

Shifting, Stretching and Piecewise Functions

Grade 9 – Algebra 1 math · Worksheet · Standards: F-BF.B.3, F-IF.C.7b

Name: _____ Date: _____ Class: _____

These 20 problems train standards F-BF.B.3 and F-IF.C.7b. The first problems describe shifts, stretches and reflections of parabolas and absolute value graphs. Later problems evaluate and graph piecewise and step functions.

The last six problems write equations from graphs and model fares, bills and a robot path.

Standards: F-BF.B.3, F-IF.C.7b · **Level:** Grade 9 Algebra 1

Problem 1 Shift Up (easy)

The graph of $g(x) = x^2 + 5$ is made from the graph of $f(x) = x^2$. Describe the change and name the vertex of g .

Problem 2 Shift Right (easy)

Describe how the graph of $g(x) = (x - 4)^2$ differs from the graph of $f(x) = x^2$.

Problem 3 Absolute Value, Shifted Down (easy)

Describe how the graph of $h(x) = |x| - 3$ differs from the graph of $f(x) = |x|$.

Problem 4 Absolute Value, Shifted Left (easy)

Describe how the graph of $f(x) = |x + 2|$ differs from the graph of $|x|$.

Problem 5 Evaluate an Absolute Value Function (easy)

Let $f(x) = |2x - 7|$. Find $f(0)$, $f(3)$, $f(5)$ and $f(-1)$.

Problem 6 Evaluate a Piecewise Function (easy)

Let $f(x) = x^2 - 1$ if $x < 0$, and $f(x) = 3x + 2$ if $x \geq 0$. Find $f(-3)$, $f(0)$ and $f(4)$.

Problem 7 Stretch, Shrink and Flip (medium)

Describe how each graph differs from the graph of $f(x) = x^2$.

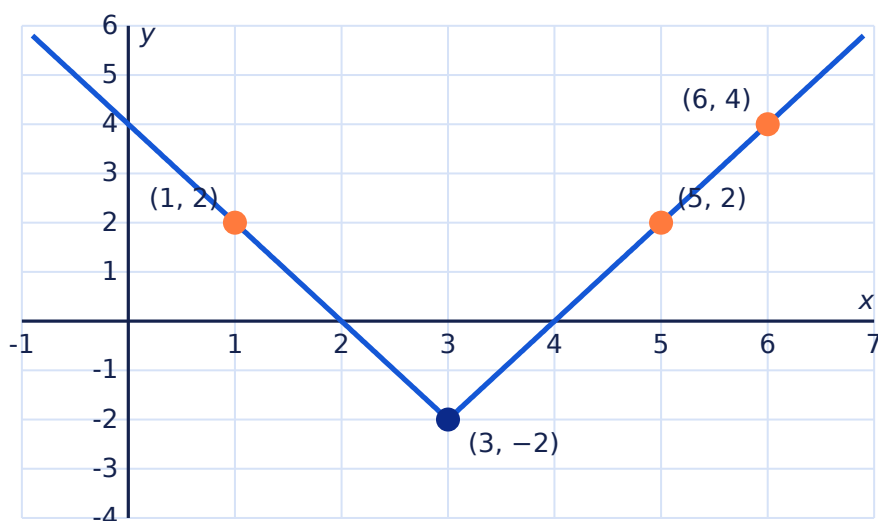
- a. $y = 3x^2$
- b. $y = \frac{1}{4}x^2$
- c. $y = -x^2$

Problem 8 Combine Several Changes (medium)

For $g(x) = -2(x - 3)^2 + 5$, list the transformations of $f(x) = x^2$, and give the vertex and the direction of opening.

Problem 9 Equation from an Absolute Value Graph (medium)

Use the vertex and one more marked point to find a rule for this V-shaped graph.



