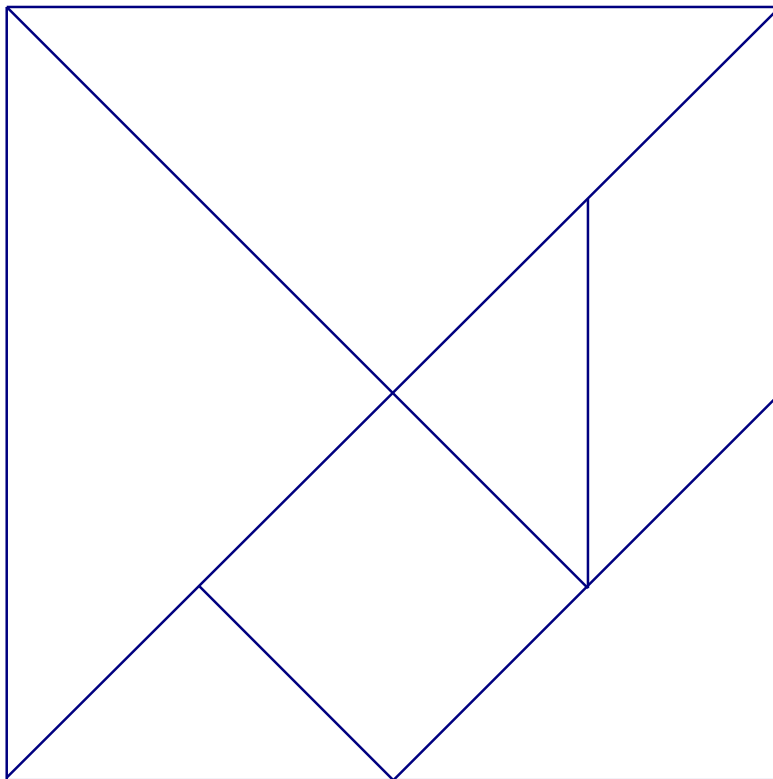


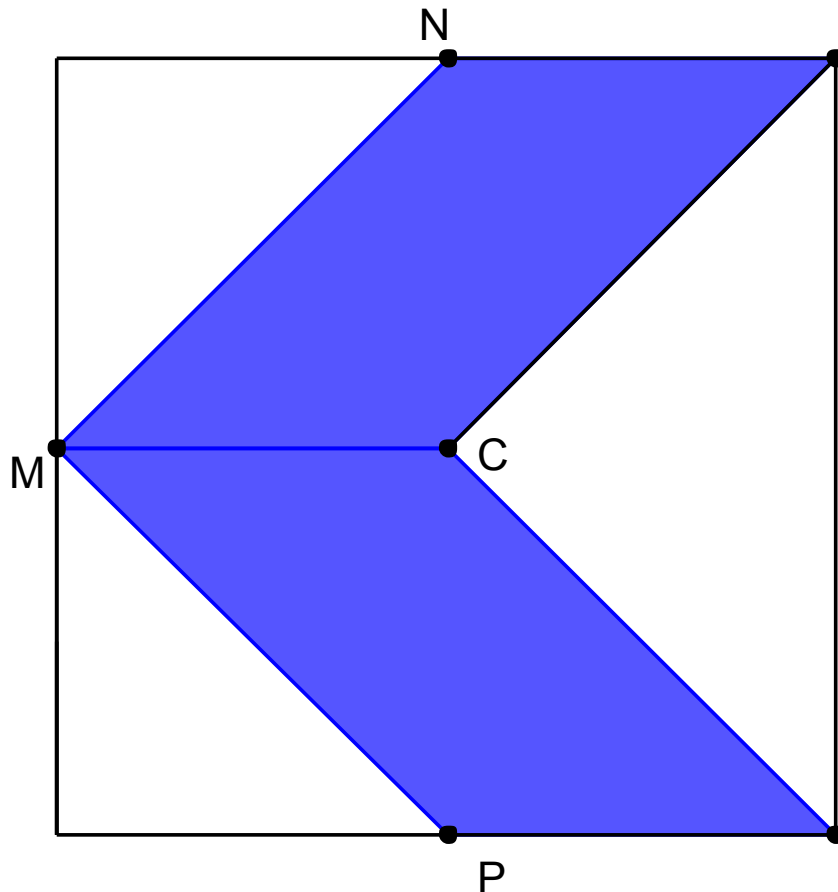
Comparing Area with Tangrams

- Use all seven tangram pieces to make a non-square rectangle.
 - A rectangle has 4 right angles and opposite sides that are congruent. How can you be sure the figure you built has those properties? Write a convincing mathematical explanation.
 - Describe a way to find the area of your rectangle without using a ruler.

