LESSON MAKER PRO

Function Shift Lab

Track how a rule and its graph move.

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 _____

MOVE THE FUNCTION

In g(x)=f(x-h)+k, h moves the graph right when h is positive, and k moves it up when k is positive. A negative sign outside f reflects the graph across the x-axis, and a number outside f multiplies all y-values.

WORKED EXAMPLE

The number line marks the x-coordinate of a point on f. Let f(x)=2x-7 and g(x)=f(x-5)+3. Write g(x) in simplified form. What is the new x-coordinate of the marked point?



1. Start with g(x)=f(x-5)+3.
2. Substitute: g(x)=2(x-5)-7+3.
3. Simplify to g(x)=2x-14. The graph moves right 5, so P moves from 1 to 6.

Answer: g(x)=2x-14; the new x-coordinate is 6.

PRACTICE 4 problems

1 Let $f(x)=x^2+4$. Write g(x)=f(x)+6 in simplified form. Describe the transformation.

ANSWER _____

2 Let f(x)=-3x+1. Write g(x)=f(x+4) in simplified form. Describe the transformation.

ANSWER _____

3 Let $p(x)=x^2-8$. Write q(x)=-p(x) in simplified form. Describe the transformation.

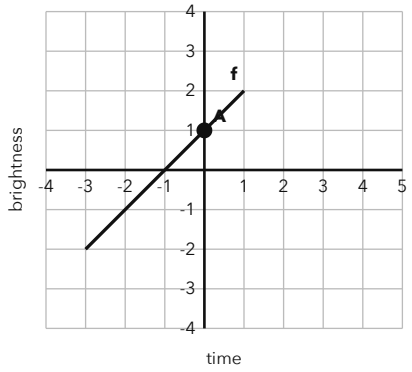
ANSWER _____

4 Let f(x)=4x-9. A graph shifts left 1 unit and down 6 units. Write the new function g(x) in simplified form.

ANSWER _____

APPLY IT Show your work

1 A video editor models a clip's brightness with f. The grid shows f and point A. A new filter uses g(x)=f(x-4)-3. Describe the translation and give the coordinates of A'.



ANSWER _____

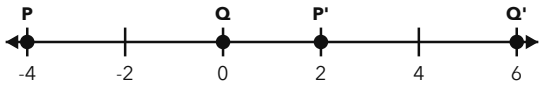
2 A game designer uses $f(x)=x^2+1$ for a bonus pattern. In a new mode, the pattern is h(x)=-2f(x+3)+4. Describe the transformations and write h(x) in simplified form.

WORK SPACE

ANSWER _____

CHALLENGE One step up

The number line marks corresponding x-coordinates for points P and Q on f and P' and Q' on g. The full coordinates are P=(-4,1), Q=(0,3), P'=(2,5), and Q'=(6,9). Find a, h, and k in g(x)=a f(x-h)+k. Explain briefly.



WORK SPACE AND ANSWER

ANSWER KEY

Function Shift Lab

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Let $f(x)=x^2+4$. Write $g(x)=f(x)+6$ in simplified form. Describe the transformation.	**$g(x)=x^2+10$; shift up 6 units.**
2	Let $f(x)=-3x+1$. Write $g(x)=f(x+4)$ in simplified form. Describe the transformation.	**$g(x)=-3x-11$; shift left 4 units.**
3	Let $p(x)=x^2-8$. Write $q(x)=-p(x)$ in simplified form. Describe the transformation.	**$q(x)=-x^2+8$; reflect across the x-axis.**
4	Let $f(x)=4x-9$. A graph shifts left 1 unit and down 6 units. Write the new function $g(x)$ in simplified form.	**$g(x)=f(x+1)-6=4x-11$; left 1 unit and down 6 units.**

PART 2 · APPLY IT

1. **Shift right 4 units and down 3 units; A'=(4,-2).** In $f(x-4)-3$, $x-4$ shifts every point right 4 and -3 shifts every point down 3. Apply these changes to A=(0,1).
2. **Shift left 3 units, reflect across the x-axis, vertically stretch by a factor of 2, then shift up 4 units; $h(x)=-2x^2-12x-16$.** Substitute $x+3$ into f, then multiply the result by -2 and add 4. Expand $(x+3)^2$ to simplify.

CHALLENGE

a=2, h=6, k=3, so $g(x)=2f(x-6)+3$. The x-coordinates move right 6. The y-values 1 and 3 become 5 and 9, so the outputs are doubled and then increased by 3.

Accept equivalent unsimplified function forms when they represent the same transformation. For the challenge, accept any clear explanation that uses both point pairs to justify the vertical scale and shift.