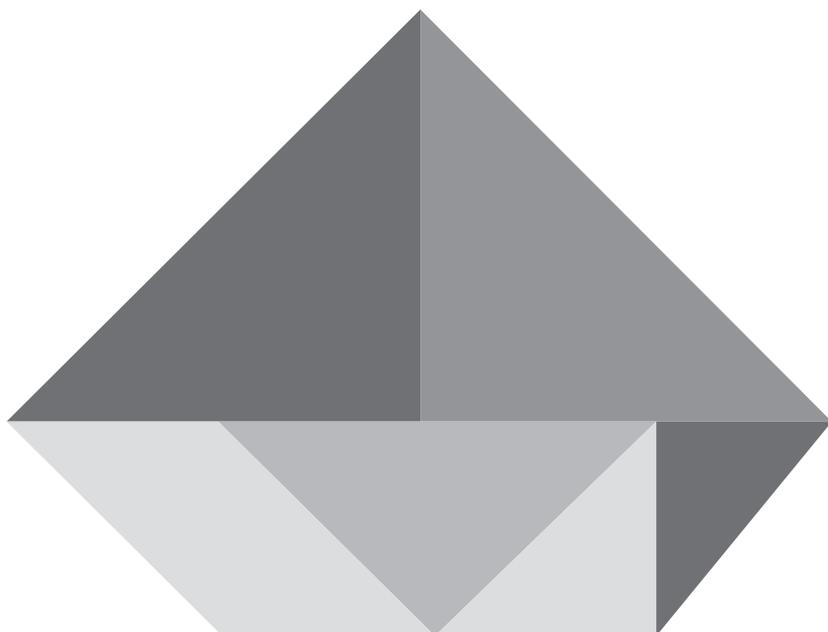


# WORKING WITH

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# TANGRAMS

Activities that Foster Shape Recognition and Spatial Visualization



VINCENT  
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# Introduction

**W***orking with Tangrams* is “all about the mathematics.” Every activity is related to the conceptual understanding of the mathematical ideas of current standards, which “define what students should understand and be able to do.” Each enriching experience provides opportunities to connect mathematical content to the recommended standards of mathematical practice.

Tangrams help students comprehend basic geometric ideas while supporting number development where relevant. This new resource, together with our early childhood PreK–2 *Hundred Board Book*, focuses on the two major experiences in early childhood mathematics education: (1) number and (2) geometry/measurement.

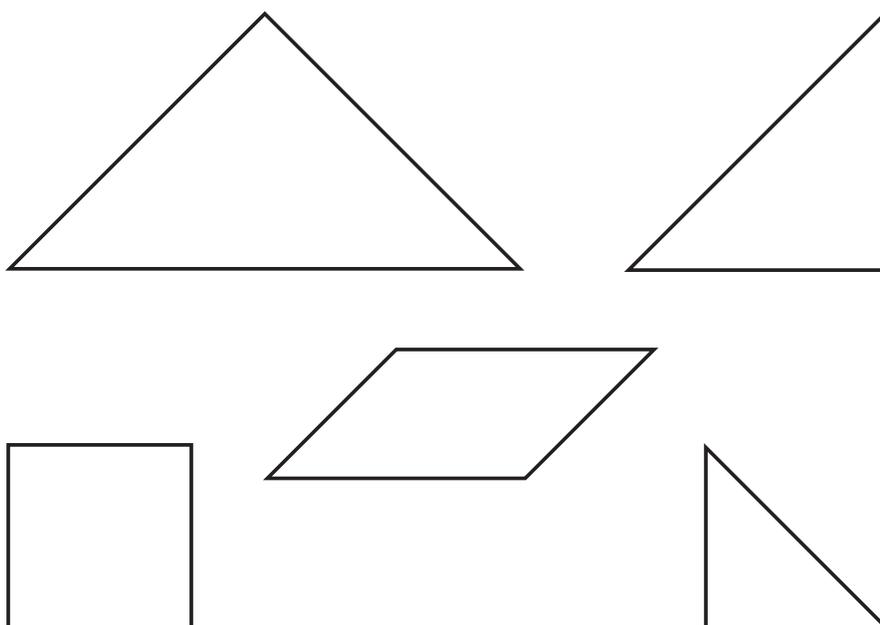
As they work their way through these 60 activities, students describe their physical world using geometric ideas, visualize spatial relationships, and reason with shapes and their attributes. Consequently, a greater understanding of these concepts occurs. Additionally, the Guided