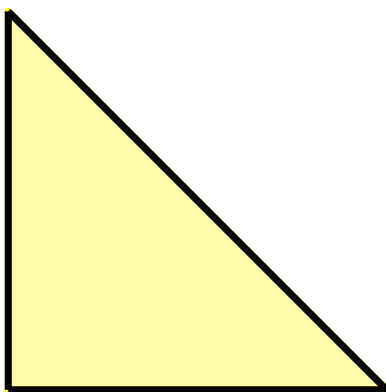
- The seven tangram pieces can be arranged to form a square. We'll call the square the Tangram Square.



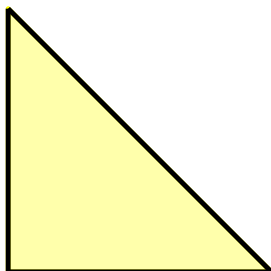
Here is the Tangram Square, with part of it shaded in. C is the center of the square and N, M, P are the midpoints of their sides.



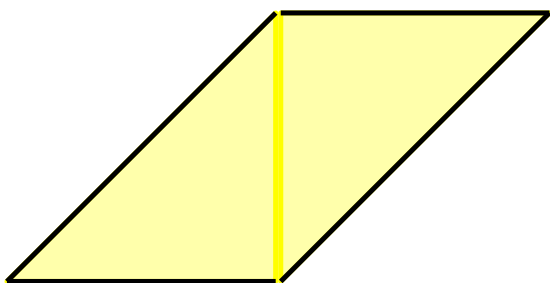
- a) How many copies of the medium-size tangram triangle fill the shaded region? Describe how you found your answer.



- b) How many copies of the small tangram triangle fill the shaded region? Describe how you found your answer.

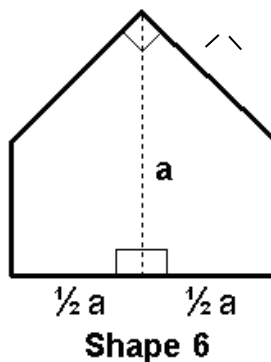
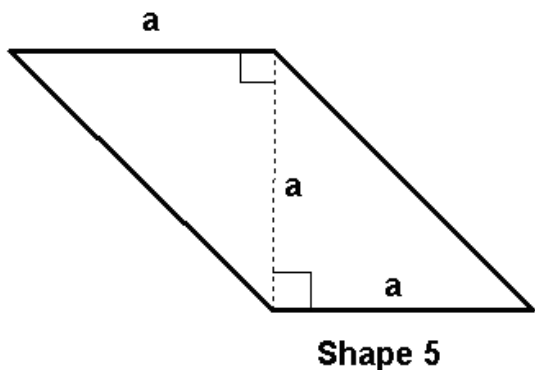
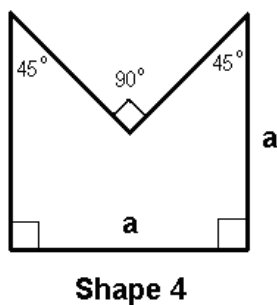
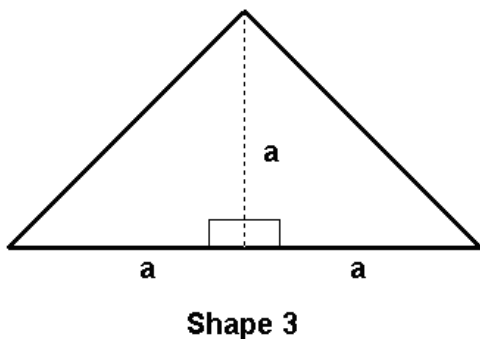
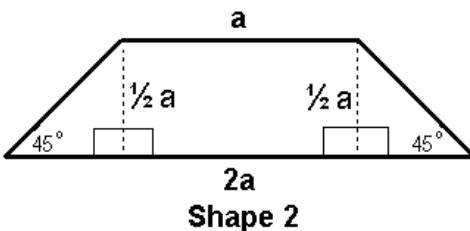
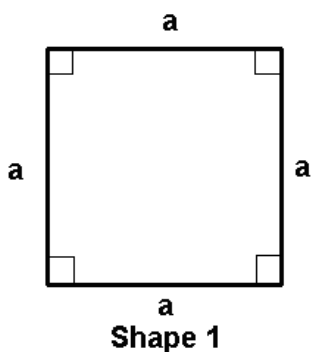


- c) How many copies of tangram parallelogram fill the shaded region? Describe how you found your answer.



