

# CSC 240

# Computer Graphics

Fall 2015  
Smith College

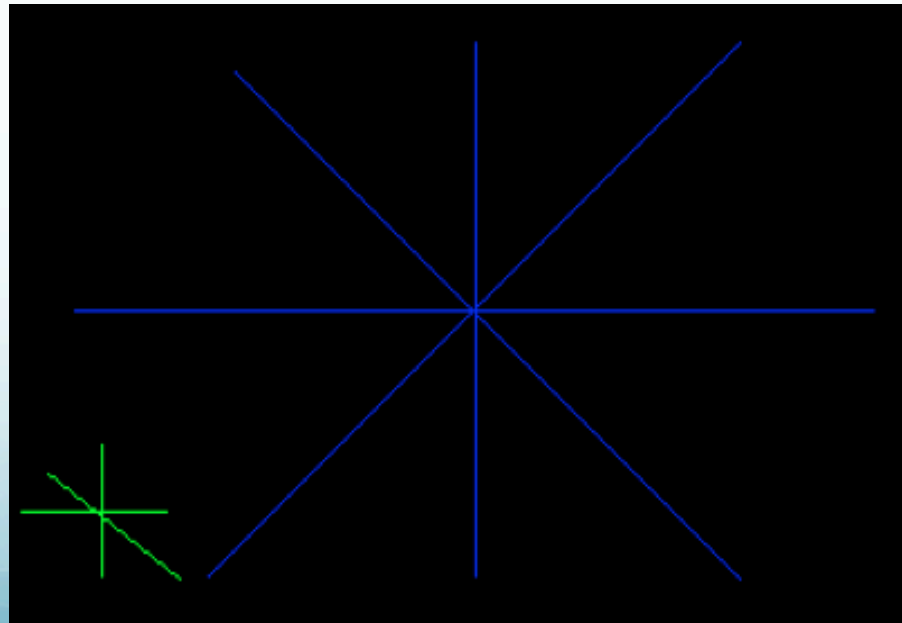
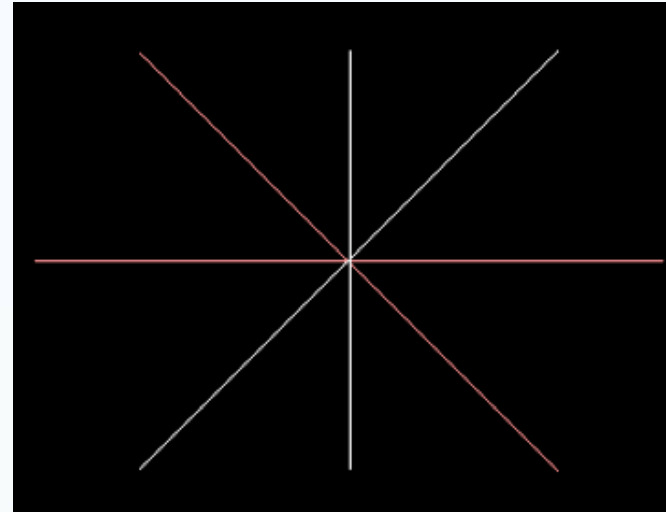
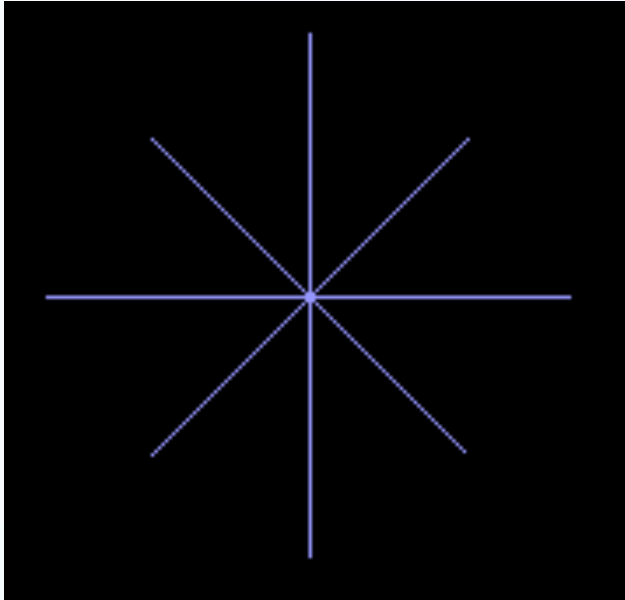
# Outline: 9/21

- Homework 1 debrief
- Fill recap
- Transformations

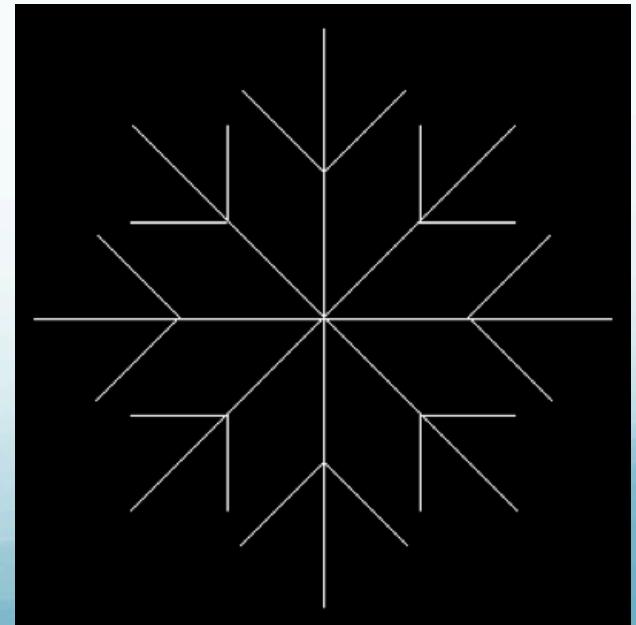
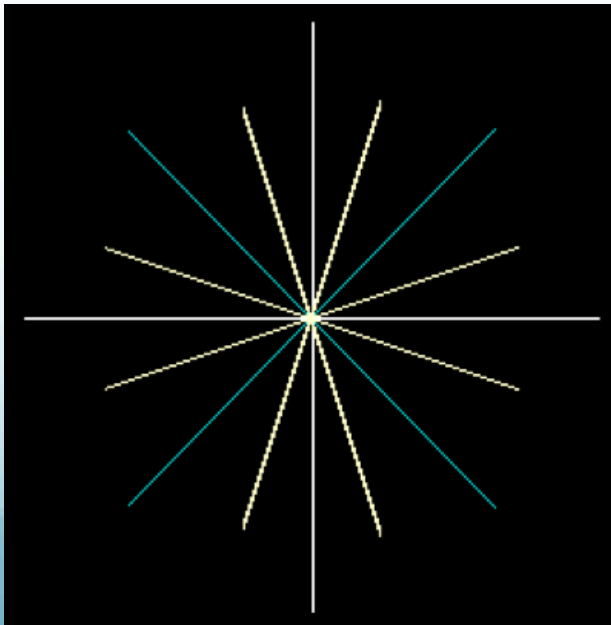
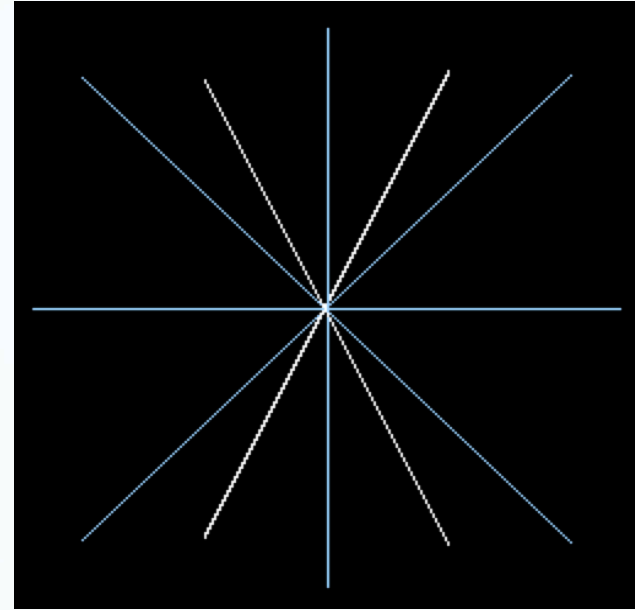
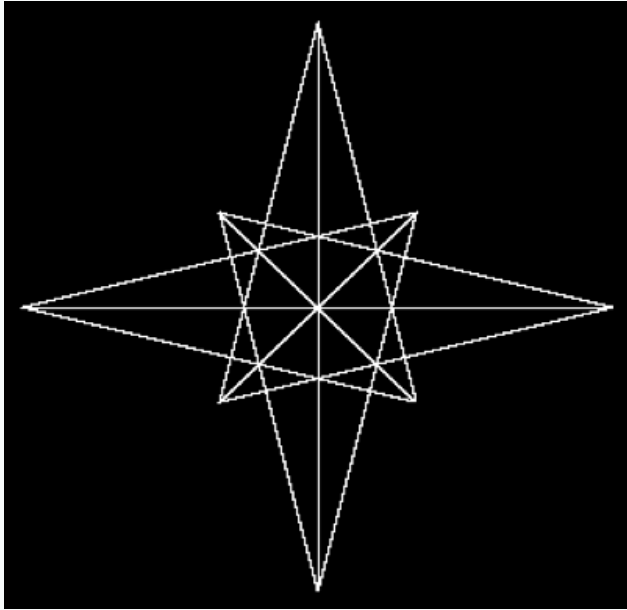
# Feedback on HW 1