Learning section that accompanies each lesson requires children to explain their solutions and justify their conclusions while using manipulatives to support their reasoning. “Mathematical understanding and procedural skills are equally important and both are assessable using mathematical tasks of sufficient richness.” ([corestandards.org](http://corestandards.org))

The authors believe all students can achieve and develop an understanding and appreciation of mathematics. There is no “math gene” passed from one generation to the next that enables only certain children to be successful. It is vital that teachers and parents alike discard this notion and change this mathematical mindset.

All students need to achieve mastery in understanding mathematics if they are to be successful in their professional and personal endeavors. Furthermore, we conclude that using rich mathematical tasks that provide valuable learning experiences will help your students on their educational journey through life.

—Vincent Altamuro and Sandra Clarkson



# Math Standards

| Standard  | Activity No.   |
|---|--|
| <b>Grade K</b>  |  |
| <b>Counting and Cardinality (K.CC)</b>  |  |
| Understand the relationship between numbers and quantities; connect counting to cardinality. (K.CC.4)   | 6, 7, 9  |
| Count to answer “how many?” questions about as many as 20 things . . . (K.CC.5)   | 9, 15, 16, 23  |
| Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group . . . (K.CC.6)   | 6, 7, 9, 23  |
| <b>Geometry (K.G)</b>   |  |
| Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as <i>above</i> , <i>below</i> , <i>beside</i> , <i>in front of</i> , <i>behind</i> , and <i>next to</i> . (K.G.1)   | 1, 2, 7, 8, 13, 18, 19                               |
| Correctly name shapes regardless of their orientation or overall size. (K.G.2)  | 1, 2, 3, 4, 5, 6, 8, 9, 10, 13, 15, 16, 22, 23       |
| Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/“corners”) and other attributes. (K.G.4)   | 2, 3, 4, 6, 8, 9, 11, 12, 13, 15, 16, 17, 20, 21, 23 |
| Compose simple shapes to form larger shapes. (K.G.6)  | 9, 10, 11, 12, 13, 14, 15, 16, 20, 21, 23            |
| <b>Grade 1</b>  |  |
| <b>Operations and Algebraic Thinking (1.OA)</b>   |  |
| Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects . . . and equations with a symbol for the unknown number to represent the problem. (1.OA.1) | 24, 25, 26, 27, 28, 32, 36, 37, 38                   |
| Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. (1.OA.2)  | 25, 26, 27, 28, 32,                                  |
| Relate counting to addition and subtraction. (1.OA.5)   | 22, 24, 26, 27, 37, 38                               |
| Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. (1.OA.6)  | 36   |
| Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. (1.OA.7)   | 25, 26, 27, 28, 36                                   |
| Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. (1.OA.8)  | 28, 37, 38   |

# Math Standards (cont.)

| Standard  | Activity No.                               |
|---|--|
| <b>Grade 1</b>  |  |
| <b>Measurement and Data (1.MD)</b>  |  |
| Order three objects by length; compare the lengths of two objects indirectly using a third object. (1.MD.1)   | 37, 38, 39                                 |
| Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. (1.MD.2)  | 37, 38                                     |
| Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. (1.MD.4)   | 39   |
| <b>Geometry (1.G)</b>   |  |
| Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes. (1.G.1)   | 20, 21, 30, 34                             |
| Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes . . . to create a composite shape, and compose new shapes from the composite shape. (1.G.2)  | 23, 24, 26, 27, 28, 29, 31, 32, 36, 40, 41 |
| Partition circles and rectangles into two and four equal shares, describe the shares using the words <i>halves</i> , <i>fourths</i> , and <i>quarters</i> , and use the phrases <i>half of</i> , <i>fourth of</i> , and <i>quarter of</i> . . . Understand for these examples that decomposing into more equal shares creates smaller shares. (1.G.3) | 33, 35                                     |
| <b>Grade 2</b>  |  |
| <b>Operations and Algebraic Thinking (2.OA)</b>   |  |
| Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions . . . (2.OA.1)   | 50, 51                                     |
| Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers. (2.OA.2)  | 44   |
| <b>Geometry (2.G)</b>   |  |
| Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes. (2.G.1)   | 41–56, 58, 59                              |
| Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words <i>halves</i> , <i>thirds</i> , <i>half of</i> , <i>a third of</i> , etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape. (2.G.3)        | 57   |

# 3 How Many Sides?

## Number of Students

Individual

## Materials

For each student:

- Set of tangrams
- HOW MANY SIDES? activity sheet

## Overview

Reintroduce the five different tangrams.