- d) Now compare the areas of the three tangram pieces pictured in parts a, b, and c to each other. How does the area of each piece compare to the area of the other 2 pieces?

3. Examine the following shapes:

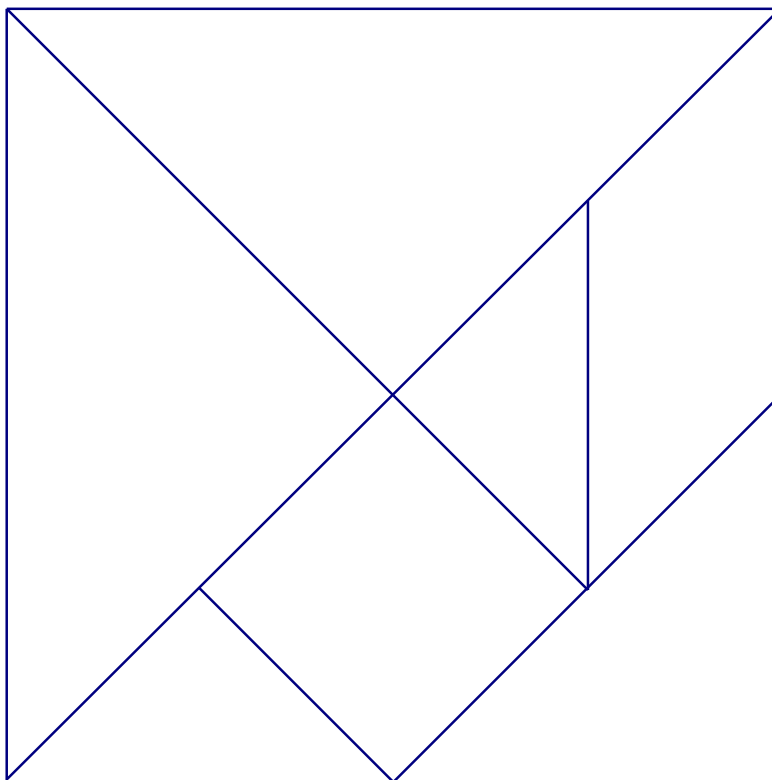


a) Which shapes have the same area?

b) How did you determine these shapes had the same area?

