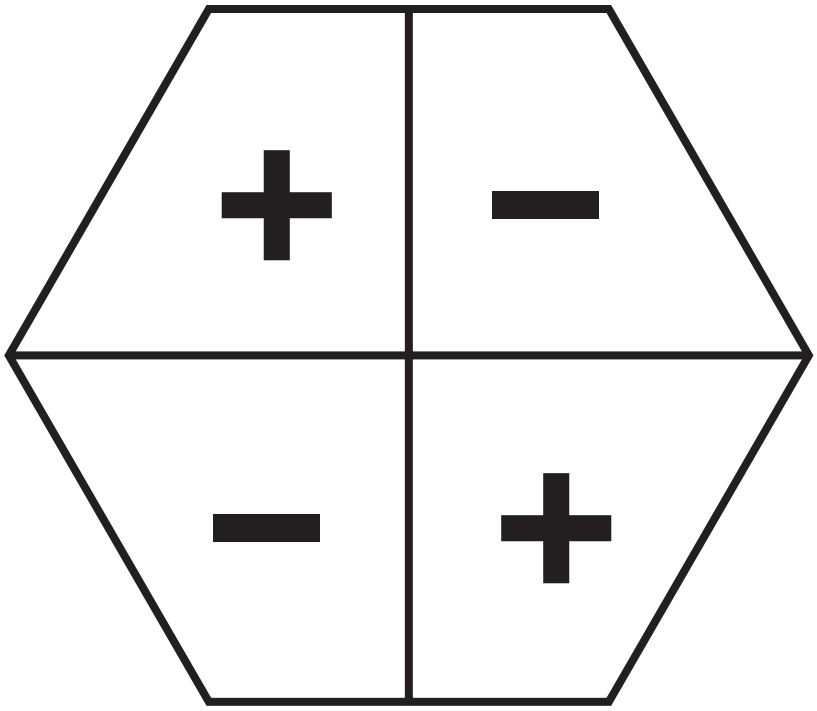
NAME _____ DATE _____

Integer Tug O' War Team 2 Game Board

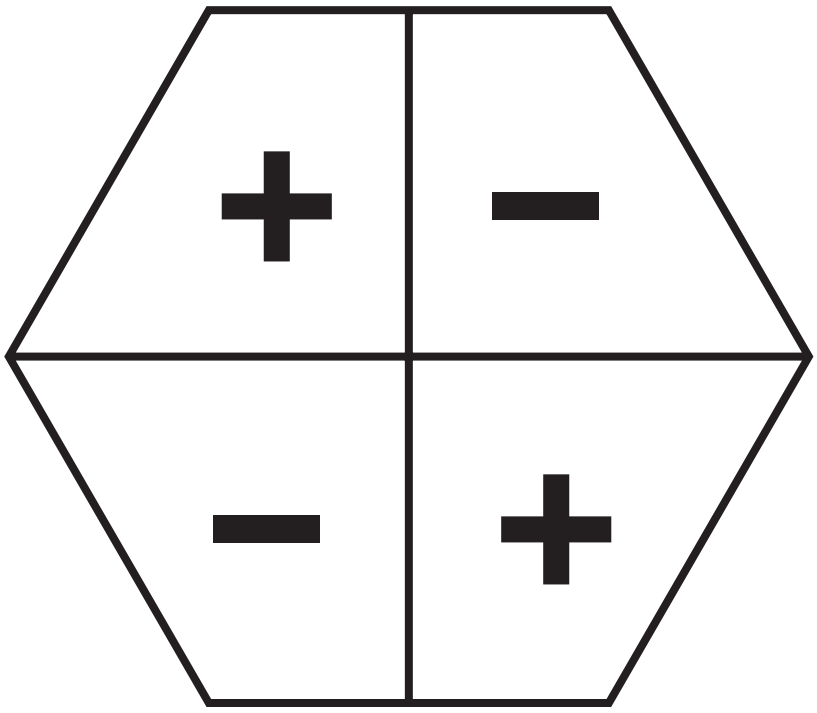


© The Math Learning Center

Positive/Negative Spinner



Positive/Negative Spinner



© The Math Learning Center

© The Math Learning Center

Set A10 ★ Activity 3

ACTIVITY

4-Quadrant Battleship

Overview

This activity provides students with opportunities to read and write ordered pairs of integers as they appear on a 4-quadrant coordinate grid. After they practice locating and recording ordered pairs, the teacher challenges the class to a modified version of Battleship.