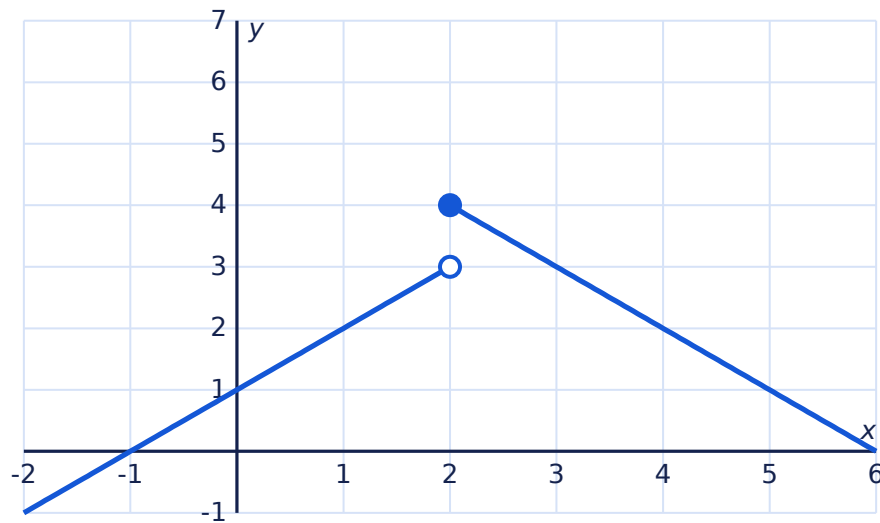
A V-shaped graph with marked points.

Problem 10 Table for $f(x - 2) + 1$ (medium)

Let $f(x) = x^2$ and $g(x) = f(x - 2) + 1$. Complete a table of g for $x = 0, 2, 4$.

Problem 11 Read a Piecewise Graph (medium)

Use the graph to find $f(-1)$, $f(1)$, $f(2)$ and $f(3)$. Say which endpoint at $x = 2$ is open and which is closed.



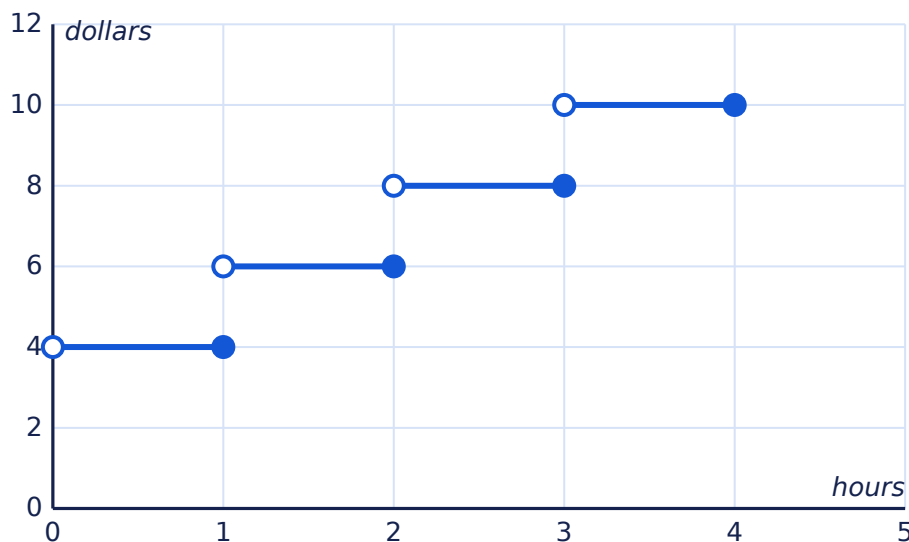
A piecewise function with a jump at $x = 2$.

Problem 12 Absolute Value Equation (medium)

For $f(x) = |x - 4| + 1$, find every x for which $f(x) = 7$.

Problem 13 Parking Fee Steps (medium)

A garage charges \$4 for the first hour or part of an hour, and \$2 for each additional hour or part of an hour, up to 4 hours. Use the graph to find the fee for 1 hour, 2.5 hours and 3.2 hours.



Parking fee against hours parked.

Problem 14 Taxi Fare Rule (medium)

A taxi charges \$3.50 plus \$2.25 per mile for the first 4 miles, and \$1.75 per mile after that. Write $C(m)$ as a piecewise function and find the fare for 2 miles and for 10 miles.

Problem 15 Move a Point (hard)

The point $(3, 5)$ is on the graph of $y = f(x)$. Give the matching point on each graph.