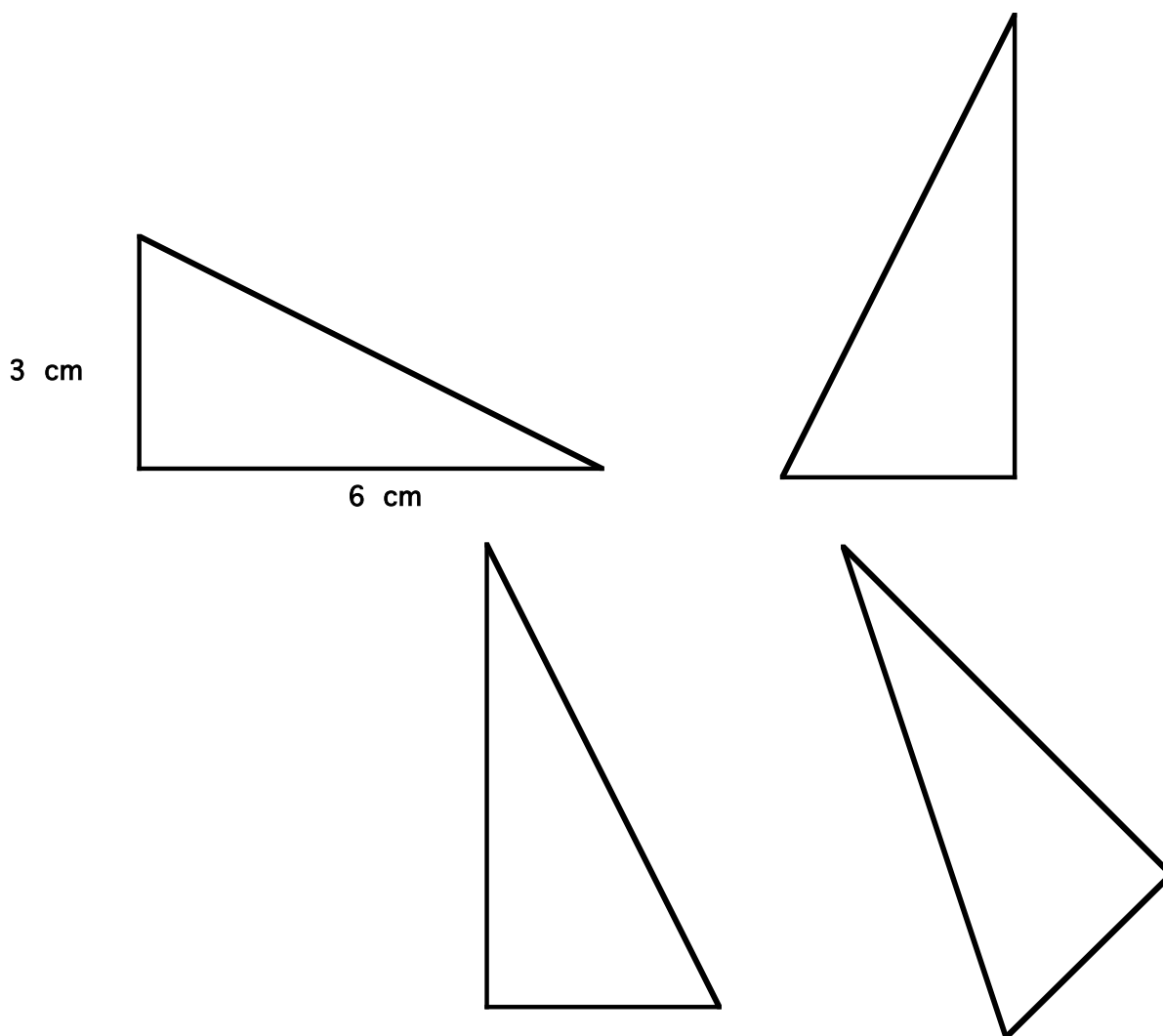
Tangram Template

If you do not have access to sets of tangrams, then create your own using this template. Make one copy of this template per person on card stock (or some other type of heavy paper), then cut out the tangram shapes.



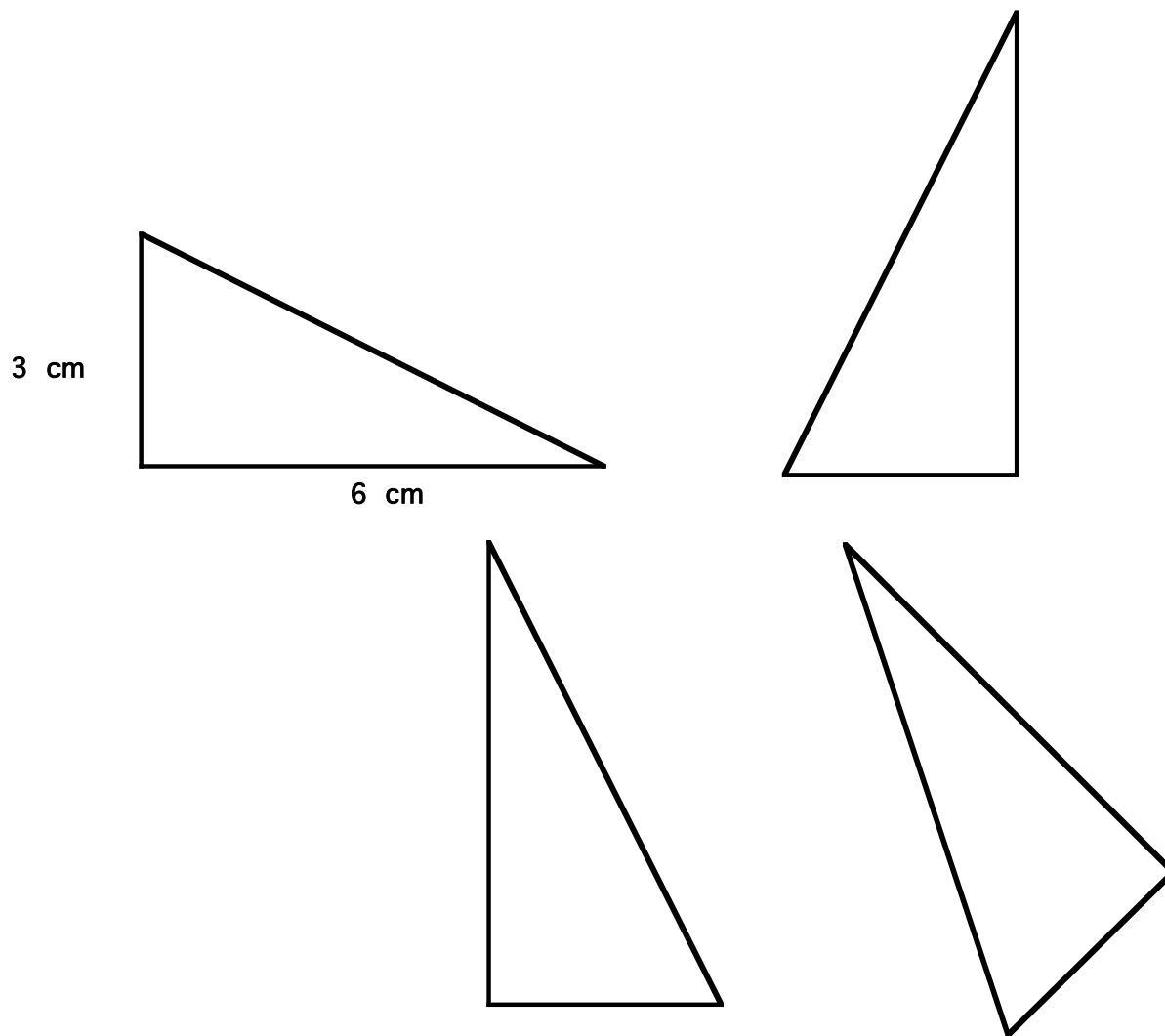
Warm-up for Comparing Area with Tangrams

