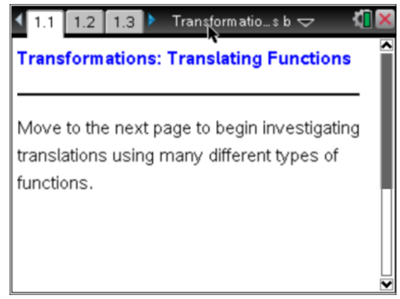
Transformations: Translating Functions
Student Activity

Open the TI-Nspire document
Transformations_Translating_Functions.tns.



This activity investigates the effect that changing parameters has on the graph. Specifically, horizontal and vertical translations are identified. Different types of functions will be explored to find rules that generalize the translations for all types of functions.

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Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

1. Grab and drag the open point identified by the coordinates. Recall that the vertex form of a parabola is $f(x) = (x - h)^2 + k$ and that the vertex of a parabola is (h, k).
   a. What changes in the function as you move the graph along the x-axis? What changes as you move it along the y-axis?

   b. Move the vertex to (3, 0). What is the equation of the graph? Then move the vertex to (–3, 0). What is the equation of the graph now? What is the relationship between the horizontally shifted graphs and the vertex?

2. Observe the function as you move the vertex point around in the first quadrant. Notice that the values of h and k are both positive in the first quadrant.
   a. What is the relationship between the vertex y-coordinate k and the value that is being added (outside the parentheses) in the function?

   b. What is the relationship between the vertex x-coordinate h and the value that is being added (inside the parentheses) in the function?

3. Move the vertex of the parabola back to the origin. What is the equation on the screen, and why does it appear that way?

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4. Make observations about the identified coordinate points as the value of *k* changes.
   a. Each function has one point identified by an ordered pair. Record the coordinates of this point for different values of *k* for each function. Click ▲ or ▼ on the left side of the screen to see the next function.

k	*a*(*x*)	*b*(*x*)	*c*(*x*)	*d*(*x*)
3				
0				
–3				

   b. Looking at the data that you recorded in the table, what effect does changing the value of *k* have on the function graph? Does it work the same way for all of the functions?

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5. Make observations about the identified coordinate points as the value of *h* changes.
   a. Each function has one point identified by an ordered pair. Record the coordinates of this point for different values of *h* for each function. Click ▲ or ▼ in the upper left corner of the screen to see the next function.

h	*t*(*x*)	*u*(*x*)	*v*(*x*)	*w*(*x*)
3				
0				
–3				

   b. Looking at the data that you recorded in the table, what effect does changing the value of *h* have on the function graph? Does it work the same way for all of the functions?

6. Suppose a function *g*(*x*) has the point (3, 4) on its graph. What translations are needed to move the point to (–2, 1)? What is the equation for this new function in terms of *g*(*x*)?

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7. Make observations as you change the value of *h* and *k*. Write the general form of the *f* function in terms of *h* and *k*.