Math 3305 Chapter 3, Sections 3.4 and 3.5 script

Let's look more closely at similar figures and how to create them in a plane.

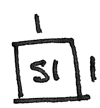
Given a polygon G and a scale factor S, you may create a second polygon H by transforming G into H with a DILATION or a Similarity Transform. Dilations are a proper subset of Similarity Transforms that include a vantage point from which the dilation occurs along emanating vectors and Similarity Transforms are usually along vectors too but can happen on a vertex of the original polygon.

Now suppose G goes to H ($G \rightarrow H$) with scale factor S. Then H can go back to G with scale factor 1/S. Now let's look at the perimeter of G: Pg and the area of G: Ag. It turns out that these are factors of the perimeter and area of H.

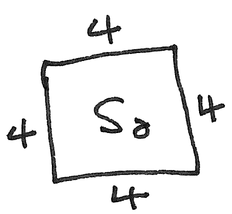
Ph = SPg and Ah = Ssquared Ag

Let's look at squares:

S1 has perimeter 4 and Area 1 squared. S = 4



$P = 4$
$A = 1$



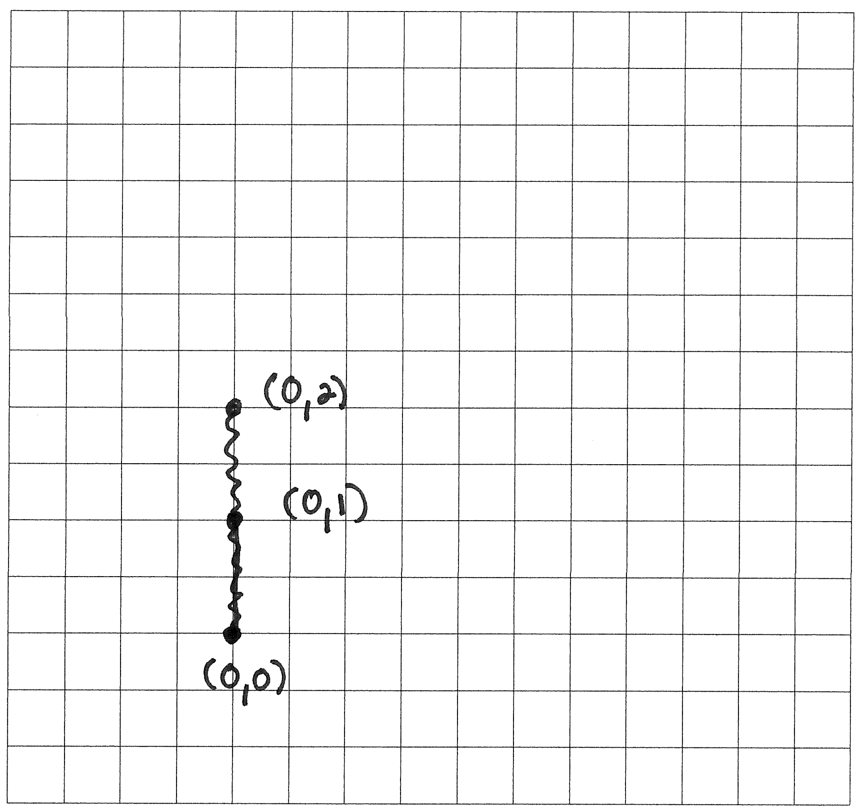
$P = 4(1) + 4(1) + 4(1) + 4(1)$
$= 4(4) \quad \underline{S\ P1}$

$A = 4\cdot 1 \times 4\cdot 1 = 4\cdot 1^{2}$
$\underline{S\ A1}$

Notation for Similarity Transforms

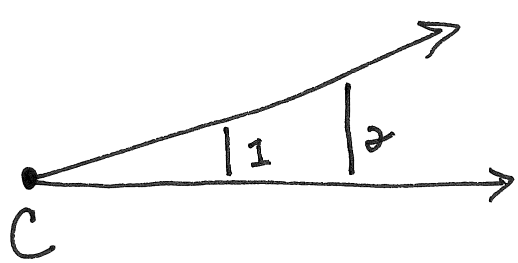
S(3, Point A) means similarity transform by a factor of 3 about Point A in most books. This is handy notation when you don't have point coordinates to work with. Also F(sx, sy) gives similarity transforms in the Cartesian Plane when you do have point coordinates to work with.

Let's look at a line segment from (0,0) to (0,1). Let's dilate it by a factor of 2 about the Origin. S(2, Origin) or F(2x, 2y).