Skills & Concepts

★ read, write, compare, and order integers in mathematical and real world situations

★ locate points defined by ordered pairs of integers

★ write an ordered pair for a point in a coordinate plane with integer coordinates

You'll need

★ 4-Quadrant Battleship game board (page A10.28, run a double-sided class set and 1 copy on a transparency)

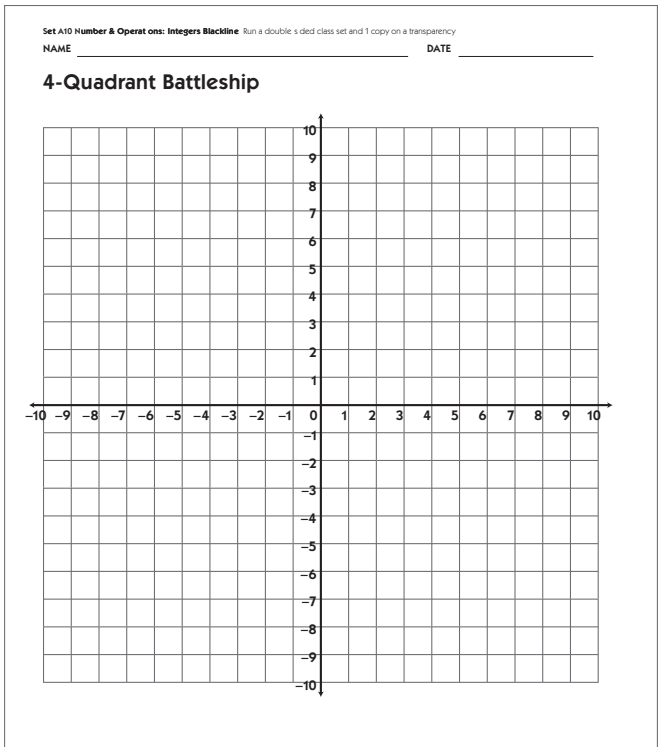
★ 7 blue game markers

★ overhead pens in red and black

★ red and blue colored pencils (class set)

Instructions for 4-Quadrant Battleship

1. Place the 4-Quadrant Battleship game board overhead on display. Ask students to examine it quietly for a few moments, and then have them pair-share observations. After a minute or so, call on volunteers to share their observations with the class.


Set A10 Number & Operat ons: Integers Blackline Run a double s ded class set and 1 copy on a transparency

NAME _____ DATE _____

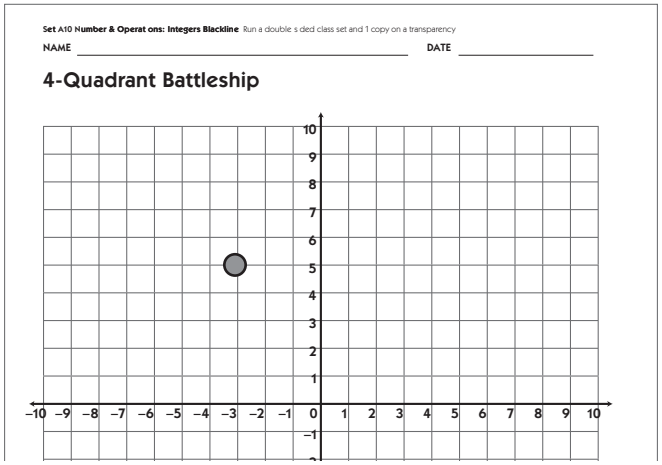
4-Quadrant Battleship

Activity 3 4-Quadrant Battleship (cont.)

Students *It's a grid for Battleship. I've played that game before!*
It has positive and negative numbers on it.
Those are integers!
It's kind of like a combination of a number line and a thermometer or an elevation line.
It's like you have a regular number line, and then one that goes up and down instead of sideways.
We've used grids like this before, but they only had positive numbers on them.

2. Tell students that this is a 4-quadrant coordinate grid, and you will use it to play a modified version of Battleship with them later. First, however, you're going to ask them to practice finding and naming coordinates on the grid. Give students each a copy of the game board.

3. Draw a large red dot at (–3, 5) on the grid. Ask students to identify the location of the dot as precisely as possible.



Students *It's on the left-hand side of the number line that's going up and down.*
It's up 5 and then you have to go over 3 the negative way.
If it was on the other side, it would be at (3, 5) so maybe it's at (5, –3).

