

# SCAVENGER HUNT



## DILATIONS: CENTER AND SCALE FACTOR

### Dilations: Center and Scale Factor

Image distance · original distance · the scale factor · the cards check the answers

**FREE**

ANSWER

**14**

A dilation has center O and scale factor  $\frac{3}{4}$ . Point P is 12 cm from O.  
How far from O is its image P'?

A scale factor less than one brings a point closer to the center.

**P**

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1. **Tape the 16 cards around the room**, in any order. Each card has a large letter in its bottom left corner. Start each group at a different one of these eight cards: *P R F K G D N A*.
2. **Say this once:** *“The image is on the ray from the center through the point. Its distance from the center is the scale factor times the original distance. Never add. Eight right answers bring you back to your first card.”*
3. **Groups solve the card, then find the card with that answer at the top.**

|                     |                                                                                                                                            |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>16 cards</b>     | pages 3–10, one copy. There are two cards on each sheet, so cut the stack once.                                                            |
| <b>Record sheet</b> | page 11, one per student. Three small pictures on it show the center and the scale factor, a factor more than 1, and a factor less than 1. |
| <b>Answers</b>      | pages 12–13, for you only. Do not put them up in the room.                                                                                 |

**Every card asks for one number.** Four cards give the factor and a distance, and ask for the image’s distance. Two cards give the factor and the image’s distance, and ask for the original distance. Four cards give two distances and ask for the factor. Four cards give one point and its image, and ask for the image of another point. One card gives a point that is its own image and asks for the factor. One card says that every point is its own image and asks for the factor. The factors are written as fractions, decimals and a percent on purpose, because students need to read all three. Students write every answer as a whole number or a decimal. Nothing here is a scale drawing. The scale factor is only the number that multiplies each distance from the center.

**Eight of the 16 cards make the ring. The other eight are where a wrong answer goes.** They look like the other cards. A group may turn the factor upside down, multiply where it should divide, add the same amount to every distance, or say 0 for a point that does not move. Then its answer is at the top of one of those eight cards. The group solves that card, and its answer sends the group back to the card it got wrong. If the group goes wrong there too, it goes to another of those cards, never onto the ring.

**Count the filled lines on each record sheet.** A clean run is **eight lines**. Every wrong answer adds two more lines. The small slanted line under each question is a tip. A group that came by a wrong answer finds there what to check. A group that came by a right answer skips it. One card asks for the scale factor when P is its own image, and many students answer 0. Settle it in one sentence: the factor is 1, because a factor of 0 would send every point to the center.



**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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ANSWER

**1**

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A dilation with center O sends S to S' and T to T'. S is 4 cm from O. S' is 7 cm from O. T is 8 cm from O. How far from O is T'?

*Find how many times as far from the center S' is. Then use that for T.*

**A**

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ANSWER

**16**

---

A dilation with center O sends S to S' and T to T'. S is 2.5 cm from O. S' is 3.5 cm from O. T is 10 cm from O. How far from O is T'?

*Multiply the distance by the scale factor. Do not divide by it.*

**B**

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ANSWER

**11**

---

A dilation with center O leaves every point where it is. What is the scale factor?

*Is  $T'$  the same number of times as far from the center as  $T$ ? Check it.*

**C**

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ANSWER

**1.25**

---

A dilation has center O and scale factor 150%. Point P is 30 cm from O. How far from O is its image  $P'$ ?

*A percent is out of 100. Write the scale factor as a decimal first.*

**D**

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ANSWER

**2.5**

---

A dilation has center O and scale factor 0.75. Point P is 12 cm from O. How far from O is its image P'?

*Put the image distance on top of the fraction and the original distance below.*

**E**

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ANSWER

**0.4**

---

A dilation with center O sends S to S' and T to T'. S is 6 cm from O. S' is 9 cm from O. T is 14 cm from O. How far from O is T'?

*A dilation multiplies each distance from the center. It does not add.*

**F**

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ANSWER

**8**

---

A dilation with center O sends P to P'. P is 16 cm from O. P' is 20 cm from O. What is the scale factor?

*Is the image farther from the center or closer? Check the factor against that.*

**G**

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ANSWER

**17**

---

A dilation with center O sends P to P'. P is 10 cm from O. P' is 4 cm from O. What is the scale factor?

*Adding one amount to each distance is not a dilation. How many times as far is it?*

**H**

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ANSWER

**O**

---

A dilation has center O and scale factor 1.5. Point P is 30 cm from O. How far from O is its image P'?

