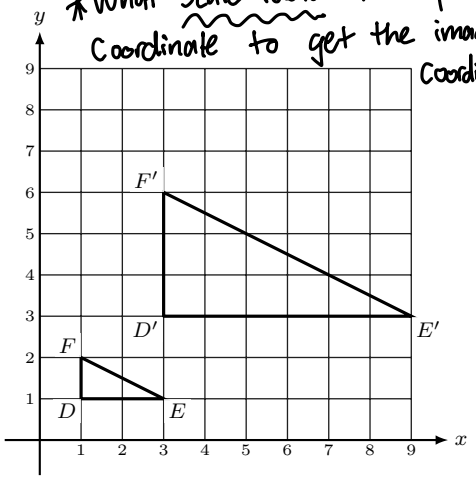
Artifact 6 – Algebraic Rules of Dilations

Driving Question: How can any dilation be written as an algebraic rule?

Example 1



*What scale factor multiplied each pre-image coordinate to get the image coordinate?

Pre-Image	Image
D (1, 1)	D' (3, 3)
E (3, 1)	E' (9, 3)
F (1, 2)	F' (1, 2)

x?

$(x, y) \rightarrow (3 \cdot x, 3 \cdot y)$

Algebraic Rule of a Dilation
*uses multiplication

K = 3

Example 2

Triangle JKL is dilated with the origin as the center of dilation to create triangle $J'K'L'$.

$\triangle JKL$	$\triangle J'K'L'$
$(-6, 8)$	$(-3, 4)$
$(4, -2)$	$(2, -1)$
$(10, 6)$	$(5, 3)$

*Key: When given the pre-image & image coordinates, divide image by pre-image (start with any y or x-value divided by its corresponding pre-image value).

$\frac{\text{image}}{\text{pre-image}} = \frac{4}{8} = \frac{1}{2}$

$\frac{\text{image}}{\text{pre-image}} = \frac{5}{10} = \frac{1}{2}$

$(x, y) \rightarrow \left(\frac{1}{2}x, \frac{1}{2}y\right)$

Same ratio (scale factor or K)

Example 3

Point $P(8, -6)$ is dilated with the origin as the center of dilation. Its image P' is located at $(12, -9)$.

$K = \frac{\text{image}}{\text{pre-image}} = \frac{12}{8} = \frac{3}{2}$

$(x, y) \rightarrow \left(\frac{3}{2}x, \frac{3}{2}y\right)$

Vocabulary

Algebraic representation (rule) of a dilation
Variable scale factor (k)
Similarity

This means the dilation produced Similar figures.

Notes to Forgetful Self

Scale factor	Rule	Scale factor	Rule
2	$(x, y) \rightarrow (2x, 2y)$	$\frac{2}{3}$	$(x, y) \rightarrow \left(\frac{2}{3}x, \frac{2}{3}y\right)$
3	$(x, y) \rightarrow (3x, 3y)$	$\frac{5}{2}$	$(x, y) \rightarrow \left(\frac{5}{2}x, \frac{5}{2}y\right)$
$\frac{1}{2}$	$(x, y) \rightarrow \left(\frac{1}{2}x, \frac{1}{2}y\right)$	k (any)	$(x, y) \rightarrow (kx, ky)$

Not a dilation.

Only translations add/subtract

$(x, y) \rightarrow (x + 2, y + 2)$ is a translation 2 units right, 2 units up

$(x, y) \rightarrow (-x, y)$ is a reflection across the y-axis.