4. Remind students that the horizontal number line is called the *x*-axis and the vertical number line is called the *y*-axis, and. Label the axes on the overhead, and write the ordered pair that describes the location of the red dot:

(–3, 5)

Review the fact that any point on the grid can be named with two numbers or *coordinates*. The first number is the *x*-coordinate. It tells the distance from the point where the two lines intersect (the origin) along the *x*-axis. The second number tells the distance from the origin along the *y*-axis. Because these two numbers are always written in order (first *x*, then *y*), they are called an *ordered pair*. Some students may remember the order by reminding themselves to go over and then up when they identify the location of a point. That still works on a 4-quadrant grid, but if the *x*-coordinate is negative, one goes over to the left instead of the right, and if the *y*-coordinate is negative, one goes down instead of up.

5. Erase the red dot, and draw another at (3, 5). Ask students to pair-share the coordinates for this point, and call it out as a group when you give them the signal by raising your hand. Record the ordered pair on the board to confirm their response.

 © The Math Learning Center

Activity 3 4-Quadrant Battleship (cont.)

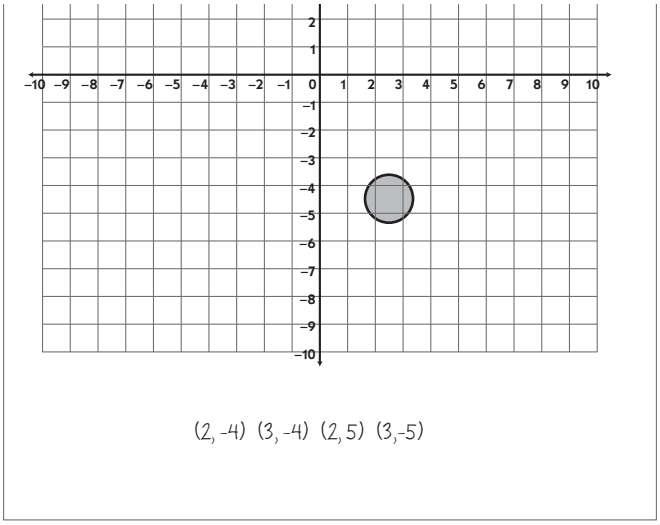
6. Repeat step 5 with several other points on the grid, including (3, –5) and (–3, –5). Then erase the overhead and tell students you are going to write an ordered pair on the board for them to locate on their grids. Write (2, –4) on the board, and ask them to mark that point on their grids with a red pencil. After a moment, invite a volunteer to the overhead to mark the point, and explain how he or she knew where to place it.

> ***Marta*** *I just went over 2, and then down 4 because it's a negative 4, and that's where I made my red dot.*

7. Repeat step 6 with several other ordered pairs:

(–4, –9) (–8, 6) (6, –10) (8, 0) (0, –7)

8. Now explain that you are going to play a modified version of the game Battleship with the class. First, you will turn off the projector and place 7 game markers on your grid. These will be your ships. You will turn the projector on for just a few seconds to give students a quick peek. Then the students will try to sink your ships by identifying their locations correctly. Show students what you mean by placing a blue game marker on the board. If you place it directly over one of the squares on the grid, it will touch 4 points. Ask students to identify the coordinates for each of the 4 points as you write them on the overhead. Explain that when you play the game, they will only have to name one of the 4 coordinates to sink your ship.



9. Erase the overhead and turn off the projector, as students turn their sheets over and get out their red and blue pencils. Place 7 blue game markers at various locations on the board. Position each so that it covers exactly 4 points, and place at least one marker in each quadrant. Turn on the projector for about 10 seconds, just long enough for students to get some sense of how you have positioned the markers, and then turn it off again.

10. Call on a volunteer to guess where one of your ships is by writing an ordered pair on the board that might identify one of the points the ship is touching. Ask the rest of the students to write the ordered pair below the grid on their paper. If one of your ships is touching the point named by the volunteer, tell the students they have made a hit, and have them mark the point on their own grid in red. If none of

© The Math Learning Center

Activity 3 4-Quadrant Battleship (cont.)