- Draw it out first!
- Make a change, test, repeat
- Comments
- Use existing classes
- Define repeated colors, values
- Double lines: more than one block executed

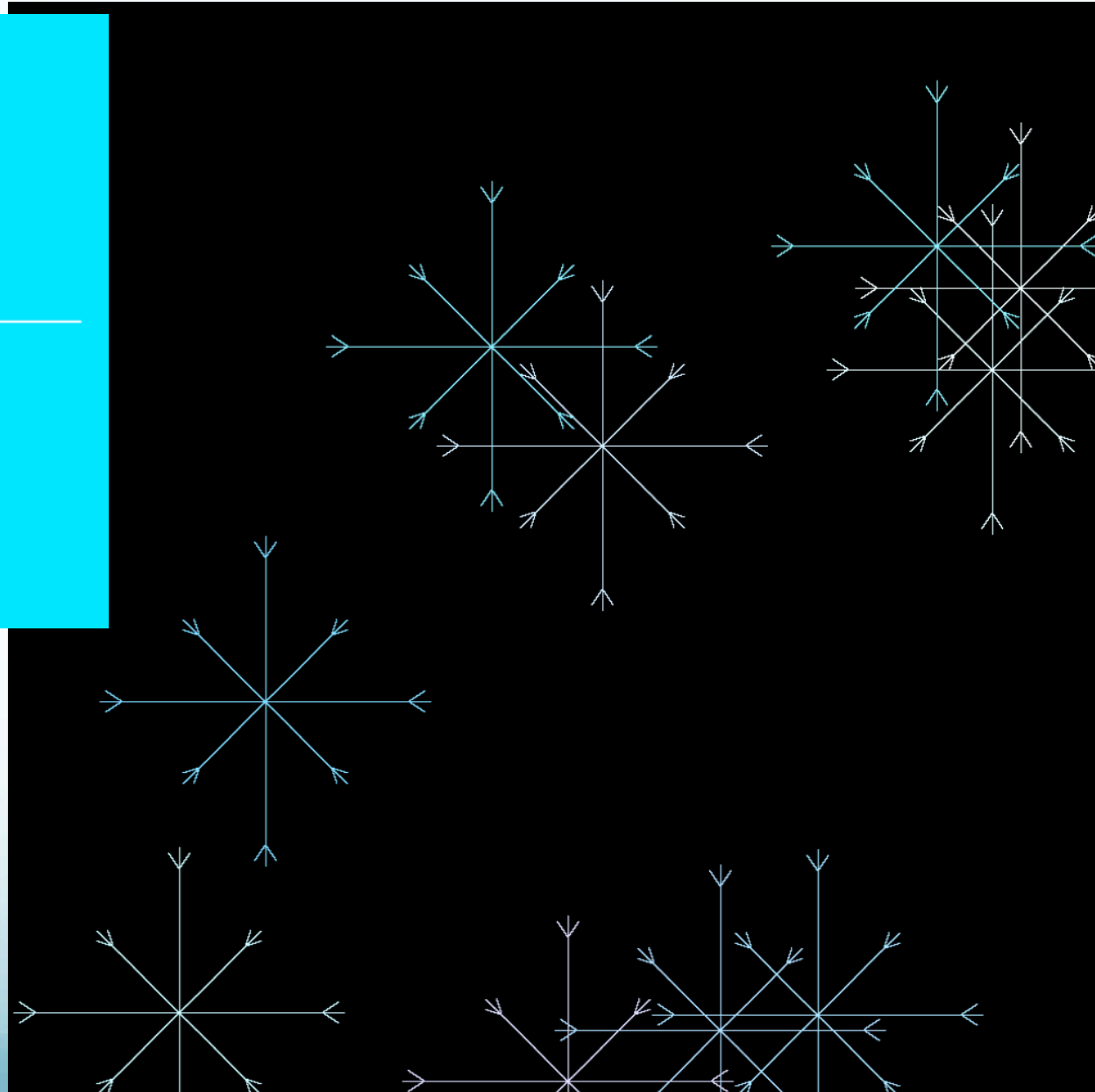
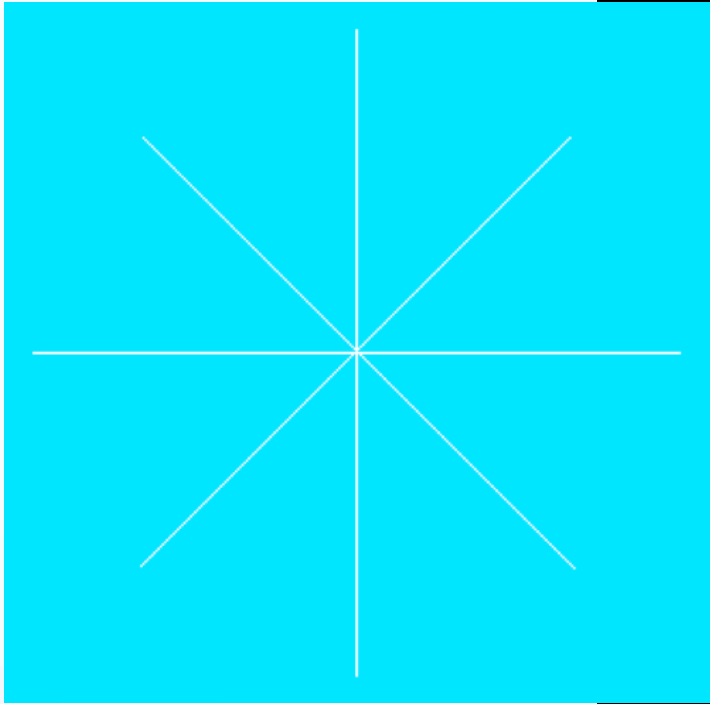
# Snowflake examples: different colors/sizes



