Plan for Grade 8 Unit 2: Dilations, Similarity and Introducing Slope

Relevant Unit(s) Missed Last Year: Grade 7 Unit 1 Scale Drawings
Grade 7 Unit 7 Angles, Triangles and Prisms

Essential prior concepts to engage with this unit	• Identify scale factors. • Identify scaled copies. • Identify angle lengths and side measurements in a triangle.
Brief narrative of approach	Begin by identifying dilations and the sequence of transformations that lead to congruence and introducing slope. This unit is major work of grade 8 and builds background for slope, therefore no lessons were removed. In this unit, we are accelerating lessons to focus on building on the previous grade's work with scaled copies (7.G.A). This leads to understanding congruence and similarity (8.G.A).

Lessons to Add	**Lessons to Remove or Modify**
1. Combine 7.1.4 and 7.1.5; Activity 1 Three Quadrilaterals; Activity 3 Missing Figure, Factor or Copy	1. Combine 8.2.3 and 8.2.4. Focus on dilations with no grid and square gids. 2. Remove 8.2.8 Activity 2. Can be done outside of class as an extension. 3. Move to outside of class 8.2.13—culminating lesson incorporating work from the unit.
Lessons added: 1	Lessons removed: 3

Modified Plan for Grade 8 Unit 2

Day	IM lesson	Notes
	assessment	8.2 Check Your Readiness Assessment Note that the Check Your Readiness assessment includes item-by-item guidance to inform just-in-time adjustments to instruction within the lessons in 8.2.
1	7.1.4 7.1.5	If the initial assessment shows that students are not familiar with the relationship of corresponding distances in scaled copies, include these activities before continuing with grade-level content.
2	8.2.1	Introduce the term “dilation” as a process that produces scaled copies.
3	8.2.2	Create dilations of polygons using a circular grid given a scale factor and center of dilation.
4	8.2.3 8.2.4	Create a dilation of a figure given a scale factor and center of dilation.
5	8.2.5	Identify what information is needed to dilate a polygon on a coordinate grid.
6	8.2.6	Comprehend that the phrase “similar figures” (in written and spoken language) means there is a sequence of translations, rotations, reflections, and dilations that takes one figure to the other.
7	8.2.7	Comprehend the phrase “similar polygons” (in written and spoken language) to mean the polygons have congruent corresponding angles and proportional side lengths.
8	8.2.8	Generalize a process for identifying similar triangles and justify that finding two pairs of congruent angles is sufficient to show similarity
9	8.2.9	Calculate unknown side lengths in similar triangles using the ratios of side lengths within the triangles and the scale factor between similar triangles
10	8.2.10	Comprehend the term “slope” to mean the quotient of the vertical distance and the horizontal distance between any two points on a line.
11	8.2.11	Create an equation relating the quotient of the vertical and horizontal side lengths of a slope triangle to the slope of a line.

12	8.2.12	Create an equation of a line with positive slope on a coordinate grid using knowledge of similar triangles.
13	Assessment	End-of-Unit Assessment

Priority and Category List for Lessons

High priority (+), Medium priority (0), Low priority (-)

E: Explore, Play, and Discuss, D: Deep Dive, A: Synthesize and Apply

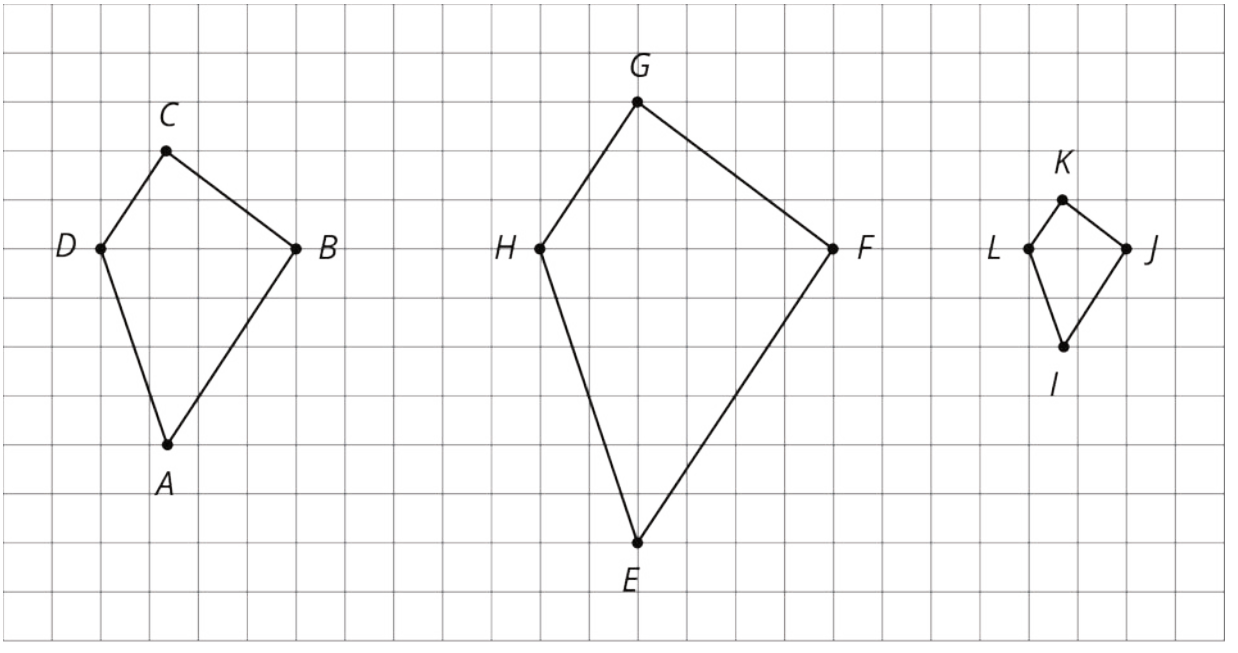
Lesson	Priority (+, 0, -)	Category (E, D, A)	Notes
8.2.1	+	E	Introduces the concept of dilation and the vocabulary.
8.2.2	+	D	Students create dilations on circular grids.
8.2.3	+	D	Students identify the center, scale factor, and image of a dilation without a circular grid.
8.2.4	+	D	Create a dilation of a polygon on a square grid given a scale factor and center of dilation.
8.2.5	+	D	Students describe and identify a sequence of transformations to include a dilation.
8.2.6	0	D	Comprehend the phrase similar figures.
8.2.7	+	E	Comprehend the phrase similar polygons. Critique (orally) arguments that claim two polygons are similar.
8.2.8	+	D	Generalize a process for identifying similar triangles.
8.2.9	+	D	Calculate unknown side lengths in similar triangles using the ratios of side lengths within the triangles and the scale factor between similar triangles.
8.2.10	+	D	Comprehend the term “slope” to mean the quotient of the vertical distance and the horizontal distance between any two points on a line.

