

Transformations of Functions and Their Graphs

Grade 11 – Algebra 2 math · Worksheet · Standards: F-BF.B.3, F-IF.C.7b

Name: _____ Date: _____ Class: _____

These problems study how shifts, reflections, stretches, and compressions change the graphs of the quadratic, absolute value, square root, cube root, and exponential parent functions, and how even and odd functions behave. They follow Common Core standards F-BF.B.3 and F-IF.C.7b.

Track one key point through every change and state the domain and range of each result. The last problems apply transformations to ball, video, and donation models.

Standards: F-BF.B.3, F-IF.C.7b · **Level:** Grade 11 Algebra 2

Problem 1 Describing shifts (easy)

Describe how each graph is obtained from its parent function.

- a. $g(x) = x^2 + 5$
- b. $h(x) = (x - 4)^2$
- c. $p(x) = |x + 6|$
- d. $q(x) = |x| - 2$

Problem 2 Writing an equation for a shift (easy)

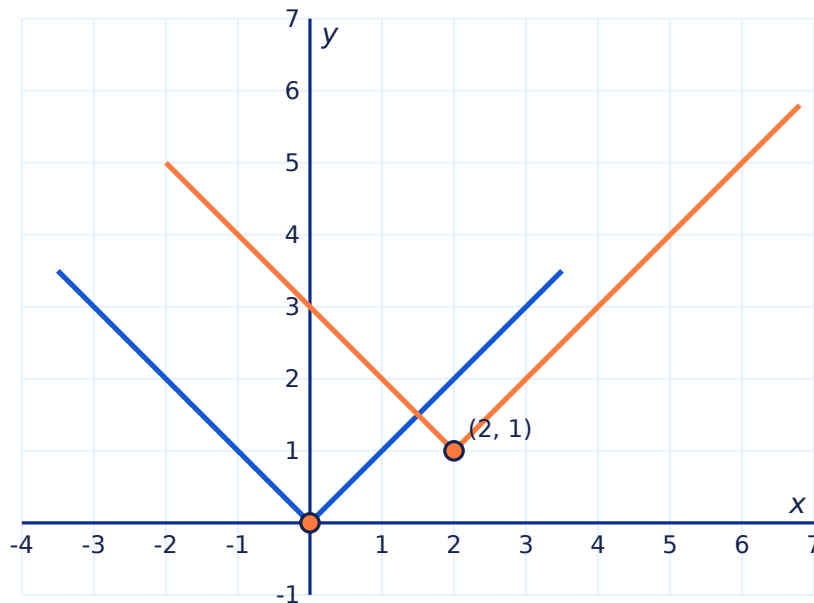
Write the equation of the graph of $y = |x|$ after it is shifted 3 units left and 6 units down.

Problem 3 Evaluating transformed functions (easy)

Let $f(x) = \sqrt{x}$. Find the value of $3f(x)$ at $x = 16$, 25, and 36.

Problem 4 Equation from a graph (easy)

The graph of $f(x) = |x|$ and a second graph g are shown. Write the equation of g .



Graphs of f and g .

Problem 5 Even, odd, or neither (easy)

Classify each function as even, odd, or neither by evaluating $f(-x)$.

- a. $f(x) = x^6 - 4x^2$
- b. $g(x) = x^5 - 9x$
- c. $h(x) = x^2 - 3x$

Problem 6 Reflections (medium)

The point $(4, 2)$ is on the graph of $f(x) = \sqrt{x}$. Name the matching point on the graphs of $g(x) = -f(x)$ and $h(x) = f(-x)$, and describe each reflection.

