

# Unit 1 Lesson 5

## Dilations

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5) Application

$ABCDE$  is a regular pentagon with center  $X$ .

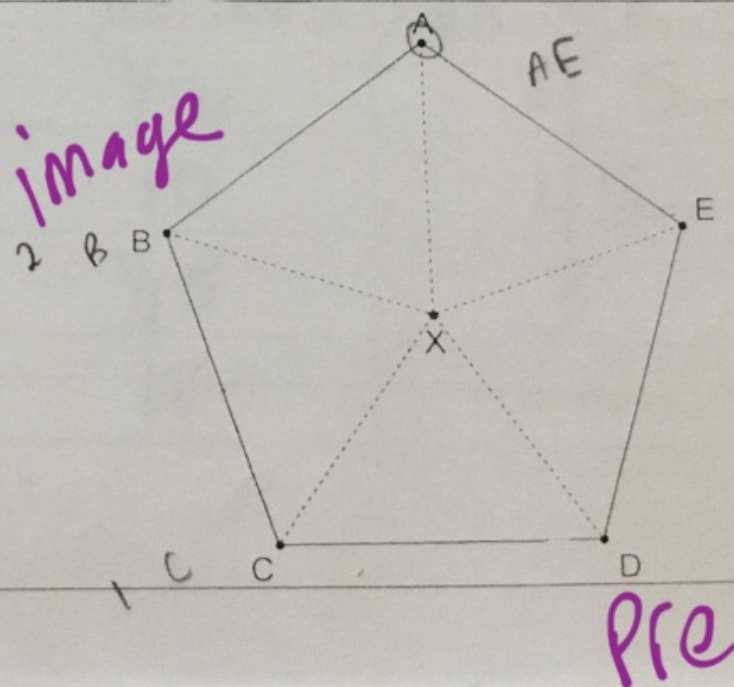
a. Name the image of point  $E$  for a counterclockwise  $72^\circ$  rotation about  $X$ .

b. Given the image for a clockwise  $216^\circ$  rotation about  $X$  is  $\overline{CB}$ . What was its preimage?

$$216 / 72 = 3$$

c. Describe 2 rotations with a preimage of point  $D$  and image of  $B$ .

$216^\circ$  CCW  
 $144^\circ$  CW



### Alice in Wonderland

In the story, Alice's Adventures in Wonderland, Alice changes size many times during her adventures. The changes occur when she drinks a potion or eats a cake. Problems occur throughout her adventures because Alice does not know when she will grow larger or smaller.



#### Part 1

As Alice goes through her adventure, she encounters the following potions and cakes:

Red potion – shrink by  $\frac{1}{9}$

Blue potion – shrink by  $\frac{1}{36}$

Green potion – shrink by  $\frac{1}{15}$

Yellow potion – shrink by  $\frac{1}{4}$

Chocolate cake – grow by 12 times

Red velvet cake – grow by 18 times

Carrot cake – grow by 9 times

Lemon cake – grow by 10 times

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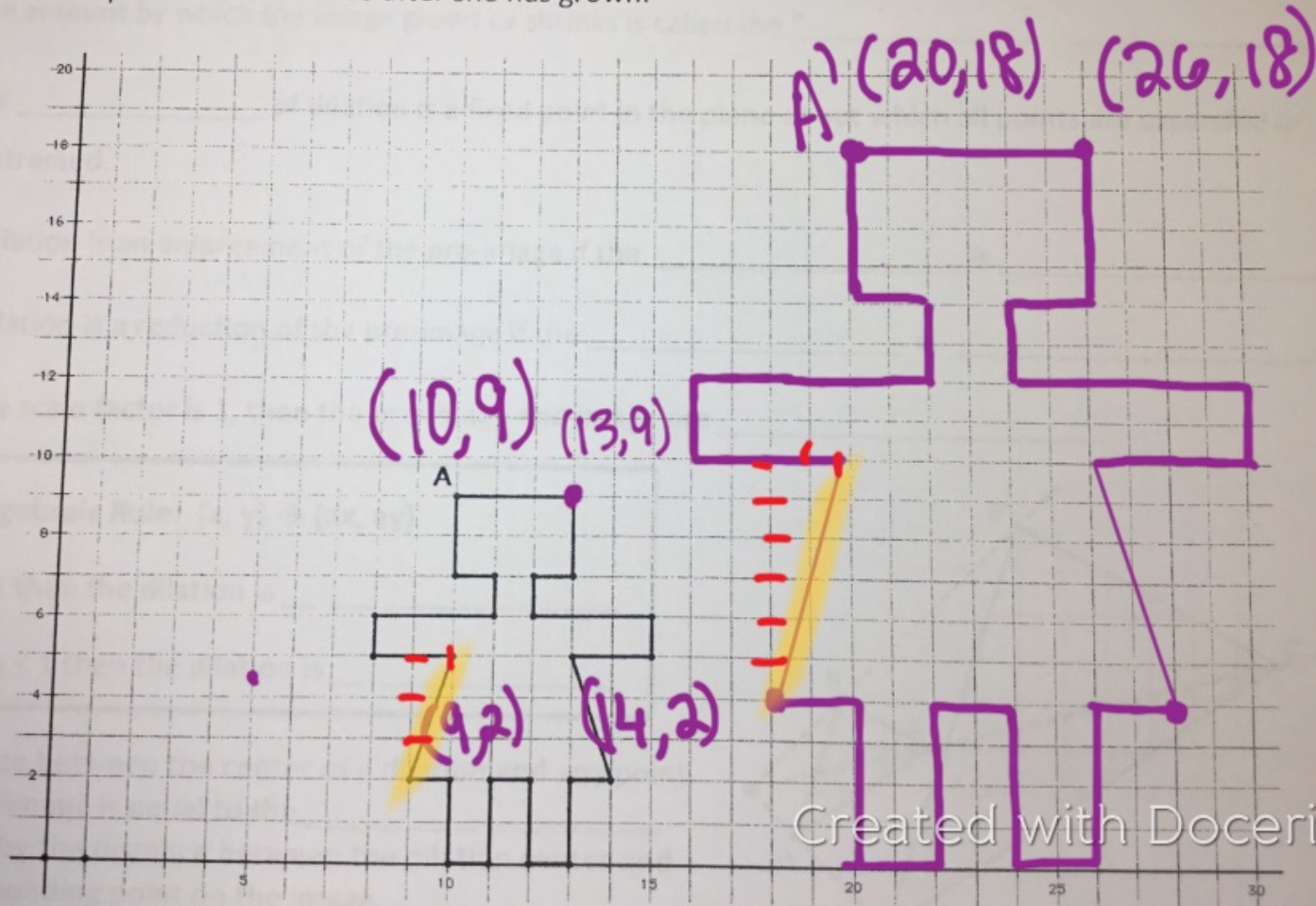
Find Alice's height after she drinks each potion or eats each bite of cake. If everything goes correctly, Alice will return to her normal height by the end.

Starting Height	Alice Eats or Drinks	Scale factor from above	New Height
54 inches	Red potion	$\frac{1}{9}$	6 inches
6 inches	Chocolate cake	$\times 12$	72 inches
72 in	Yellow potion	$\times \frac{1}{4}$	18 in
18	Carrot cake	9	162
162	Blue potion	$\frac{1}{36}$	4.5
4.5	Lemon cake	10	45
45	Green potion	$\frac{1}{15}$	3
3	Red velvet cake	18	54 inches

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B) Plot point  $A'$  such that it is twice as far from the origin as point  $A$ . Do the same with all of the other points  
Connect the points to show Alice after she has grown.



1. How many times larger is the new Alice? double, 2 times as large

2. How much farther away from the origin is the new Alice? 10 units twice as far

3. What are the coordinates for point A? (10,9) Point A'? (20,18)

4. What arithmetic operation do you think happened to the coordinates of A? Multiply by 2

5. Write your conclusion as an Algebraic Rule  $(x, y) \rightarrow$   $(2x, 2y)$


6. What arithmetic operation on the coordinates do you think would shrink Alice in half?  $\times \frac{1}{2}$

7. Write your conclusion as an algebraic rule.  $(\frac{1}{2}x, \frac{1}{2}y)$

8. If Alice shrinks in half, how far away from the origin will her image be from her preimage?  $\frac{1}{2}$  as far, 5

9. Sketch Alice after she shrinks.

10. Choose a diagonal segment on Alice's dress. Calculate the slope of this segment on all three dresses. What do you notice about all three of the slopes?  $= 3$   
What is the name given to this geometric relationship? parallel

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- A **DILATION** stretches or shrinks the original figure. *(Multiply by scale factor)*
- The **description** of a dilation should include the Scale factor, the center of the dilation, and whether the dilation is an enlargement or a reduction.
  - The amount by which the image grows or shrinks is called the "Scale factor."
  - The center of dilation is a fixed point in the plane about which all points are expanded or contracted.
  - A dilation is an enlargement of the pre-image if the Scale factor is  $> 1$ .
  - A dilation is a reduction of the pre-image if the Scale factor is  $0 < r < 1$ .
  - If the scale factor is 1, then the pre-image and image are  $\cong$ , congruent.