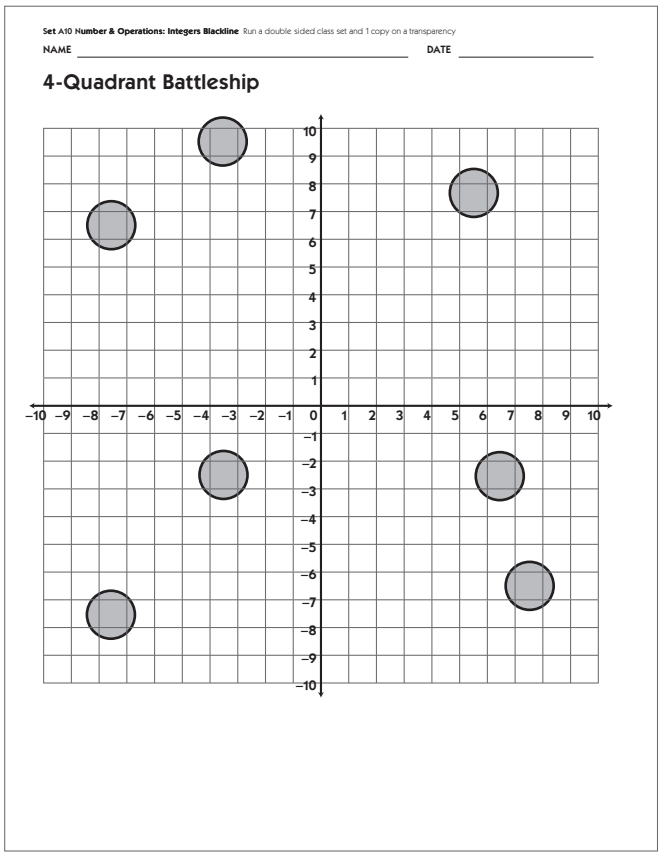
your ships is touching the point named by the volunteer, tell the students they have missed, and have them mark the point on their own grid in blue.

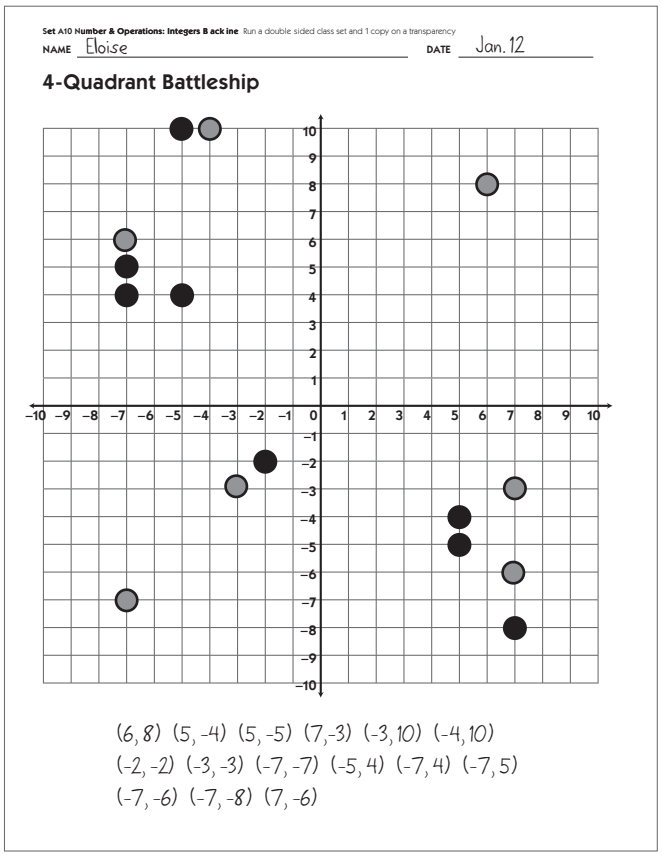
> ***Teacher*** *Who would like to take the first shot at sinking one of my ships. Charlie?*
>
> ***Charlie*** *Okay, I think you have a ship at (6, 8).*
>
> ***Teacher*** *Please write those coordinates on the board so the rest of the class can see. Boys and girls, please copy that ordered pair on your own sheet below the grid. Okay, I'm going to tell you that's a hit. How are you going to show that on your grid?*
>
> ***Students*** *We get to put a red dot at (6, 8) on our grids!*
> *It's red for the explosion that sunk your ship!*

11. Repeat step 10 as many times as necessary. In order to prevent the game from becoming tedious, give the students hints when they name a point that is near one of your ships.

> ***Teacher*** *(5, –4) is a miss, but you are getting very warm. Try going up 1 and over 2 from there and see what happens.*

When students have hit all 7 of your ships, turn on the projector so they can see exactly where you positioned the ships.





© The Math Learning Center

Activity 3 4-Quadrant Battleship (cont.)