- a. $y = f(x) + 4$
- b. $y = f(x - 2)$
- c. $y = -f(x)$
- d. $y = 3f(x)$

Problem 16 Write the Transformed Parabola (hard)

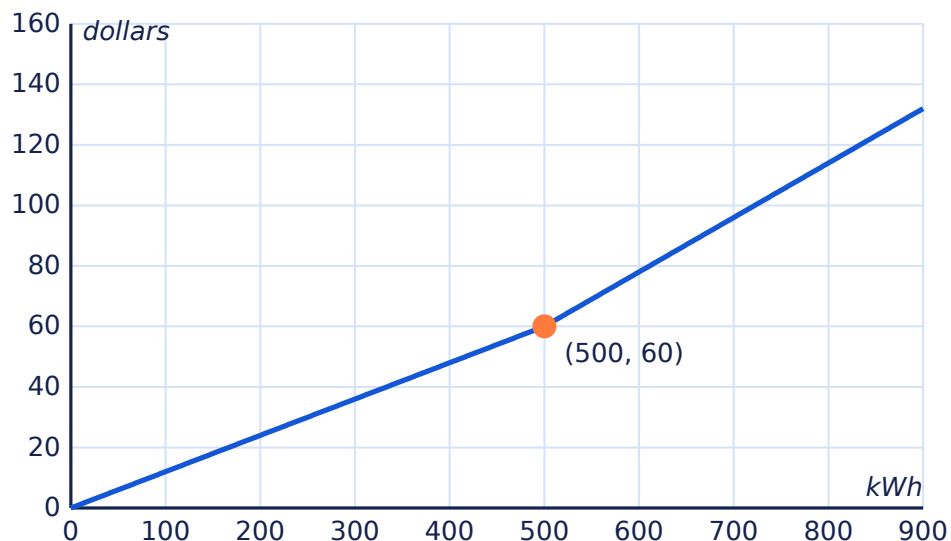
Write the equation of the graph made from $y = x^2$ by moving it 4 units left, reflecting it over the x -axis and moving it 7 units up. Then find the y -value at $x = -2$.

Problem 17 Absolute Value as Piecewise (hard)

Write $f(x) = |x - 3|$ as a piecewise function without absolute value bars. Check it at $x = -1$ and $x = 6$.

Problem 18 Electricity Bill (hard)

An electric company charges \$0.12 per kilowatt-hour (kWh) for the first 500 kWh and \$0.18 per kWh for each kWh above 500. Write the bill $C(k)$ as a piecewise function and find the bill for 430 kWh and for 760 kWh.



Bill for the first 500 kWh and beyond.

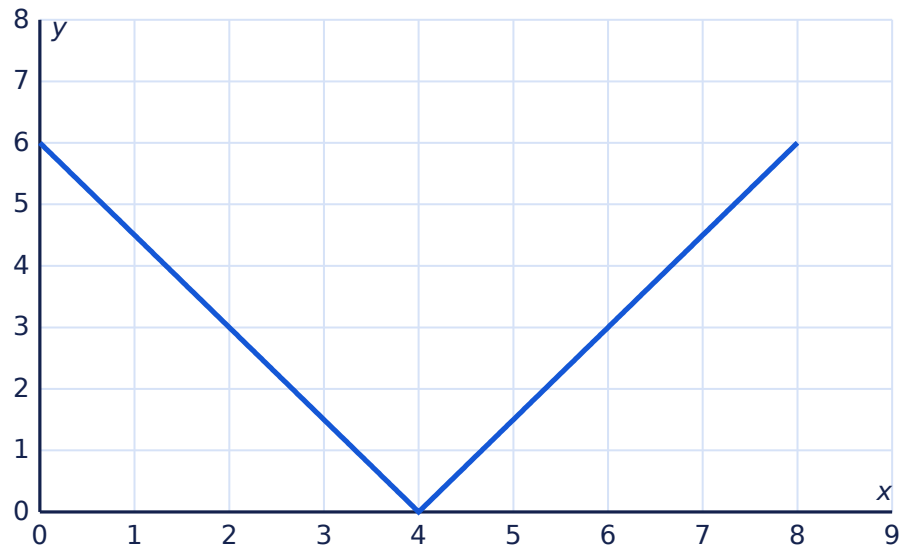
Problem 19 Describe a Transformed Absolute Value (hard)

Describe the transformations that turn $f(x) = |x|$ into $g(x) = -3|x + 1| + 2$. Name the vertex and

find $g(-4)$ and $g(2)$.

Problem 20 Robot on a Track (hard)

A robot drives along a track. Its distance d from a charging dock, in feet, after t seconds follows the V-shaped graph: 6 feet at $t = 0$, 0 feet at $t = 4$ and 6 feet at $t = 8$. Write an equation $d = a|t - h| + k$ and explain what the vertex means.



Distance of a robot from a charging dock.