# Snowflake examples: different shapes

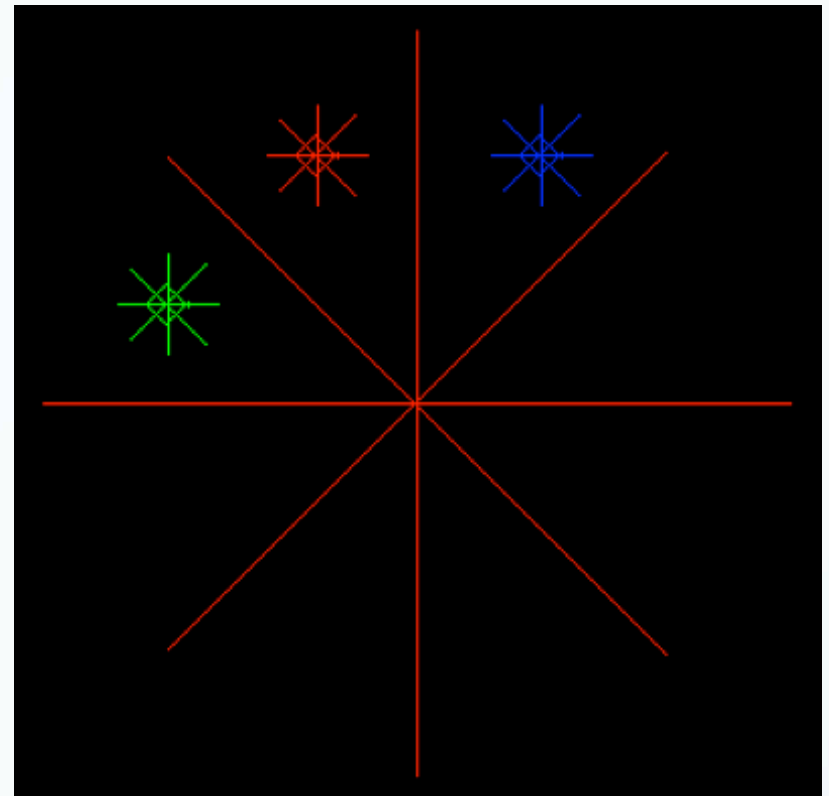
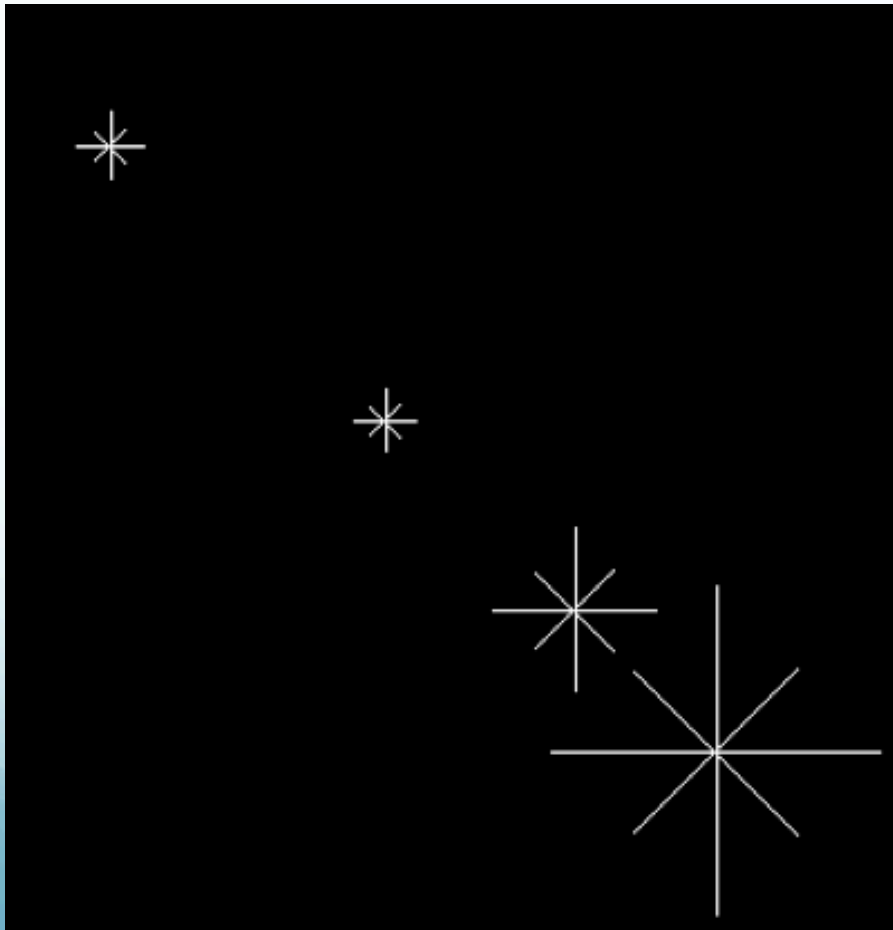


# Snowflake examples: background color

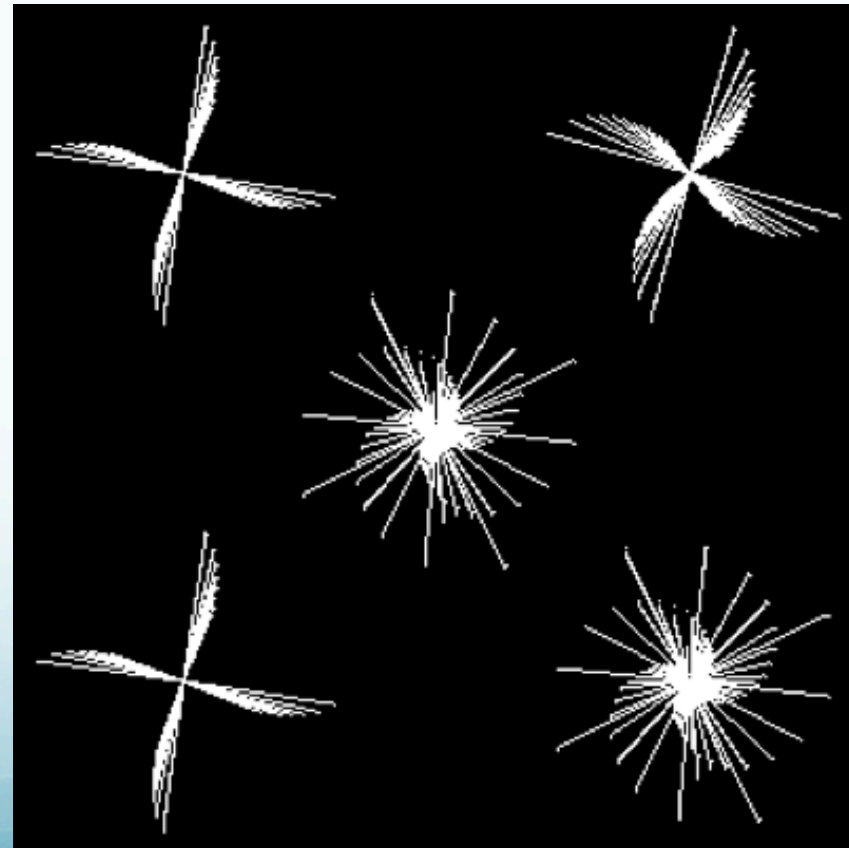
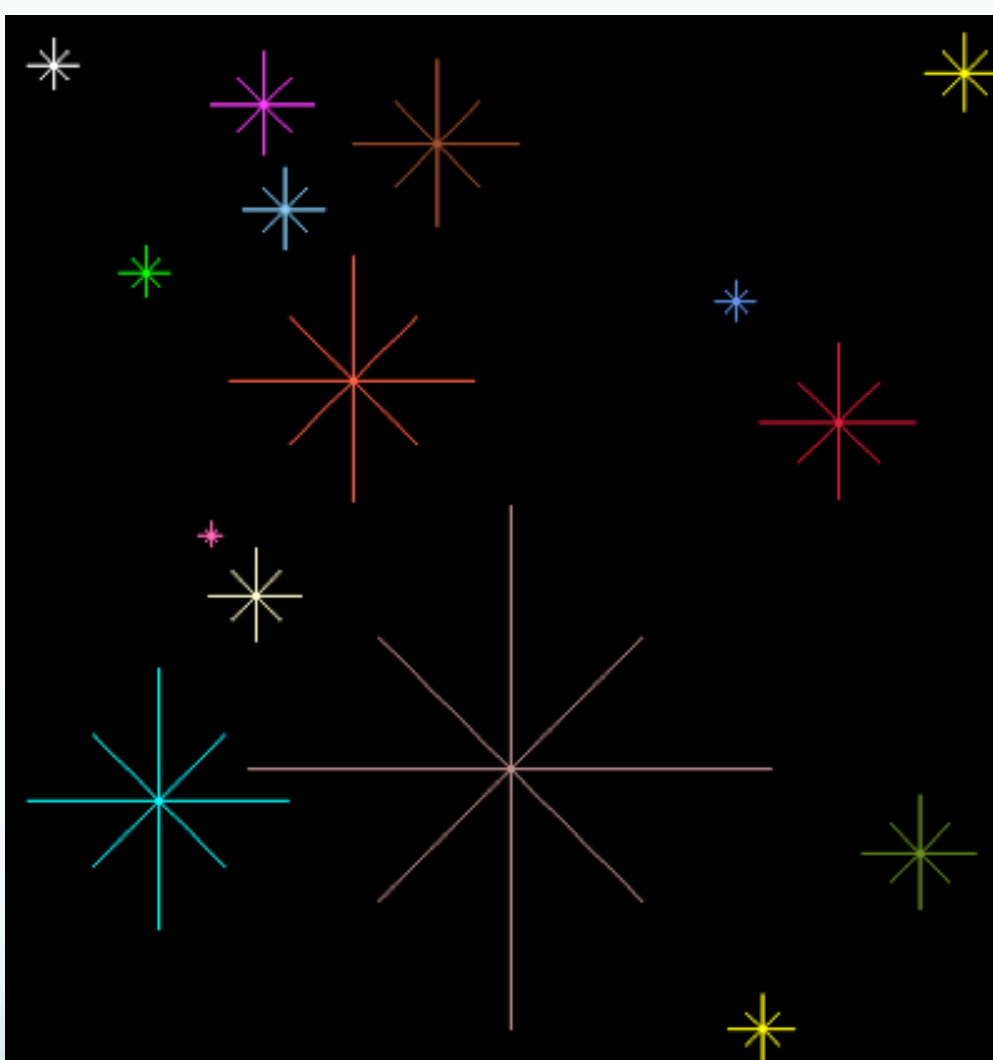


