

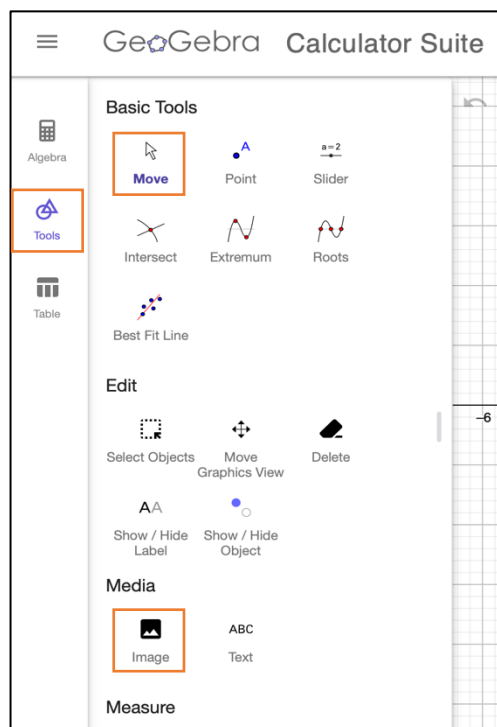
GeoGebra is a powerful tool that can be used for all sorts of mathematical and entrepreneurial purposes. This document will help you learn how to transform figures in GeoGebra. While you do not need to have an account to work in GeoGebra, you can make a free account if you would like to save your work so you can revisit it at a later time.

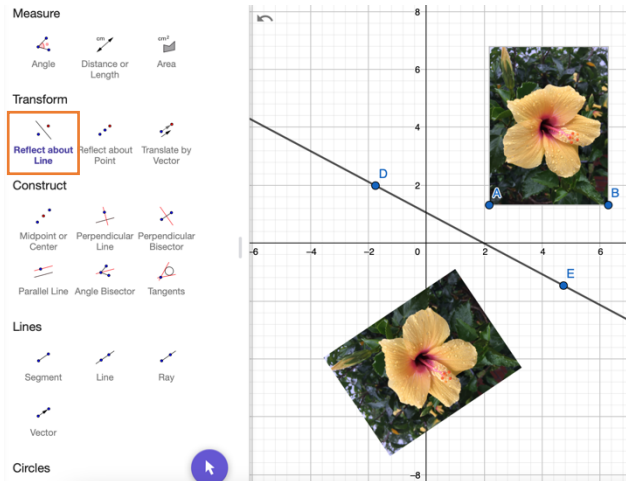
Beginning

To perform any of these transformations, you must first have a figure or an image. Once you open the Calculator, you can use a variety of the tools in GeoGebra to draw a figure or you can upload an image of your own. To upload your own image, click on Tools on the left-hand menu. Scroll to the section entitled Media and click Image. Here, you can upload an image and place it on your coordinate plane.

Translations

Translations move a figure across a plane while keeping it in its original orientation. Translations can move left or right, up or down, or across any diagonal. In GeoGebra, you can perform a translation using the Move tool. To begin, either create a figure or upload an image. Then, duplicate your image by clicking on it, clicking on the three vertical dots, and selecting Duplicate. Finally, click on the copy of your image or drag to select all of the components of your duplicated figure and drag them around the coordinate plane.



