

SCAVENGER HUNT



DILATING LINES, SEGMENTS AND ANGLES

Dilating Segments and Angles

Image lengths · scale factors · angle measures · the cards check the answers

FREE

ANSWER

7

A dilation has scale factor 2. Angle ABC measures 36° . What does its image, angle A'B'C', measure?

The measure of an angle does not depend on how long its arms are.

J

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Scavenger Hunt — how to run it

a full class period

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: *J M G K Q E P D*.
2. **Say this once:** *“A dilation multiplies every length by the scale factor. It does not change any angle. 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.**

16 cards	pages 3–10, one copy. There are two cards on each sheet, so cut the stack once.
Record sheet	page 11, one per student. Five small pictures on it show what a dilation is and the four results of this lesson.
Answers	pages 12–13, for you only. Do not put them up in the room.

Every card asks for one number. Four cards give a segment and the factor, and ask for the length of its image. One card gives an image segment and the factor, and asks for the original length. Two cards give two lengths and ask for the factor. Two cards give one segment and its image, and ask for the image of another segment. One card gives one segment and its image, and asks for the original of another image segment. Three cards give an angle and the factor, and ask for the image angle. Three cards give an angle, the factor and the two lengths of one arm, and ask for the image angle. Students write every answer as a whole number or a decimal, with no units.

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 multiply an angle by the factor, because an angle looks bigger when its arms are longer. It may give the image segment the same length as the original, turn the factor upside down, or multiply where it should divide. 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. Some cards give the two lengths of one arm on purpose: the arm changes length, but the angle does not.



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

28

A dilation has scale factor 0.5. Angle FGH measures 50° . Its arm GF is 8 cm long, so $G'F'$ is 4 cm long. What does angle $F'G'H'$ measure?

Multiply the length by the scale factor. Do not divide by it.

A

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ANSWER

96

A dilation takes segment XY to segment $X'Y'$. XY is 6 cm long. $X'Y'$ is 15 cm long. What is the scale factor?

The arms grow, but the opening between them stays the same.

B

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ANSWER

0.4

One dilation takes segment AB to A'B' and segment CD to C'D'. AB is 2 cm long and A'B' is 6 cm long. CD is 4.5 cm long. How long is C'D'?

Put the image length on top of the fraction and the original length below.

C

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ANSWER

50

A dilation has scale factor $\frac{1}{2}$. Segment ST is 14 cm long. It does not lie on a line through the center. How long is its image S'T'?

A factor less than one makes a segment shorter. Multiply by the factor.

D

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ANSWER

15

A dilation has scale factor 4. The image segment $G'H'$ is 22 cm long. It does not lie on a line through the center. How long is the original segment GH ?

Which length does the card give: the original or the image?

E

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ANSWER

72

A dilation has scale factor 0.5. Segment UV is 14 cm long. It does not lie on a line through the center. How long is its image $U'V'$?

A dilation keeps every angle measure. Only the lengths change.

F

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ANSWER

13.5

A dilation takes segment MN to segment M'N'. MN is 8 cm long. M'N' is 20 cm long. What is the scale factor?

Scale factor = image length $\div$ original length. Which segment is the image?

G

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ANSWER

25

One dilation takes segment AB to A'B' and segment CD to C'D'. AB is 8 cm long and A'B' is 32 cm long. C'D' is 22 cm long. How long is CD?

A factor less than one shrinks lengths, not angles. Check the measure.

H

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ANSWER

7

A dilation has scale factor 2. Angle ABC measures 36° . What does its image, angle A'B'C', measure?

The measure of an angle does not depend on how long its arms are.

J

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ANSWER

2.5

A dilation has scale factor 1.5. Angle DEF measures 64° . Its arm ED is 4 cm long, so E'D' is 6 cm long. What does angle D'E'F' measure?

Longer arms make an angle look bigger. Does its measure change?

K

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ANSWER

4.5

A dilation has scale factor 2. Angle RST measures 36° . Its arm SR is 3 cm long, so S'R' is 6 cm long. What does angle R'S'T' measure?

Parallel does not mean the same length. Is the image longer or shorter?

L

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ANSWER

36

A dilation has scale factor 3. Segment PQ is 4.5 cm long. It does not lie on a line through the center. How long is its image P'Q'?

A dilation with factor k makes each segment k times as long.

M

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ANSWER

88

A dilation has scale factor 2.5. Segment KL is 6 cm long. It does not lie on a line through the center. How long is its image K'L'?

To go from the image to the original, divide by the scale factor.

N

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ANSWER

5.5

A dilation has scale factor $\frac{1}{2}$. Angle JKL measures 50° . What does its image, angle J'K'L', measure?

With a factor less than one, the arms get shorter. What happens to the measure?

P

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ANSWER

64

One dilation takes segment AB to $A'B'$ and segment CD to $C'D'$. AB is 4 cm long and $A'B'$ is 10 cm long. CD is 6 cm long. How long is $C'D'$?