Snowflake function:  
random position

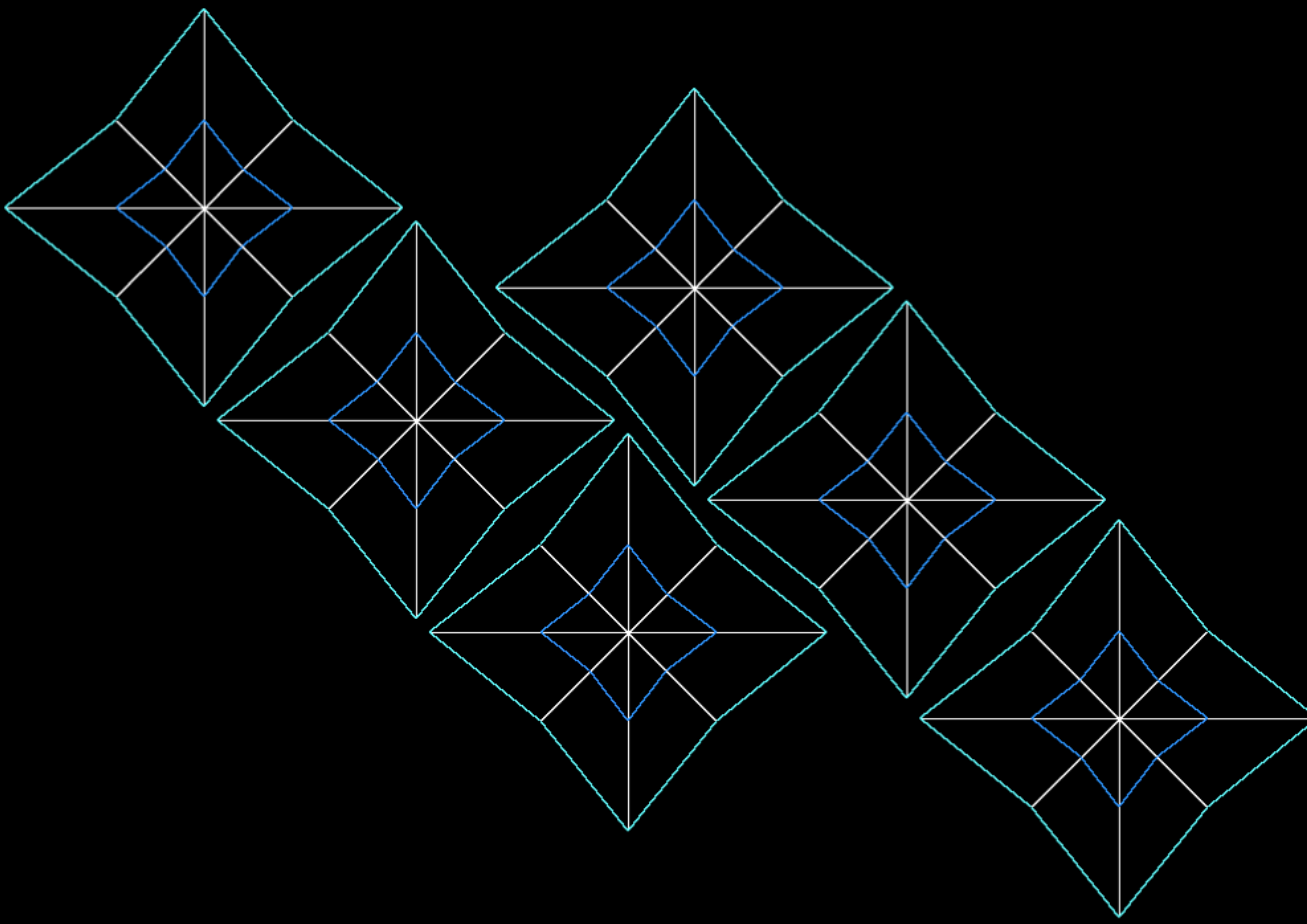
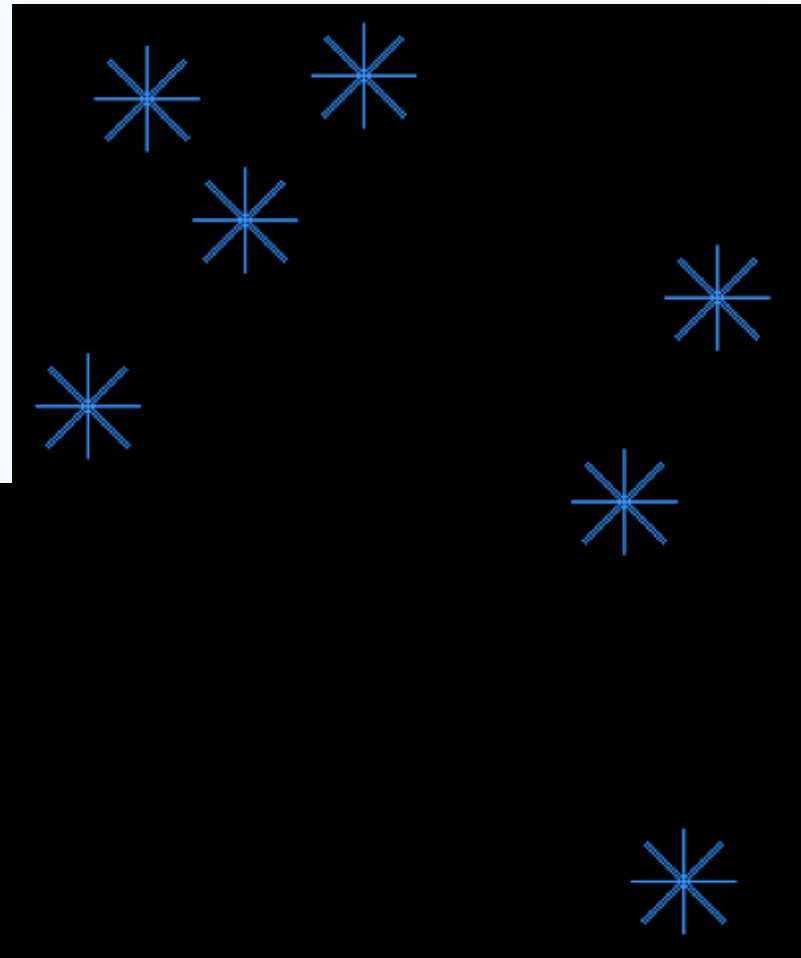
Snowflake functions:  
size and color arguments