Extensions

- Reposition your markers and play the game again. Challenge students to sink your ships with fewer guesses this time.
- Invite a student to act as the leader in the game.
- A search for Battleship on the Internet will turn up a variety of results. Some web sites, including Math is Fun at http://www.mathsisfun.com/games/battleship.html allow students to play the game with the computer as a partner. While the version on the Math is Fun web site of the game doesn't involve a coordinate grid, it does promote spatial reasoning.

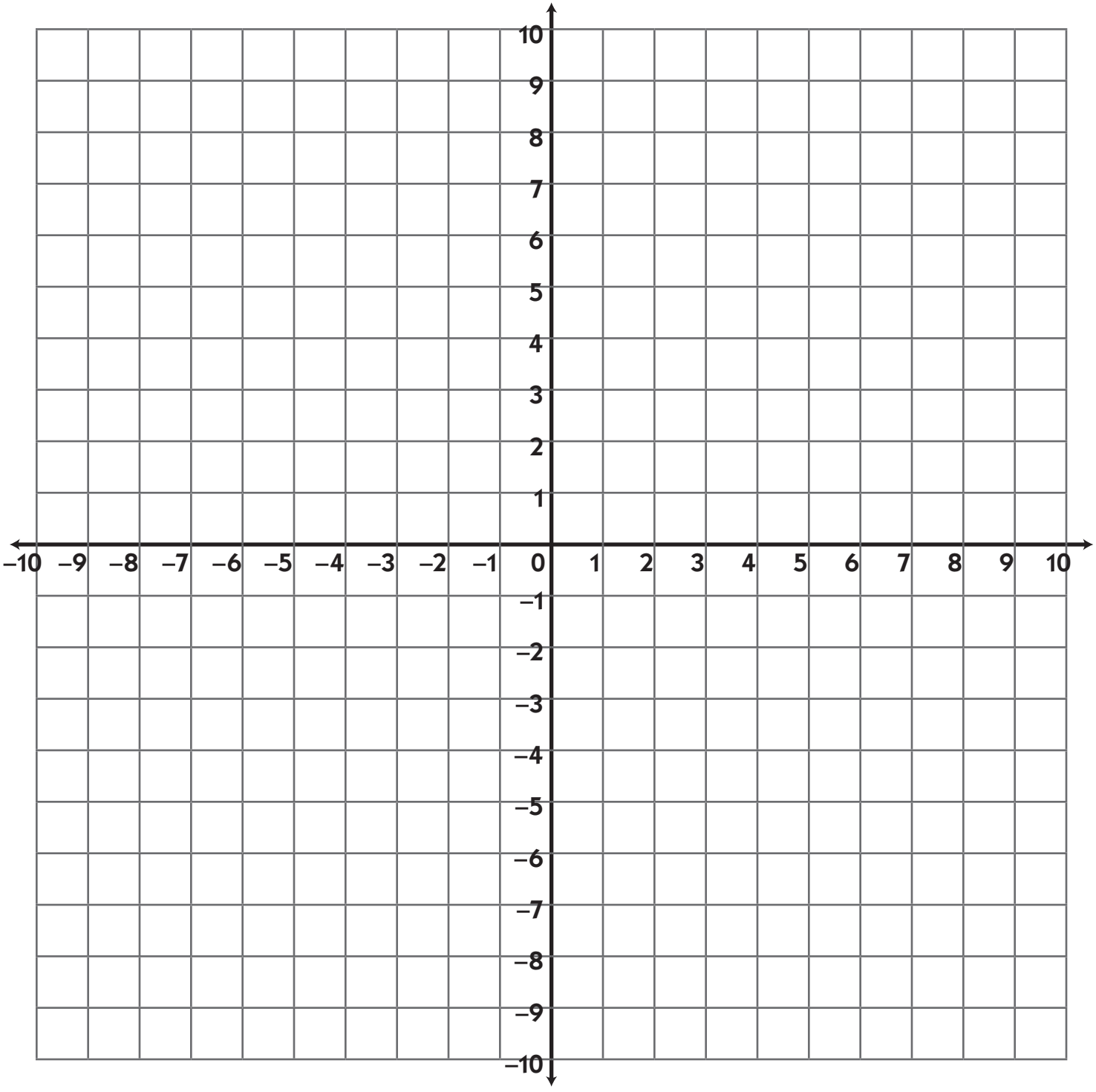
INDEPENDENT WORKSHEET

Use Set A10 Independent Worksheets 1–3 (pages A10.29–A10.34) to provide students with more practice reading, writing, and comparing negative numbers in real world and mathematical contexts.

