

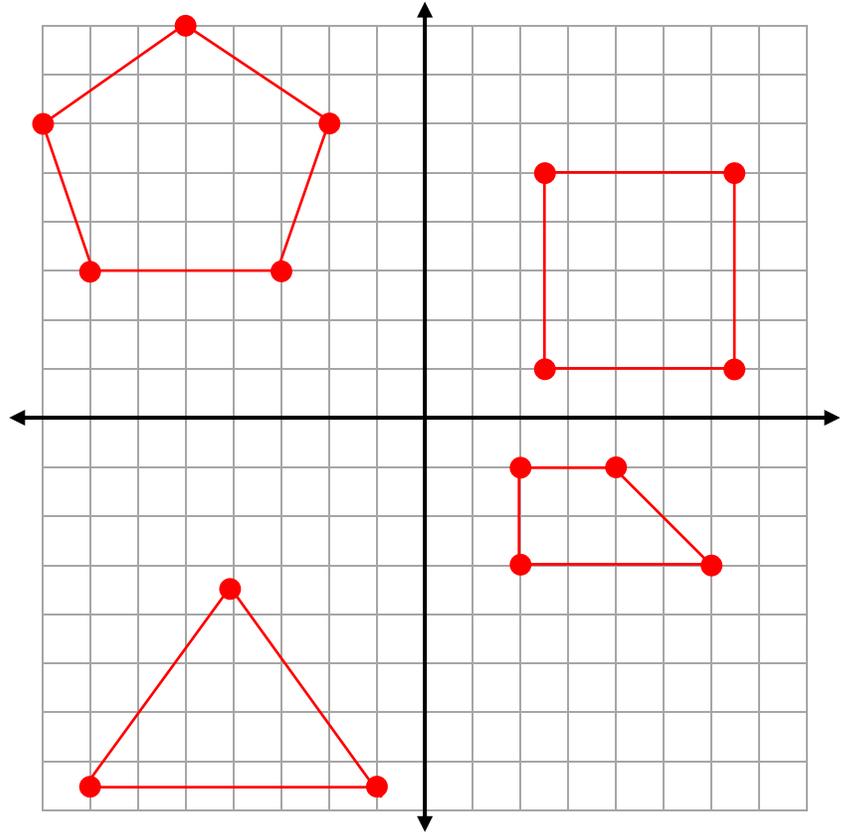
### 8-4 ESSENTIAL SKILLS NAME THAT SHAPE!

Graph each set of ordered pairs and connect them to form polygons.

1.  $(2.5, 1), (2.5, 5), (6.5, 5), (6.5, 1)$   
 polygon: square  
 in quadrant I

2.  $(-3, 3), (-7, 3), (-8, 6), (-5, 8), (-2, 6)$   
 polygon: pentagon  
 in quadrant II

3.  $(-4, -3\frac{1}{2}), (-7, -7\frac{1}{2}), (-1, -7\frac{1}{2})$   
 polygon: triangle (isosceles)  
 in quadrant III



4. Construct a right trapezoid in quadrant IV.  
 Draw points on the four vertices and list them as ordered pairs below.  
 Trapezoids will vary.  
 Example:  $(2, -3), (2, -1), (4, -1), (6, -3)$ .

## 8-4 ESSENTIAL SKILLS BATTLING SHIPS

Provide graph paper for additional games.

### The Setup:

Each player uses two coordinate grids. Label both axes from -5 to 5. One grid is labeled “my tries” and the other “my ships.”

Each player decides where to place three rectangular ships on the Self grid: a **Battleship** (5 units  $\times$  1 unit), a **Cruiser** (3 units  $\times$  1 unit), and a **Destroyer** (2 units  $\times$  1 unit) so that edges and corners are on the grid lines. All ships must be placed either horizontally or vertically, and therefore all ordered pairs for vertices will have integer coordinates. Two ships may be adjacent to each other (may share part or all of a side), but they cannot overlap. Label the ships by the first letters of their names, B, C, and D.