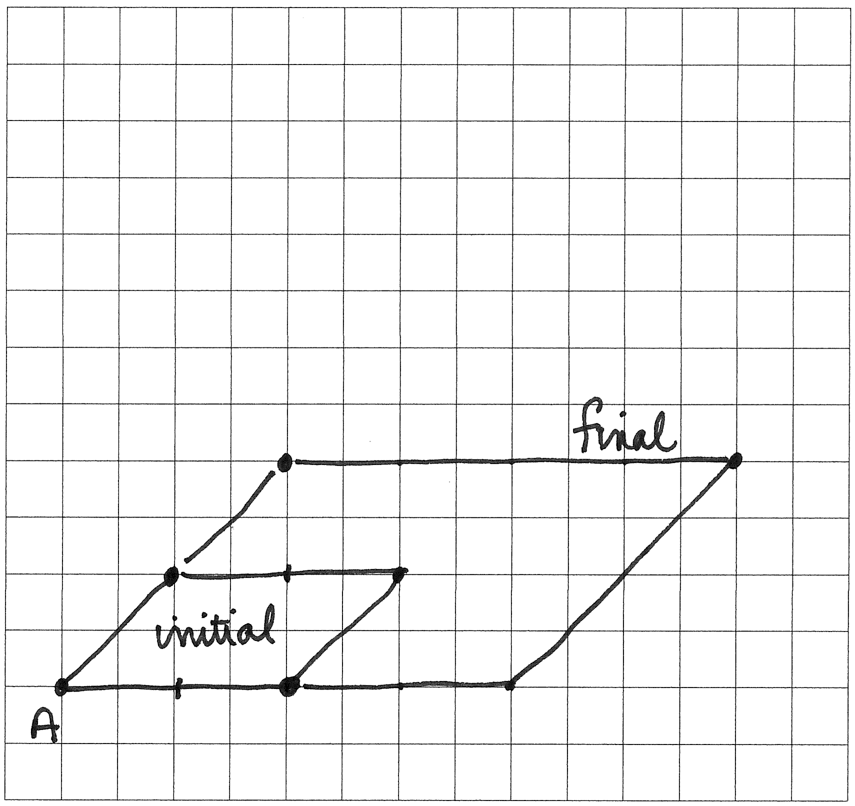


initial		final
(0,0)	$\xrightarrow{\times 2}$	(0,0)
(0,1)	$\xrightarrow{\times 2}$	(0,2)

If I dilate about a point C by a scale factor of 2: S(2, C). Let's look at that:



Now let's up the ante and use a parallelogram. I'll make it's legs measure [redacted] $\sqrt{2}$ and the bases measure 2. And I'll label the bottom left corner A. And the measure of angle A is 45 degrees. Next I'll dilate it by a factor of 2 about A.



Popper 3.4 Question 1

S(5,B) means dilate the polygon by a scale factor of 5 about Point B.

A. True

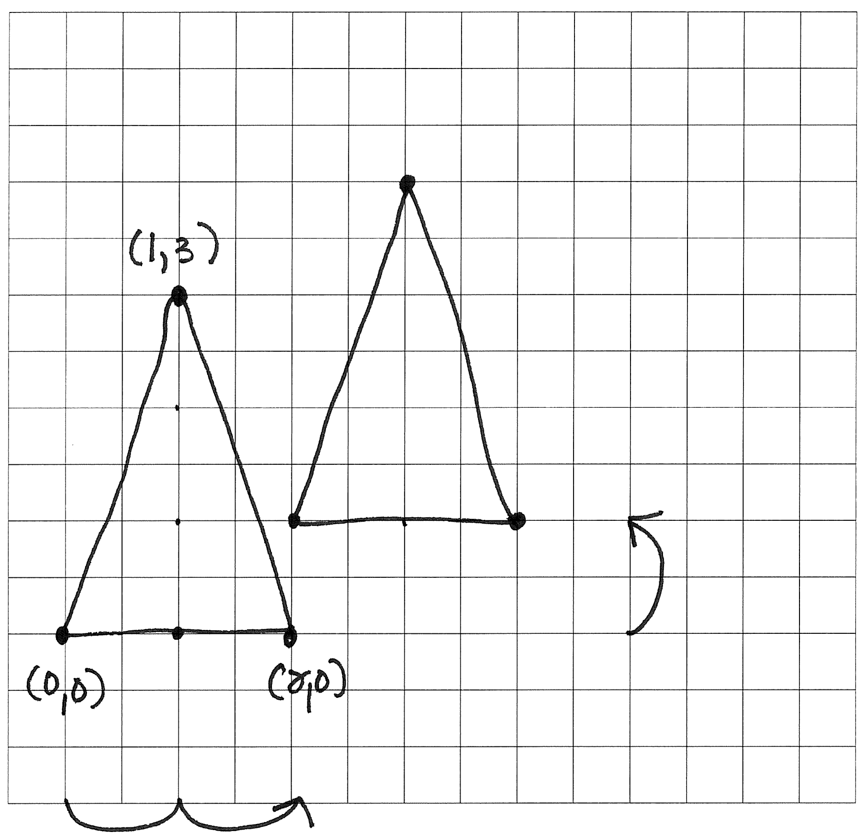
B. False

Now let's look at MOVING polygons and here, only with coordinates.

