Notes Unit 2.10
Pre-Calculus Markwalter

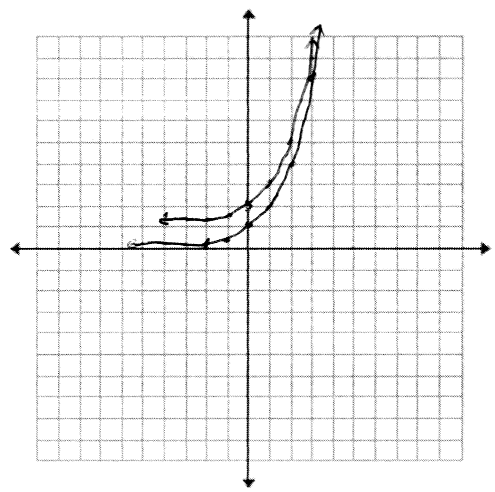
Transformation	General Form	Example 1	Example 2
Translation Up/Down	$f(x) \pm b$	$y = \log_2(x) + 7$ up	$y = x^2 - 2$ down
Translation Left/Right	$f(x \pm b)$	$y = 2^{x+1}$ left	$y = (x+3)^3$ right
Reflection over the x-axis	$-f(x)$	$y = -\lvert x \rvert$	$y = -\sqrt[3]{x}$

1. For parts (a) to (c),
   - Sketch the graph of each pair of functions on the same coordinate axes showing end behavior and intercepts, and
   - Describe the graph of g as a series of transformations of the graph of f.

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

x	f(x)
-2	1/4
-1	1/2
0	1
1	2
2	4
3	8

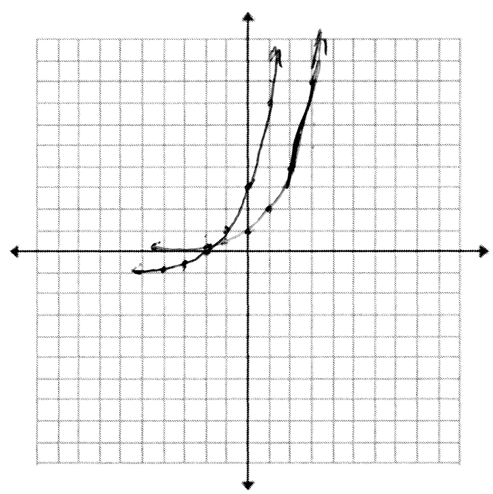
$\xrightarrow{\text{transl up 1}}$ g(x)



b. $f(x)=2^x$, and $g(x)=2^{x+2}-1$

x	f(x)
-2	1/4
-1	1/2
0	1
1	2
2	4
3	8

transl down 1
left 2 $\longrightarrow$ g(x)



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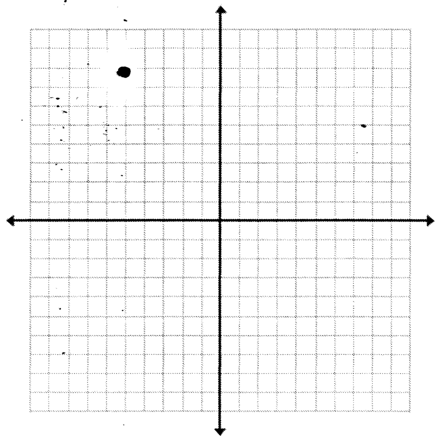
$f(x)=2^x$, and $g(x)=2^{x+1}-3$

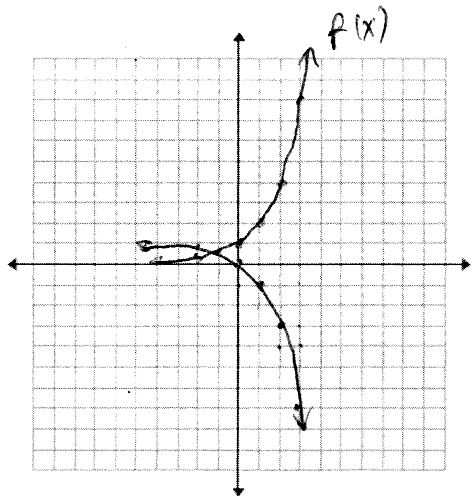


1. For parts (a) to (c),
   - Sketch the graph of each pair of functions on the same coordinate axes showing end behavior and intercepts, and
   - Describe the graph of g as a series of transformations of the graph of f.

