LESSON MAKER PRO

Graph Shift Detective

Find how a change in a function moves or reshapes its graph.

HIGH SCHOOL · A2S.AF.G.16

A2S.AF.G.16 "Identify the effect on the graph of replacing f(x) by f(x) + k, k · f(x), f(k · x), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs..."

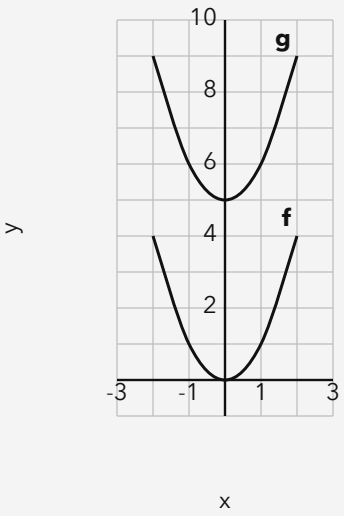
NAME _____ DATE _____

READ THE CHANGE

Adding k outside f(x) moves its graph up or down, while multiplying f(x) by k changes its height and reflects it across the x-axis if k is negative. In f(x + k), the graph moves horizontally in the direction opposite the sign of k. In f(kx), the graph changes width by a factor of 1/|k| and reflects across the y-axis if k is negative.

WORKED EXAMPLE

The graph shows f and g. Find k if g(x) = f(x) + k.

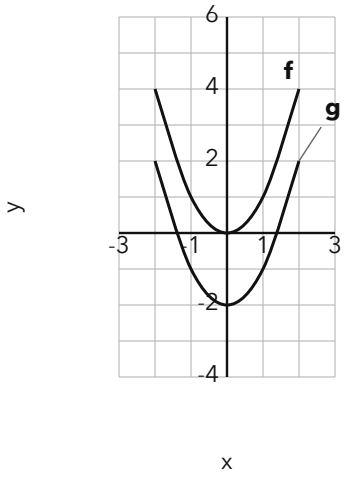


1. At x = 0, the graph of f has y-value 0.
2. At x = 0, the graph of g has y-value 5.
3. The y-value increased by 5, so k = 5.

Answer: k = 5

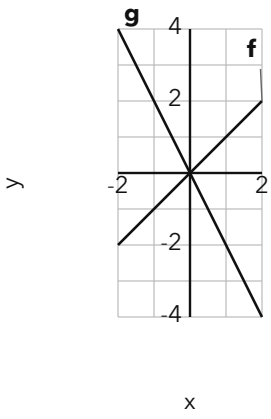
PRACTICE 6 problems

1 The graph shows f and g. Find k if g(x) = f(x) + k.



ANSWER _____

2 The graph shows f and g. Find k if g(x) = k · f(x).

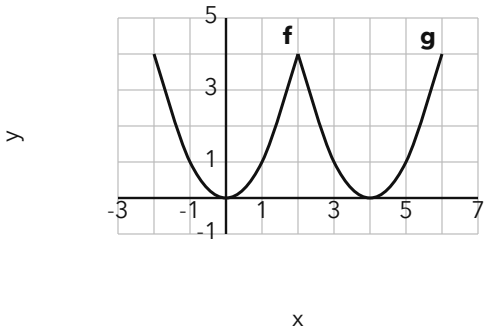


ANSWER _____

3 Let f(x) = √x and g(x) = f(4x). Write a formula for g(x), then state the horizontal scale factor from f to g.

ANSWER _____

4 The graph shows f and g. Find k if g(x) = f(x + k).



ANSWER _____

5 Let f(x) = 1/(x - 1) and g(x) = f(-x). Write g(x) as a simplified fraction, then name the reflection that takes the graph of f to the graph of g.

ANSWER _____

6 Let f(x) = $\log_2(x)$ and g(x) = f(x + 2). State how the graph moves and give the domain of g.

ANSWER _____

APPLY IT Show your work

1 An app tracks downloads in hundreds. Its forecast after x days is f(x) = 2x + 4. A promotion adds 7 hundred downloads to the forecast each day, so g(x) = f(x) + 7. Write g(x) and find the forecast for day 2 in downloads.

WORK SPACE

ANSWER _____

2 An LED display pulses according to f(x) = cos(x), where x is time in seconds. A new setting uses g(x) = f(2x). Find k in g(x) = f(kx), and give the new period in seconds.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A piecewise function is defined by f(x) = x + 1 when x < 0, and f(x) = 2 when x ≥ 0. Write a piecewise rule for g(x) = f(-2x). Then describe the horizontal changes from the graph of f to the graph of g.

WORK SPACE AND ANSWER

ANSWER KEY

Graph Shift Detective

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	The graph shows f and g. Find k if g(x) = f(x) + k.	**k = -2**
2	The graph shows f and g. Find k if g(x) = k · f(x).	**k = -2**
3	Let f(x) = √x and g(x) = f(4x). Write a formula for g(x), then state the horizontal scale factor from f to g.	**g(x) = √(4x) = 2√x; horizontal scale factor = 1/4**
4	The graph shows f and g. Find k if g(x) = f(x + k).	**k = -4**
5	Let f(x) = 1/(x - 1) and g(x) = f(-x). Write g(x) as a simplified fraction, then name the reflection that takes the graph of f to the graph of g.	**g(x) = -1/(x + 1); reflection across the y-axis**
6	Let f(x) = $\log_2(x)$ and g(x) = f(x + 2). State how the graph moves and give the domain of g.	**Left 2 units; x > -2**

PART 2 · APPLY IT

1. **g(x) = 2x + 11; 1,500 downloads on day 2** Add 7 to the output: g(x) = 2x + 4 + 7. Then g(2) = 15 hundreds, or 1,500 downloads.
2. **k = 2; period = π seconds** The input is multiplied by 2, so k = 2. The period changes from 2π seconds to 2π/2 = π seconds.

CHALLENGE

g(x) = 2 when x ≤ 0, and g(x) = -2x + 1 when x > 0. The graph is reflected across the y-axis and compressed horizontally by a factor of 1/2.

Accept √(4x) or 2√x for practice problem 3. In the challenge, check the inequalities carefully: -2x ≥ 0 when x ≤ 0.