

Function Shift Lab

Track how each change moves or reshapes a graph.

HIGH SCHOOL • MA.912.F.2

MA.912.F.2 "Identify and describe the effects of transformations on functions. Create new functions given transformations."

NAME _____

DATE _____

TRANSFORMATION RULES

In $g(x)=a f(x-h)+k$, h moves the graph right, k moves it up, and a changes the vertical size. A negative value of a reflects the graph across the x -axis. In $f(bx)$, a value of b greater than 1 makes a horizontal compression by a factor of $1/b$.

WORKED EXAMPLE

Let $f(x)=x^3$. Write $g(x)$ if $g(x)=-3f(x-5)+7$.

1. Start with $f(x)=x^3$.
2. Replace x with $x-5$: $f(x-5)=(x-5)^3$.
3. Multiply by -3 and add 7 : $g(x)=-3(x-5)^3+7$.

Answer: $g(x)=-3(x-5)^3+7$

PRACTICE 6 problems

- 1** Describe the transformations from $f(x)$ to $g(x)=f(x+4)-6$.

ANSWER _____

- 2** Let $f(x)=x^2$. Write $g(x)$ if $g(x)=2f(x)-1$.

ANSWER _____

- 3** Describe the transformations from $f(x)=|x|$ to $g(x)=f(x-8)+9$.

ANSWER _____

- 4** Describe the transformations from $f(x)=x^4$ to $h(x)=-f(x+2)$.

ANSWER _____

- 5** If $f(x)=1/x$ and $q(x)=f(4x)$, describe the horizontal transformation.

ANSWER _____

- 6** Start with $y=x^2$. Write the new function after shifting right 1 unit, vertically shrinking by a factor of $1/2$, and shifting up 10 units.

ANSWER _____

APPLY IT Show your work

- 1** In a video game, a creator models a character's jump path with $f(x)$. An alternate jump path is $g(x) = -f(x+12)+4$. Describe how the alternate path changes from the original path.

WORK SPACE

ANSWER _____

- 2** A student designs a profile banner using the base curve $f(x) = x^2$. The curve is moved right 14 units and down 15 units. Write the new function $g(x)$.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A game designer changes a base function $f(x)$ into $g(x) = -\frac{1}{2}f(4(x-16))+18$. Describe every transformation and explain how you know.

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Describe the transformations from $f(x)$ to $g(x)=f(x+4)-6$.	Shift left 4 units and down 6 units.
2	Let $f(x)=x^2$. Write $g(x)$ if $g(x)=2f(x)-1$.	$g(x)=2x^2-1$
3	Describe the transformations from $f(x)= x $ to $g(x)=f(x-8)+9$.	Shift right 8 units and up 9 units.
4	Describe the transformations from $f(x)=x^4$ to $h(x)=-f(x+2)$.	Shift left 2 units and reflect across the x-axis.
5	If $f(x)=1/x$ and $q(x)=f(4x)$, describe the horizontal transformation.	Horizontal compression by a factor of $1/4$.
6	Start with $y=x^2$. Write the new function after shifting right 1 unit, vertically shrinking by a factor of $1/2$, and shifting up 10 units.	$y=1/2(x-1)^2+10$

PART 2 · APPLY IT

- Shift left 12 units, reflect across the x-axis, and shift up 4 units.** The $x+12$ inside the function shifts the path left 12 units. The negative outside reflects it across the x-axis, and $+4$ shifts it up.
- $g(x)=(x-14)^2-15$** A right shift replaces x with $x-14$. A downward shift subtracts 15 from the output.

CHALLENGE

The graph is horizontally compressed by a factor of $1/4$, shifted right 16 units, reflected across the x-axis, vertically shrunk by a factor of $1/2$, and shifted up 18 units. The 4 inside causes the horizontal compression, $x-16$ causes the right shift, $-1/2$ causes the reflection and vertical shrink, and $+18$ causes the upward shift.

Accept equivalent expanded or factored forms for created functions. For horizontal compression, accept "compression by a factor of $1/4$," but not "stretch by 4."