

# MYSTERY PICTURE

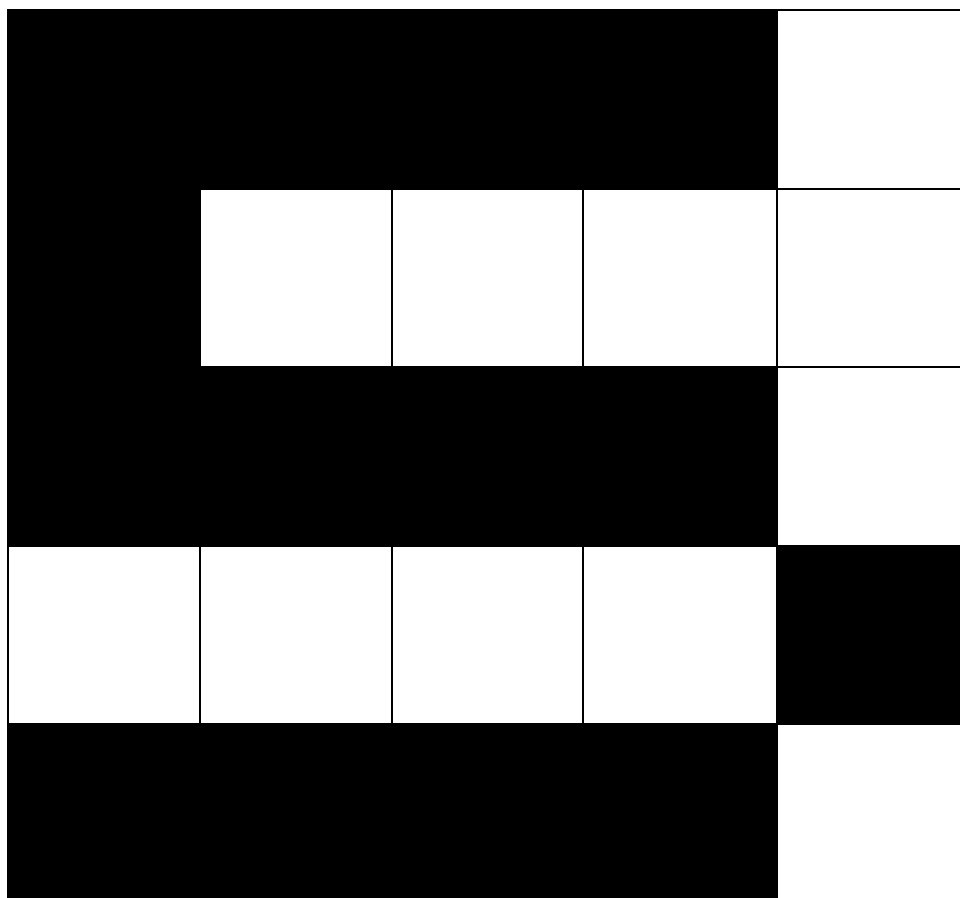


## DILATIONS IN THE COORDINATE PLANE

### Dilations: Is That the Image?

25 squares · a center, a point and a scale factor · count from the center, not from the origin

**FREE**



1. **Hand out page 3**, one per student. Students need pencils, and a ruler helps.
2. **Say this once:** *“Each square has its own center  $C$ . Count the squares from  $C$  to  $P$ . Then count from  $C$  to  $P'$ . Is  $P'$  the correct image? If yes, fill the square with slanted lines. If no, leave it white.”*
3. **When they finish, they look at the picture.** If part of it is missing, or one square does not fit, they check that square again.

**Student sheet** page 3, one per student. It says in one sentence where an image lies.

**Answers** page 4. It shows the finished picture and the reason for every square.

**Fourteen squares are filled and eleven are white. The finished picture is the number 5.** No coordinates are printed in any square. The student counts grid squares from the center  $C$ , not from the origin.