8.2.11	+	D	Create an equation relating the quotient of the vertical and horizontal side lengths of a slope triangle to the slope of a line.
8.2.12	+	D	Create an equation of a line with positive slope on a coordinate grid using knowledge of similar triangles.
8.2.13	0	A	Calculate the unknown heights of objects by using proportional reasoning and explain (orally) the solution method.

Lesson 4: Scaled Relationships

4.1: Three Quadrilaterals (Part 1)

Each of these polygons is a scaled copy of the others.

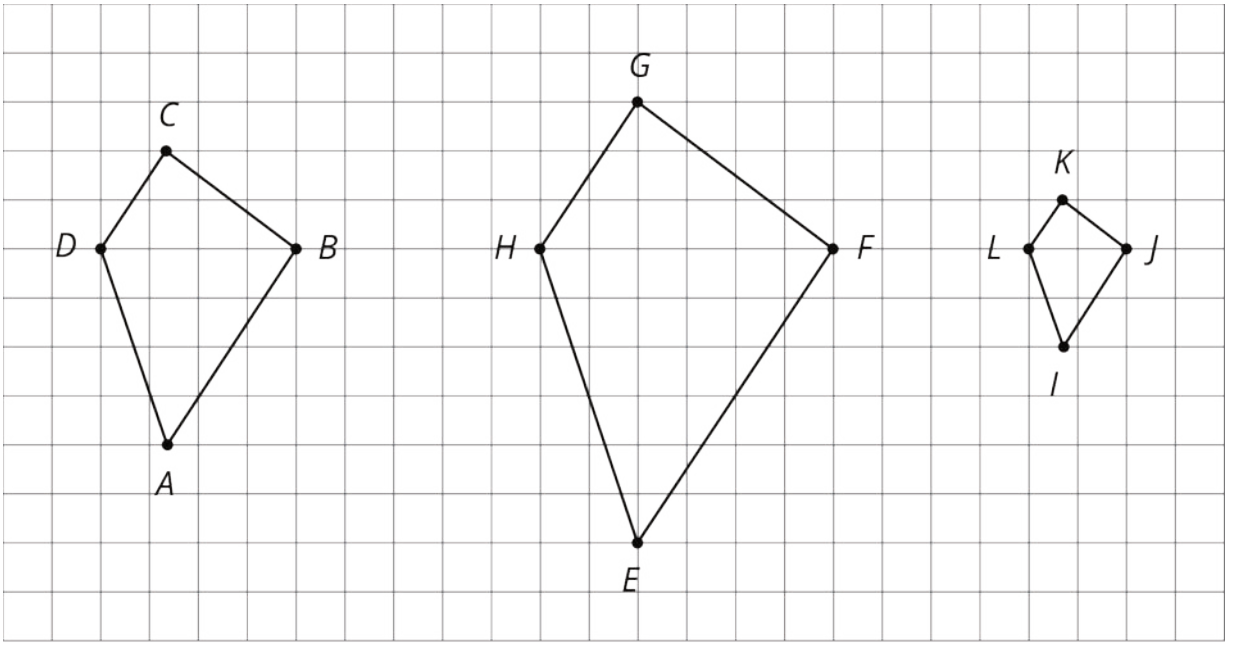


1. Name two pairs of corresponding angles. What can you say about the sizes of these angles?

2. Check your prediction by measuring at least one pair of corresponding angles using a protractor. Record your measurements to the nearest 5°.

4.2: Three Quadrilaterals (Part 2)

Each of these polygons is a scaled copy of the others. You already checked their corresponding angles.



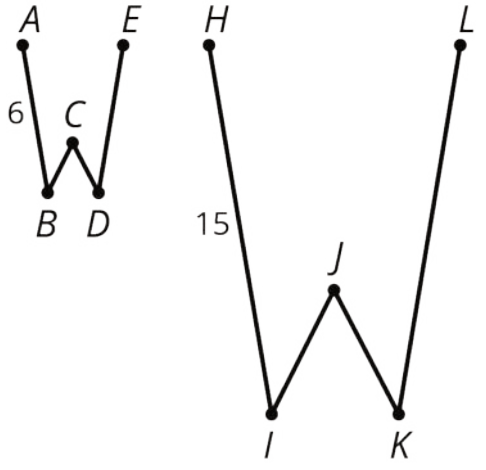
1. The side lengths of the polygons are hard to tell from the grid, but there are other *corresponding distances* that are easier to compare. Identify the distances in the other two polygons that correspond to DB and AC, and record them in the table.

quadrilateral	distance that corresponds to DB	distance that corresponds to AC
$ABCD$	$DB = 4$	$AC = 6$
$EFGH$		
$IJKL$		

2. Look at the values in the table. What do you notice?

Pause here so your teacher can review your work.

3. The larger figure is a scaled copy of the smaller figure.

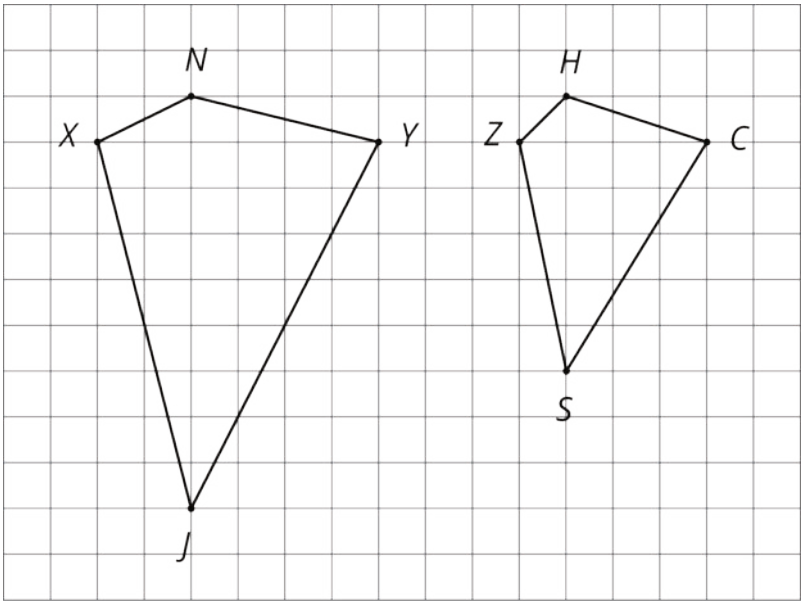


a. If $AE = 4$, how long is the corresponding distance in the second figure? Explain or show your reasoning.

b. If $IK = 5$, how long is the corresponding distance in the first figure? Explain or show your reasoning.