*A factor of 0 sends every point onto the center. Is that what happens to P?*

**J**

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ANSWER

**21**

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A dilation has center O and scale factor  $\frac{5}{2}$ . The image P' is 20 cm from O. How far from O is the original point P?

*Which distance does the card give: the original or the image?*

**K**

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ANSWER

**0.8**

---

A dilation has center O and scale factor 2.5. The image P' is 20 cm from O. How far from O is the original point P?

*Is the image farther from the center here? Then the factor is more than one.*

**L**

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ANSWER

**20**

---

A dilation with center O sends P to P'. P is 8 cm from O. P' is 10 cm from O. What is the scale factor?

*A factor more than one puts the image farther from the center. Is your answer farther?*

**M**

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ANSWER

**45**

---

A dilation with center O sends point P to itself. P is not O. What is the scale factor?

*Does P move at all? Think about what the factor does to its distance from O.*

**N**

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ANSWER

**14**

---

A dilation has center O and scale factor  $\frac{3}{4}$ . Point P is 12 cm from O. How far from O is its image P'?

*A scale factor less than one brings a point closer to the center.*

**P**

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ANSWER

**50**

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A dilation with center O sends S to S' and T to T'. S is 5 cm from O. S' is 15 cm from O. T is 7 cm from O. How far from O is T'?

*The image is  $k$  times as far from the center as the original. Which one does the card give?*

**Q**

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ANSWER

**9**

---

A dilation with center O sends P to P'. P is 20 cm from O. P' is 8 cm from O. What is the scale factor?

*Scale factor = image distance  $\div$  original distance. Which point is the image?*

**R**

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# Scavenger Hunt — where I went

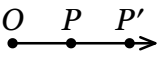
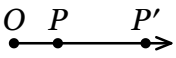
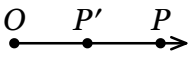
*Dilations: center and scale factor*

Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

Solve the card you are at and fill in one line. Then find the card with your answer at the top. Write every answer as a whole number or a decimal. A clean run is eight lines. **Each card has a small slanted line under its question. If you are on a card because you went wrong, that line says what to check. If you were right, skip it.**

|                                                                                                                                                                                                     |                                                                                                                                                       |                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>center O • scale factor k</b><br/> <math>k = \text{image distance} \div \text{original distance}</math></p> |  <p><b>k more than 1</b><br/> <i>P' is farther from O than P</i></p> |  <p><b>k less than 1</b><br/> <i>P' is closer to O than P</i></p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|

| Card letter | My working | My answer |
|-------------|------------|-----------|
| 1           |            |           |
| 2           |            |           |
| 3           |            |           |
| 4           |            |           |
| 5           |            |           |
| 6           |            |           |
| 7           |            |           |
| 8           |            |           |
| 9           |            |           |
| 10          |            |           |

**Where does a dilation always put the image of a point?**

Every number stands for a letter. Write the letter for each of your answers in the box above that number. Leave the other boxes empty. Then read the boxes you filled, from left to right. **If they do not spell three words, one answer is wrong.**

0 = Y   0.4 = O   0.8 = A   1 = N   1.25 = T   2.5 = R   8 = H   9 = E   11 = E   14 = R   16 = T   17 = H   20 = N   21 = A   45 = Y  
 50 = O

|    |     |     |    |      |     |    |    |
|----|-----|-----|----|------|-----|----|----|
|    |     |     |    |      |     |    |    |
| 0  | 0.4 | 0.8 | 1  | 1.25 | 2.5 | 8  | 9  |
|    |     |     |    |      |     |    |    |
| 11 | 14  | 16  | 17 | 20   | 21  | 45 | 50 |



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# Scavenger Hunt — answers

For the teacher

This is the ring, in order. A group may start at any card on it. Wherever it starts, eight right answers bring it back to that card.

**P → R → F → K → G → D → N → A → P**

The joke on the record sheet is “**Where does a dilation always put the image of a point?**” The answer is *ON THE RAY*. Students read it in the boxes, which are in order of the numbers.

