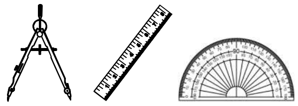
Name: ____________________________________ Date: _________________

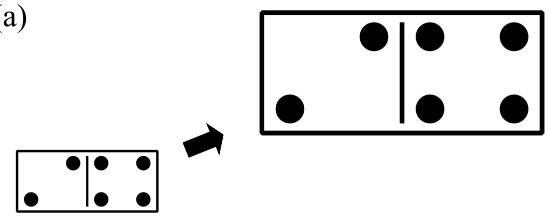


DILATIONS
COMMON CORE GEOMETRY

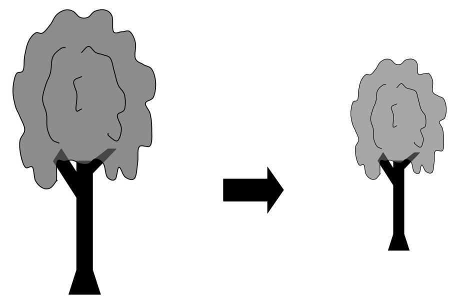
We've seen three fundamental transformations so far that are **rigid motions**, i.e. transformations that **do not change** the **shape** nor the **size** of an object. There is an important transformation, though, that you encounter often in the real world, the **dilation**. This transformation enlarges or shrinks an object by some factor, but leaves its overall shape the same.

***Exercise* #1:** Given the following images, determine the dilation scale factor, *k*.

(a)



(b)



In order for phones, tablets, computers, and other electronic devices to be able to enlarge or shrink images, the process needs to be able to be described mathematically. The definition of a dilation involves two things, a **center of dilation** and a dilation **scale factor**. The technical definition is the following:

DILATIONS

A dilation *D* with a center at point *C* and a scale factor of *k* (where *k* must be positive) is a **function** that has as its input a point in the plane, *A*, and has as its output the image point, A', such that:

1. If *A* is the center of dilation, i.e. *C*, then $D(C)=C$, in other words the dilation does not move the center.

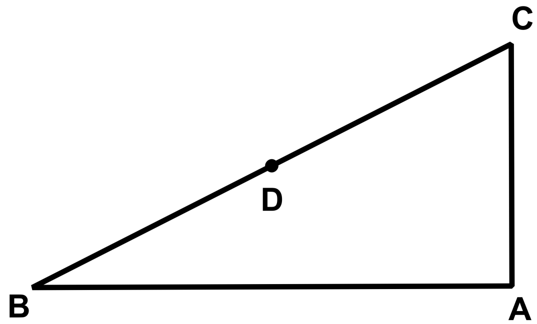
2. If *A* is any other point and $D(A)=A'$ then A' is a point on the ray $\overrightarrow{CA}$ such that $CA'=k\cdot CA$.

***Exercise* #2:** If *C* is the center of the dilation, use your ruler to find the image of *A* after a dilation by a factor of (a) $k=2$ and (b) $k=0.5$. Label the first image point A' and the second A''. Leave all marks. Write down equations relating the length of $\overline{CA}$ to $\overline{CA'}$ and $\overline{CA''}$

Length Equations:

***Exercise* #3:** Given ΔABC shown below, we would like to dilate it using A as a center with a scale factor of 2.

(a) Using a straightedge and a compass, find the image of B and C and label them as B' and C'. Leave all marks. Connect B' and C' to form $\overline{B'C'}$.



(b) Why wouldn't A change its location under this dilation?

(c) Explain why any points along either line $\overleftrightarrow{AC}$ or $\overleftrightarrow{AB}$ will still lie on these lines after the dilation?

(d) D is the midpoint of $\overline{BC}$. Find its image under this same dilation. Does it fall on $\overline{B'C'}$? Does it fall at the midpoint of $\overline{B'C'}$? Check using your ruler.

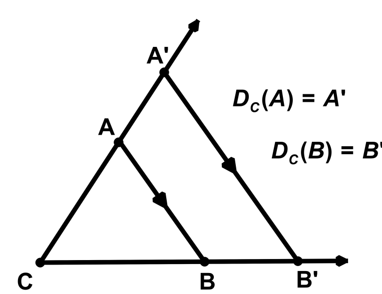
(e) How does the length of $\overline{B'C'}$ compare to the length of $\overline{BC}$? Check using your ruler or compass.

(f) What else seems to be true about the segments $\overline{BC}$ and $\overline{B'C'}$? How can you verify this experimentally?