4.3: Scaled or Not Scaled?

Here are two quadrilaterals.



1. Mai says that Polygon $ZSCH$ is a scaled copy of Polygon $XJYN$, but Noah disagrees. Do you agree with either of them? Explain or show your reasoning.

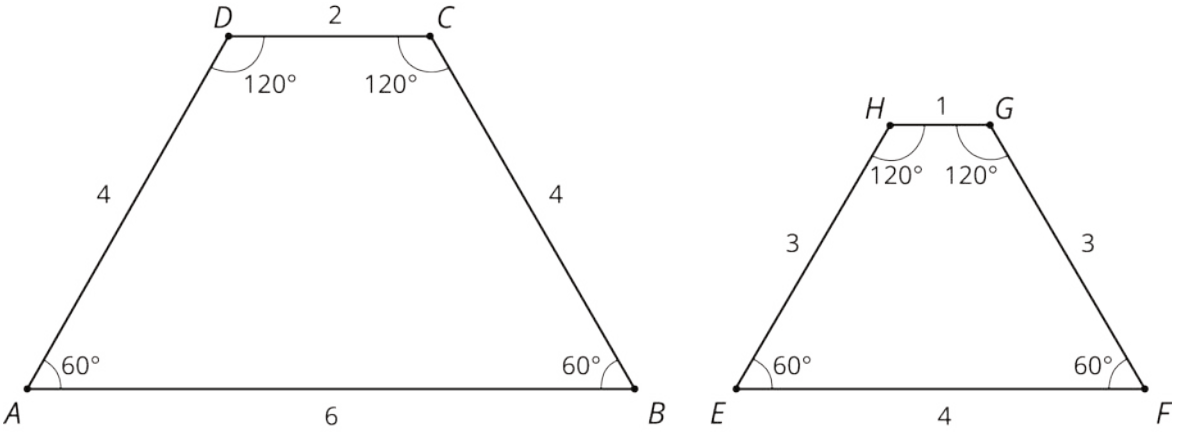
2. Record the corresponding distances in the table. What do you notice?

quadrilateral	horizontal distance	vertical distance
$XJYN$	$XY =$	$JN =$
$ZSCH$	$ZC =$	$SH =$

3. Measure at least three pairs of corresponding angles in $XJYN$ and $ZSCH$ using a protractor. Record your measurements to the nearest 5°. What do you notice?

4. Do these results change your answer to the first question? Explain.

5. Here are two more quadrilaterals.



Kiran says that Polygon $EFGH$ is a scaled copy of $ABCD$, but Lin disagrees. Do you agree with either of them? Explain or show your reasoning.

Are you ready for more?

All side lengths of quadrilateral $MNOP$ are 2, and all side lengths of quadrilateral $QRST$ are 3. Does $MNOP$ have to be a scaled copy of $QRST$? Explain your reasoning.

4.4: Comparing Pictures of Birds

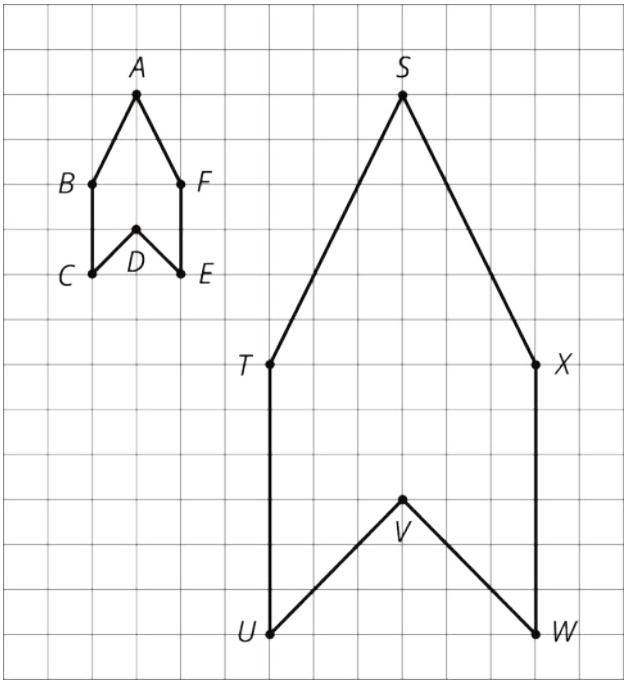
Here are two pictures of a bird. Find evidence that one picture is not a scaled copy of the other. Be prepared to explain your reasoning.

Lesson 4 Summary

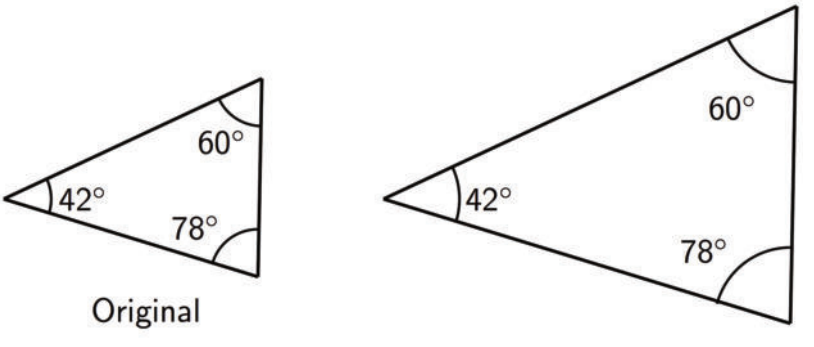
When a figure is a scaled copy of another figure, we know that:

- All distances in the copy can be found by multiplying the *corresponding distances* in the original figure by the same scale factor, whether or not the endpoints are connected by a segment.

  For example, Polygon $STUVWX$ is a scaled copy of Polygon $ABCDEF$. The scale factor is 3. The distance from T to X is 6, which is three times the distance from B to F.