© The Math Learning Center

NAME _____ **DATE** _____

4-Quadrant Battleship



© The Math Learning Center

NAME _____ **DATE** _____

Set A10 ★ Independent Worksheet 1

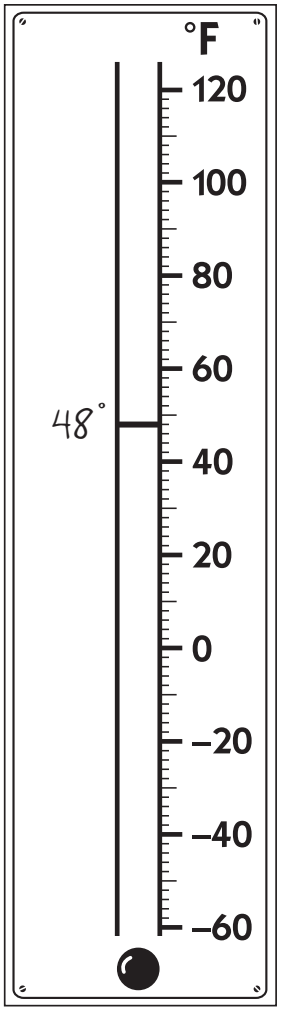
INDEPENDENT WORKSHEET

Negative & Positive Temperature

Water freezes at 32 degrees Fahrenheit, but temperatures on Earth can get much colder than that. Some places even report temperatures below 0 in the winter time.

1 This chart shows the average low temperatures for January in several different cities. Mark each one on the thermometer at right. The first one has been marked for you.

City or Town	Average Low, January*
Orlando, FL.	48° F
Tok, AK.	–27° F
Memphis, TN	30° F
Nome, AK	0° F
Little Falls, MN	–2° F
Honolulu, HI	65° F
Hoyt Lakes, MN	–11° F



2 Write less than (<) or greater than (>) in each circle to show how some of the temperatures from the chart compare. Use the thermometer to help.

a 48° F ◯ 65° F

b –2° F ◯ –11° F

c 0° F ◯ – 27° F

d –27° F ◯ – 11° F

3 Write the temperatures in order from lowest to highest on the lines below.

_____ _____ _____ _____ _____ _____ _____

lowest highest

* Temperatures listed above are found on the US Weather website@ http://countrystudies.us/united-states/weather/

© The Math Learning Center

© The Math Learning Center

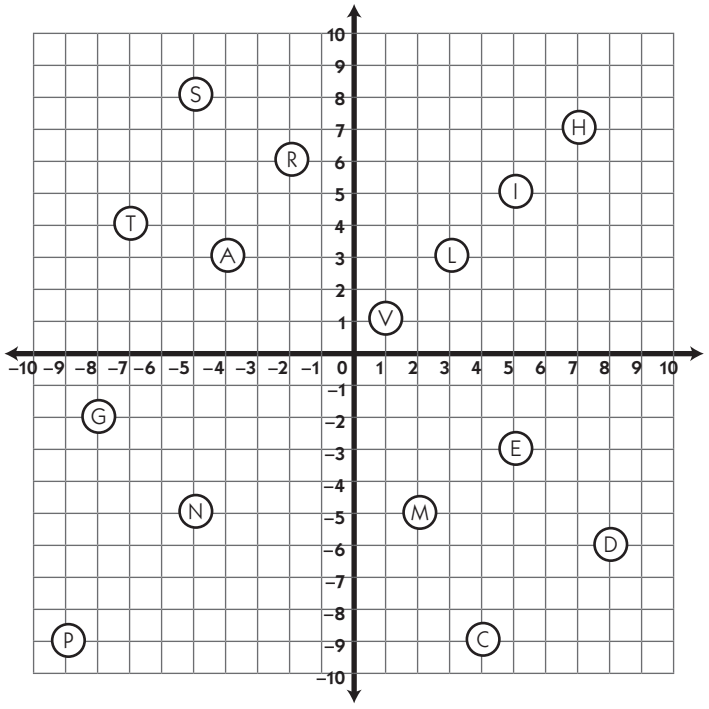
NAME _____ **DATE** _____

Set A10 ★ Independent Worksheet 2

INDEPENDENT WORKSHEET

Temperature & Elevation Riddles

The number pairs under each line below tell you the x and y coordinates of the letters that will answer these riddles about temperatures and elevations around the world. The first two letters are filled in for you in the first riddle.