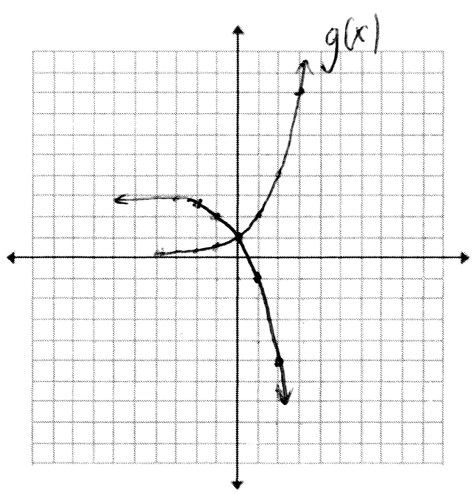
a. $f(x)=2^x$, and $g(x)=-2^x+1$

x	f(x)
-2	1/4
-1	1/2
0	1
1	2
2	4
3	8

Refl over x-axis
transl up 1 $\longrightarrow$ g(x)



$f(x)=2^x$, and $g(x)=-2^{x+1}+3$



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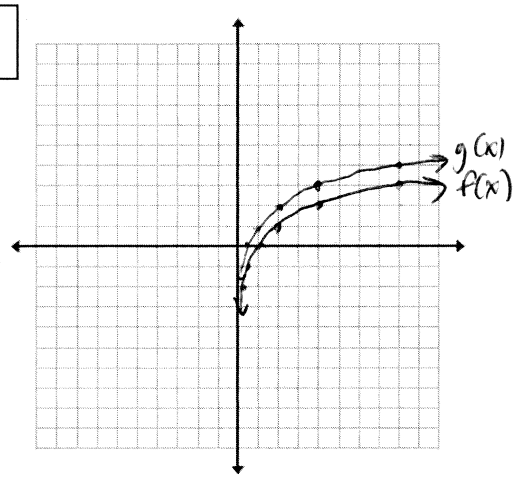
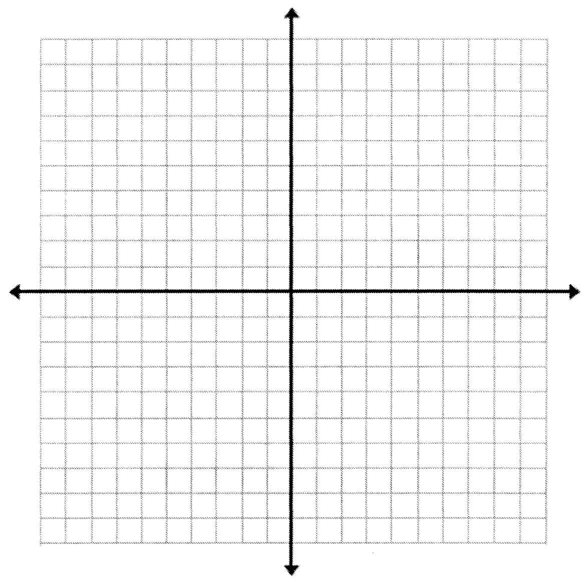
$f(x)=\log_2(x)$, and $g(x)=\log_2(x)+1$

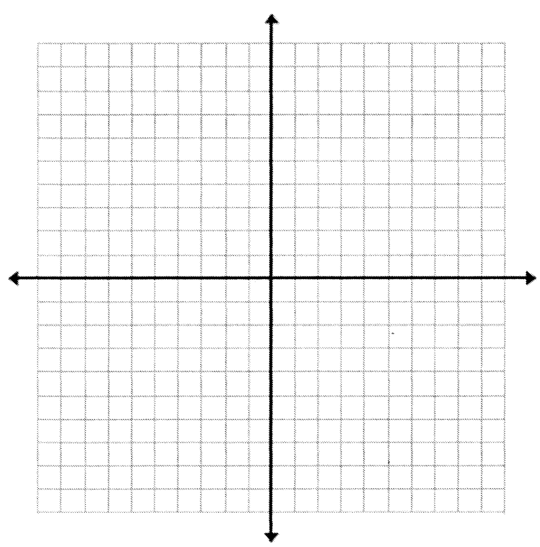
x	f(x)
$\frac{1}{4}$	-2
$\frac{1}{2}$	-1
1	0
2	1
4	2
8	3



$f(x)=\log_2(x)$, and $g(x)=\log_2(x+1)+1$



$f(x)=\log_2(x)$, and $g(x)=\log_2(x-2)$



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For each problem, determine whether the two given functions (g and h) are equivalent. Show your work. Then describe the transformation that would change f into g.

1. $g(x) = 2 \cdot 2^x$ *and* $h(x) = 2^{x+1}$ trans'l left 1 $f(x) = 2^x$

   $g(x) = 2^{x+1}$

2. $g(x) = 3^{x+2}$ *and* $h(x) = 9 \cdot 3^x$ $f(x) = 3^x$

   $3^2 \cdot 3^x$ translate left 2

   $g(x) = 9 \cdot 3^x$

3. $g(x) = 3^{x-3}$ *and* $h(x) = 3^{3x}$ $f(x) = 3^x$

   No! $3^{-3} \cdot 3^x$ transl right 3

   $g(x) = \frac{1}{27} \cdot 3^x$

4. $g(x) = 3^{x}$ *and* $h(x) = 3^{-1} \cdot 3^x$ $f(x) = 3^x$

5. $g(x) = \log(x-2)$ *and* $h(x) = \log(x) - \log(2)$ $f(x) = \log(x)$

   No transl right 2

6. $g(x) = \log(10x)$ *and* $h(x) = \log(x) + 1$ transl up 1 $f(x) = \log(x)$

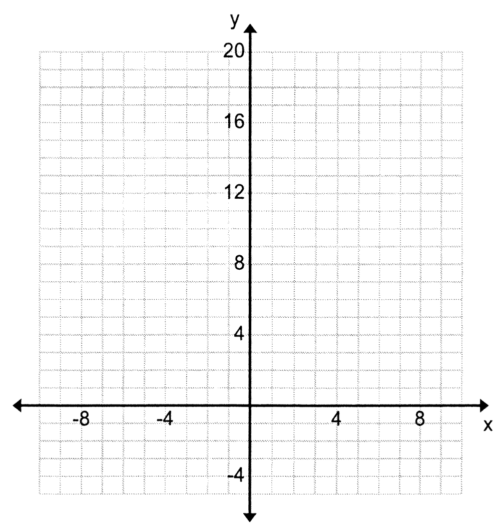
   $g(x) = \log(10) + \log(x)$

   $= \log(x) + 1$

7. $g(x) = \log\left(\frac{x}{100}\right)$ *and* $h(x) = \log(x) - 2$ $f(x) = \log(x)$

   $g(x) = \log(x) - 2$ transl down 2

8. Graph $f(x) = 2^x$, $g(x) = 8(2^x)$, and $h(x) = 2^{x+3}$ on the same coordinate axes. Describe the graphs of g and h as transformations of the graph of f. Use the properties of exponents to explain why g and h are equivalent.



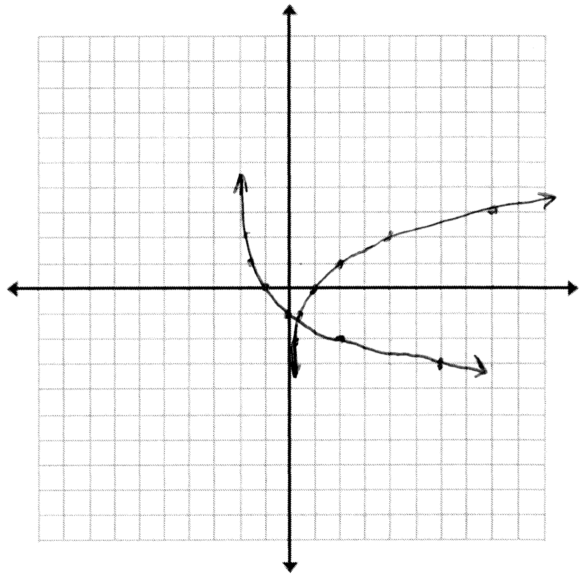
Problem Set

f(x)=log$_2$(x), and g(x)=-log$_2$(x+2)

X	f(x)
$\frac{1}{4}$	-2
$\frac{1}{2}$	-1
1	0
2	1
4	2
8	3

reflection over x-axis
transl left 2

$\longrightarrow g(x)$



2. Identify whether functions f and g are equivalent. Then identify the kinds of transformations used to get from function f to function k.

a. $f(x) = 3 \cdot 3^x$ *and* $g(x) = 3^{x+1}$

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

Same

$k(x) = 3^x$

Translation left 1

b. $f(x) = \frac{1}{4} \cdot 2^x$ *and* $g(x) = 2^{x-3}$

$f(x) = 2^{-2} \cdot 2^x$
$f(x) = 2^{x-2}$ $\quad g(x) = 2^{x-3}$

Not same/equivalent

$k(x) = 2^x$

$K(x) \rightarrow f(x)$
translation right 2

c. $f(x) = \log\left(\frac{x}{10}\right)$ *and* $g(x) = \log(x) - 1$

$f(x) = \log\left(\frac{x}{10}\right) = \log(x) - \log(10)$
$= \log(x) - 1 = g(x)$

Same!

$k(x) = \log(x)$

translation down 1