## Presenting the Activity

1. Have students remove all their tangram pieces from the bag. Review previous discoveries.
2. Show the large triangle. Ask: *How many of these triangles are there?* Say: *Put one back in the bag.*
3. Show the small triangle. Ask: *How many of these triangles are there?* Say: *Put one back in the bag.*
4. Take the large triangle. Trace your finger along one edge and stop at the corner (vertex).  
Say: *This is one side. When you reach the end of one side, you must make a turn.*
5. Trace the second side, stopping at the next corner (vertex).  
Say: *Two sides. Did we reach the end of another side? (Yes.) Now we need to make another turn.*
6. Complete tracing the edge of the third side until you return to the starting point.

Ask: *How many sides does the triangle have?*

7. Have students take their large triangle and trace the sides along with you. Be sure to emphasize side 1, turn, side 2, turn, side 3, turn.

Say: *Now let's do the same for the four other pieces.*

8. Have students return all five pieces to the bag. Instruct them to trace the outline of each shape on the student page and put an "S" on each side of each shape.

## Guided Learning

Ask/say:

- How many tangram pieces (actual size) are shown on the page? (5)
- How many of those shapes are triangles? (3)
- How many sides does each triangle have? (3) Show me how you know.
- Put an X on the shapes that are not triangles. How many sides do these shapes have? (4) Explain how you know.
- How many four-sided shapes are there? (2: the square and the other four-sided shape)

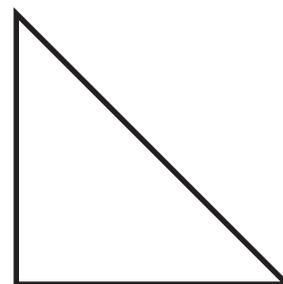
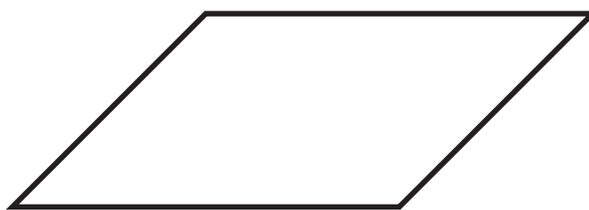
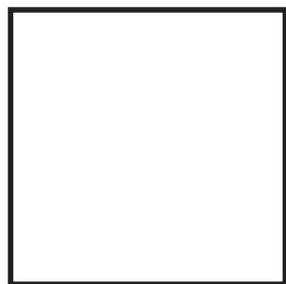
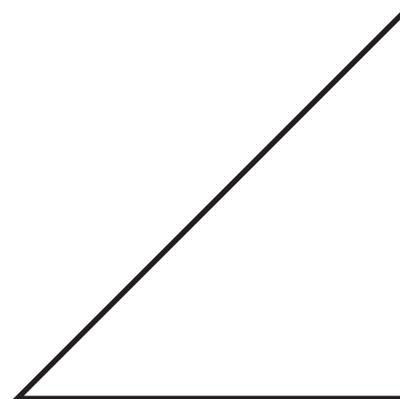
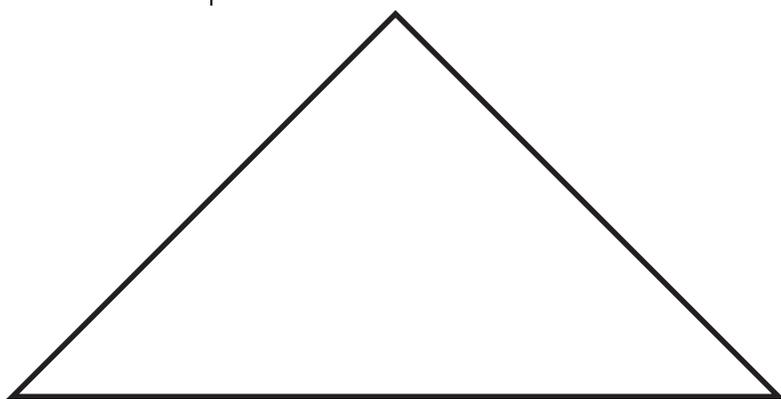
**Grade K Math Standards** K.G.2, 4; MPS 7

Name \_\_\_\_\_

### 3 How Many Sides?



Trace each shape with a crayon. Put an "S" on each side of each shape.