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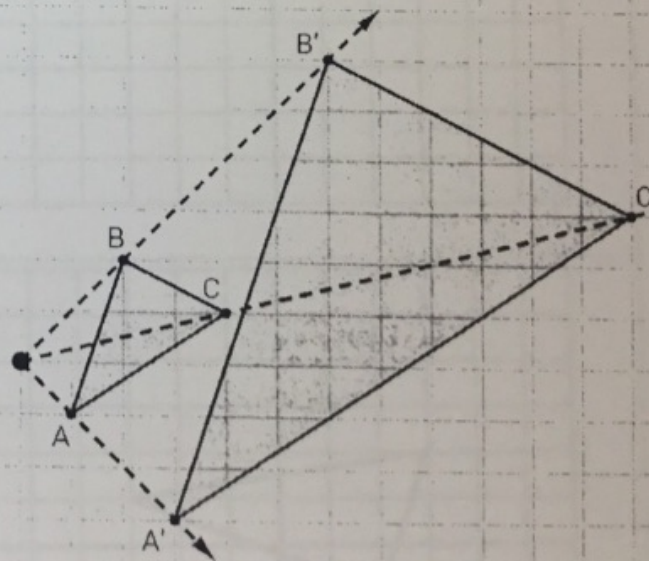


❖ Algebraic Rule:  $(x, y) \rightarrow (ax, ay)$

If  $a > 1$  then the dilation is an enlargement

If  $0 < a < 1$  then the dilation is a reduction

The distance between the center of a dilation and any point on the pre-image is equal to the scale factor multiplied by the distance between the dilation center and the corresponding point on the image.



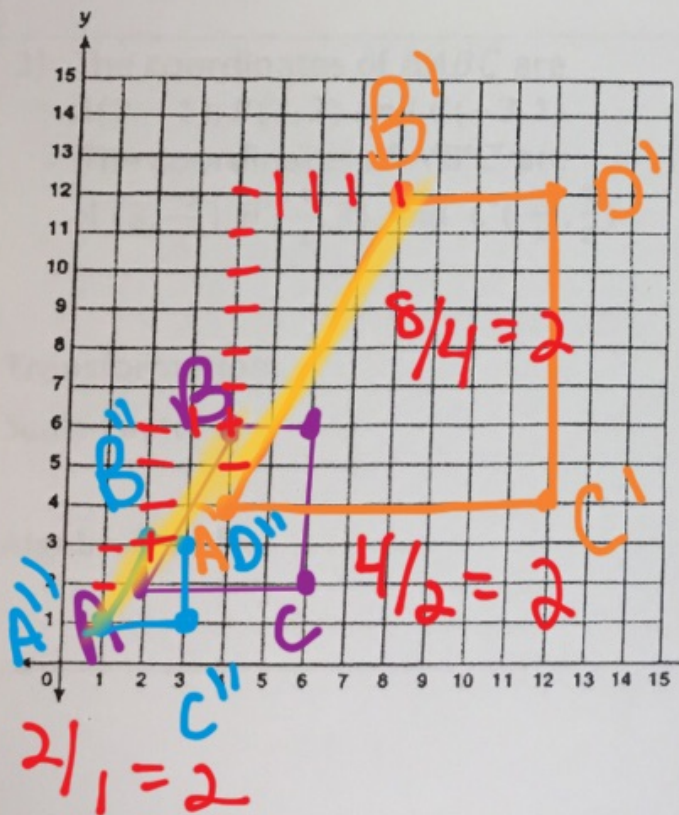
❖ A dilation is SOMETIMES ALWAYS / NEVER

an 'Isometry', when  $SF = 1$

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1. Graph and connect these points:  $A(2, 2)$   $B(4, 6)$   $C(6, 2)$   $D(6, 6)$ .



2. Graph the image on the same coordinate plane by applying a scale factor of 2.

Write the rule:  $T: (x, y) \rightarrow (2x, 2y)$

3. Graph the image on the same coordinate plane by applying a scale factor of  $\frac{1}{2}$ .

Write the rule:  $T: (x, y) \rightarrow (\frac{1}{2}x, \frac{1}{2}y)$

4. Choose a **diagonal segment** on the trapezoid. Calculate the slope of this segment on all three figures.

What do you notice about all three of the slopes?  $= 2$

What is the name given to this geometric relationship?

**parallel**



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