THE TWO PRIMARY PROPERTIES OF DILATIONS

When a dilation of a line segment $\overline{AB}$ not containing the center by a scale factor of k produces $\overline{A'B'}$ then:

1. $A'B' = k \cdot AB$
2. $\overline{A'B'} \parallel \overline{AB}$

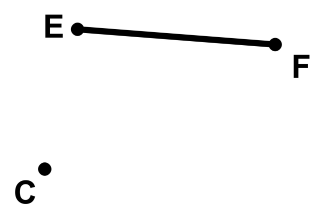


Name: ____________________________________ Date: _________________

DILATIONS
COMMON CORE GEOMETRY HOMEWORK

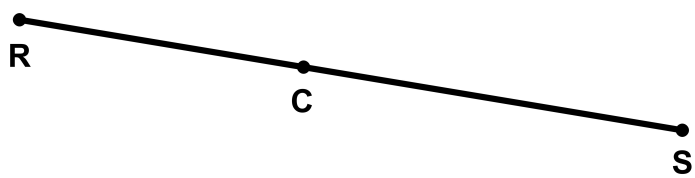
MEASUREMENT AND CONSTRUCTION

1. Given the center point C, construct the dilated image of segment $\overline{EF}$ after a dilation by a scale factor of 3. Use only a compass and straight edge. Label its image $\overline{E'F'}$. Leave all marks.



2. Verify using your compass that $E'F' = 3 \cdot EF$ in the diagram above. Leave your construction marks.

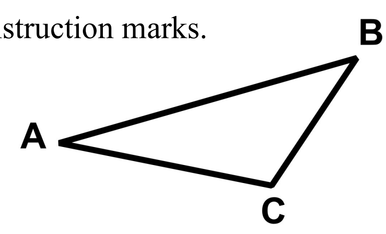
3. In the image below, point C lies on segment $\overline{RS}$. User your ruler to help dilate $\overline{RS}$ using C as a center with a scale factor of $\frac{1}{2}$. Label the image $\overline{R'S'}$.



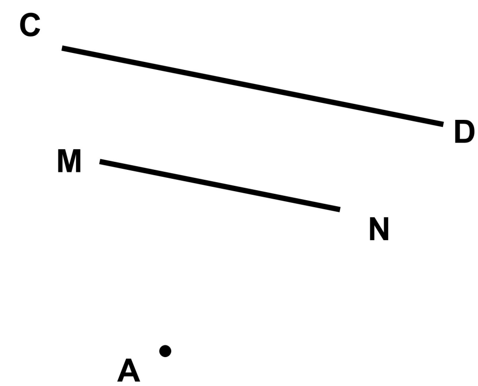
4. Using your ruler, give the measurements of $\overline{RS}$ and $\overline{R'S'}$ in inches and verify that $R'S' = \frac{1}{2}RS$.

$RS =$ $R'S' =$

5. Dilate ΔABC below using A as the center and a scale factor of 2. Leave all construction marks.



6. Line segment $\overline{MN}$ is the image of $\overline{CD}$ after a dilation by a factor k with a center at point A. Using your ruler, determine the value of k to the nearest *hundredth*. Show the work that leads to your answer.



PROBLEM SOLVING/REASONING

7. If $\overline{JK}$ is dilated by a factor of 5 with a center point not on $\overline{JK}$ to produce the image $\overline{J'K'}$, then which of the following is true?

(1) $\overline{J'K'} \parallel \overline{JK}$ and $J'K' = 5JK$

(2) $\overline{J'K'} \perp \overline{JK}$ and $J'K' = 5JK$

(3) $\overline{JK} \parallel \overline{J'K'}$ and $J'K' = \frac{1}{5}JK$

(4) $\overline{JK} \perp \overline{J'K'}$ and $J'K' = \frac{1}{5}JK$ __________

8. If $\overline{RS}$ is dilated by a factor of 4 with a center of R then which of the following is true about the segment joining point S with its image S'? Hint: draw a picture of this one!

(1) $SS' = 4RS$ and $\overline{SS'} \parallel \overline{RS}$

(2) $SS' = \frac{1}{4}RS$ and $\overline{SS'}$ lies on top of $\overline{RS}$

(3) $SS' = \frac{1}{3}RS$ and $\overline{SS'} \perp \overline{RS}$

(4) $SS' = 3RS$ and $\overline{SS'}$ is collinear with $\overline{RS}$ __________

9. Below, ΔABC has had the midpoints of sides $\overline{AB}$ and $\overline{AC}$ marked as D and E with $\overline{DE}$ drawn. Give a dilation, both the center and the scale factor, that would map $\overline{DE}$ onto $\overline{BC}$. Explain why this will work.

Center:

Scale factor:

Explanation: