WARM-UF

Describe and graph the transformation for each:

1. $g(x) = 2(x-3)^2 - 4$

2. $f(x) = -3\sqrt{x+1}$

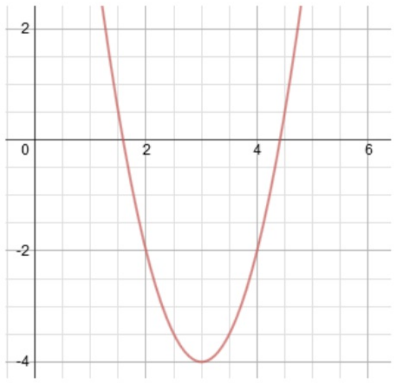
Write an equation for the following transformations:

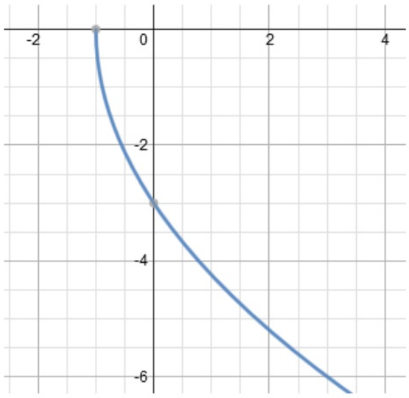
3. $y = x^2$: a shift left 3 units, then a vertical stretch by a factor of 2.

4. $y = |x|$: shift right 4 units, reflected over the x-axis, and finally a shift down 2 units.

5. $f(x) = \frac{\sqrt{x+3}}{x+5}$ **Give the Domain**

WARM-UF

1) 

2) 

3) $2(x + 3)^2$

4) $-|x - 4| - 2$

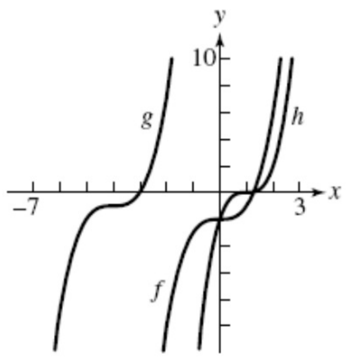
5) $[-3, \infty)$

2. Vertical translation up 5.2 units

4. Horizontal translation right 3 units

10. Horizontal translation right 5 units

22.



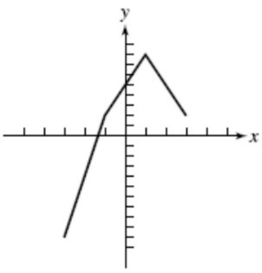
25. Since the graph is translated left 5 units, $f(x) = \sqrt{x + 5}$.

26. The graph is reflected across the y-axis and translated right 3 units. $y = \sqrt{-x}$ would be reflected across the y-axis; the horizontal translation gives $f(x) = \sqrt{-(x - 3)} = \sqrt{3 - x}$.
See also Exercise 12 in this section, and note accompanying that solution.

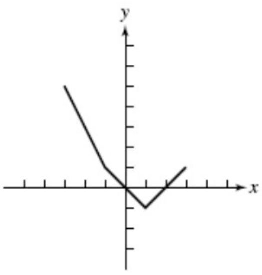
27. The graph is reflected across the x-axis, translated left 2 units, and translated up 3 units. $y = -\sqrt{x}$ would be reflected across the x-axis, $y = -\sqrt{x + 2}$ adds the horizontal translation, and finally, the vertical translation gives $f(x) = -\sqrt{x + 2} + 3 = 3 - \sqrt{x + 2}$.

28. The graph is vertically stretched by 2, translated left 5 units, and translated down 3 units. $y = 2\sqrt{x}$ would be vertically stretched, $y = 2\sqrt{x + 5}$ adds the horizontal translation, and finally, the vertical translation gives $f(x) = 2\sqrt{x + 5} - 3$.

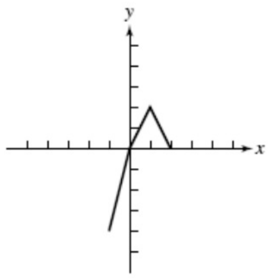
51. Translate left 1 unit, then vertically stretch by 3, and finally translate up 2 units. The four vertices are transformed to $(-3, -10)$, $(-1, 2)$, $(1, 8)$, and $(3, 2)$.



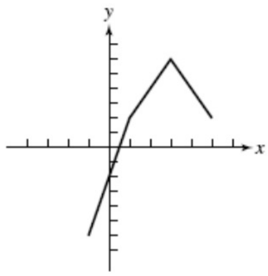
52. Translate left 1 unit, then reflect across the x-axis, and finally translate up 1 unit. The four vertices are transformed to $(-3, 5)$, $(-1, 1)$, $(1, -1)$, and $(3, 1)$.



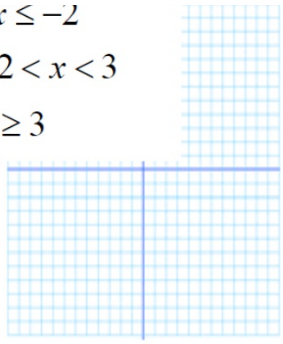
53. Horizontally shrink by $\frac{1}{2}$. The four vertices are transformed to $(-1, -4)$, $(0, 0)$, $(1, 2)$, $(2, 0)$.