Problem 7 Stretches and shrinks (medium)

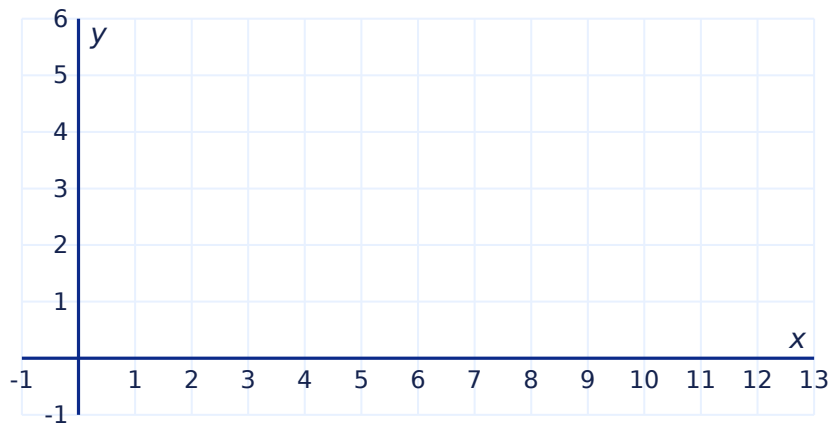
Describe $g(x) = -\frac{1}{2}x^2 + 3$ as a transformation of $f(x) = x^2$, and give $g(4)$.

Problem 8 Several transformations at once (medium)

Describe $g(x) = -2|x + 1| + 4$ as a transformation of $f(x) = |x|$ and give the vertex.

Problem 9 Graphing a square root function (medium)

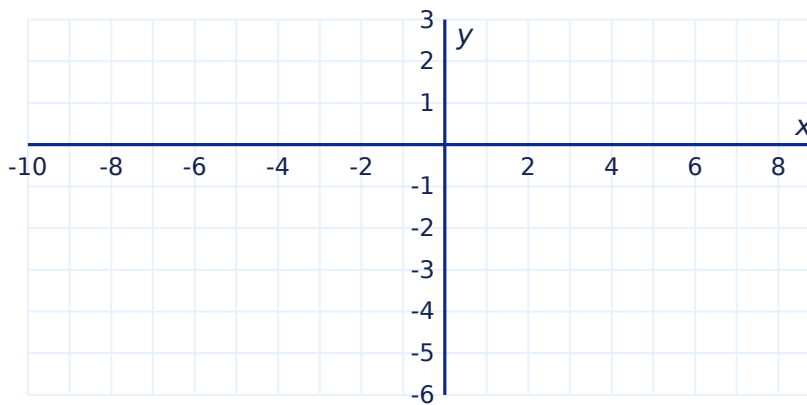
Graph $y = \sqrt{x - 2} + 1$ on the grid. Give the starting point, the domain, and the range.



Grid for the graph.

Problem 10 Graphing a cube root function (medium)

Graph $y = \sqrt[3]{x + 1} - 2$ on the grid by finding the center and four more points. State the domain and range.



Grid for the graph.

Problem 11 An exponential transformation (medium)