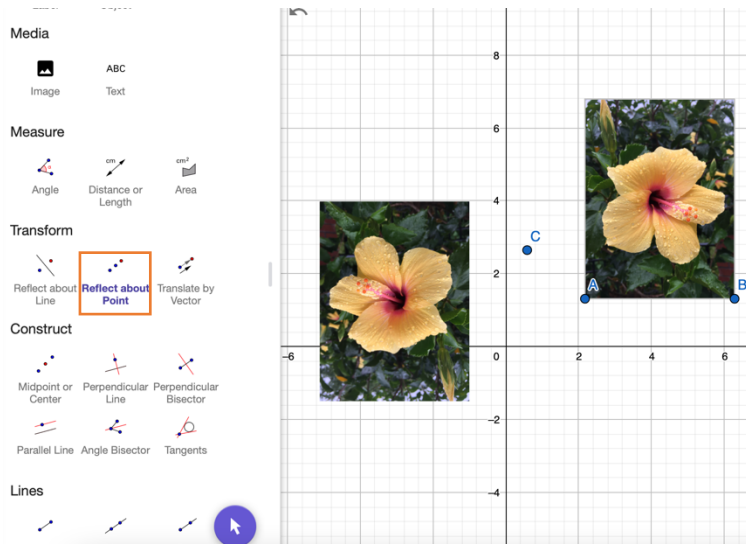


Reflections

Reflections create a mirror image of your figure or image. In GeoGebra, you can reflect your image across a line or about a point. To reflect an image across a line, you must first construct the line across which you want to reflect your image. Once you have constructed the line you want to use as your line of reflection, scroll down to the fifth section of the left-hand menu entitled Transform and click Reflect about Line. Then, click the image you want to reflect and your line of

reflection. Your reflected image should appear. If your reflected image is not where you want it to be, try adjusting your line of reflection. In the example above, the original image has been reflected across the line DE.

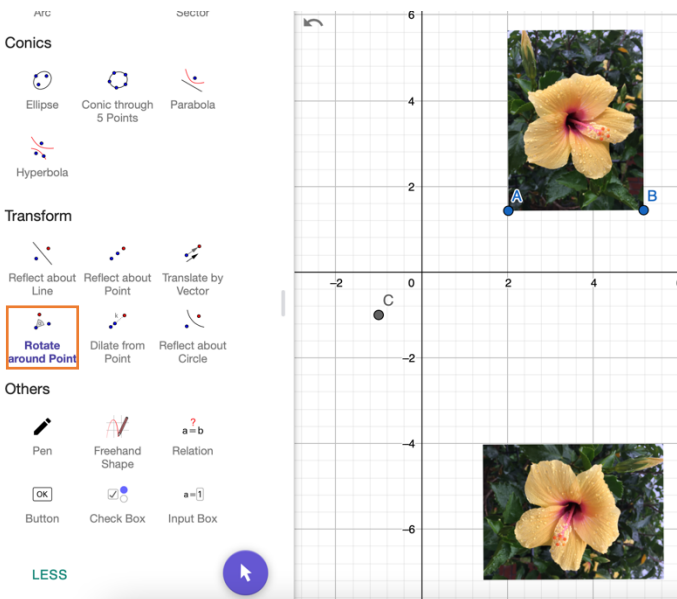
To reflect about a point, you must first construct the point about which you want to reflect your image. Once you have constructed your point of reflection, click on Reflect about Point under the Transform menu. Then select your image and the point of reflection. Your reflected image should appear. If your reflected image is not where you want it to be, try adjusting your point of reflection. In the example to the right, the original image has been



reflected about point C. What do you notice is similar and different between reflecting images about a line compared to reflecting an image about a point?

Rotations

Rotations change the orientation of a figure or image by rotating it around a specified point called the center of rotation. To rotate an image in GeoGebra, scroll to the bottom of the left-hand menu and click More. This will expand the menu options, including



adding a Rotate around Point option to the Transform menu. Before you click this new option, make sure you have a figure or image that you want to rotate and the point that will be your center of rotation in the plane. Click Rotate around Point, select your image and center of rotation, then enter your angle of rotation and whether you want a clockwise or counterclockwise rotation in the box. Click OK to get your rotated image. In the example to the left, you can see the original image rotated 90° clockwise around point C. How can you tell by looking at the images on the graph?

Dilations

Dilations, also known as scaling, make figures and images either bigger (scaling up) or smaller (scaling down) without distorting the image. In GeoGebra, you can dilate an image by defining a point that will be the center of dilation. To see the option to Dilate from Point in GeoGebra, scroll to the bottom of the left-hand menu and click More.

Then, under Transform, click Dilate from Point and select your image and your center of dilation. Then enter your dilation factor and click OK to get your dilated image. In the example to the right, you can see the original image (partially hidden by the scaled up version) and two dilated images. The larger image was dilated by a factor of 2, and the smaller, upside down image was dilated by a factor of -0.5 .