Let's pick a triangle with vertices at (0,0), (2,0) and (1, 3). Suppose I want to move it 1 up and 2 over to the right.

The instructions for this are F(x + 2, y + 1) Let's make a table of this

(0,0) → (2, 1) (2,0) → (4, 1) (1,3) →(3, 2)



Popper 3.4 Question 2

To move right 1 rewrite F(x,y) as F(x – 1, y).

A. True

B. False

So function notation is pretty handy. How about a dilation plus moving the object?

Let's take a checkmark and dilate it by two, go 2 down and 1 left. Take a minute and think about how you'd write out those instructions!

Ok dilate it by two, go 2 down and 1 left.

Dilate by 2: F(2x, 2y)

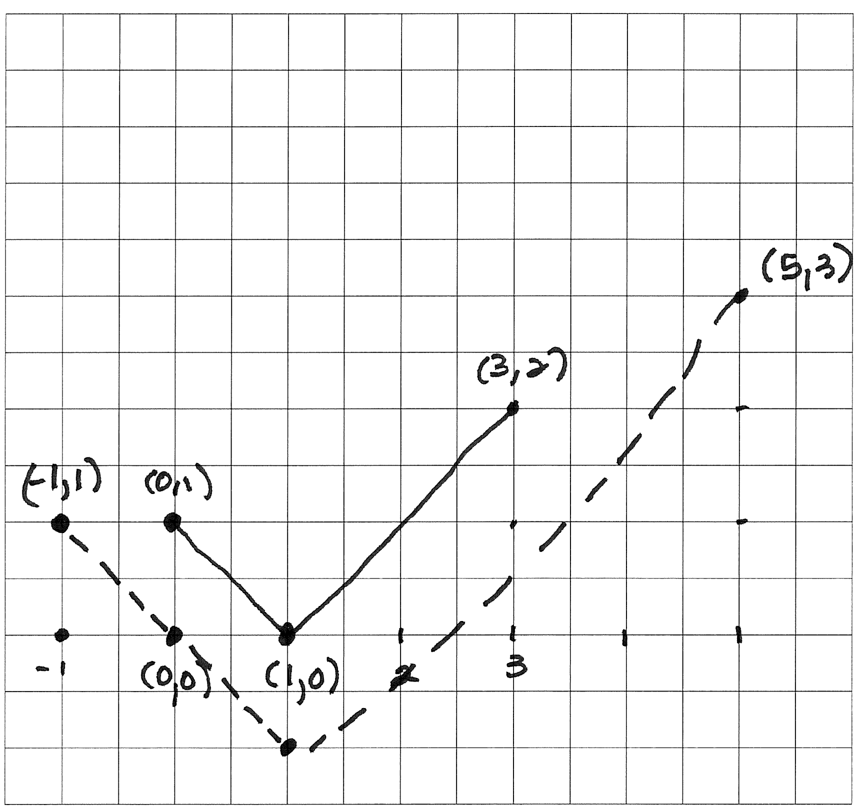
2 down: F(2x, 2y – 1)

1 left: F(2x – 1, 2y – 1). Done!

Since we are going down and left, put our checkmark in the upper right!

Points: Transformed points:

Go!