# Snowflake function examples

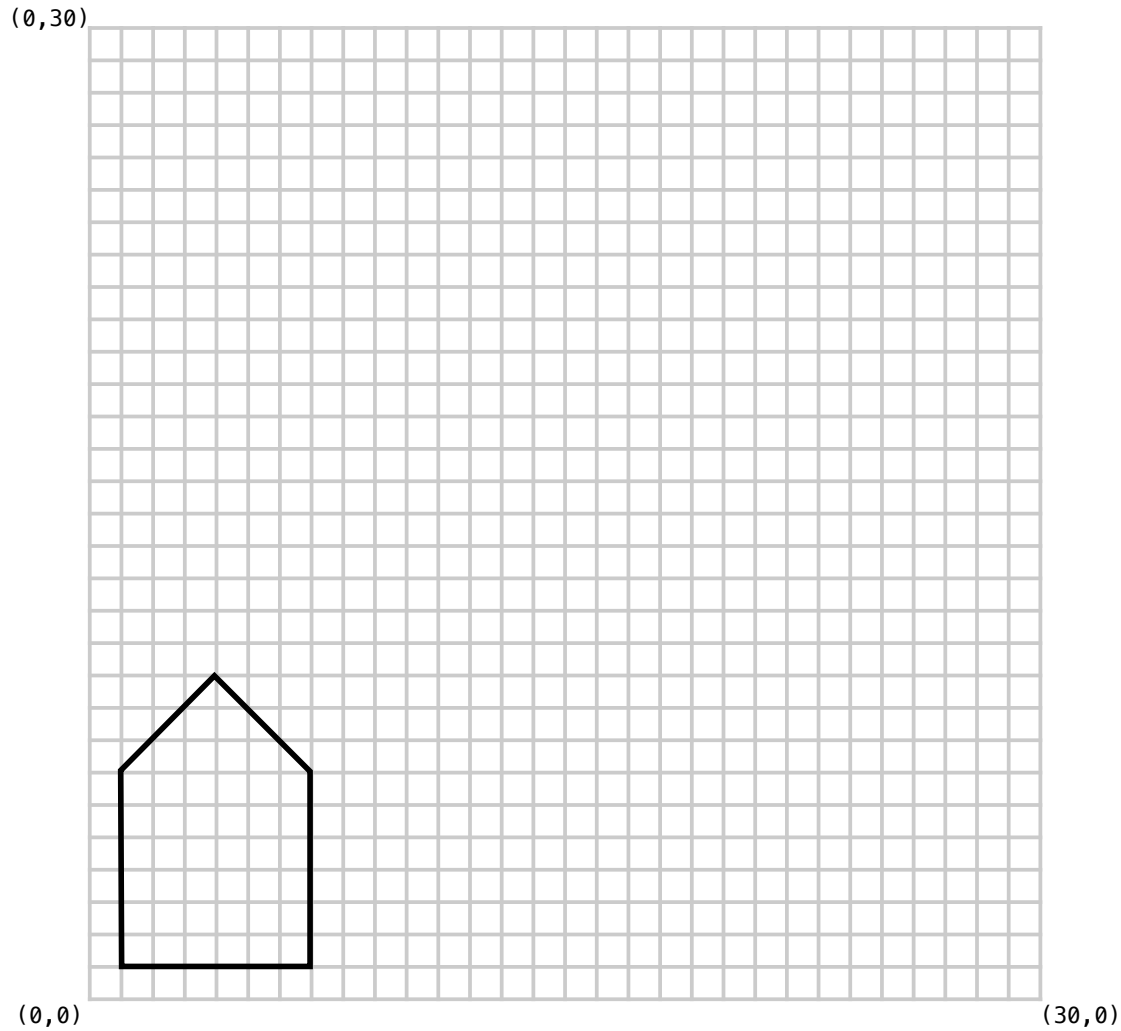


# Snowflake function examples



# Transformations

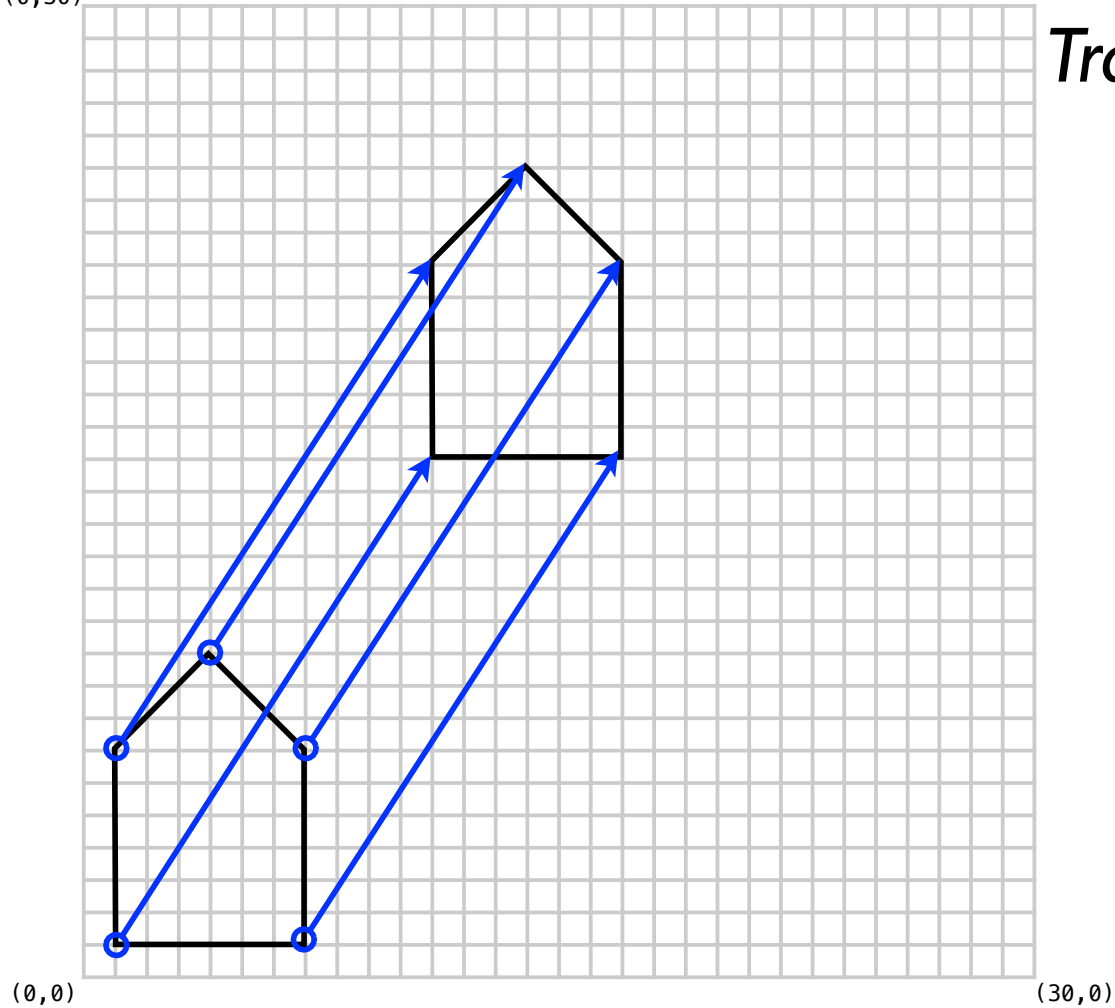
# Translation



# Translation

$(0, 30)$

*Trans*(10,15)

