Unit 1

Lesson 5

Dilations

Part 1

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

Red potion – shrink by $\frac{1}{9}$

Chocolate cake – grow by 12 times

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

Red velvet cake – grow by 18 times

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

Carrot cake – grow by 9 times

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

Lemon cake – grow by 10 times

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

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

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.

A'(20, 18)
B'(26, 18)
C'(28, 4)
D'(18, 4)

(10, 9) A
(13, 9) B
D (9, 2)
C (14, 2)
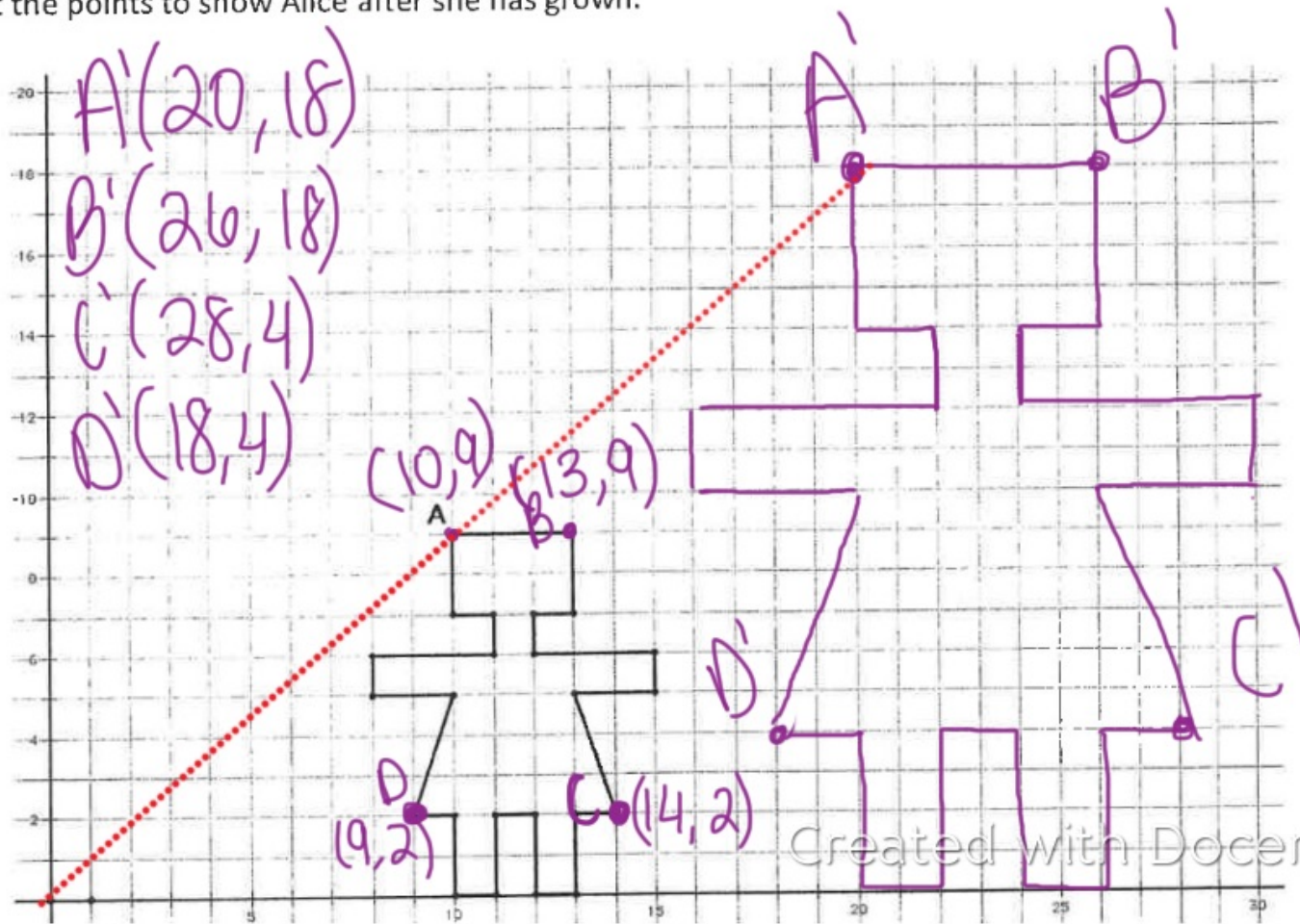
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C) Answer the following questions:

1. How many times larger is the new Alice? **2 times**

2. How much farther away from the origin is the new Alice? **Double**

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? **Multiplication**

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? **Dividing by 2**

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

8. If Alice shrinks in half, how far away from the origin will her image be from her preimage? **Half as far**

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? _____
    What is the name given to this geometric relationship? _____

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➢ A **DILATION** stretches or shrinks the original figure.

