Name:_____ Date:_____

Math 12 Honours: Section 2.4 Expansions and Compressions of Functions

1. Indicate the transformation from the function on the left to the function on the right. What are all the different possible transformations:

a) $y=|x| \rightarrow y=3|2x|$

b) $y=\sqrt{x} \rightarrow y=\sqrt{4x}$

c) $y=\dfrac{1}{2x-3} \rightarrow y=\dfrac{3}{4x-3}$

d) $y=x^2 \rightarrow y=4x^2-12x+9$

e) $y=x^3 \rightarrow y=8x^3-12x^2+6x-1$

f) $y=2^{x+4} \rightarrow y=4\left(2^x\right)^3-1$

2. Indicate the transformation for each of the following:

a) $y=f(x) \rightarrow y=2f(x+1)$	b) $y=f(x) \rightarrow y=f(2x)+5$
c) $y=f(x) \rightarrow y=\dfrac{1}{3}f(2x)-4$	d) $y=f(x) \rightarrow y=\dfrac{f(2x-4)}{4}$
e) $y=f(x) \rightarrow y=\dfrac{3}{2}f\left(\dfrac{2}{3}x-3\right)$	f) $y=f(x) \rightarrow y=1-\dfrac{4}{3}f\left(\dfrac{2x+1}{3}\right)$

g) $y=f\left(x\right)\rightarrow y=3-5f\left(0.5x-4\right)$	h) $y=f\left(x\right)\rightarrow y=\frac{-5+2f\left(0.3x-2\right)}{3}$

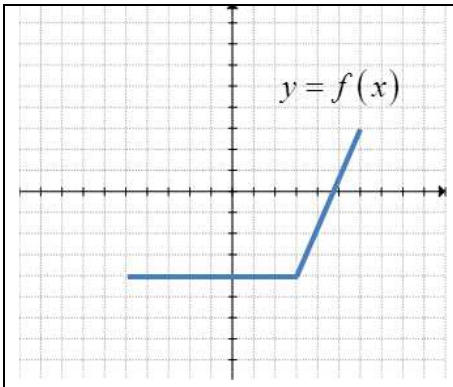
3. Given $y=f\left(x\right)$, indicate the new equation after each transformation in the order stated:

a) $f\left(x\right)=2x+3$	1. A horizontal expansion by a factor of 3 2. Then shifted up by 5 units
b) $f\left(x\right)=\left(x-3\right)^2-4$	1. A vertical reflection and compression by a factor of 0.5 2. A shift of 2 units left, and 3. Shift of 6 units down
c) $f\left(x\right)=\sqrt{x+2}+4$	1. A Reflection in the y-axis and 2. A Horizontal compression by a factor of 1/3. 3. A shifted 3 units left.
d) $f\left(x\right)=2^x+3$	1. A reflection in both the “x” and “y” axis 2. A horizontal expansion by a factor of 2, 3. A shifted of 11 units down
e) $x^2+\left(y-1\right)^2=9$	1. A reflection in the “y” axis, 2. A Horizontal expansion by a factor of 2 and 3. A vertical compression by a factor of 0.5.

f) $y=\dfrac{1}{x-1}-3$	1. A reflection in the line $y=x$, 2. A Horizontal compression by 1/3, and 3. A shift of 2 units left.
g) $y=x^4+x^3-2x+1$	1. A reflection in the line $y=x$ 2. A shift of 6 units down
h) $y=\left\|\dfrac{1}{x-1}\right\|+3$	1. A vertical expansion by a factor of 2, 2. A horizontal compression by a factor of 0.25, 3. A shift of 3 units left and 2 units up.
i) $y=3^x$	1. A horizontal reflection and 2. A Horizontal compression by 0.5, and 3. An inverse reflection over the line $y=x$

4. If $f(x)=\dfrac{3x-7}{x+1}$ and $g(x)$ is the inverse of $f(x)$ then determine the value of $g(2)$

5. Given the graph of $y=f(x)$, draw the graph of the following:



i) $y = 2f(x)$

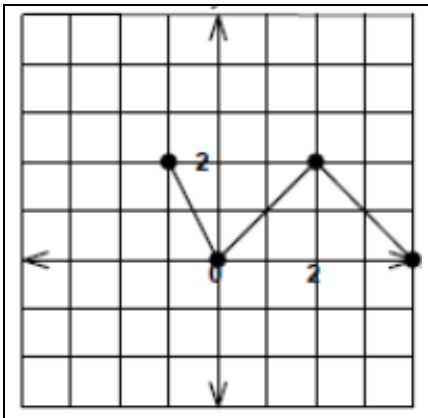
ii) $y = 0.\bar{3}f(2x)$

iii) $x = -0.5f(2y)$

iv) $y = f(0.25x - 1) + 1$

v) $y = 5 - 3f(1 - 2x)$

6. Given the graph of $y = f(x)$, draw the graph of the following:



i) $y = -f(-x - 2)$

ii) $y = -3f(-2x - 6) - 1$

iii)

iv)

v)

7. If (a,b) is a point on the graph of $y = f(x)$, determine the coordinates in each of the following functions:

a) $y=2f\left(3x\right)+1$	b) $y=-\frac{1}{2}f\left(-4x\right)+3$
c) $x=-0.5f\left(y\right)-4$	d) $y=-f\left(\frac{2}{3}x-3\right)-2$
e) $x=-f\left(2y+4\right)-2$	f) $y=\frac{1}{2f\left(3x\right)}+1$

8. Given the equation $f\left(x\right)=\sqrt{3x-2}$, if we were to perform two transformations:

   A) A horizontal compression by a factor of 0.5 B) A horizontal shift of 4 units right

   What would the function look like if we performed "A" first and then "B"?

   What would the function look like if we performed "B" first and then "A"?

9. Determine the equation of $y=f^{-1}\left(x\right)$ for the following equations:

a) $f(x)=\frac{1}{4}x+5$	b) $y=3(x+7)^2-6$	c) $f(x)=\frac{2}{x-3}$

10. Let $y=mx+b$ be the image when the line $x+3y+11=0$ is reflected across the x-axis. Find the value of $m+b$

11. For the previous question, what is the reflection is across the line $y=x$. What would the new equation be?

12. Find the reflection of the point (2,2) in the line $x+2y=4$

13. Draw the graph of $y=-2\sqrt{x+1}$ and $y=\sqrt{x-2}$. For what value(s) of "k" will the graphs of the function $y=-2\sqrt{x+1}$ and $y=\sqrt{x-2}+k$ intersect? (Assume that "x" and "k" are real numbers)