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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)

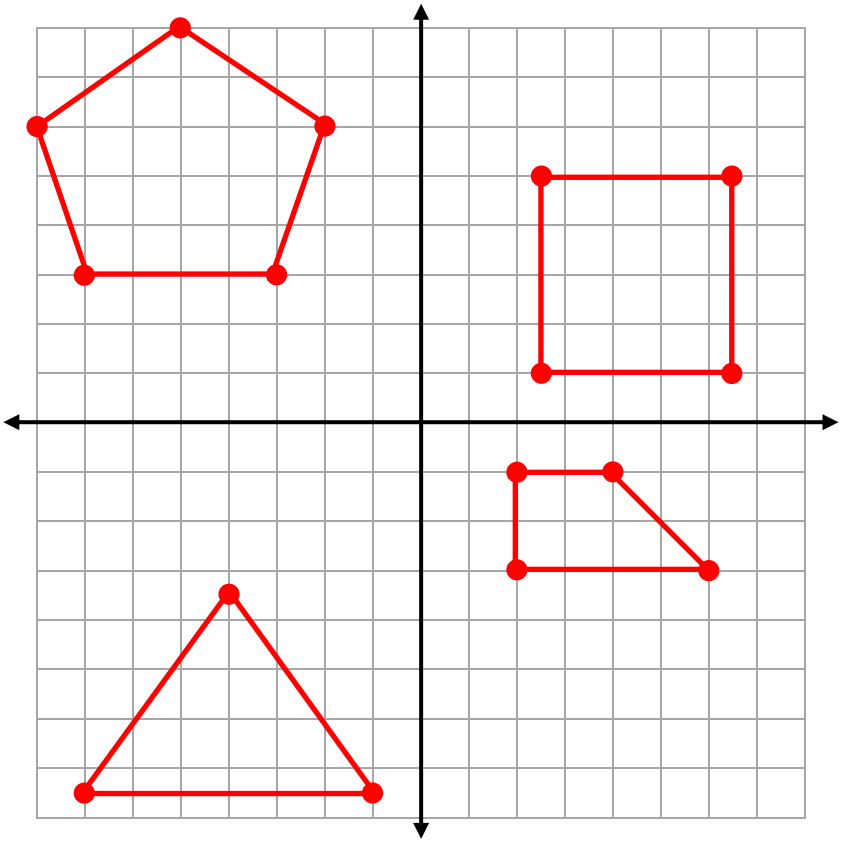
   polygon: pentagon

   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 may vary.
   Example: (2,-3), (2,-1), (4,-1), (6,-3).

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BATTLING SHIPS

The Setup:
Each player uses two coordinate grids. Label both axes from -5 to 5. One grid is labeled "Self" and the other "Opponent."

Each player then decides where to place three rectangular ships: a **B**attleship (5 units x 1 unit), a **C**ruiser (3 units x 1 unit), and a **D**estroyer (2 units x 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, but they cannot overlap. Label the ships by the first letters of their names, B, C, and D.

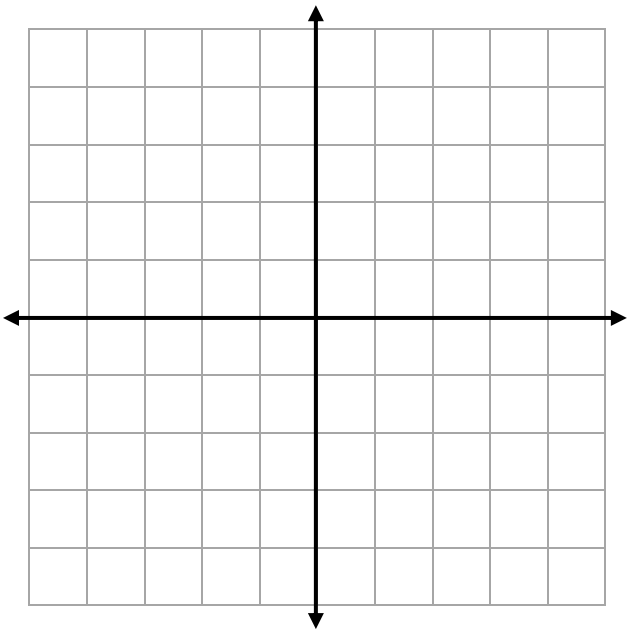
The Game:
Players take turns calling out one ordered pair of integers at a time. If a player calls an ordered pair where an edge or corner of a ship is located, the opponent says "hit" and the player gets another turn. If no ship is located at the ordered pair, the opponent says "miss," and players change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

Players should take care to record their hits and misses on their "Opponent" grid so that they do not call an ordered pair more than once. Players should also mark the "Self" grid with shots taken by their opponent.