Put an "X" on the shapes that are NOT triangles.

How many shapes are not triangles? \_\_\_\_\_

# 26 Rectangle Puzzles

## Number of Students

Individual

## Materials

For each student:

- Set of tangrams for each student
- RECTANGLE PUZZLES activity sheet

## Activity Focus

Use addition and subtraction within 20 to solve problems. Analyze and compare two-dimensional shapes.

## Presenting the Activity

Say to students:

1. Use three tangram pieces to make each rectangle on the activity sheet. The first one is done for you.
2. For each rectangle, remove the pieces before making the next rectangle. Draw lines inside the rectangle to show which pieces you used.
3. Different tangrams may be used for different rectangles.
4. You will need four pieces to make the last rectangle (D).

## Guided Learning

Ask/say:

- How many triangles did you use to cover rectangles A–C? (7)
- How many triangles did you use to cover rectangle D? (4)
- How many triangles did you use to cover all 4 rectangles on this page? (11) Make an addition sentence to prove it. ( $7 + 4 = 11$ )
- Which rectangles are the same size? (A–C)
- Which is the largest of the four rectangles? (D) Explain.
- Each rectangle has how many sides? (4)
- Each rectangle has how many corners? (4)
- Each triangle has how many sides? (3)
- Each triangle has how many corners? (3)
- Look at your tangram pieces. Is the number of corners always the same as the number of sides? (Yes.) Explain.
- Make a different rectangle using two small triangles, a square, and the other quadrilateral. Turn your paper over and draw it. Draw the inside lines to show the different pieces you used.

**Grade 1 Math Standards** 1.OA.1, 2, 5, 7; 1.G.2;  
MPS 5, 7

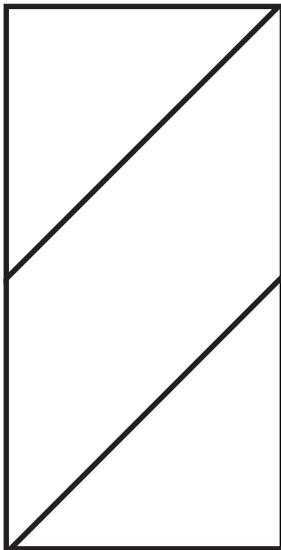
Name \_\_\_\_\_

# 26 Rectangle Puzzles

Make each rectangle with the tangram pieces shown.

Take off the pieces. Draw lines to show how you placed the pieces.

A.



2 triangles and  
quadrilateral  
(not the square)

B.



2 triangles and  
1 square

C.



3 triangles only

D.



4 triangles only

# 44 Pentagons

## Number of Students

Individual

## Materials

For each student:

- Set of tangrams
- Straightedge or ruler
- Crayons or colored pencils
- PENTAGONS activity sheet

## Activity Focus

Review shapes and defining attributes; compose two-dimensional shapes.

## Presenting the Activity

Say to students:

1. Today, we will be finding pentagons. How many sides does a pentagon have? How many corners?
2. All seven tangram pieces were placed on the picture of the CROSSING GUARD. Then three lines were erased and some of the tangrams are now hidden.
3. Place the seven tangram pieces where they belong on the picture. Then, draw the three lines that were erased.
4. Write a different letter inside each shape beginning with A and ending with G.
5. Now, try to find two different pentagons in the picture. Outline each pentagon with a different color.

## Guided Learning

Ask/say:

- How is a pentagon different from a triangle or a quadrilateral? (Pentagons have 5 sides and corners instead of 3 or 4.)
- How are all three shapes the same? (two-dimensional; Each has sides and corners.)
- How many pentagons were you able to find? (Answers may vary.) Name them. (NOTE: Students may have lettered their shapes differently than the answer key.)
- Did anyone find a pentagon made of three tangram pieces? Convince the class. (C, E, G)
- Did anyone find a pentagon made of four tangram pieces? Show us.
- Name a shape made of C, D, E, and F. Explain.
- Ask: What shape is formed with G, C, B, and D? (pentagon) Convince us.