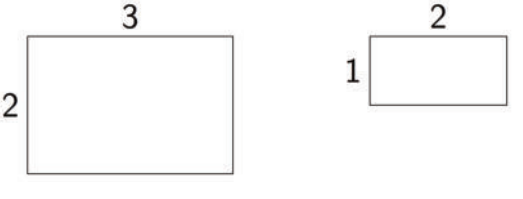


- All angles in the copy have the same measure as the corresponding angles in the original figure, as in these triangles.



These observations can help explain why one figure is *not* a scaled copy of another.

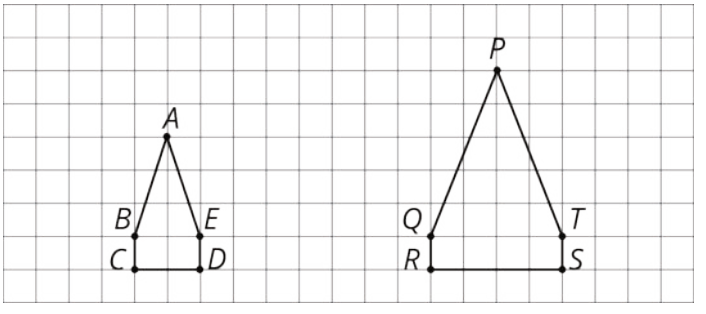
For example, even though their corresponding angles have the same measure, the second rectangle is not a scaled copy of the first rectangle, because different pairs of corresponding lengths have different scale factors, $2 \cdot \frac{1}{2} = 1$ but $3 \cdot \frac{2}{3} = 2$.



Lesson 4: Scaled Relationships

Cool Down: Corresponding Polygons

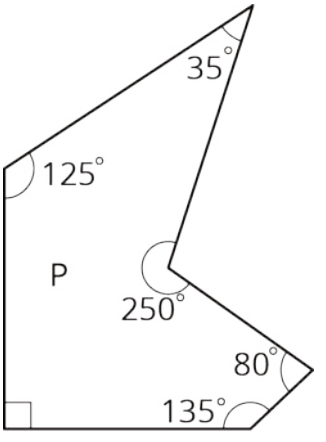
Here are two polygons on a grid.



Is $PQRST$ a scaled copy of $ABCDE$? Explain your reasoning.

Unit 1 Lesson 4 Cumulative Practice Problems

1. Select **all** the statements that must be true for *any* scaled copy Q of Polygon P.



A. The side lengths are all whole numbers.

B. The angle measures are all whole numbers.

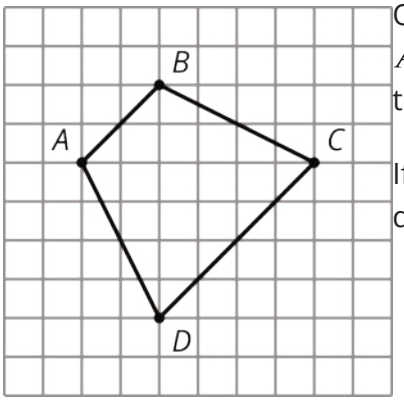
C. Q has exactly 1 right angle.

D. If the scale factor between P and Q is $\frac{1}{5}$, then each side length of P is multiplied by $\frac{1}{5}$ to get the corresponding side length of Q.

E. If the scale factor is 2, each angle in P is multiplied by 2 to get the corresponding angle in Q.

F. Q has 2 acute angles and 3 obtuse angles.

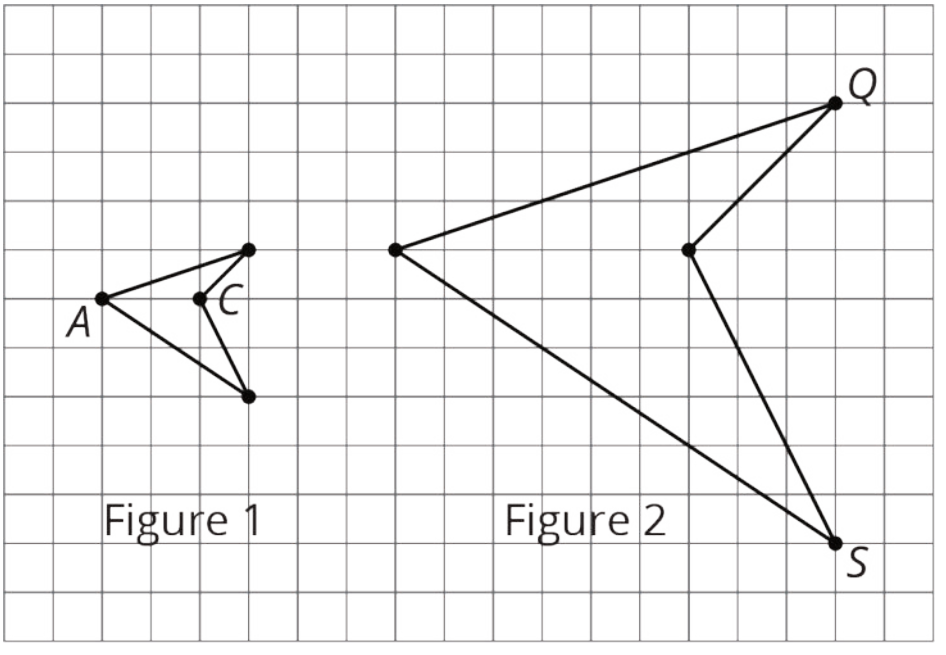
2. Here is Quadrilateral $ABCD$.



Quadrilateral $PQRS$ is a scaled copy of Quadrilateral $ABCD$. Point P corresponds to A, Q to B, R to C, and S to D.

If the distance from P to R is 3 units, what is the distance from Q to S? Explain your reasoning.

3. Figure 2 is a scaled copy of Figure 1.



a. Identify the points in Figure 2 that correspond to the points A and C in Figure 1. Label them P and R. What is the distance between P and R?

b. Identify the points in Figure 1 that correspond to the points Q and S in Figure 2. Label them B and D. What is the distance between B and D?

c. What is the scale factor that takes Figure 1 to Figure 2?

d. G and H are two points on Figure 1, but they are not shown. The distance between G and H is 1. What is the distance between the corresponding points on Figure 2?

