Basic Transformations and Algebraic Rules

General Rules

(-) means sign of coordinate is changed. Usually means a reflection.	**Example:** (x, y)→(-x, y)	*x*-coordinate's sign is changed. Results in a reflection over the *y*-axis.
A coefficient other than 1 means a dilation.	**Example:** (x, y)→(5x, 5y)	Both coordinates are multiplied by 5. This results in an enlargement by 5.
Swapping positions of x and y means either a reflection or a rotation	Both (+) or (-) = reflection One (+), one (-) = rotation	**Example:** (x, y)→(y, x) Reflection over line $y = x$ **Example:** (x, y)→(-y, x) 90° rotation

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Translations
Translate by vector $< a,b >$ **(x, y)→(x+a, y+b)**

Reflections	
(x, y)→(x, -y)	Reflect over x-axis
(x, y)→(-x, y)	Reflect over y-axis
(x, y)→(-x, -y)	Reflect over both axes (same as a **180° rotation**)
(x, y)→(y, x)	Reflect over line $y = x$
(x, y)→(-y, -x)	Reflect over line $y = -x$

Rotations
90° rotation (counter-clockwise) **(x, y)→(-y, x)**
180° rotation (same as a **reflection around both axes**) **(x, y)→(-x, -y)**
270° rotation (counter-clockwise) **(x, y)→(y, -x)**
360° rotation **(x, y)→(x, y)**

Dilations and Stretches/Shrinks	
(x, y)→(ax, ay)	Dilate by factor *a*, Centered on **the origin**. $a > 1$ means **enlarged** $a < 1$ means **shrunk**

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A coefficient other than 1 means a dilation.	**Example:** (x, y)→(5x, 5y)	The coordinates are both multiplied by 5. This results in an enlargement by 5.
Swapping positions of x and y means either a reflection or a rotation	Both (+) or (-) = reflection One (+), one (-) = rotation	**Example:** (x, y)→(y, x) Reflection over line $y = x$ **Example:** (x, y)→(-y, x) 90° rotation

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Translations	Reflections
	_____ Reflect over x-axis
Translate by vector $<a, b>$	_____ Reflect over y-axis
_____	_____ Reflect over both axes (same as _____)
	_____ Reflect over line $y = x$
	_____ Reflect over line $y = -x$

Rotations	Dilations
90° rotation (counter-clockwise) _____	
180° rotation (same as a _____ _____ _____ _____)	Dilate by factor *a,* Centered on _____. _____ $a > 1$ means _____
270° rotation (counter-clockwise) _____	$0 < a < 1$ means
360° rotation _____	_____