LESSON MAKER PRO

Shift the Graph

Track how a function moves.

HIGH SCHOOL · A1.F.2.2

A1.F.2.2 "Recognize the parent functions f(x) = x and f(x) = |x|. Predict the effects of vertical and horizontal transformations f(x + c) and f(x) + c, algebraically and graphically."

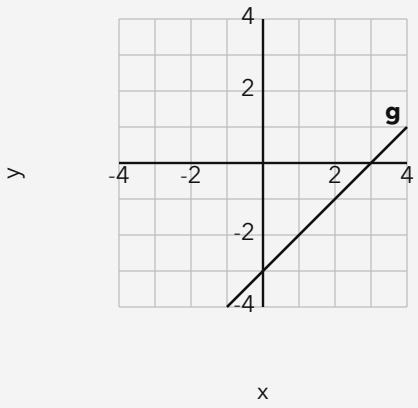
NAME _____ DATE _____

THE SHIFT RULE

The graph of f(x) = x is a line. The graph of f(x) = |x| has a V shape. In f(x + c), a positive c shifts the graph left; in f(x) + c, it shifts the graph up. A negative c reverses the direction.

WORKED EXAMPLE

Use the graph of g. Name its parent function, write g(x), and describe the shift.



1. The graph is a line with slope 1, so its parent is f(x) = x.
2. It crosses the y-axis at -3, so g(x) = x - 3.
3. Subtracting 3 outside f shifts the parent down 3 units.

Answer: Parent: f(x) = x; g(x) = x - 3; shift down 3 units.

PRACTICE 4 problems

1 Let f(x) = |x| and g(x) = f(x + 4). Write g(x) and give its vertex.

ANSWER _____

2 Let f(x) = x and g(x) = f(x - 5). Write g(x) and name the shift shown by this form.

ANSWER _____

3 Let f(x) = |x| and g(x) = f(x) - 6. Write g(x) and give its vertex.

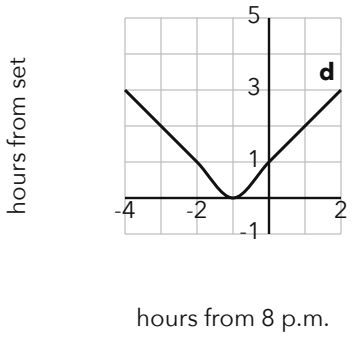
ANSWER _____

4 Let f(x) = x and g(x) = f(x) + 1. Write g(x) and name the shift shown by this form.

ANSWER _____

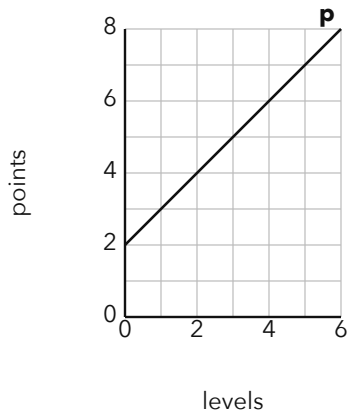
APPLY IT Show your work

1 At a concert, x is the number of hours from 8 p.m. The graph shows d(x), the number of hours until or since the set begins. Use the graph to find the set time and write d(x).



ANSWER _____

2 A game starts you with bonus points. You earn 1 more point per level. Use the graph of total points p to find the starting bonus, write p(x), and name the shift from f(x) = x.



ANSWER _____

CHALLENGE One step up

A student says |x + 4| and |x| + 4 have the same graph because both add 4. Explain why this is false using the two vertices.

WORK SPACE AND ANSWER

ANSWER KEY

Shift the Graph

HIGH SCHOOL · A1.F.2.2

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Let f(x) = |x| and g(x) = f(x + 4). Write g(x) and give its vertex.	**g(x) = |x + 4|; vertex (-4, 0).**
2	Let f(x) = x and g(x) = f(x - 5). Write g(x) and name the shift shown by this form.	**g(x) = x - 5; shift right 5 units.**
3	Let f(x) = |x| and g(x) = f(x) - 6. Write g(x) and give its vertex.	**g(x) = |x| - 6; vertex (0, -6).**
4	Let f(x) = x and g(x) = f(x) + 1. Write g(x) and name the shift shown by this form.	**g(x) = x + 1; shift up 1 unit.**

PART 2 · APPLY IT

1. **7 p.m.; d(x) = |x + 1|.** The graph reaches 0 at x = -1, one hour before 8 p.m. Its V shape has the vertex of |x| shifted left 1 unit.
2. **2 points; p(x) = x + 2; shift up 2 units.** At x = 0, the graph shows 2 points. Adding 2 outside f shifts the line up 2 units.

CHALLENGE

|x + 4| has vertex (-4, 0), while |x| + 4 has vertex (0, 4). The first shifts left 4 units, and the second shifts up 4 units.

For f(x) = x, a horizontal shift can produce the same line as a vertical shift. In practice problems 2 and 4, accept the shift specified by the given form.