Part 1. Each of the 4 triangles pictured here is a right triangle. Each triangle has a side 3 cm long and a side 6 cm long. The triangles are congruent.

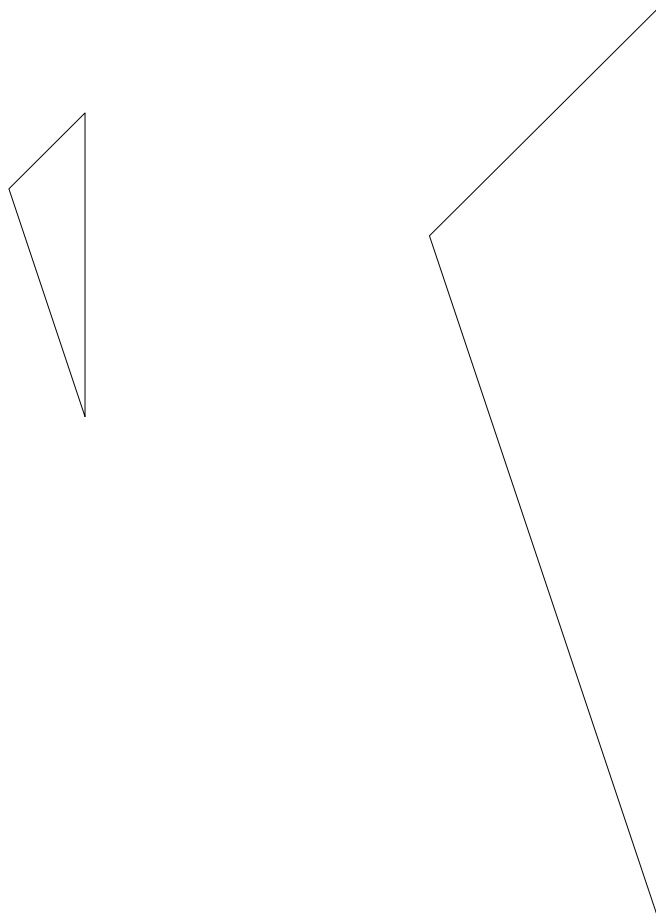


Cut out all four triangles and, using all of them, make a rectangle. (Remember: a square is a rectangle, so your rectangle can be a square.)

Below are copies of the same congruent right triangles. Cut out these four triangles and, using all of them, make a rectangle that is not congruent to the rectangle you just made. (Remember: a square is a rectangle, so your rectangle can be a square.)



Part 2. Below are two similar triangles. How much bigger is the area of the triangle on the right than the triangle on the left? Why do you think so?



Cut out this little shaded triangle and use it to determine whether you are correct in your claim about how much larger the triangle on the right is.

Potential Sentence Starters and Frames

Some ideas for sentence frames/starters that could be incorporated into your lesson are listed below. If you think a sentence frame/starter will be helpful, consider how will it support students' mathematical learning and/or development of academic language, and decide which sentence frame/starter (from the list below or that you create) would best support students' learning. You may find that the starters and frames vary in level of difficulty, and plan to provide them to students accordingly.

Starters

To create four right angles in this rectangle, I _____

To form opposite sides that are congruent, I _____

Frames

The _____ tangram piece has a bigger/smaller area than the _____ tangram piece.