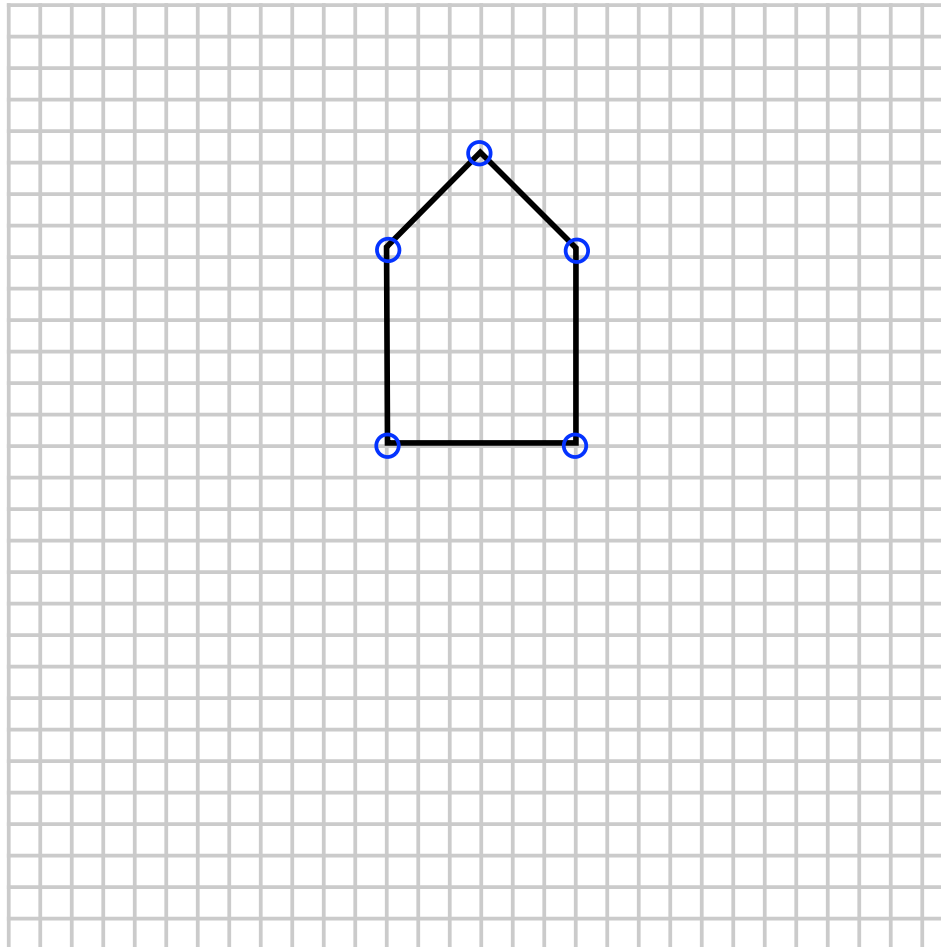


$(0, 0)$

$(30, 0)$

# Rotation

$(0, 30)$



$(0, 0)$

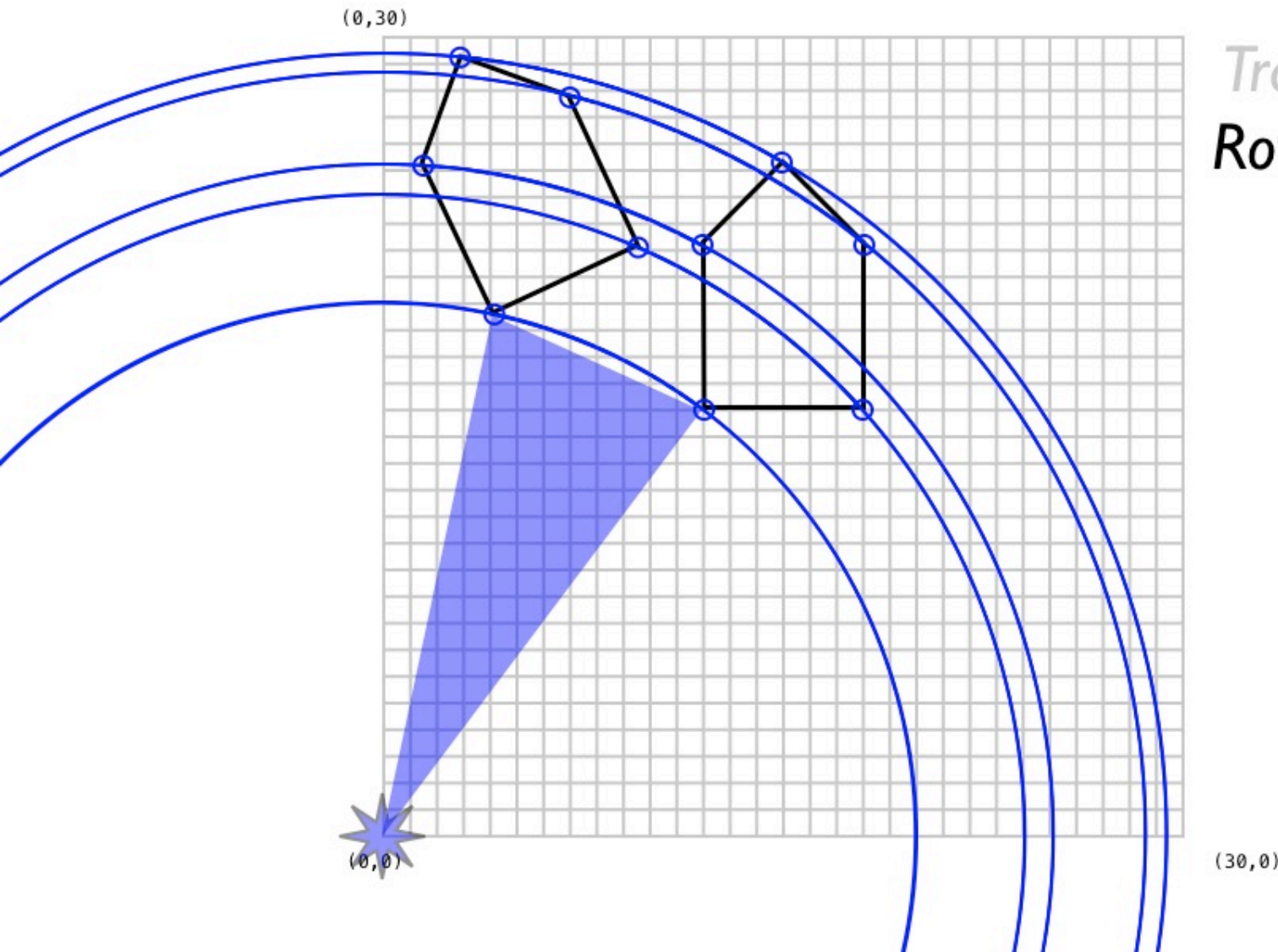
*Trans(10, 15)*

*Rot(25°)*



$(30, 0)$

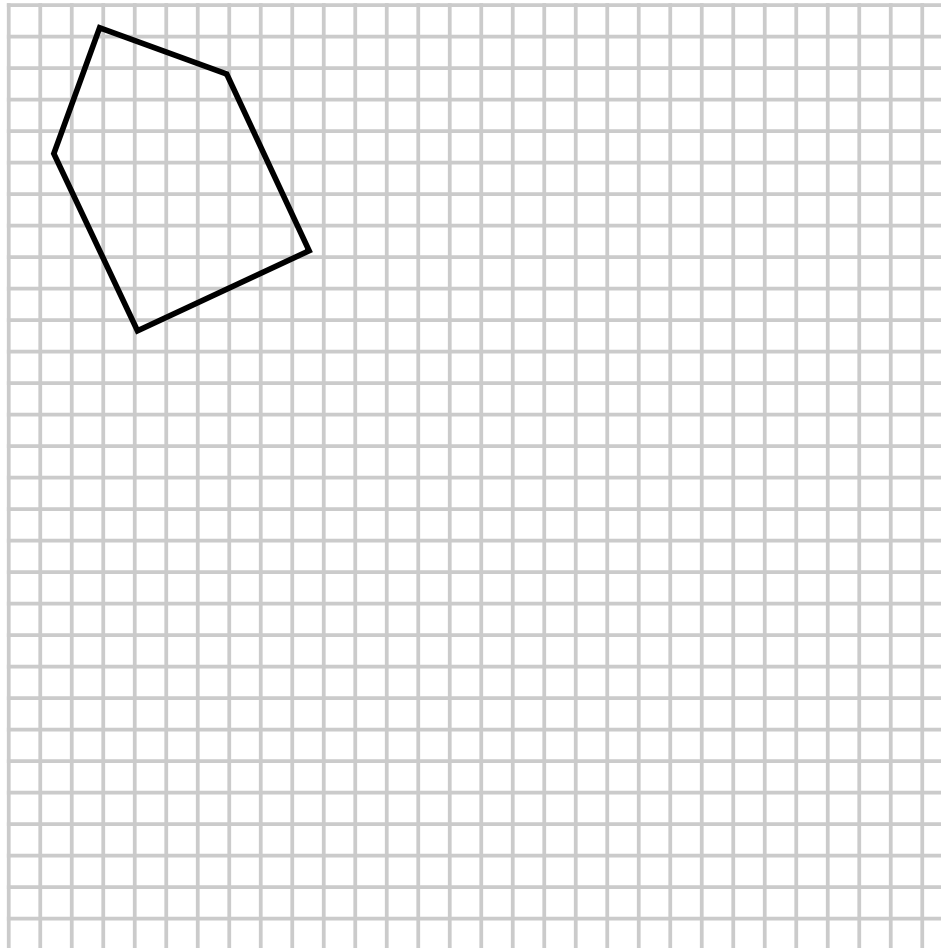
# Rotation



*Trans*(10,15)  
*Rot*(25°)

# Rotation

(0,30)