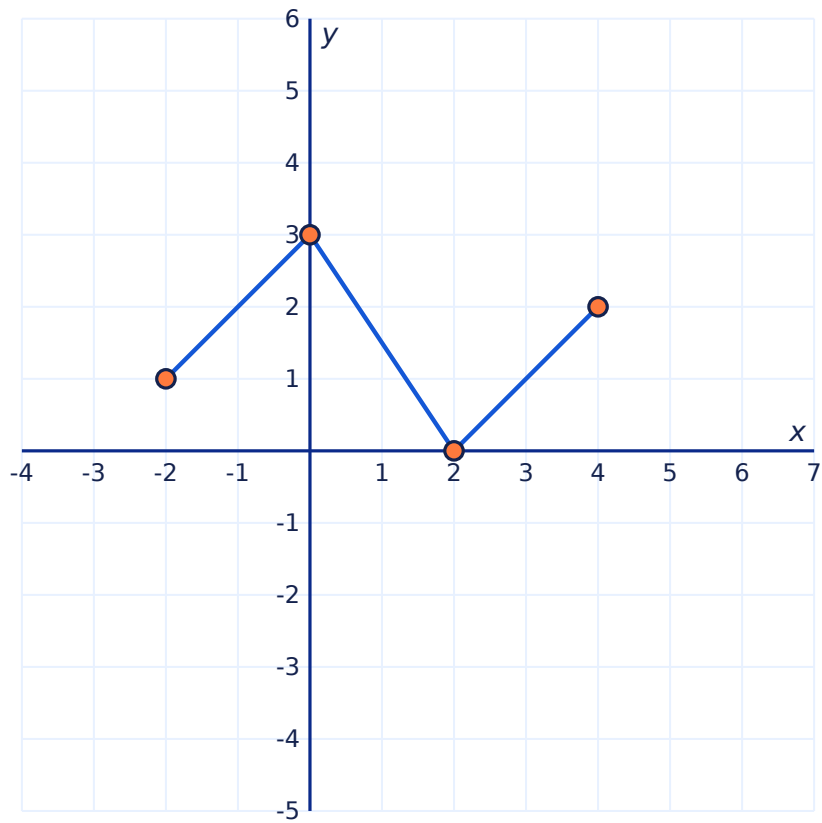
Describe $g(x) = 5^{x-1} + 4$ as a transformation of $f(x) = 5^x$. Give the horizontal asymptote and the y-intercept.

Problem 12 Domain and range (medium)

Find the domain and range of $g(x) = -\sqrt{x - 4} + 5$.

Problem 13 Transforming a polygonal graph (medium)

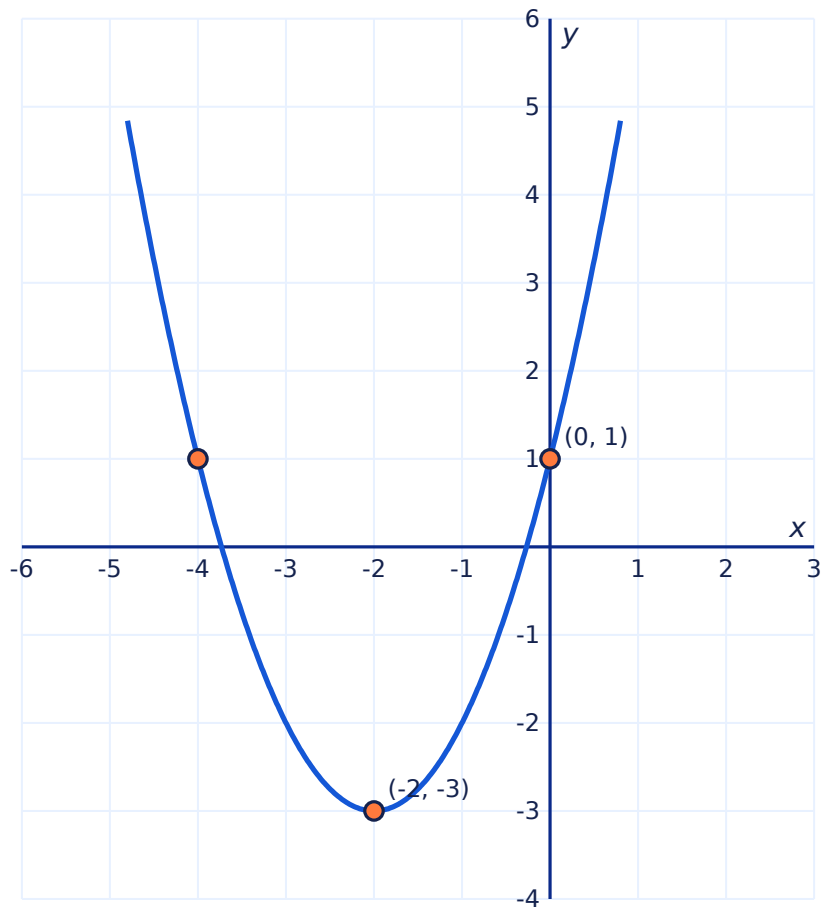
The graph of f consists of segments joining $(-2, 1)$, $(0, 3)$, $(2, 0)$, and $(4, 2)$. List the corresponding vertices of $g(x) = f(x - 1) + 2$ and of $h(x) = -f(x)$.



