

MYSTERY PICTURE

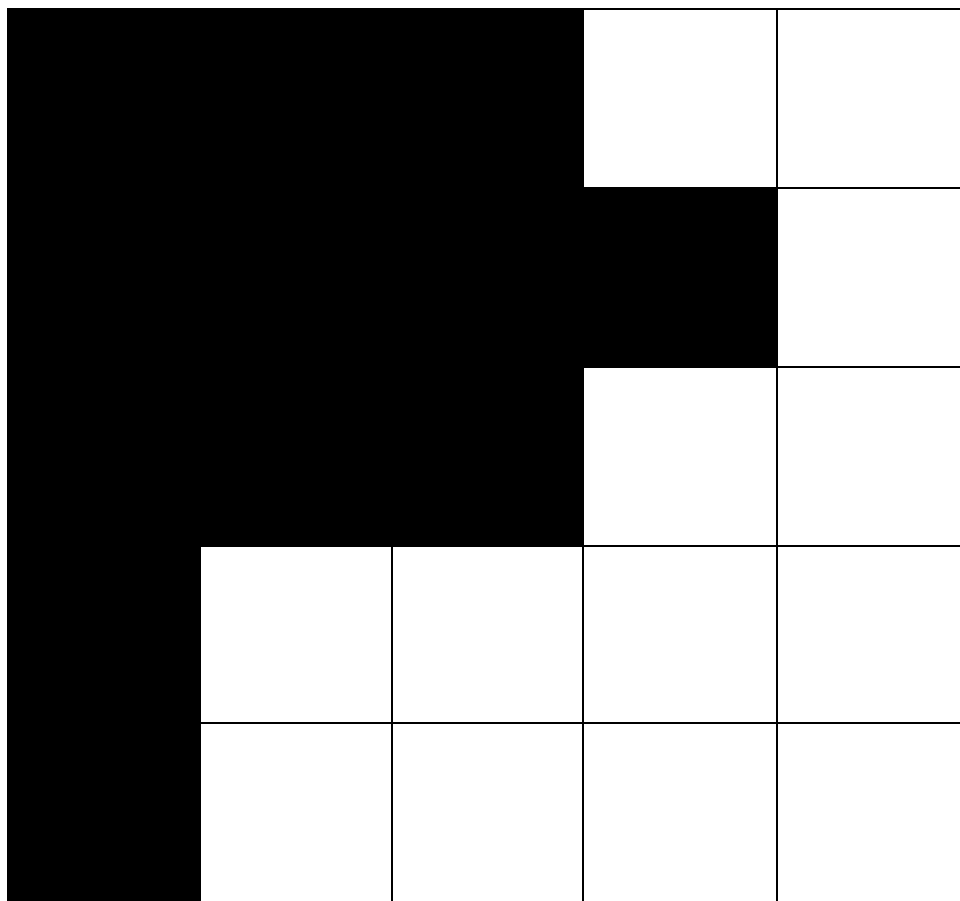


SIMILARITY TRANSFORMATIONS AND SIMILAR FIGURES

Same Shape, Any Size?

25 pairs of shapes · similar or not?

FREE



1. **Hand out page 3**, one per student. Pencils. Nothing else is needed.
2. **Say this once:** *“Similar means every angle matches and one number multiplies every side. Shapes of the same size are similar too. If the two shapes in a square are similar, fill the square with slanted lines. If not, leave it white.”*
3. **When a student finishes, look at the picture.** If it is not a flag, a square is wrong. The student finds it and checks it again.

Student sheet	page 3, one per student. It prints the meaning of similar and shows a dilation, a slide, a turn and a flip as small pictures.
Answers	page 4: the finished picture and the reason for every square.

Twelve squares are filled and thirteen are white. The finished picture is a flag. Three of the filled squares show two shapes of the same size. Many students think “similar” must mean a different size and leave these white, and the flag has gaps. Other filled squares have the smaller shape second. Each white square tests another common mistake: every side made 2 longer, only some sides multiplied, a stretch in one direction, or a square and a rhombus with every side doubled.

The arithmetic is small. In each filled square with numbers, one number multiplies every side, and it is $\frac{1}{2}$, 1, 2 or 3. Six squares are drawings with no numbers. Their tick marks and corner marks decide them: two squares, two equilateral triangles and two isosceles right triangles are always similar. Every white drawing is clearly not similar.

Which definition of similar these sheets use. Your class may have learned either one. One says a dilation followed by slides, turns or flips moves one shape exactly onto the other. The other says every pair of matching angles is equal and every pair of matching sides is in the same ratio. The student sheet prints both, and both give the same answer on every item. Some textbooks use other definitions, so tell the class which ones this sheet uses. No square shows a curved shape.

Guessing does not work. Every simple guessing rule, such as filling every square that has a drawing, gets at least eight squares wrong.



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.

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Mystery Picture

Similar or not?

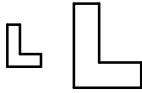
Name _____

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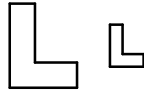
Date _____

Each square shows two shapes, or tells you about two shapes. Are the two shapes similar? If yes, fill the square with slanted lines. If no, leave it white.

Two shapes are **similar** when every angle of one matches an angle of the other, and every side is multiplied by the same number, the **scale factor**. That is the same as saying a dilation, and then slides, turns or flips, can move one shape exactly onto the other. Congruent shapes are similar too: their scale factor is 1.



dilation, scale factor 2



dilation, scale factor $\frac{1}{2}$



slide



turn



flip (turn over)

In a drawing, sides with tick marks are equal, and a small square in a corner is a right angle. When you finish, look at the picture. If part of it is missing, or one square does not fit, check that square again.