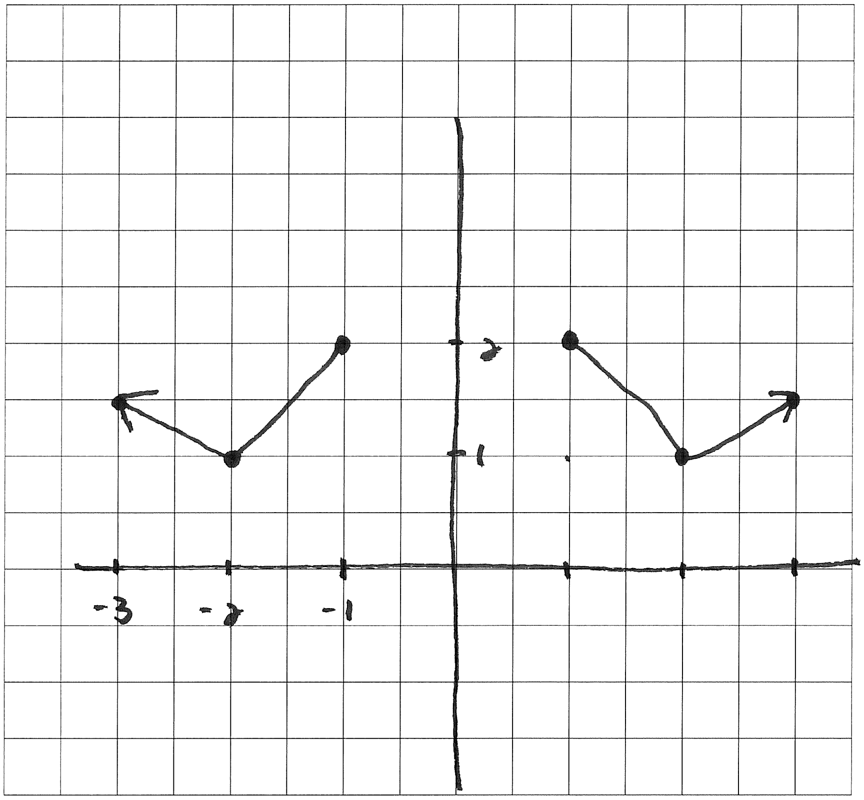


(0,1)	(−1,1)
(1,0)	(1,−1)
(3,2)	(5,3)

dilation plus moving left & down

Ok now, how about F(- x, y) and F(x, - y)?

$F(-x, y)$



$(1, 2)$ $(-1, 2)$

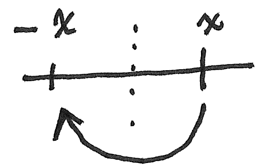
$(2, 1)$ $(-2, 1)$

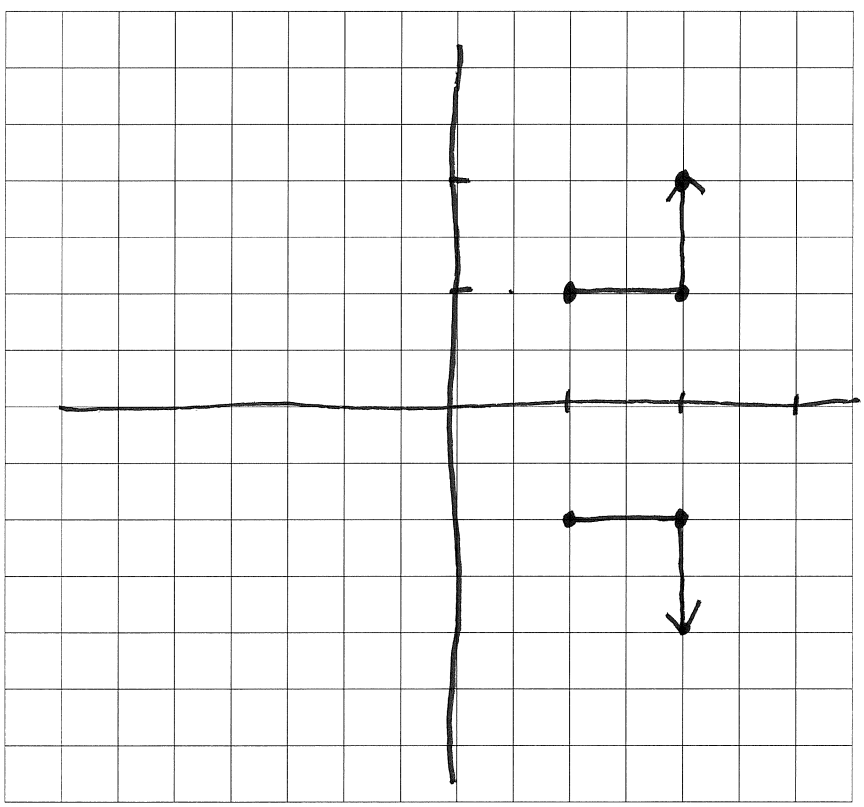
$(3, 1.5)$ $(-3, 1.5)$

reflect about y axis

$Q1 \longrightarrow Q2$

$Q4 \longrightarrow Q3$





$F(x, -y)$

$(1, 1)$ $(1, -1)$

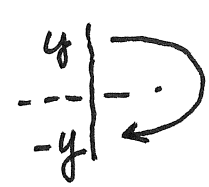
$(2, 1)$ $(2, -1)$

$(2, 2)$ $(2, -2)$

reflect about the x axis

$Q1 \longrightarrow Q4$

$Q2 \longrightarrow Q3$



☆ Popper 3.4 Question 3

Which of the following is reflect about the y-axis?

A. F(-x,y)

B. F(x,-y)

☆ Popper 3.4 Question 4

Which of the following is a dilation and a slide to the left?

A. F(3x +1, 2y)

B. F(2x-2, 3y)

Ok now let's talk wrapping it up.

In 3.5 you learn that you can find similar volumes for similar figures using S cubed so be sure to skim that section.

In Chapter 4 we'll look at Transformations again, but the other 4 that are not Similarity Transforms, they are called Isometries.

Homework 3.4 #2 and #6

Review problems: #2, #12, #14 (Rsquared is the usual plane),

#18, #26, #28

Popper 3.4 4 questions. No essays!