4. To make 1 batch of lavender paint, the ratio of cups of pink paint to cups of blue paint is 6 to 5. Find two more ratios of cups of pink paint to cups of blue paint that are equivalent to this ratio.

Lesson 5: The Size of the Scale Factor

5.1: Number Talk: Missing Factor

Solve each equation mentally.

$16x = 176$

$16x = 8$

$16x = 1$

$\frac{1}{5}x = 1$

$\frac{2}{5}x = 1$

5.2: Card Sort: Scaled Copies

Your teacher will give you a set of cards. On each card, Figure A is the original and Figure B is a scaled copy.

1. Sort the cards based on their scale factors. Be prepared to explain your reasoning.
2. Examine cards 10 and 13 more closely. What do you notice about the shapes and sizes of the figures? What do you notice about the scale factors?

3. Examine cards 8 and 12 more closely. What do you notice about the figures? What do you notice about the scale factors?

Are you ready for more?

Triangle B is a scaled copy of Triangle A with scale factor $\frac{1}{2}$.

1. How many times bigger are the side lengths of Triangle B when compared with Triangle A?
2. Imagine you scale Triangle B by a scale factor of $\frac{1}{2}$ to get Triangle C. How many times bigger will the side lengths of Triangle C be when compared with Triangle A?
3. Triangle B has been scaled once. Triangle C has been scaled twice. Imagine you scale triangle A n times to get Triangle N, always using a scale factor of $\frac{1}{2}$. How many times bigger will the side lengths of Triangle N be when compared with Triangle A?

5.3: Scaling A Puzzle

Your teacher will give you 2 pieces of a 6-piece puzzle.

1. If you drew scaled copies of your puzzle pieces using a scale factor of $\frac{1}{2}$, would they be larger or smaller than the original pieces? How do you know?
2. Create a scaled copy of each puzzle piece on a blank square, with a scale factor of $\frac{1}{2}$.
3. When everyone in your group is finished, put all 6 of the original puzzle pieces together like this:

1	2	3
4	5	6

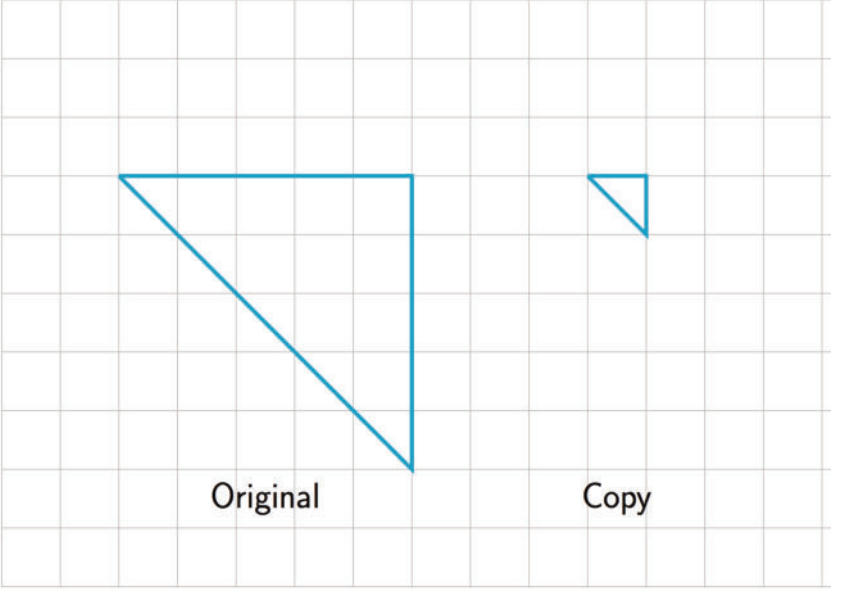
Next, put all 6 of your scaled copies together. Compare your scaled puzzle with the original puzzle. Which parts seem to be scaled correctly and which seem off? What might have caused those parts to be off?

4. Revise any of the scaled copies that may have been drawn incorrectly.

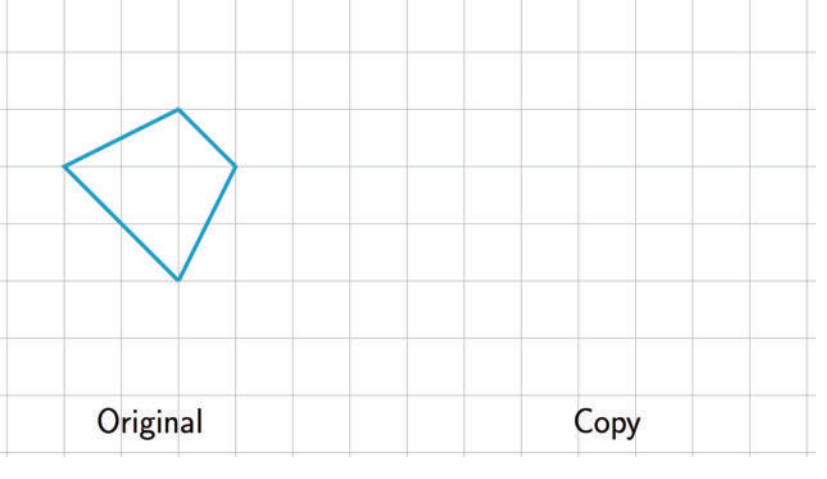
5. If you were to lose one of the pieces of the original puzzle, but still had the scaled copy, how could you recreate the lost piece?

5.4: Missing Figure, Factor, or Copy

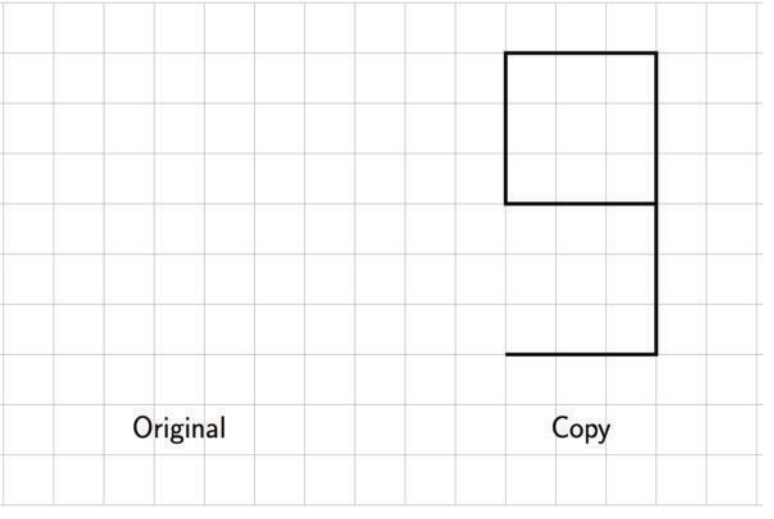
1. What is the scale factor from the original triangle to its copy? Explain or show your reasoning.