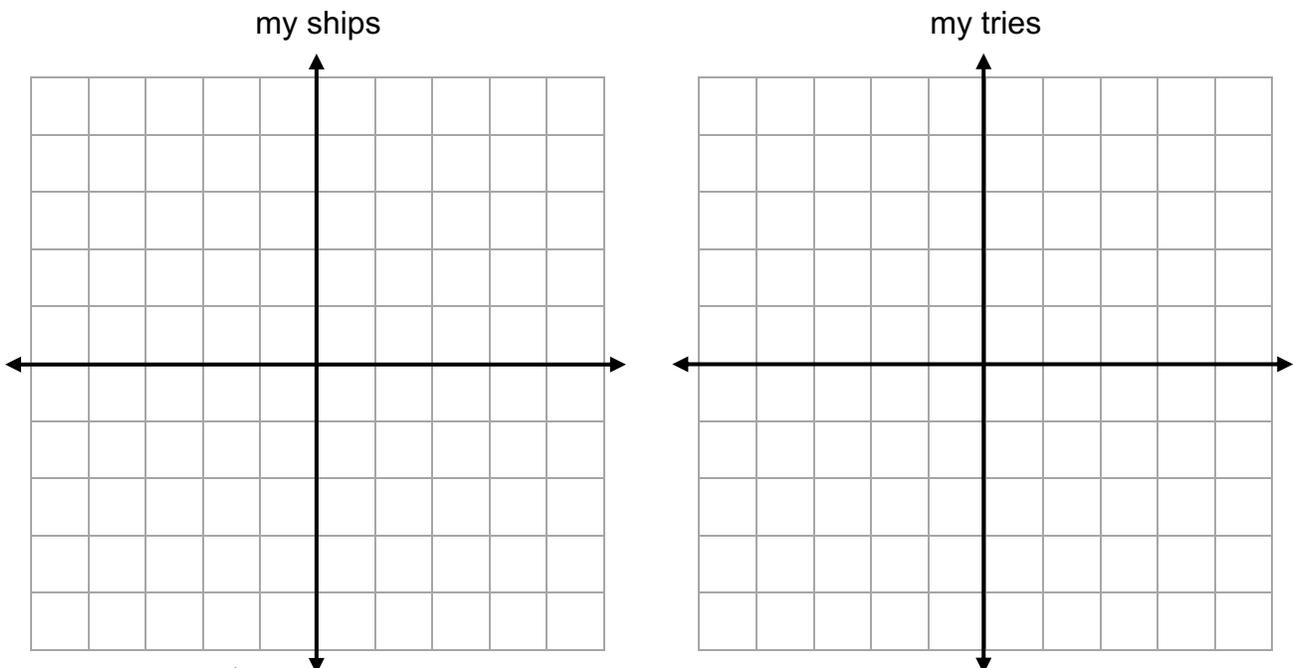
### The Game:

Players take turns calling out one ordered pair of integers at a time. If a player calls an ordered pair where an edge or corner of a ship is located, the opponent says “hit” and the player gets another turn. If no ship is located at the ordered pair, the opponent says “miss,” and players change roles.

Players mark the “my ships” grid with shots taken by their opponent. Players should take care to record their hits and misses on their “my tries” grid so that they do not call an ordered pair more than once.

A ship is sunk when all of its corner and edge points have been hit. When this happens, the player whose ship was sunk says, “You sank my \_\_\_\_\_.”

You win by sinking all of your opponent’s ships. If time is called, the player who has sunk more of the opponent ships wins. If tied, the winner is the one who scored the most hits. Make sure to exchange grids afterwards to check that both players marked coordinates correctly.



## 8-4 ESSENTIAL SKILLS INPUT-OUTPUT TABLES

An input-output rule explains what operation(s) can be performed on an input value to arrive at the corresponding output value.

Study the arithmetic used in each step, complete steps 4 and 5, and explain each number pattern in words.

### 1. Number Pattern A

Step 1	Step 2	Step 3	Step 4	Step 5
$1 + 4$ $= 5$	$2 + 4$ $= \underline{6}$	$3 + 4$ $= \underline{7}$	$\underline{4} + 4$ $= \underline{8}$	$5 + 4 = 9$
Input-output rule: To get each result, add <u>4</u> to... <i>the step number.</i>				

### 2. Number Pattern B

Step 1	Step 2	Step 3	Step 4	Step 5
$1 \cdot 4 + 6$ $= \underline{10}$	$2 \cdot 4 + 6$ $= \underline{14}$	$3 \cdot 4 + 6$ $= \underline{18}$	$\underline{4} \cdot 4 + 6$ $= \underline{22}$	$5(4) + 6 = 26$
Input-output rule: <i>To get each result, multiply the step number by 4 and add 6.</i>				

### 3. Number Pattern C

Step 1	Step 2	Step 3	Step 4	Step 5
$1 \cdot 3 - 3$ $= \underline{0}$	$2 \cdot 3 - 3$ $= \underline{3}$	$3 \cdot 3 - 3$ $= \underline{6}$	$4(3) - 3 = 9$	$5(3) - 3 = 12$
Input-output rule: <i>To get each result, multiply the step number by 3 and subtract 3.</i>				

## 8-4 ESSENTIAL SKILLS TOOTHPICK PATTERNS

*Teaching note: distribute toothpicks to build the patterns for tactile learners.*

An input-output rule explains what operation(s) can be performed on an input value to arrive at the corresponding output value.