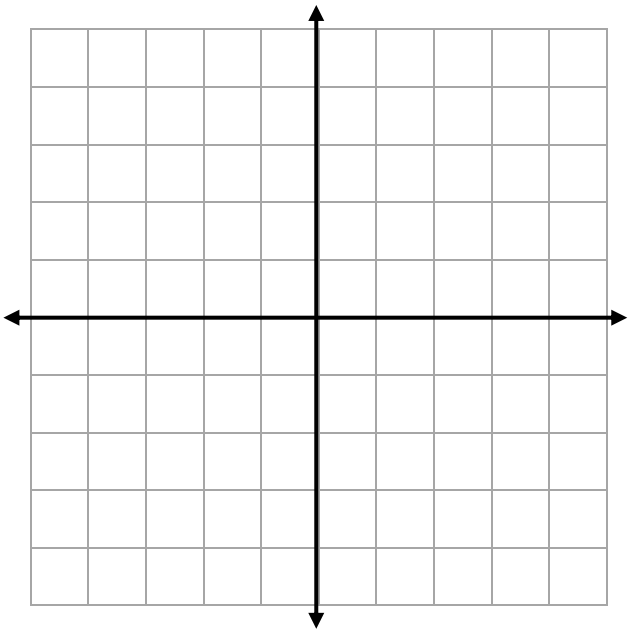
A ship is sunk when all of its corner and edge points have been hit. When this happens, the player whose ship was sunk says, "You sank my _____."

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.

Self



Opponent



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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 = 6	3 + 4 = 7	4 + 4 = 8	5 + 4 = 9
Input-output rule: To get the result, add 4 to… the step number.				

2. Number Pattern B

Step 1	Step 2	Step 3	Step 4	Step 5
1 • 4 + 6 = 10	2 • 4 + 6 = 14	3 • 4 + 6 = 18	4 • 4 + 6 = 22	5(4) + 6 = 26
Input-output rule: To get the result, multiply the step number by 4 and add 6.				

3. Number Pattern C

Step 1	Step 2	Step 3	Step 4	Step 5
1 • 3 – 3 = 0	2 • 3 – 3 = 3	3 • 3 – 3 = 6	4(3) – 3 = 9	5(3) – 3 = 12
Input-output rule: To get the result, multiply the step number by 3 and subtract 3.				

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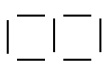
TOOTHPICK PATTERNS

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

Continue each pattern and complete the table. Examples of rules are below.

1. Step #	Step 1	Step 2	Step 3	Step 4 (build, then sketch below)
Pattern				
Number of toothpicks	4	7	10	13

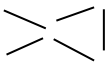
Rule: To get the number of toothpicks, multiply the step number by 3 and add 1.

How many toothpicks for Step 100? 301

2. Step #	Step 1	Step 2	Step 3	Step 4 (build, then sketch below)
Pattern				
Number of toothpicks	3	6	9	12

Rule: To get the number of toothpicks, multiply the step number by 3.

How many toothpicks for Step 100? 300

3. Step #	Step 1	Step 2	Step 3	Step 4 (build, then sketch below)
Pattern				
Number of toothpicks	1	3	5	7

Rule: To get the number of toothpicks, multiply the step number by 2 then subtract 1.

How many toothpicks for Step 100? 199

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INPUT OUTPUT RULES

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 two times input plus 1.
$y = 2x + 1$

Pattern A	
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 B	
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.
$y = 0.5x$

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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 numbers in Box A and 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 (answer key provided) 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: VALUE		
-4	2	-2
1	4	-3

GAME BOARD: EVALUATE (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

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FOUR IN A ROW: EVALUATING EXPRESSIONS
ANSWER KEY

		BOX B					
	Evaluate	-4	2	-2	1	4	-3
BOX A	$3x - 4$	-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