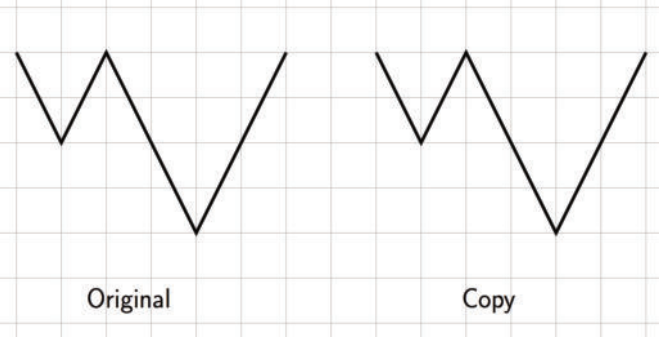
2. The scale factor from the original trapezoid to its copy is 2. Draw the scaled copy.



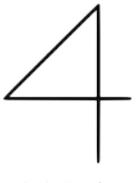
3. The scale factor from the original figure to its copy is $\frac{3}{2}$. Draw the original figure.



4. What is the scale factor from the original figure to the copy? Explain how you know.



5. The scale factor from the original figure to its scaled copy is 3. Draw the scaled copy.



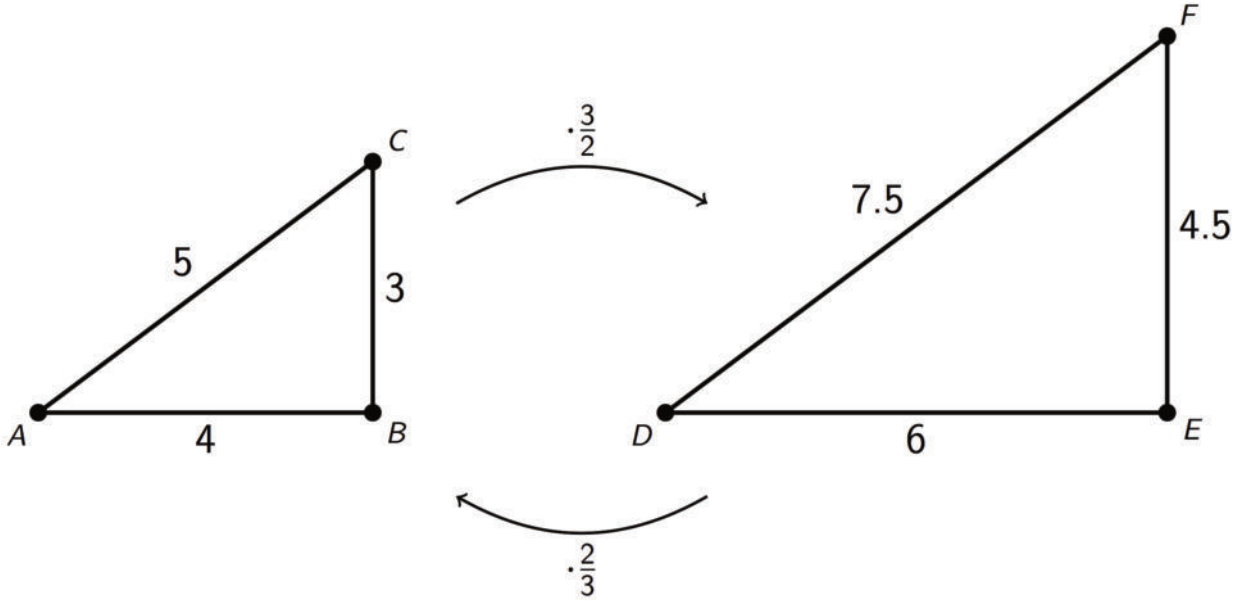
Original

Copy

Lesson 5 Summary

The size of the scale factor affects the size of the copy. When a figure is scaled by a scale factor greater than 1, the copy is larger than the original. When the scale factor is less than 1, the copy is smaller. When the scale factor is exactly 1, the copy is the same size as the original.

Triangle DEF is a larger scaled copy of triangle ABC, because the scale factor from ABC to DEF is $\frac{3}{2}$. Triangle ABC is a smaller scaled copy of triangle DEF, because the scale factor from DEF to ABC is $\frac{2}{3}$.



This means that triangles ABC and DEF are scaled copies of each other. It also shows that scaling can be reversed using **reciprocal** scale factors, such as $\frac{2}{3}$ and $\frac{3}{2}$.

In other words, if we scale Figure A using a scale factor of 4 to create Figure B, we can scale Figure B using the reciprocal scale factor, $\frac{1}{4}$, to create Figure A.

Lesson 5: The Size of the Scale Factor

Cool Down: Scaling a Rectangle

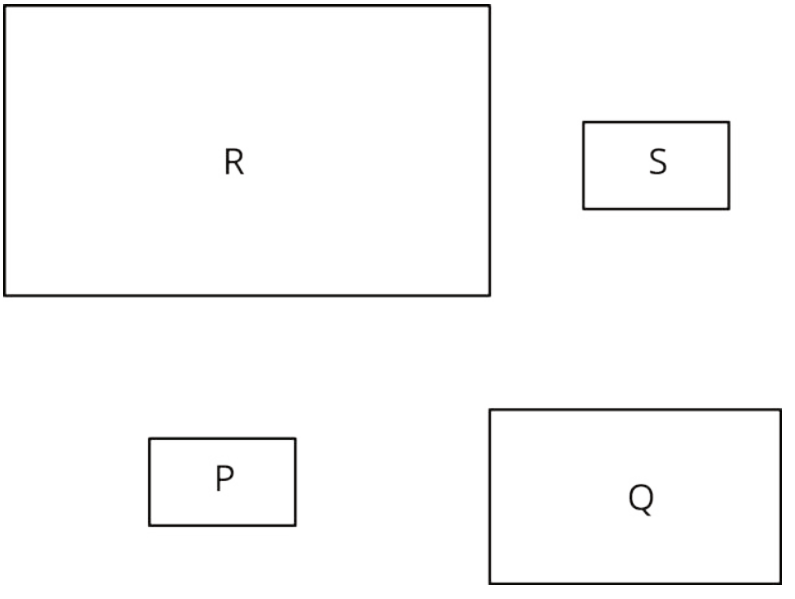
A rectangle that is 2 inches by 3 inches has been scaled by a factor of 7.