The answers on the ring, smallest first: 0.4 = O, 1 = N, 1.25 = T, 8 = H, 9 = E, 14 = R, 21 = A, 45 = Y, which spells ON THE RAY.

| Card       | Right answer, and why                                                                                 | Wrong answer, and the mistake behind it                                               | Letter for the number at its top |
|------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------|
| 1 <b>P</b> | <b>9.</b> Multiply the distance by the scale factor: $12 \times 3/4 = 9$ .                            | <b>16.</b> It divides 12 by $3/4$ instead of multiplying.                             | R                                |
| 2 <b>R</b> | <b>0.4.</b> The factor is the image distance divided by the original distance: $8 \div 20 = 0.4$ .    | <b>2.5.</b> It is $20 \div 8$ , the original distance divided by the image distance.  | E                                |
| 3 <b>F</b> | <b>21.</b> The factor is $9 \div 6 = 1.5$ , so T' is $14 \times 1.5 = 21$ cm from O.                  | <b>17.</b> It adds 3 cm, the same amount S moved, instead of multiplying.             | O                                |
| 4 <b>K</b> | <b>8.</b> P' is $5/2$ times as far from O as P, so divide: $20 \div 5/2 = 8$ .                        | <b>50.</b> It multiplies 20 by $5/2$ , as if P' were the original point.              | A                                |
| 5 <b>G</b> | <b>1.25.</b> The factor is the image distance divided by the original distance: $20 \div 16 = 1.25$ . | <b>0.8.</b> It is $16 \div 20$ , the original distance divided by the image distance. | H                                |
| 6 <b>D</b> | <b>45.</b> Multiply the distance by the scale factor: $30 \times 150\% = 45$ .                        | <b>20.</b> It divides 30 by 150% instead of multiplying.                              | T                                |
| 7 <b>N</b> | <b>1.</b> P stays the same distance from O, so its distance is multiplied by 1.                       | <b>0.</b> The student thinks a point that does not move has a factor of 0.            | Y                                |
| 8 <b>A</b> | <b>14.</b> The factor is $7 \div 4 = 1.75$ , so T' is $8 \times 1.75 = 14$ cm from O.                 | <b>11.</b> It adds 3 cm, the same amount S moved, instead of multiplying.             | N                                |

**Each wrong answer in the table is the number at the top of a card off the ring.** Those cards are on the next page. Each wrong answer comes from a common mistake about dilations, not from a slip in arithmetic.

# Scavenger Hunt — the cards off the ring

For the teacher

These eight cards are where a wrong answer goes. **A group never reaches one by being right.** The number at the top of each card is the wrong answer from one ring card. Its own answer is the number at the top of that ring card, so the group goes back to the card it got wrong. Each card asks the same kind of question as the ring card before it, with other numbers or with the factor written another way. So a group that goes wrong twice is never sent forward.

| Card     | Right answer, and why                                                                                | Wrong answer, and the mistake behind it                                              | Letter for the number at its top |
|----------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------|
| <b>B</b> | <b>14.</b> The factor is $3.5 \div 2.5 = 1.4$ , so T' is $10 \times 1.4 = 14$ cm from O.             | <b>11.</b> It adds 1 cm, the same amount S moved, instead of multiplying.            | T                                |
| <b>E</b> | <b>9.</b> Multiply the distance by the scale factor: $12 \times 0.75 = 9$ .                          | <b>16.</b> It divides 12 by 0.75 instead of multiplying.                             | R                                |
| <b>H</b> | <b>0.4.</b> The factor is the image distance divided by the original distance: $4 \div 10 = 0.4$ .   | <b>2.5.</b> It is $10 \div 4$ , the original distance divided by the image distance. | H                                |
| <b>Q</b> | <b>21.</b> The factor is $15 \div 5 = 3$ , so T' is $7 \times 3 = 21$ cm from O.                     | <b>17.</b> It adds 10 cm, the same amount S moved, instead of multiplying.           | O                                |
| <b>L</b> | <b>8.</b> P' is 2.5 times as far from O as P, so divide: $20 \div 2.5 = 8$ .                         | <b>50.</b> It multiplies 20 by 2.5, as if P' were the original point.                | A                                |
| <b>M</b> | <b>1.25.</b> The factor is the image distance divided by the original distance: $10 \div 8 = 1.25$ . | <b>0.8.</b> It is $8 \div 10$ , the original distance divided by the image distance. | N                                |
| <b>J</b> | <b>45.</b> Multiply the distance by the scale factor: $30 \times 1.5 = 45$ .                         | <b>20.</b> It divides 30 by 1.5 instead of multiplying.                              | Y                                |
| <b>C</b> | <b>1.</b> Every distance from O stays the same, so every distance is multiplied by 1.                | <b>0.</b> The student thinks a point that does not move has a factor of 0.           | E                                |

**Other mistakes never lead onto the ring.** A group may add the factor to the distance, take the factor away, or give the difference of two distances as the factor. On a card with two points, it may turn the factor upside down. None of those answers is at the top of a card on the ring.

**Guessing does not work.** Every simple rule that uses only the printed numbers, such as multiplying them, gives the right answer on at most six of the 16 cards.