To create four right _____ in this rectangle, I _____

Academic Language

Students should have opportunities to see, hear, and write key mathematical ideas during this activity. There are some specific terms that students need to understand in order to engage in this task, and there are some additional terms and phrases that may surface as the students engage with the task. You may think of additional words or phrases that are key to this activity. As the task is introduced, solved by the students, and discussed, ensure that students have opportunities to experience (i.e., through discussion, pictures, and the use of gestures) and to build understanding for key words and phrases. Examples of words and phrases that may be involved in work on this problem include:

- tangram pieces
- nonsquare rectangle
- right angle
- opposite sides
- congruent
- properties
- convincing mathematical explanation
- midpoint
- small/medium/large tangram triangle; tangram parallelogram; tangram small square; Tangram Square; tangram parallelogram
- determine
- area



Word Chart for Comparing Area with Tangrams

Spanish, French, Portuguese

* = Cognate

Words and Phrases	Academic Language Meaning	Everyday Language Version	Other Forms of the Word or Phrase	Related Words or Phrases	Translation	Examples of word use with students
Area	The number of square units contained in the interior of a figure; the extent of a two-dimensional surface enclosed within a boundary	The space something occupies, two-dimensional	---	Enclosed Space Two-dimensional size	*Area *Aire/ Superficie *Área	
Convincing	Persuading or assuring by argument or evidence	Causing one to believe the truth of something; plausible	Convince Convinced Convincer Convincible Convincingly	Persuasive Believable Credible Plausible	*Convincente *Convaincant(e) *Convincente	



Words and Phrases	Academic Language Meaning	Everyday Language Version	Other Forms of the Word or Phrase	Related Words or Phrases	Translation	Examples of word use with students
Congruent	Two geometric figures in the plane are congruent if one can be obtained from the other by some combination of rotations, reflections, and translations	The same or equal in some way; same size and shape.	Congruently Congruence	Congruous Same shape	*Congruente *Congruent(e) Coincidente	
Non-square rectangle	A quadrilateral with four right angles, opposite sides of the same length, and adjacent sides of different lengths	---	Non-square rectangles		Rectángulo (que no sea cuadrado) Rectangle (qui ne soit pas carré) Retângulo (que não seja quadrado)	
Right Angle	A quarter of a full turn, equal to 90 degrees.	---	Right Angles	Perpendicular	Ángulo recto Angle droit Ângulo reto	



Words and Phrases	Academic Language Meaning	Everyday Language Version	Other Forms of the Word or Phrase	Related Words or Phrases	Translation	Examples of word use with students
Arrange	--	To place in a particular order.	Arranges Arranging Arranged	Organize Put in order	Ordenar *Ranger *Arranjar	
Square	A quadrilateral in which all sides are congruent to each other and all angles are right angles.	--	Squares Squared Squaring	---	Cuadrado Carré Cuadrado	
Shaded	--	A place or area of comparative darkness.	Shade Shades Shading	Not white Tinted Colored in	En color (tonalizado) En couleur (ombré) Colorido (sombreado)	
Mid-point	A point on a line segment that divides it into two equal parts The halfway point of a line segment	A point at the center or middle.	Midpoints	Center Middle Halfway point Midway	*Punto medio *Point médian Ponto central	