1. What are the side lengths of the scaled copy?

2. Suppose you want to scale the copy back to its original size. What scale factor should you use?

Unit 1 Lesson 5 Cumulative Practice Problems

1. Rectangles P, Q, R, and S are scaled copies of one another. For each pair, decide if the scale factor from one to the other is greater than 1, equal to 1, or less than 1.



a. from P to Q

b. from P to R

c. from Q to S

d. from Q to R

e. from S to P

f. from R to P

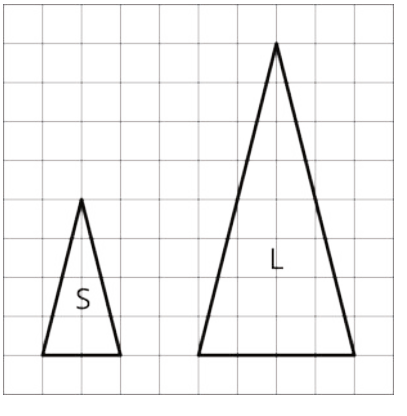
g. from P to S

2. Triangle S and Triangle L are scaled copies of one another.

a. What is the scale factor from S to L?

b. What is the scale factor from L to S?

c. Triangle M is also a scaled copy of S. The scale factor from S to M is $\frac{3}{2}$. What is the scale factor from M to S?



3. Are two squares with the same side lengths scaled copies of one another? Explain your reasoning.

4. Quadrilateral A has side lengths 2, 3, 5, and 6. Quadrilateral B has side lengths 4, 5, 8, and 10. Could one of the quadrilaterals be a scaled copy of the other? Explain.

(From Unit 1, Lesson 2.)