1 At 29,035 feet, this mountain has the highest elevation in the world.

M	T								
(2, –5)	(2, –5)	(5, –3)	(1, 1)	(5, –3)	(–2, 6)	(5, –3)	(–5, 8)	(–7, 4)	

2 The deepest part of the ocean is 35,838 feet below sea level. It is called the

(4, –9)	(7, 7)	(–4, 3)	(3, 3)	(3, 3)	(5, –3)	(–5, –5)	(–8, –2)	(5, –3)	(–2, 6)

(8, –6)	(5, –3)	(5, –3)	(–9, –9)

3 The coldest temperature on earth (–129° F) was recorded in

(–4, 3)	(–5, –5)	(–7, 4)	(–4, 3)	(–2, 6)	(4, –9)	(–7, 4)	(5, 5)	(4, –9)	(–4, 3)

© The Math Learning Center

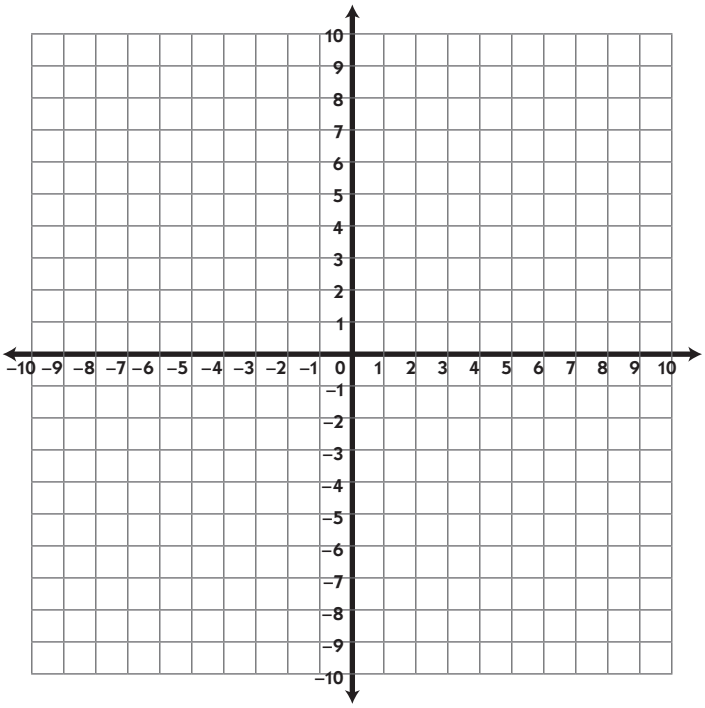
© The Math Learning Center

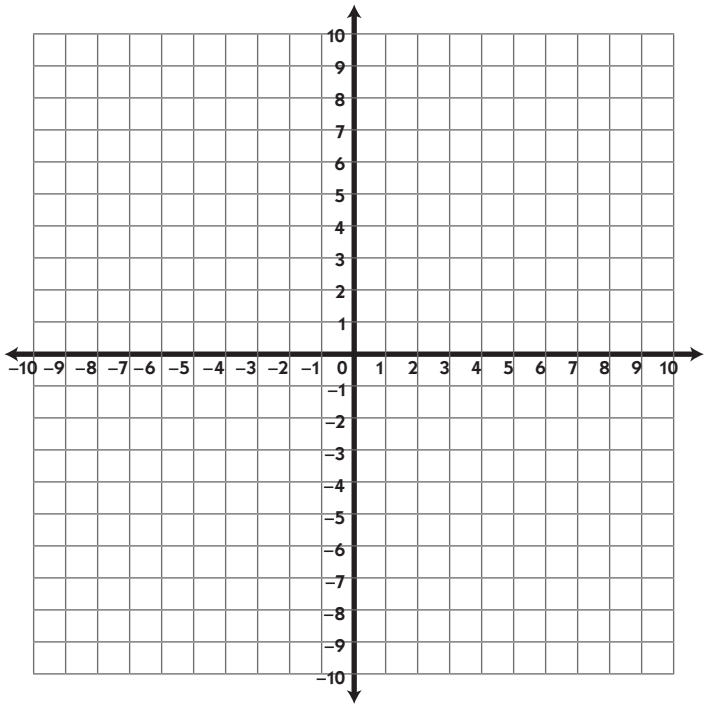
NAME _____ **DATE** _____

Set A10 ★ Independent Worksheet 3

INDEPENDENT WORKSHEET

Shapes on a 4-Quadrant Grid





1a Plot the following points on the coordinate grid above.

① (–5, 2)
② (–3, 5)
③ (3, 5)
④ (5, 2)
⑤ (5, –2)
⑥ (3, –5)
⑦ (–3, –5)
⑧ (–5, –2)

b Connect the dots in order. Then connect the last dot to the first dot. What is the name of this shape?