Continue each pattern and complete the table.

*Examples of rules are below. Any rule that is adequately justified is correct.*

1. Step #	Step 1	Step 2	Step 3	Step 4 (build, then sketch below)
<b>Pattern</b>				
<b>Number of toothpicks</b>	<u>3</u>	<u>6</u>	<u>9</u>	<u>12</u>
Input-output rule: <i>To get the number of toothpicks, multiply the step number by 3.</i>				
How many toothpicks are in Step 100? <b>300</b>				

2. Step #	Step 1	Step 2	Step 3	Step 4 (build, then sketch below)
<b>Pattern</b>				
<b>Number of toothpicks</b>	<u>4</u>	<u>7</u>	<u>10</u>	<u>13</u>
Input-output rule: <i>To get the number of toothpicks, multiply the step number by 3 and add 1.</i>				
How many toothpicks are in Step 100? <b>301</b>				

3. Step #	Step 1	Step 2	Step 3	Step 4 (build, then sketch below)
<b>Pattern</b>				
<b>Number of toothpicks</b>	<u>1</u>	<u>3</u>	<u>5</u>	<u>7</u>
Input-output rule: <i>To get the number of toothpicks, multiply the step number by 2 then subtract 1.</i>				
How many toothpicks are in Step 100? <b>199</b>				

## 8-4 ESSENTIAL SKILLS INPUT OUTPUT RULES

An input-output rule explains what operation(s) can be performed on an input value to arrive at the corresponding output value.

Each table has  $(x, y)$  values that follow a pattern. Determine missing input and output values based on the patterns you notice. Describe the pattern using an input-output rule with words or symbols.

Pattern A	
Input Value ( $x$ )	Output Value ( $y$ )
1	-4
2	-3
3	-2
4	-1
10	5
-2	-7
Input-output rule: Output is equal to input minus 5. $y = x - 5$	

Pattern B	
Input Value ( $x$ )	Output Value ( $y$ )
0	1
1	3
2	5
3	7
-4	-7
11	23
Input-output rule: Output is equal to 2 times input plus 1. $y = 2x + 1$	

Pattern C	
Input Value ( $x$ )	Output Value ( $y$ )
0	0
2	10
4	20
6	30
-----	
-6	-30
-----	
-2	-10
Input-output rule: Output is equal to input multiplied by 5. $y = 5x$	

Pattern D	
Input Value ( $x$ )	Output Value ( $y$ )
2	1
-4	-2
5	2.5
7	3.5
-----	
-9	-4.5
-----	
-16	-8
Input-output rule: Output is equal to half the input. $y = 0.5x$	

## 8-4 ESSENTIAL SKILLS FOUR IN A ROW: EVALUATING EXPRESSIONS

*See Activity Routines in the Teacher Portal for directions.*

**Players:** 2+

**Objective:** Be the first player to claim 4 spaces in a row, column, or diagonal to win the game.

**Materials:** Board game, 2 sets of colored counters (for the game board), 2 objects (e.g. cubes, paperclips, cut up paper) that will cover expressions in Box A and values in Box B.

**Rules:** Two players alternate evaluating expressions by choosing an expression from Box A and a quantity to substitute in for  $x$  from Box B. Players check the value and, if successful, place their colored counter on a space with the appropriate value.

BOX A: EXPRESSION		
$3x - 4$	$x^2 + 2$	$-2(x - 1)$
$x^3 - 2x$	$-5x + 4$	$2x^2 - 2$

BOX B: $x$ -VALUE		
-4	2	-2
1	4	-3

GAME BOARD: EVALUATING EXPRESSIONS (SUBSTITUTE B INTO A)					
-6	-2	-1	8	6	-10
-13	19	11	-56	-1	16
30	-4	18	2	6	3
-16	6	0	-1	18	8
-6	-21	10	56	30	0
6	14	24	6	-16	4

**8-4 ESSENTIAL SKILLS**  
**FOUR IN A ROW: EVALUATING EXPRESSIONS**  
**ANSWER KEY**

		BOX B					
<b>Evaluate</b>		-4	2	-2	1	4	-3
<b>BOX A</b>	$3x - 4$	-16	2	-10	-1	8	-13
	$x^2 + 2$	18	6	6	3	18	11
	$-2(x - 1)$	10	-2	6	0	-6	8
	$x^3 - 2x$	-56	4	-4	-1	56	-21
	$-5x + 4$	24	-6	14	-1	-16	19
	$2x^2 - 2$	30	6	6	0	30	16