Graph of f .

Problem 14 Equation of a parabola from its graph (medium)

The graph of a transformed parabola has vertex $(-2, -3)$ and passes through $(0, 1)$. Write its equation in the form $g(x) = a(x - h)^2 + k$.



A parabola.

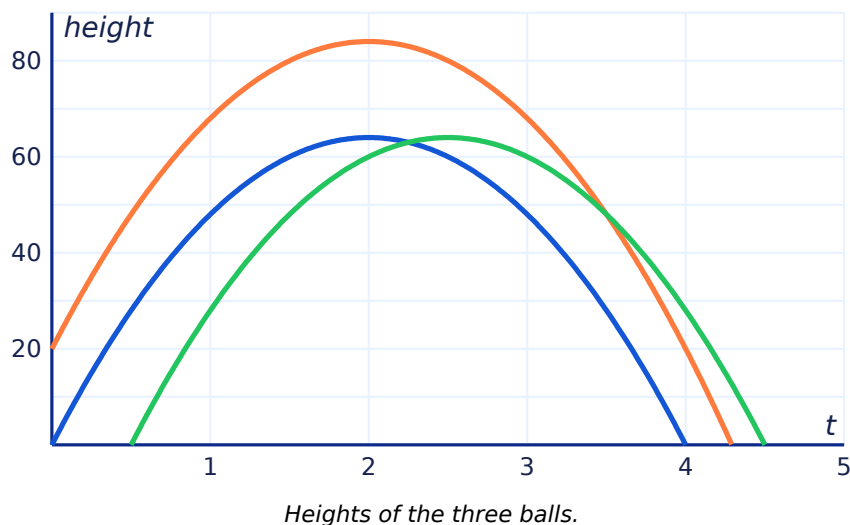
Problem 15 Proving even and odd (hard)

Determine algebraically whether each function is even, odd, or neither.

- a. $f(x) = \frac{x^3}{(x^2 + 4)}$
- b. $g(x) = |x| + x^4$
- c. $h(x) = x^4 + x^3$

Problem 16 Three launches of a ball (hard)

A ball launched from the ground reaches height $h(t) = -16t^2 + 64t$ feet after t seconds. A second ball is launched from a platform 20 feet high with the same motion, so its height is $h(t) + 20$. A third ball is launched 0.5 second later from the ground, so its height is $h(t - 0.5)$. Describe each transformation and find the maximum height of each ball.



Problem 17 Delayed video views (hard)

Views of a video are modeled by $V(t) = 500 \cdot 2^t$, where t is the number of days after it is posted. A second video of the same kind is posted 3 days later. Write the model for the second video, find its views on day 5, and write the model if it also begins with 800 extra views.

Problem 18 Weekly donations (hard)

A school fundraiser models weekly donations, in hundreds of dollars, by $D(w) = 2\sqrt{w-1} + 3$ for $w \geq 1$ weeks. Describe the transformation of $\sqrt{w}$, find $D(10)$ and $D(5)$, and find the week when donations reach 11 hundred dollars.

Problem 19 Writing and using a transformed function (hard)

The graph of g comes from $f(x) = |x|$ by reflecting across the x -axis, stretching vertically by 3, shifting right 2, and shifting down 1. Write $g(x)$, find $g(-1)$, $g(2)$, and $g(5)$, and explain why the graph has no x -intercepts.

Problem 20 A horizontal change that is really vertical (hard)

For $f(x) = \sqrt{x}$, write $g(x) = f(4x - 12)$ and show that g is a vertical stretch of a shifted copy of f . Give the domain of g .