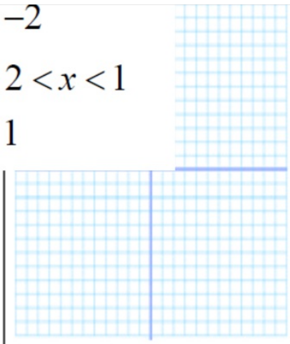
54. Translate right 1 unit, then vertically stretch by 2, and finally translate up 2 units. The four vertices are transformed to $(-1, -6)$, $(1, 2)$, $(3, 6)$, and $(5, 2)$.



$$f(x)=\begin{cases} 3, & x \le -2 \\ -2-4x & -2 < x < 3 \\ x^2-1, & x \ge 3 \end{cases}$$



$$f(x)=\begin{cases} 3x-2, & x \le -2 \\ x^2+1, & -2 < x < 1 \\ 6, & x \ge 1 \end{cases}$$



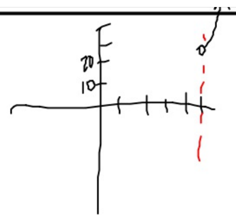
Also list Domain, Range, Continuity and evaluate:

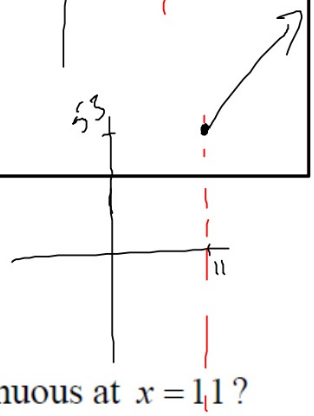
f(-2) f(0) f(4)

for each piecewise function above

$25 = 5c + 7$

$c = \frac{18}{5}$





$53 = 44 + c$

Let $g(x) = \begin{cases} 4x + c \text{ , if } x < 11 \\ 5x - 2 \text{ , if } x \geq 11 \end{cases}$

What is the value of c that will make $f(x)$ continuous at $x = 11$?

$c = 9$

1-4 Operations and Compositions of Functions

$f(x) = x^2 - 4$ $g(x) = x + 2$

$\left(\frac{f}{g}\right)(x)$

$(f+g)(x)$ $(f-g)(x)$ $(f \cdot g)(x)$

Find a. f(x) + g(x) b. f(x) - g(x) c. f(x) g(x) d. f(x)/g(x)

a. $x^2 - 4 + x + 2$

$x^2 + x - 2$

b. $x^2 - 4 - (x+2)$

$x^2 - 4 - x - 2$

$x^2 - x - 6$

c. $(x^2 - 4)(x+2)$

$x^3 + 2x^2 - 4x - 8$

d. $\frac{x^2 - 4}{x+2}$

$\frac{(x+2)(x-2)}{x+2}$

$x - 2$

Other Notation

What is the notation for *composition of functions*?

$(f \circ g)(x)$ is read " f of g of x ".

$f(g(x))$

$(f \circ g)(x)$ can also be written as $f(g(x))$

$(f \circ g)(x)$

x is the input

$(f \cdot g)x$

f(x) or y is the output

Find $(f \circ g)(x)$ and $(g \circ f)(x)$. $f(g(x))$ $g(f(x))$

1. $f(x) = 2x$ and $g(x) = x + 2$

x^2

$f(2)$

$f(x+2)$ $(f \cdot g)(x)$ $g(2x)$

$f(x) = 2x$

$f(g(x)) = 2(x+2)$

$= 2x+4$

$g(x) = x+2$

$g(f(x)) = (2x)+2$

2. $f(x) = x^2 + x - 1$ **and** $g(x) = x + 3$ $f(g(x))$ $g(f(x))$

$f(x+3)$

$f(g(x))$ $(x+3)^2 + (x+3) - 1$

$g(x^2+x-1)$

$(x^2+x-1)+3$

$g(f(x)) = x^2+x+2$

If $f(x) = x + 2$, $g(x) = 2x - 1$, and $h(x) = x^2 + x - 3$, find each value:

3. $g(f(0))$

$g(2) = 3$

4. $f(h(-4))$

$f(9) = 11$

5. $h(g(3))$

$h(5) = 27$

6. $f(g(-3))$

$f(-7) = -5$

For each function h, find functions f and g such that $h(x) = f(g(x))$.

(a) $h(x) = (x + 1)^2 - 3(x + 1) + 4$

(b) $h(x) = \sqrt{x^3 + 1}$

$f(g(x))$ $f(x) = x^2 - 3x + 4$ $g(x) = (x+1)$

$f(x)\ \sqrt{x}$ $g(x)\ x^3+1$

$f(g(x))$ $\sqrt{x^3+1}$

$f(x^3+1)$

$f(x) = 2x^2$ and $g(x) = 3 - x$

Extra Practice

Find $(f \circ g)(x)$ and $(g \circ f)(x)$

$2(3-x)^2$ $3-2x^2$

Find $(f \circ g)(5)$ and $(g \circ f)(2)$ -5

8 $g(f(2))$

Find $(g \circ g)(1)$ and $(f \circ f)(-1)$

-15 2 -17

Challenge: Find $g(f(3)) - f(g(4))$

Wrap up

1. Given $f(x) = x^3$ consider the following transformation: reflected over the x axis, shifted 3 left and 4 down.

a. Write the equation b. graph without a calculator

2. Describe the transformation of $g(x) = -2|x+3|$ from the parent function $f(x) = |x|$

3. Determine if the function $f(x) = x^5 - x^3 + 2$ is even odd or neither. Justify your answer

Find the Domain of the following functions

1. $f\left(x\right) = \dfrac{\sqrt{x-5}}{x+2}$

2. $f\left(x\right) = \dfrac{4-x}{\sqrt{x-3}}$

3. $f\left(x\right) = \dfrac{\sqrt{5-x}}{x+2}$