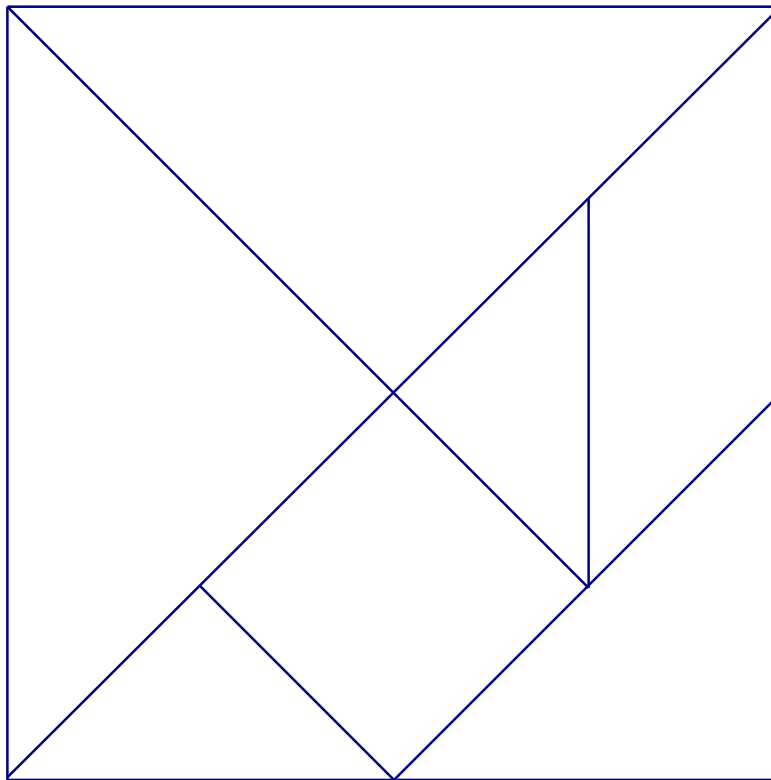
Shaded

Note that the translations for “shaded” in the word chart for this task are “En color,” “En couleur” and “Colorido” (In English “in color/colored”).

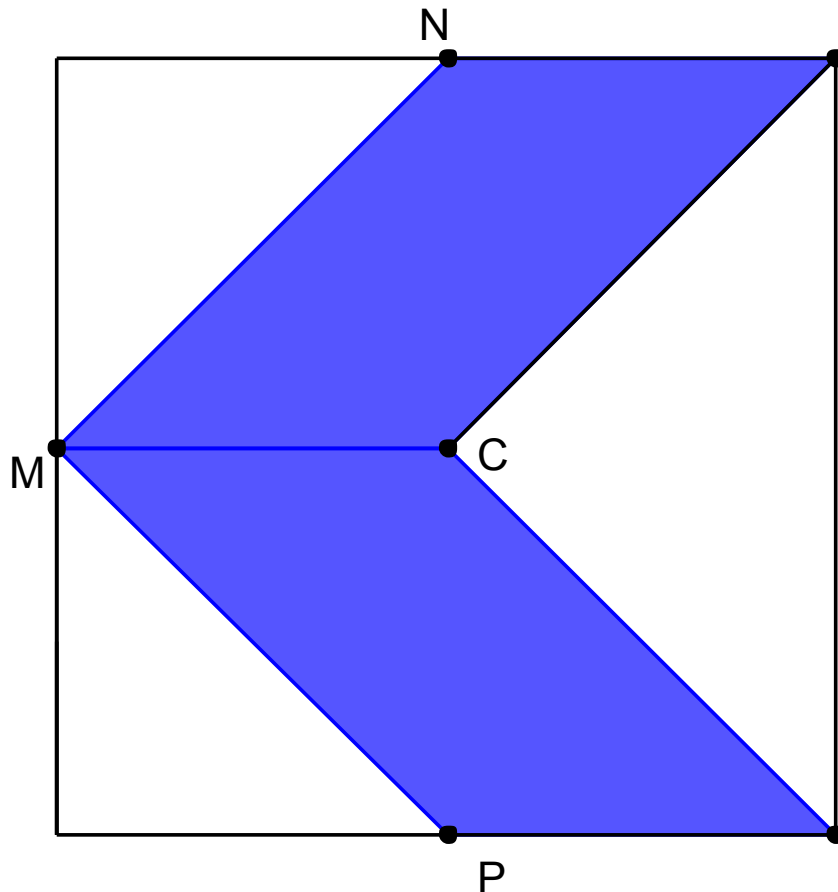
The exact translations for “shaded” in the Romance Languages may be unfamiliar to students. The translations are often used in a technical manner – for example, the “shading employed by an artist in a painting,” as in the “tonal” differences in a painting. Other translations for “shaded” strongly connote “shadow(s)” —the shade cast by an object in the presence of light. Hence, the expression to “shade something in” (e.g., bubbles, boxes) is less common than in English. If the student is unfamiliar with the translation provided, consider using the alternatives “in color/colored.”

Comparando el área con Tangrams

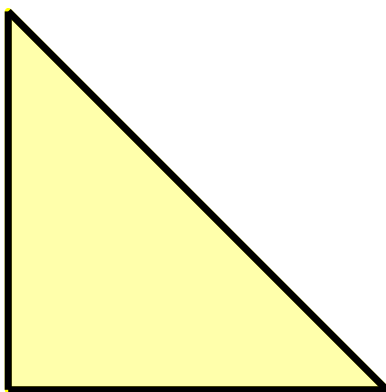
- Usar las siete piezas para hacer un rectángulo que no sea un cuadrado.
 - Un rectángulo tiene 4 ángulos rectos y lados opuestos que son congruentes. ¿Cómo puedes estar seguro de que el rectángulo que tu hicistes tiene estas propiedades? Escribe una explicación matemática convincente.
 - Describe cómo encontrar el area del rectángulo que hicistes sin usar la regla.
- Del tangram de siete piezas se puede formar un cuadrado. Nosotros lo llamaremos el “Tangram Cuadrado”.