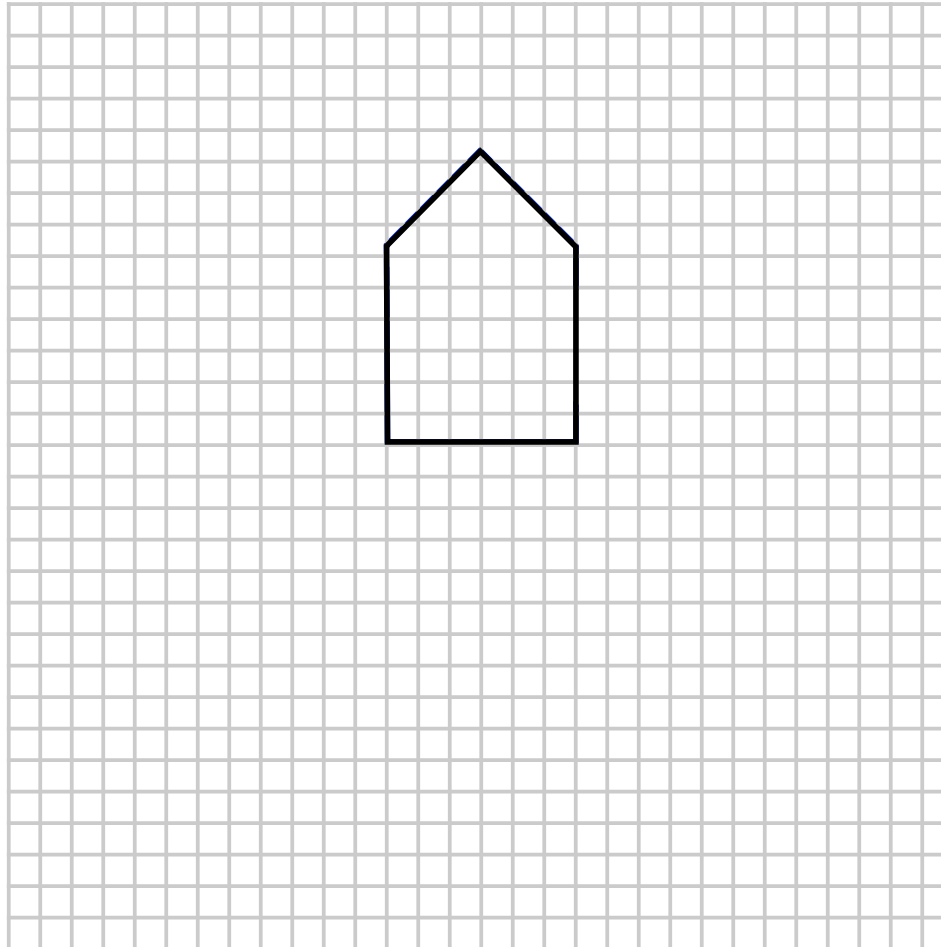
(0,0)

*Trans(10,15)*  
***Rot(25°)***

(30,0)

# Rotation

(0,30)



(0,0)

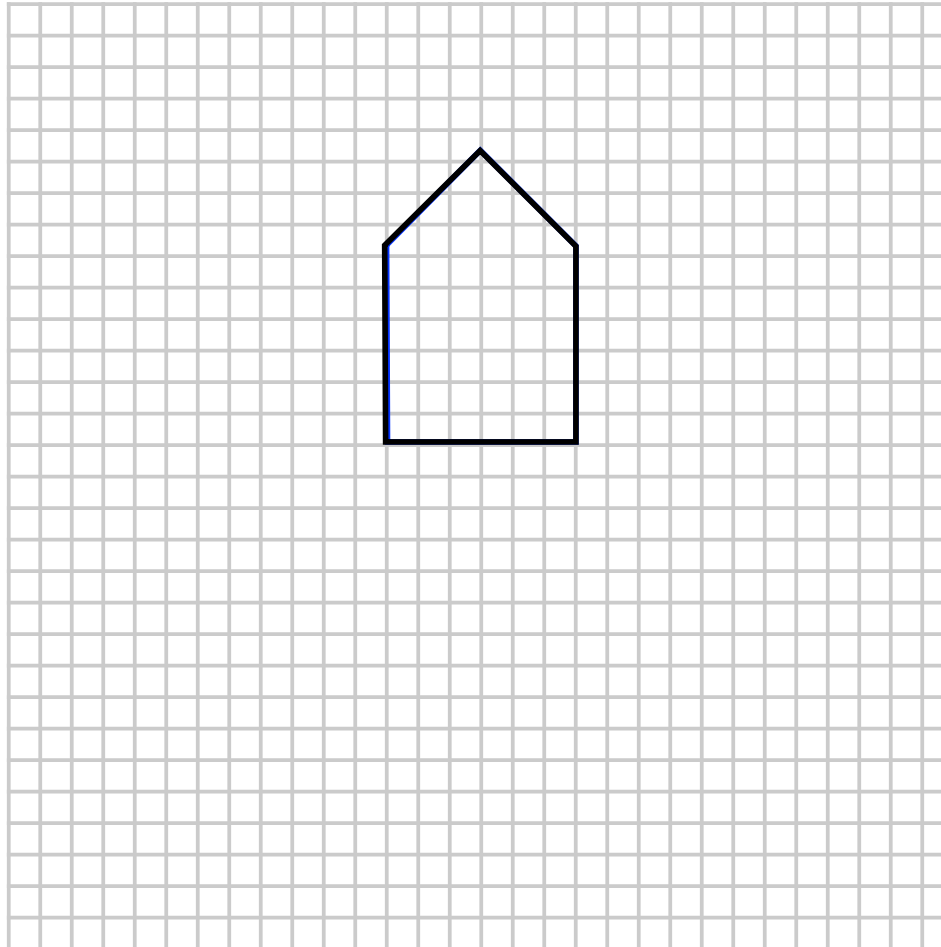
*Trans(10,15)*



(30,0)

# Rotation

(0,30)



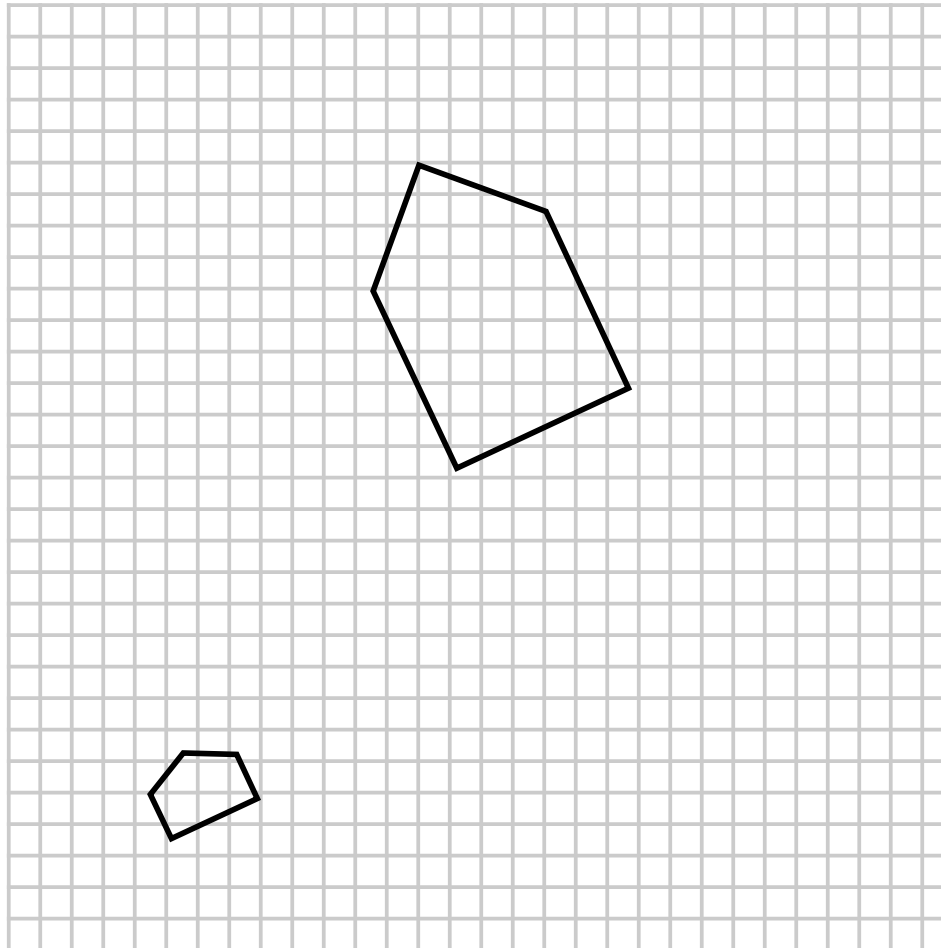
(0,0)

*Trans(10,15)*  
***Trans(-14,-21)***  
***Rot(25°)***  
***Trans(14,21)***

(30,0)

# Scale

(0,30)



(0,0)

