In this activity you will investigate families of functions. All of the functions that belong to the same family behave similarly to each other, and differently from functions that belong to other families.

## INVESTIGATE FUNCTION BEHAVIOR

1. Open Identify Function Families.gsp. Look at the Learning Goal and then go to page 1. This page contains four functions.
2. Try to drag each of the points on this page.

Q1 How do the labels of the points help you determine which points are independent variables and which are dependent variables?

Q2 How do the labels help you determine which dependent variable is related to each independent variable?
3. Press Tracing On. Then drag each independent variable to make a small shape such as a circle or triangle.

Q3 Describe how each function behaves, based on the shapes. Circle the name of the function that's different.


| Function | Behavior |
| :---: | :---: |
| $f$ |  |
| $g$ |  |
| $h$ |  |
| $j$ |  |

You may have to drag farther on this page to see the differences.
4. On page 2 , turn on tracing and drag the independent variables.

Q4 Which function behaves differently? Describe the behavior of the three similar functions, and tell how the other function behaves differently.
5. On page 3, turn on tracing and drag the input variables. For each function, try to drag the independent variable to bring the input and output variables together in the same location. (Such a location is called a fixed point of the function.)

Q5 Which function is different? Use the fixed points to describe how three functions are similar and the fourth is different.
6. Trace the functions on page 4. For each function, drag the input variable in a straight line and notice the direction of the output variable.

Q6 Which function is different? Use the relative directions of the traces to describe the similarities and differences.

You can use the lengths of the traces to help judge the speeds of the variables.
7. Trace the functions on page 5. For each function, drag the input variable in a straight line and notice the speed of the output variable.

Q7 Which function is different? Use the relative speeds of the traces to describe the similarities and differences.

On page 9, you can identify the different picture by its letter. On pages 10 and 11, you can name the animal or the shape.

Q8 For pages 6, 7, and 8, list the different function in the Fn column, and describe how it's different.

| Page | Fn | Describe the difference |
| :---: | :---: | :---: |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |

Q9 For pages 9, 10, and 11, drag the pictures. Then list the different function in the Picture column, and describe how it's different.

| Page | Different <br> Picture | Describe the difference |
| :---: | :---: | :---: |
| 9 |  |  |
| 10 |  |  |
| 11 |  |  |

## EXPLORE MORE

8. On page 12 , follow the directions to reflect three of the independent variables, and to rotate the fourth variable. Hide the mirror and the center point, and challenge a friend to figure out which function is different from the others.
9. On pages 13 and 14 , use transformations to make a similar puzzle. For tips on using transformations, choose Help I Using Sketchpad I

Sketchpad Tips | Transform and then click the $\square$ icon for Translate,
Rotate, Dilate, or Reflect. (Don't click the icon unless you have headphones.)