5. Select **all** the ratios that are equivalent to the ratio $12 : 3$.

   A. $6 : 1$

   B. $1 : 4$

   C. $4 : 1$

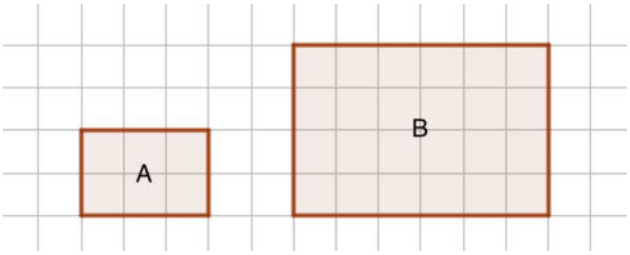
   D. $24 : 6$

   E. $15 : 6$

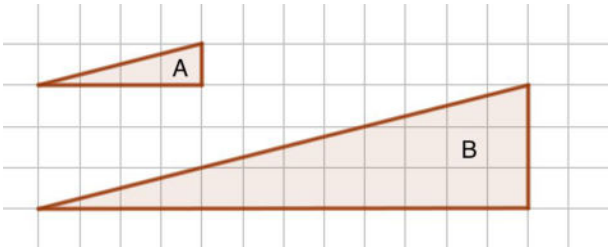
   F. $1{,}200 : 300$

   G. $112 : 13$

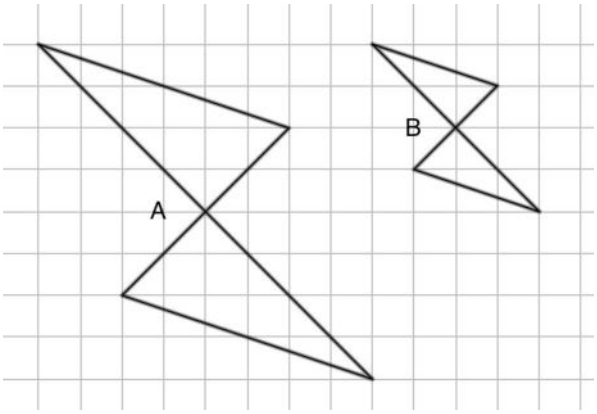
Scaled Copies Card Sort - Card 1



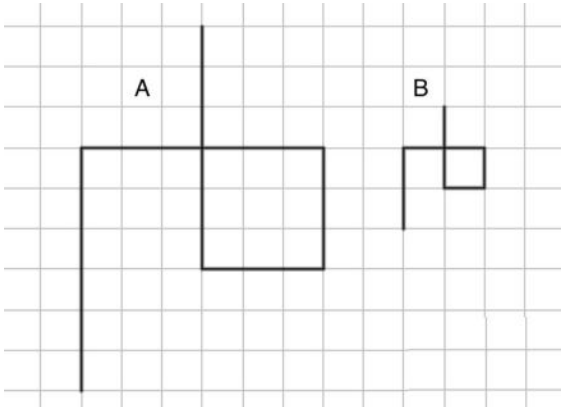
Scaled Copies Card Sort - Card 2



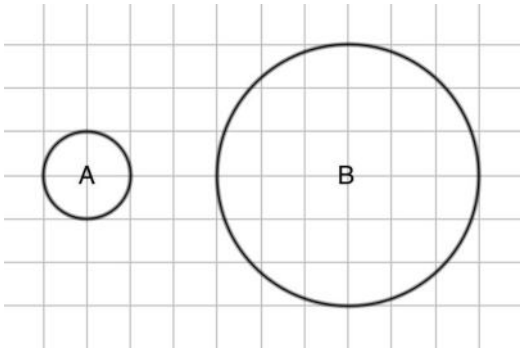
Scaled Copies Card Sort - Card 3



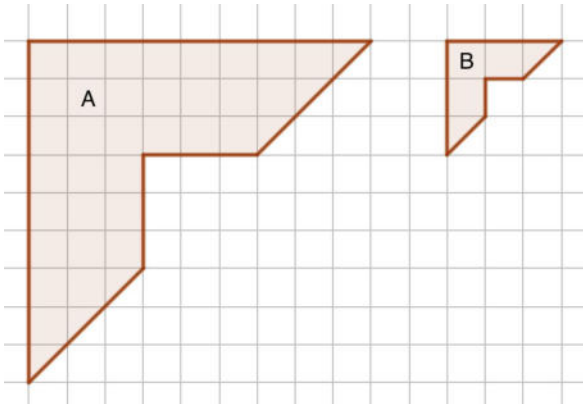
Scaled Copies Card Sort - Card 4



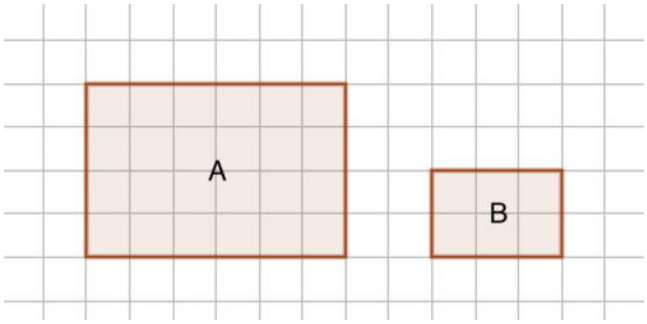
Scaled Copies Card Sort - Card 5



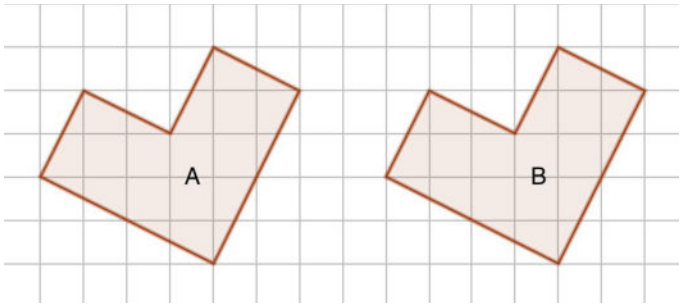
Scaled Copies Card Sort - Card 6



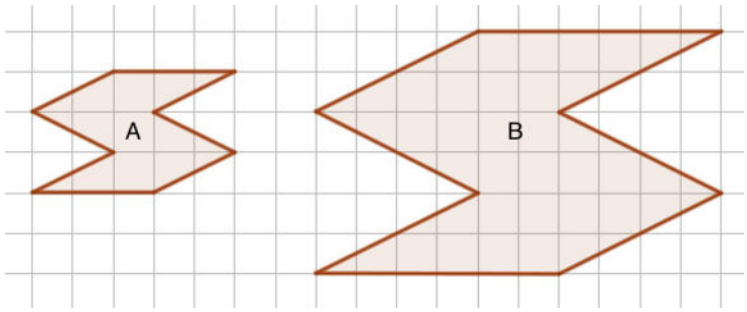
Scaled Copies Card Sort - Card 7



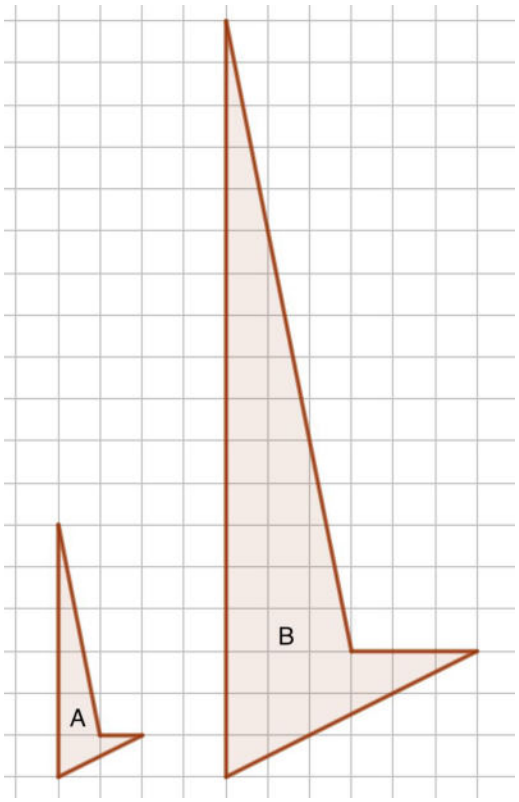
Scaled Copies Card Sort - Card 8



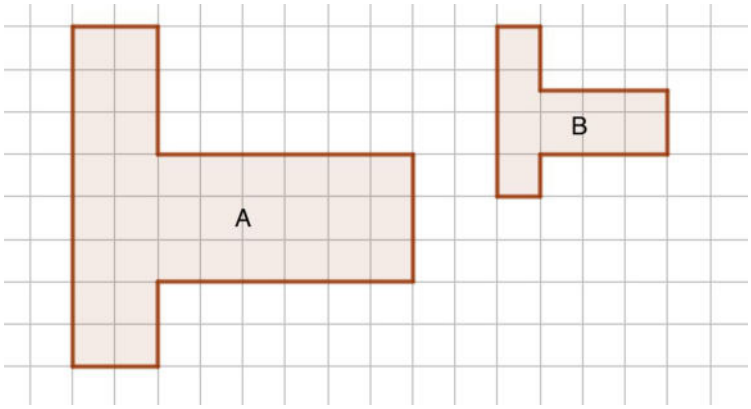
Scaled Copies Card Sort - Card 9



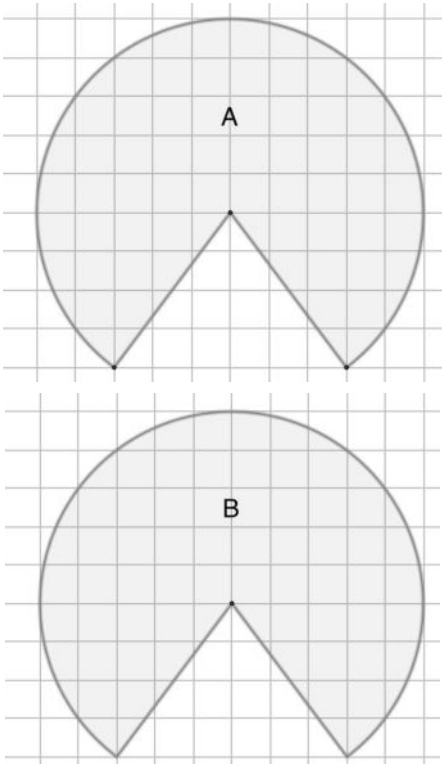
Scaled Copies Card Sort - Card 10



Scaled Copies Card Sort - Card 11



Scaled Copies Card Sort - Card 12



Scaled Copies Card Sort - Card 13