**Each white square shows a common mistake.** In three of them,  $P'$  is where the rule  $(x, y) \rightarrow (kx, ky)$  puts it. That rule is right only when the center is the origin. In one, the center was taken away and never added back. In one, the scale factor was added instead of multiplied. In one, the scale factor was used upside down. Three more are on the line through  $C$  and  $P$ , but too far, too near, or on the wrong side of  $C$ . In two, the two numbers of the step from  $C$  are swapped.

**Half a method is not enough, and the picture shows it.** A student who checks only that  $C$ ,  $P$  and  $P'$  are on one line gets four squares wrong. A student who checks only the distance from  $C$  gets three wrong. Every simple guessing rule, such as filling every square where  $P'$  is farther from  $C$  than  $P$  is, gets at least eleven 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

Is that the image?

Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

**In each square, the open square  $\square$  is the center  $C$ . The dot  $\bullet$  is the point  $P$ . The open circle  $\circ$  is the point  $P'$ . Is  $P'$  the image of  $P$  under the dilation with center  $C$  and the scale factor shown? If yes, fill the square with slanted lines. If no, leave it white. The image is on the line from  $C$  through  $P$ . Scale factor 2 means it is 2 times as far from  $C$  as  $P$  is. Count the squares from  $C$  to  $P$ : how many right or left, and how many up or down. Then count from  $C$  to  $P'$ . When you finish, look at the picture. If part of it is missing, or one square does not fit, check that square again.**

|                           |                          |                            |                          |                            |
|---------------------------|--------------------------|----------------------------|--------------------------|----------------------------|
| 1<br>Scale factor 3<br>   | 2<br>Scale factor 2<br>  | 3<br>Scale factor 1/2<br>  | 4<br>Scale factor 2<br>  | 5<br>Scale factor 2<br>    |
| 6<br>Scale factor 1/2<br> | 7<br>Scale factor 2<br>  | 8<br>Scale factor 2<br>    | 9<br>Scale factor 2<br>  | 10<br>Scale factor 2<br>   |
| 11<br>Scale factor 3<br>  | 12<br>Scale factor 2<br> | 13<br>Scale factor 1/2<br> | 14<br>Scale factor 3<br> | 15<br>Scale factor 2<br>   |
| 16<br>Scale factor 2<br>  | 17<br>Scale factor 2<br> | 18<br>Scale factor 2<br>   | 19<br>Scale factor 3<br> | 20<br>Scale factor 1/2<br> |
| 21<br>Scale factor 2<br>  | 22<br>Scale factor 3<br> | 23<br>Scale factor 1/2<br> | 24<br>Scale factor 2<br> | 25<br>Scale factor 2<br>   |

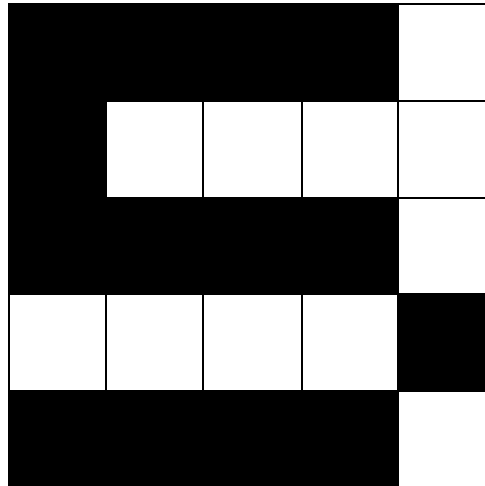


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# Mystery Picture — answers

For the teacher

The finished sheet is **the number 5**. The table reads left to right, as the sheet does. A step such as (2, -1) means 2 squares right and 1 square down. The image of  $P$  is always  $k$  times the step from  $C$  to  $P$ , counted from  $C$ .