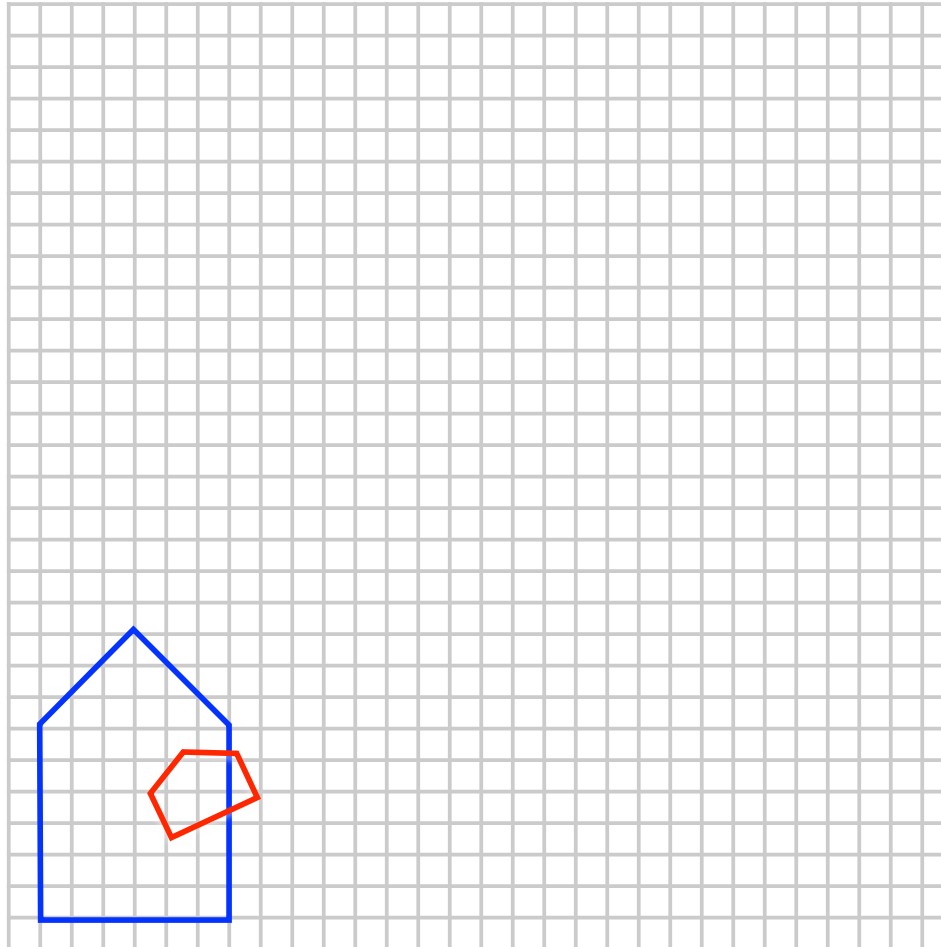
*Trans(10,15)*  
*Trans(-14,-21)*  
*Rot(25°)*  
*Trans(14,21)*  
**Scale(.5, .25)**



(30,0)

# Composition

(0,30)



(0,0)

*Trans(10,15)*  
*Trans(-14,-21)*  
*Rot(25°)*  
*Trans(14,21)*  
*Scale(.5, .25)*

(30,0)

# Composition

$$(\mathbf{S}_{[.5, .25]} \mathbf{T}_{[14, 21]} \mathbf{R}_{[25]} \mathbf{T}_{[-14, -21]} \mathbf{T}_{[10, 15]}) \mathbf{P}$$

$$\begin{bmatrix} .5 & 0 & 0 \\ 0 & .25 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

# Composition

$$(S_{[.5, .25]} \mathbf{T}_{[14, 21]} R_{[25]} T_{[-14, -21]} T_{[10, 15]}) P$$

$$\begin{bmatrix} .5 & 0 & 0 \\ 0 & .25 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 14 \\ 0 & 1 & 21 \\ 0 & 0 & 1 \end{bmatrix}$$

# Composition

$$(S_{[.5, .25]} T_{[14, 21]} \mathbf{R}_{[25]} T_{[-14, -21]} T_{[10, 15]}) P$$

$$\begin{bmatrix} .5 & 0 & 0 \\ 0 & .25 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 14 \\ 0 & 1 & 21 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos(25) & -\sin(25) & 0 \\ \sin(25) & \cos(25) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

# Composition

$$(S_{[.5, .25]} T_{[14, 21]} R_{[25]} \mathbf{T}_{[-14, -21]} T_{[10, 15]} ) P$$

$$\begin{bmatrix} .5 & 0 & 0 \\ 0 & .25 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 14 \\ 0 & 1 & 21 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos(25) & -\sin(25) & 0 \\ \sin(25) & \cos(25) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -14 \\ 0 & 1 & -21 \\ 0 & 0 & 1 \end{bmatrix}$$

# Composition

$$(S_{[.5, .25]} T_{[14, 21]} R_{[25]} T_{[-14, -21]} \mathbf{T}_{[10, 15]} ) P$$

$$\begin{bmatrix} .5 & 0 & 0 \\ 0 & .25 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 14 \\ 0 & 1 & 21 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos(25) & -\sin(25) & 0 \\ \sin(25) & \cos(25) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -14 \\ 0 & 1 & -21 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 10 \\ 0 & 1 & 15 \\ 0 & 0 & 1 \end{bmatrix}$$

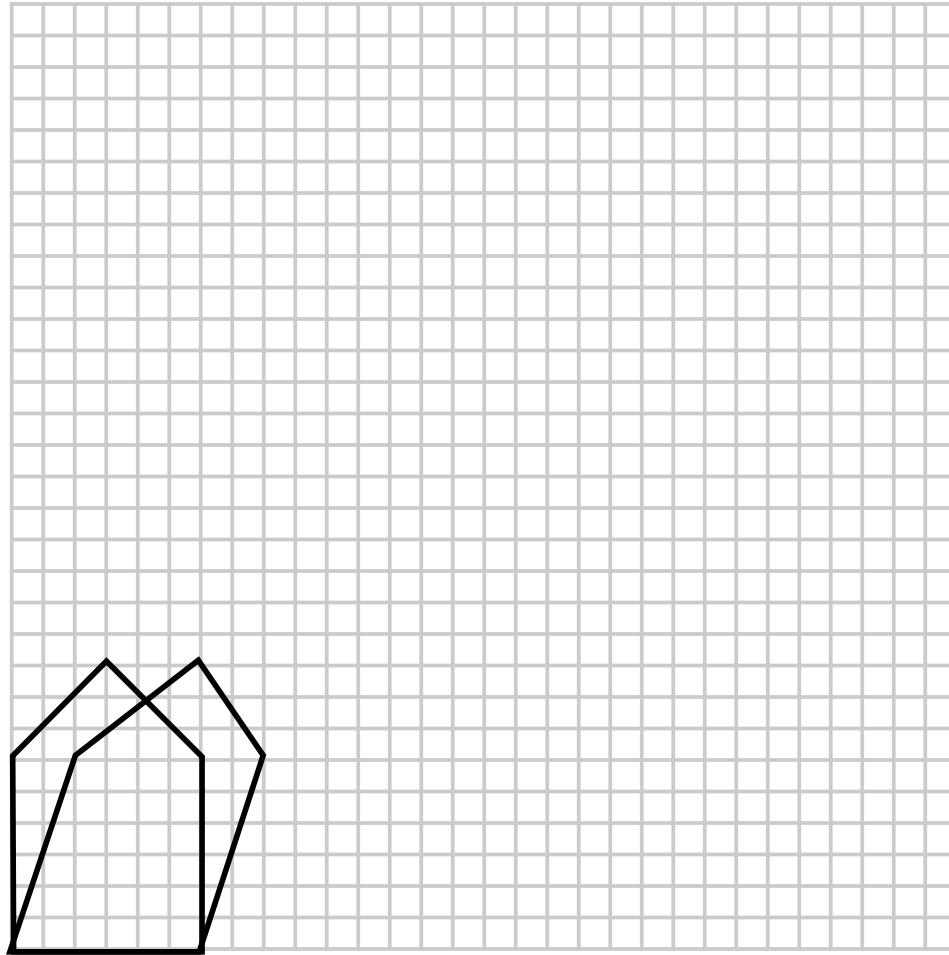
# Composition

$$(S_{[.5, .25]} T_{[14, 21]} R_{[25]} T_{[-14, -21]} \mathbf{T}_{[10, 15]}) P$$

$$\begin{bmatrix} .5 & 0 & 0 \\ 0 & .25 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 14 \\ 0 & 1 & 21 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos(25) & -\sin(25) & 0 \\ \sin(25) & \cos(25) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -14 \\ 0 & 1 & -21 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 10 \\ 0 & 1 & 15 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 0.453 & -0.211 & 6.45 \\ 0.106 & 0.227 & 3.47 \\ 0 & 0 & 1 \end{bmatrix}$$

# Shear



# Shear