2a If you plot the points listed below on the coordinate grid above and connect the dots, what shape will you get?

Points: (–4, 7) (3, 4) (–6, –4)

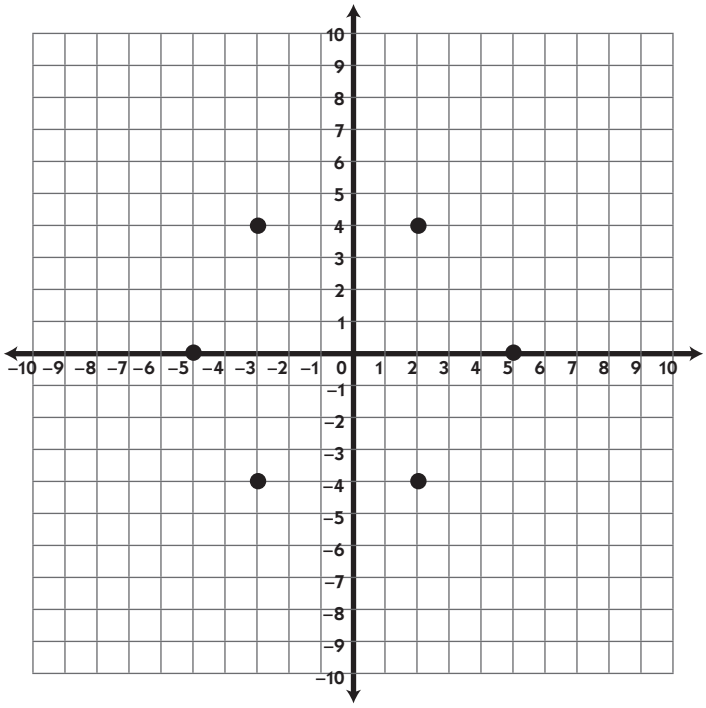
b How do you know for sure?

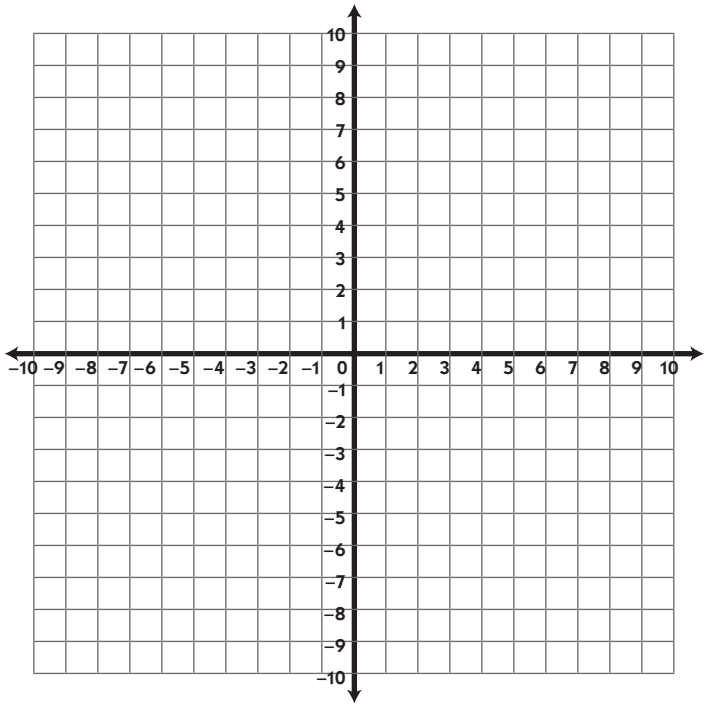
c Plot the points and connect the dots to find out if you are correct.

(continued on back)

© The Math Learning Center

Independent Worksheet 3 Shapes on a 4-Quadrant Grid (cont.)





3a Six points have been marked on the coordinate grid above. List the coordinates for each point below. The first one has been done for you.

(-5, 0)

(____, ____)

(____, ____)

(____, ____)

(____, ____)

(____, ____)

b Connect the dots. Then connect the last dot to the first dot. What is the name of this shape?

4 Ramani wants to program her robot to walk in a square on this grid. She wants to include all 4 quadrants in the path. List the coordinates for 4 points that would work. Then plot them on the grid above and connect them to check.

(____, ____)

(____, ____)

(____, ____)

(____, ____)

© The Math Learning Center