- 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 ___$X > 1$___.

- A dilation is a reduction of the pre-image if the ___*scale factor*___ is ___*between −1 and 1*___.

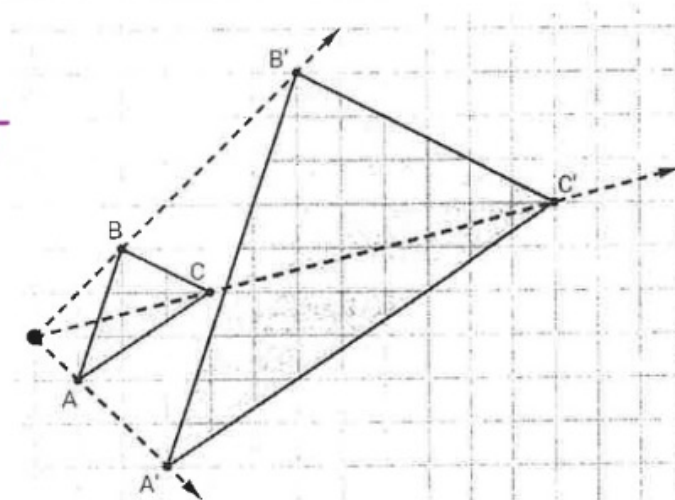- If the scale factor is 1, then the pre-image and image are ___*≅*___.

❖ **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.
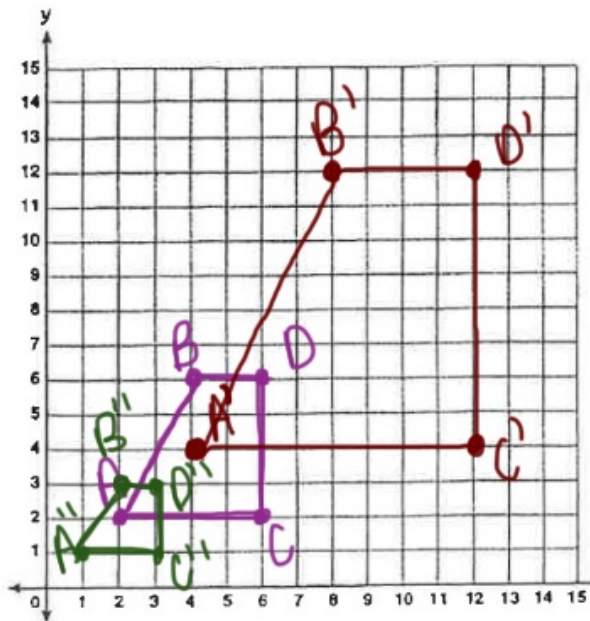
❖ A dilation is   SOMETIMES / ALWAYS / NEVER   an 'Isometry'.

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

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

   Write the rule: $(2x, 2y)$ $D'(12,12)$ $A'(4,4)$ $B'(8,12)$ $C'(12,4)$

   $A(2,2)$

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

   Write the rule: $(\frac{1}{2}x, \frac{1}{2}y)$ $D''(3,3)$ $A''(1,1)$ $B''(2,3)$ $C''(3,1)$

   $A(2,2) \rightarrow (4,6)$

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? _____
   What is the name given to this geometric relationship?

   _____

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9.

5   P   C

P'

$\cancel{12} \cancel{4}$

4

12 6

$4 \to 12$

x

y

$\frac{4x}{4} = \frac{12}{4}$

$x = 3$

SF = 3   Enlarge

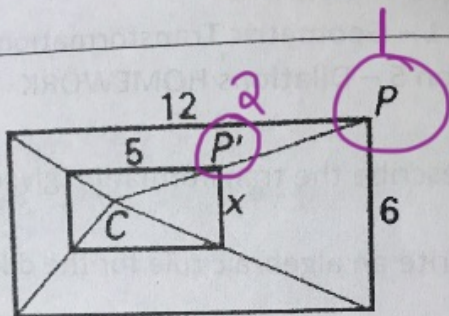x = 15   y = 18

Determine if the following scale factor would create an enl

nent or a reduction. Then find the values

10.

12   2   P

5   P'

C   x   6

$SF = \underline{\quad 5/12 \quad}$ Reduction

$x = \underline{\quad 2.5 \text{ or } 5/2 \quad}$

$6\left(5/12\right)$

Bigger → Smaller

$12 \rightarrow 5$

$$\frac{12x}{12} = \frac{5}{12}$$

S.F.

$\cancel{x} = \dfrac{5}{12}$

$6\left(5/12\right)$

Practice

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