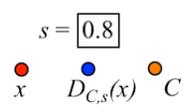
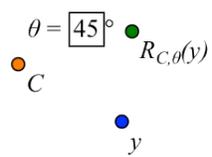
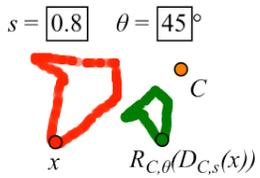


Compose a Locus (long form) Name: _____

In this activity you will compose two functions, restrict the independent variable to a domain, and construct a locus to investigate the range of the dependent variable.

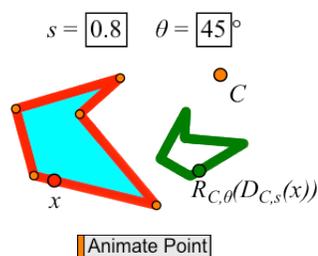
COMPOSE TRANSFORMATIONS AND RESTRICT THE DOMAIN

- In a new sketch choose **Number** | **New Parameter**. Create parameter $s = 0.8$.
- With parameter s selected, choose **Transform** | **Mark Scale Factor**.
- Construct a point, label it C , and choose **Transform** | **Mark Center**.
- Construct independent variable x and dilate it by choosing **Transform** | **Dilate**.
 
- Label the dilated point $D[C,s](x)$.
- Create an angle parameter $\theta = 45^\circ$. Type {theta} for the name of the parameter, and Sketchpad will change the name to θ .
- With parameter θ selected, choose **Transform** | **Mark Angle**.
 
- Construct independent variable y and rotate it by choosing **Transform** | **Rotate**.
- Label the rotated point $R[C,\theta](y)$.
- Compose the two functions by selecting both y and $D_{C,s}(x)$, and choosing **Edit** | **Merge Points**.
- Relabel $R_{C,\theta}(y)$ appropriately by changing it to $R[C,\theta](D[C,s](x))$.
 You can read $R_{C,\theta}(D_{C,s}(x))$ as “the rotation, around C by θ , of the dilation, about C by s , of x .”
- Hide the merged point.
- Turn on tracing for the remaining two variables by selecting them and choosing **Display** | **Trace Points**.
 
- Q1** Drag independent variable x and describe the behavior of the variables, including their relative rates of change and the existence and location of any fixed points.
- Q2** Draw the resulting shapes on your paper. Include the points and their labels.
- Construct a polygon with at least 5 vertices.
- Merge x to the polygon by selecting both x and the polygon, and choosing **Edit** | **Merge**.
- Erase the traces and then drag independent variable x .
- Make an action button by selecting x and choosing **Edit** | **Action Button** | **Animation**. Click OK in the dialog box.

18. Press the new animation button.

Q3 Describe the appearance of the traced domain and range. Include whether the shapes appear congruent, similar, or otherwise. Draw and label the shapes.

19. With x still animating, select θ and hold the + sign on your keyboard until $\theta = 90^\circ$.



The traces get messed up. You could erase the traces, but there's an even better way.

CONSTRUCT THE LOCUS

20. Stop the animation by pressing , the action button again.

21. Turn off tracing for both variables by selecting them and using the Display menu. Erase the traces.

22. Construct the locus of $R_{C,\theta}(D_{C,s}(x))$ by selecting both variables and choosing **Construct | Locus**.

23. Restart the animation by pressing the action button.

Q4 Draw a picture showing what you see. What does the locus represent?

24. With x still animating, select s and hold the – sign on your keyboard until $s = 0.5$. Similarly, change θ to -90° .

25. With x still animating, drag point C to a new location.

26. With x still animating, change the domain by dragging a vertex.

Q5 Describe and draw the result of each change.

EXPLORE MORE

Q6 Create an animation button to animate θ bidirectionally between 0° and 180° . Describe what happens when you press the button.

Q7 Describe the effect of an animation button to animate s between -2 and 2 .

Q8 Construct your own function composition. Include a locus to show the corresponding range for a restricted domain. Use animation buttons to change parameters and show different members of this function family.

In this activity you will compose two functions, restrict the independent variable to a domain, and construct a locus to investigate the range of the dependent variable.

COMPOSE TRANSFORMATIONS AND RESTRICT THE DOMAIN

1. In a new sketch create a parameter $s = 0.8$ and use it to construct $D_{C,s}(x)$.
2. Create an angle parameter $\theta = 45^\circ$ and use it to construct $R_{C,\theta}(y)$.
3. Compose the two functions by merging y to $D_{C,s}(x)$. Relabel $R_{C,\theta}(y)$ appropriately.
4. Hide the merged point, and turn on tracing for the remaining two variables.

Q1 Drag independent variable x and describe the behavior of the variables, including their relative rates of change and the existence and location of any fixed points.

Q2 Draw the resulting shapes on your paper. Include the points and their labels.

5. Construct a polygon with at least 5 vertices, merge x to the polygon, and create an action button to animate x . Press the button.

Q3 Describe the appearance of the traced domain and range. Include whether the shapes appear congruent, similar, or otherwise. Draw and label the shapes.

6. While x is still animating, change the angle to 90° .

The traces get messed up. You could erase the traces, but there's an even better way.

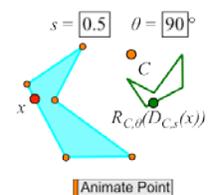
CONSTRUCT THE LOCUS

7. Stop the animation, turn off tracing for both variables, and erase the traces.
8. Construct the locus of $R_{C,\theta}(D_{C,s}(x))$ as x varies. Then restart the animation.

To construct the locus, select both variables and choose **Construct | Locus**.

Q4 Draw a picture showing what you see. What does the locus represent?

9. With x still animating, change s to 0.5 and θ to -90° . Drag point C to a new location, and change the domain by dragging a vertex.



Q5 Describe and draw the result of each change.

EXPLORE MORE

Q6 Create an animation button to animate θ bidirectionally between 0° and 180° . Describe what happens when you press the button.

Q7 Describe the effect of an animation button to animate s between -2 and 2 .

Q8 Construct your own function composition. Include a locus to show the corresponding range for a restricted domain. Use animation buttons to change parameters and show different members of this function family.

Compose a Locus Answers Name: _____

Q1 Drag independent variable x and describe the behavior of the variables, including their relative rates of change and the existence and location of any fixed points.

Q2 Draw the resulting shapes on your paper. Include the points and their labels.

Q3 Describe the appearance of the traced domain and range. Include whether the shapes appear congruent, similar, or otherwise. Draw and label the shapes.

Q4 Draw a picture showing what you see. What does the locus represent?

Compose a Locus Answers

- Q5** What happens as you make each of these changes? Draw and label the new shapes.
- Q6** Create an animation button to animate θ bidirectionally between 0° and 180° . Describe what happens when you press the button.
- Q7** Describe the effect of an animation button to animate s between -2 and 2 .
- Q8** Construct your own function composition. Include a locus to show the corresponding range for a restricted domain. Use animation buttons to change parameters and show different members of this function family.

Compose a Locus Exit Ticket Name: _____

1. Describe in your own words what you learned by constructing and observing the locus.

2. What happened to the composed function when you animated the scale factor s ?