**Grade 2 Math Standards** 2.G.1; MPS 7, 8

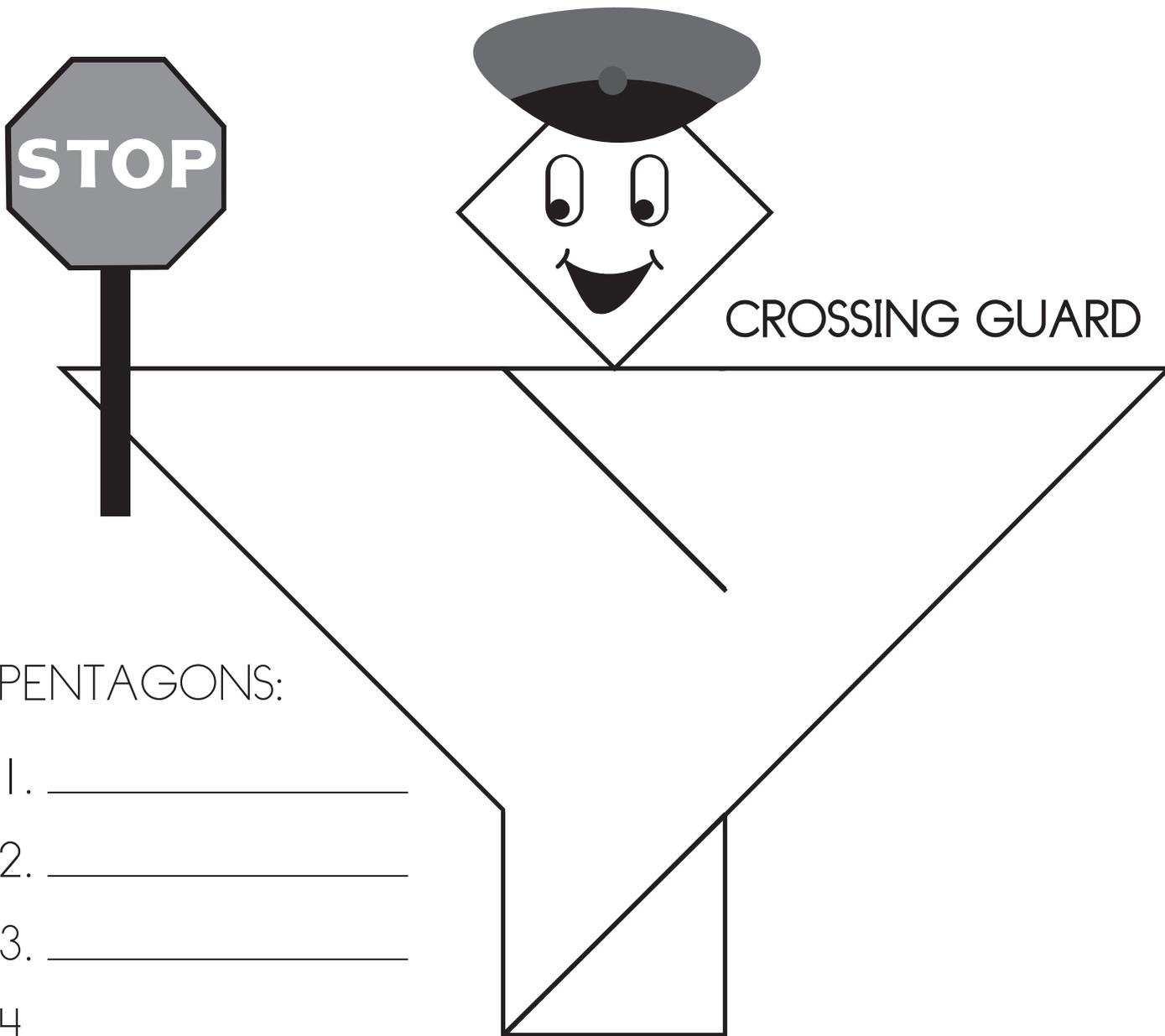
Name \_\_\_\_\_

# 44 Pentagons



Draw the missing lines to show all 7 tangram pieces.

Put a letter A-G on each shape. How many pentagons did you find?



PENTAGONS:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_