1 	2 A is a 2 by 1 rectangle. B is a 6 by 3 rectangle.	3 Shape B is shape A after a dilation with scale factor 3, then a turn.	4 A is a 2 by 1 rectangle. B is a 6 by 2 rectangle.	5
6 Triangle A has sides 3, 4 and 5. Triangle B has sides 6, 8 and 10.	7 	8 Shape B is shape A flipped over a line. Nothing else changes.	9 A and B are rhombuses with a 60° angle. A has sides of 2. B has sides of 6.	10 Shape B is shape A stretched to twice its width. Its height stays the same.
11 A is a 10 by 6 rectangle. B is a 5 by 3 rectangle.	12 Triangle A has sides 3, 4 and 5. Triangle B has sides 4, 5 and 3.	13 	14 Triangle A has sides 3, 4 and 5. Triangle B has sides 5, 6 and 7.	15
16 Shape B is shape A after a dilation with scale factor $\frac{1}{2}$, then a flip.	17 A is a square with sides of 3. B is a rhombus with sides of 6 and a 60° angle.	18 A is a 4 by 2 rectangle. B is a 6 by 4 rectangle. Each side grew by 2.	19 	20 A and B are rhombuses with sides of 2. A has a 60° angle. B has an 80° angle.
21 A is a 3 by 1 rectangle. B is a 1 by 3 rectangle.	22 Triangle A has sides 3, 4 and 5. Triangle B has sides 6, 8 and 5.	23 A is a 4 by 2 rectangle. B is a parallelogram with sides 8 and 4 and a 70° angle.	24 Shape B is shape A after a dilation with scale factor 2. Then B is stretched to twice its height.	25 A is a square with sides of 3. B is a 3 by 6 rectangle.

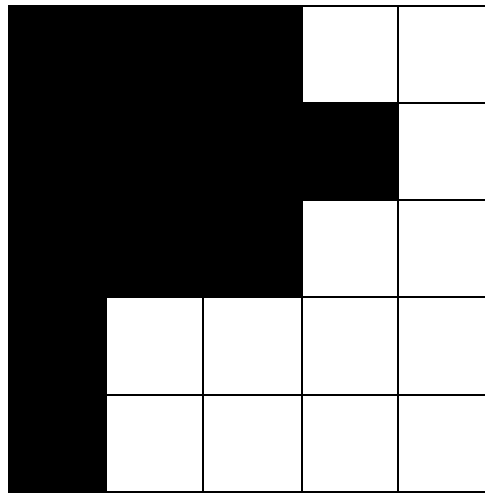


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Mystery Picture — answers

For the teacher

The finished picture is **a flag**: a pole down the left side, and the flag at the top. A square is filled only when its two shapes are similar. The table gives the reason for every square.



1–5	1 · FILL Every square has four 90° angles, and one number multiplies every side. Any two squares are similar.	2 · FILL Every angle is 90° , and every side is multiplied by 3: $2 \times 3 = 6$ and $1 \times 3 = 3$.	3 · FILL A dilation multiplies every side by 3 and keeps the angles. A turn changes nothing.	4 · white The long side is multiplied by 3 and the short side by 2. No one number works.	5 · white The square has 90° angles. The rhombus has no right angle, so the angles do not match.
6–10	6 · FILL Every side is multiplied by 2: $3 \times 2 = 6$, $4 \times 2 = 8$ and $5 \times 2 = 10$.	7 · FILL Every angle of an equilateral triangle is 60° , and one number multiplies every side. Any two are similar.	8 · FILL A flip keeps every side and angle, so A and B are congruent. Congruent shapes are similar, with scale factor 1.	9 · FILL The angles are 60° and 120° in both, and every side is multiplied by 3.	10 · white The widths are doubled and the heights are not. A stretch in one direction changes the shape.
11–15	11 · FILL Every angle is 90° , and every side is multiplied by 0.5. B is smaller, and that is allowed.	12 · FILL Both have sides 3, 4 and 5, so they are congruent. Congruent shapes are similar, with scale factor 1.	13 · FILL Both have a right angle and two equal sides, so their angles are 90° , 45° and 45° . One number multiplies every side.	14 · white Every side is 2 longer, but adding is not multiplying. $4 \times 1.5 = 6$, but $3 \times 1.5 = 4.5$, not 5.	15 · white The equilateral triangle has 60° angles. The other triangle has a 90° angle.
16–20	16 · FILL A dilation multiplies every side by $\frac{1}{2}$ and keeps the angles. A flip changes nothing.	17 · white Every side is doubled, but the square has 90° angles and the rhombus has a 60° angle.	18 · white The long side is multiplied by 1.5 and the short side by 2. Adding 2 is not multiplying.	19 · white Every angle is 90° , but the rectangle is twice as long as it is wide and the square is not.	20 · white The sides are the same, but one angle is 60° and the other is 80° .
21–25	21 · FILL B is A turned, so they are congruent. Congruent shapes are similar, with scale factor 1.	22 · white Two sides are doubled, but the side of 5 is not. No one number works.	23 · white Every side is doubled, but the rectangle has 90° angles and the parallelogram has a 70° angle.	24 · white The dilation keeps the shape, but the stretch makes the heights 4 times as long and the widths only 2 times.	25 · white Every angle is 90° , but one side is multiplied by 1 and the other by 2.