Find the scale factor from the first pair. It is the same for each segment.

Q

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ANSWER

6

A dilation has scale factor $\frac{3}{2}$. Angle UVW measures 64° . What does its image, angle $U'V'W'$, measure?

Every segment in one figure grows by the same factor. Does CD grow too?

R

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Scavenger Hunt — where I went

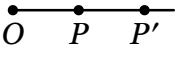
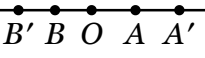
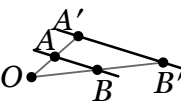
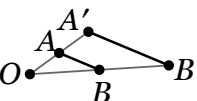
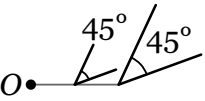
Dilating segments and angles

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, with no units. 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, its line says what to check. If you were right, skip it.**

 center O • scale factor k P' is on ray OP, k times as far from O	 a line through O its image is the same line	 a line not through O its image is a new line, parallel to it	 a segment AB A'B' is k times as long as AB	 an angle its image has the same measure
--	---	--	---	---

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

What does a dilation do to the measure of an angle?

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 two words, one answer is wrong.**

0.4 = O 2.5 = N 4.5 = N 5.5 = O 6 = H 7 = C 13.5 = H 15 = A 25 = C 28 = N 36 = N 50 = G 64 = E 72 = A
88 = E 96 = G

0.4	2.5	4.5	5.5	6	7	13.5	15
25	28	36	50	64	72	88	96



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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.

J → M → G → K → Q → E → P → D → J

The joke on the record sheet is “**What does a dilation do to the measure of an angle?**” The answer is *NO CHANGE*. Students read it in the boxes, which are in order of the numbers.

The answers on the ring, smallest first: 2.5 = N, 5.5 = O, 7 = C, 13.5 = H, 15 = A, 36 = N, 50 = G, 64 = E, which spells NO CHANGE.

Card	Right answer, and why	Wrong answer, and the mistake behind it	Letter for the number at its top
1 J	36. A dilation never changes an angle measure, so the image is still 36° .	72. It multiplies 36° by 2, as if the angle changed size with its arms.	C
2 M	13.5. The image is 3 times as long: $4.5 \times 3 = 13.5$.	4.5. It gives the image the same length as the original.	N
3 G	2.5. The factor is the image length divided by the original length: $20 \div 8 = 2.5$.	0.4. It is $8 \div 20$, the original length divided by the image length.	H
4 K	64. A dilation never changes an angle measure, so the image is still 64° . The arm changes length, but the angle does not.	96. It multiplies 64° by 1.5, as if the angle changed size with its arms.	N
5 Q	15. The factor is $10 \div 4 = 2.5$, so $C'D' = 6 \times 2.5 = 15$.	6. It gives the image the same length as the original.	E
6 E	5.5. The image is 4 times as long as the original, so divide: $22 \div 4 = 5.5$.	88. It multiplies 22 by 4, as if the image were the original.	A
7 P	50. A dilation never changes an angle measure, so the image is still 50° .	25. It multiplies 50° by $1/2$, as if the angle changed size with its arms.	O
8 D	7. The image is $1/2$ times as long: $14 \times 1/2 = 7$.	28. It divides 14 by $1/2$ instead of multiplying.	G

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 letters, other numbers or 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
F	7. The image is 0.5 times as long: $14 \times 0.5 = 7$.	28. It divides 14 by 0.5 instead of multiplying.	A
L	36. A dilation never changes an angle measure, so the image is still 36° . The arm changes length, but the angle does not.	72. It multiplies 36° by 2, as if the angle changed size with its arms.	N
C	13.5. The factor is $6 \div 2 = 3$, so $C'D' = 4.5 \times 3 = 13.5$.	4.5. It gives the image the same length as the original.	O
B	2.5. The factor is the image length divided by the original length: $15 \div 6 = 2.5$.	0.4. It is $6 \div 15$, the original length divided by the image length.	G
R	64. A dilation never changes an angle measure, so the image is still 64° .	96. It multiplies 64° by $3/2$, as if the angle changed size with its arms.	H
N	15. The image is 2.5 times as long: $6 \times 2.5 = 15$.	6. It gives the image the same length as the original.	E
H	5.5. The factor is $32 \div 8 = 4$, so $CD = 22 \div 4 = 5.5$.	88. It multiplies 22 by 4, as if $C'D'$ were the original.	C
A	50. A dilation never changes an angle measure, so the image is still 50° . The arm changes length, but the angle does not.	25. It multiplies 50° by 0.5, as if the angle changed size with its arms.	N

Other mistakes never lead onto the ring. A group may divide an angle by the factor, add the factor to a length or take it away, or give the difference of two lengths as the factor. On a card with two segments, 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 copying the biggest number, gives the right answer on at most six of the 16 cards.