|       |                                                                                                                                                      |                                                                                                                                            |                                                                                                                                        |                                                                                                                                       |                                                                                                                                                       |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1–5   | <b>FILL.</b> From $C$ to $P$ is (1, -1). 3 times that is (3, -3), and $P'$ is there.                                                                 | <b>FILL.</b> From $C$ to $P$ is (2, -1). 2 times that is (4, -2), and $P'$ is there.                                                       | <b>FILL.</b> From $C$ to $P$ is (-4, -2). 1/2 times that is (-2, -1), and $P'$ is there.                                               | <b>FILL.</b> From $C$ to $P$ is (2, 1). 2 times that is (4, 2), and $P'$ is there.                                                    | <b>White.</b> From $C$ to $P$ is (1, -2), so $P'$ should be (2, -4) from $C$ . It is (3, -3). $P'$ is 2 times $P$ , as if the center were the origin. |
| 6–10  | <b>FILL.</b> From $C$ to $P$ is (-4, -2). 1/2 times that is (-2, -1), and $P'$ is there.                                                             | <b>White.</b> From $C$ to $P$ is (1, 1), so $P'$ should be (2, 2) from $C$ . It is (0, 4). The center was taken away but never added back. | <b>White.</b> From $C$ to $P$ is (2, 1), so $P'$ should be (4, 2) from $C$ . It is (6, 3). $P'$ is on the line, but too far from $C$ . | <b>White.</b> From $C$ to $P$ is (-2, 1), so $P'$ should be (-4, 2) from $C$ . It is (0, 3). 2 was added to each number of $P$ .      | <b>White.</b> From $C$ to $P$ is (2, 1), so $P'$ should be (4, 2) from $C$ . It is (3, 0). $P'$ is 2 times $P$ , as if the center were the origin.    |
| 11–15 | <b>FILL.</b> From $C$ to $P$ is (-1, 1). 3 times that is (-3, 3), and $P'$ is there.                                                                 | <b>FILL.</b> From $C$ to $P$ is (2, -1). 2 times that is (4, -2), and $P'$ is there.                                                       | <b>FILL.</b> From $C$ to $P$ is (4, -2). 1/2 times that is (2, -1), and $P'$ is there.                                                 | <b>FILL.</b> From $C$ to $P$ is (2, 1). 3 times that is (6, 3), and $P'$ is there.                                                    | <b>White.</b> From $C$ to $P$ is (2, 1), so $P'$ should be (4, 2) from $C$ . It is (-4, -2). $P'$ is on the wrong side of $C$ .                       |
| 16–20 | <b>White.</b> From $C$ to $P$ is (-1, 1), so $P'$ should be (-2, 2) from $C$ . It is (1, 0). $P'$ is 2 times $P$ , as if the center were the origin. | <b>White.</b> From $C$ to $P$ is (4, 2), so $P'$ should be (8, 4) from $C$ . It is (2, 1). The scale factor was used upside down, as 1/2.  | <b>White.</b> From $C$ to $P$ is (1, 2), so $P'$ should be (2, 4) from $C$ . It is (4, 2). The two numbers of the step are swapped.    | <b>White.</b> From $C$ to $P$ is (1, -1), so $P'$ should be (3, -3) from $C$ . It is (2, -2). $P'$ is on the line, but too near $C$ . | <b>FILL.</b> From $C$ to $P$ is (-2, 2). 1/2 times that is (-1, 1), and $P'$ is there.                                                                |
| 21–25 | <b>FILL.</b> From $C$ to $P$ is (-1, -2). 2 times that is (-2, -4), and $P'$ is there.                                                               | <b>FILL.</b> From $C$ to $P$ is (-2, -1). 3 times that is (-6, -3), and $P'$ is there.                                                     | <b>FILL.</b> From $C$ to $P$ is (2, 4). 1/2 times that is (1, 2), and $P'$ is there.                                                   | <b>FILL.</b> From $C$ to $P$ is (2, 1). 2 times that is (4, 2), and $P'$ is there.                                                    | <b>White.</b> From $C$ to $P$ is (1, 2), so $P'$ should be (2, 4) from $C$ . It is (4, 2). The two numbers of the step are swapped.                   |