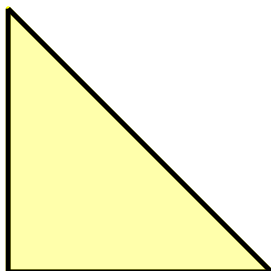
Aquí tenemos el Tangram Cuadrado, con una parte sombreada. C es el centro del cuadrado y N, M, P son los puntos medios de los lados.



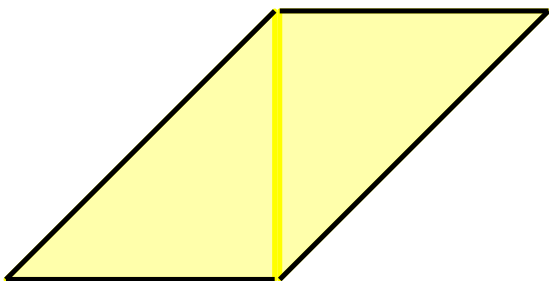
- a) ¿Cuántas copias del triángulo tangram mediano están sombreadas? Describe cómo encuentras la respuesta.



- b) ¿Cuántas copias del triángulo tangram pequeño están sombreadas? Describe cómo encontrastes la respuesta.

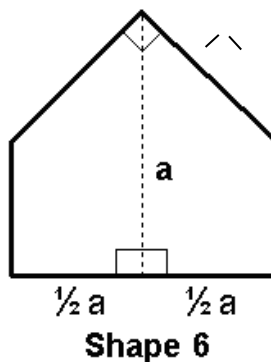
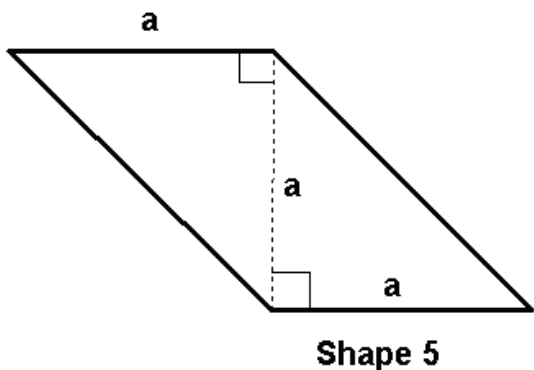
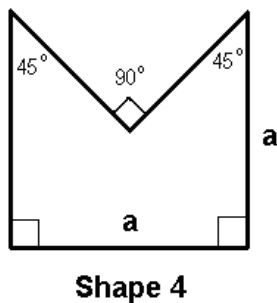
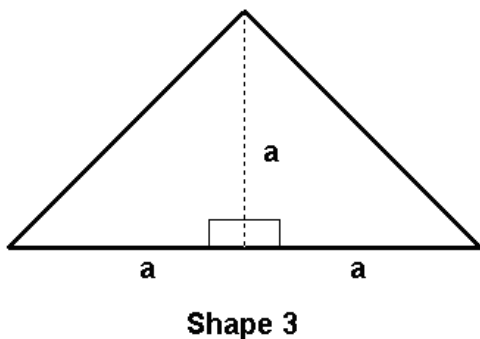
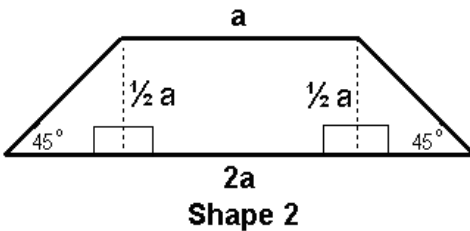
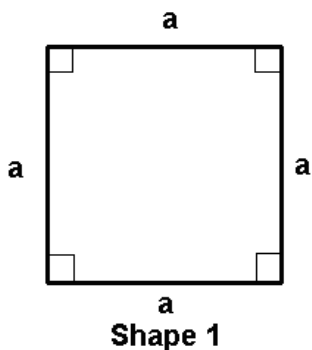


- c) ¿Cuántas copias del tangram paralelogramo están sombreadas? Describe cómo encontrastes la respuesta



- d) Ahora compara los áreas de las tres piezas tangram dibujadas en las partes a, b, y c. ¿Como se compara el area de cada pieza con el área de las otras dos piezas?

3. Examina las siguientes formas:



a) ¿Qué formas tienen la misma área?

b) ¿Cómo determinastes que estas formas tienen la misma área?

Tangram Template

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