Transformations of Functions~Effect on y-values

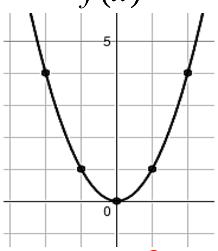
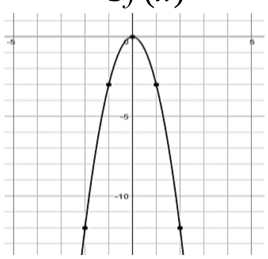
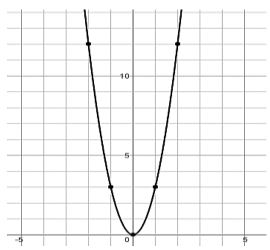
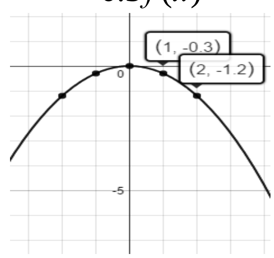
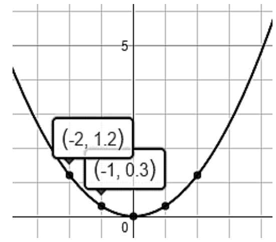
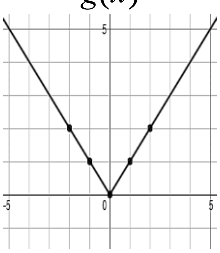
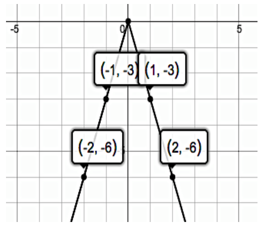
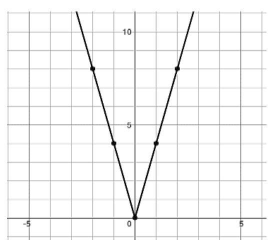
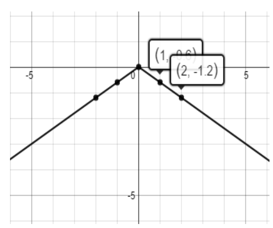
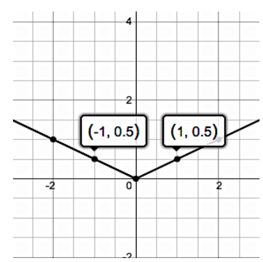
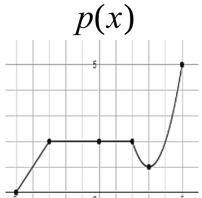
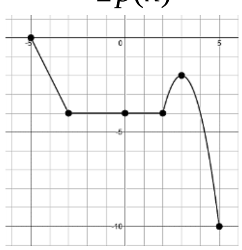
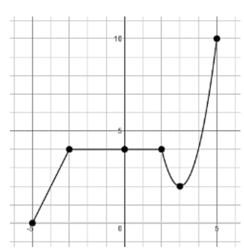
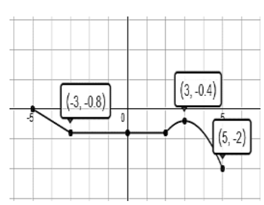
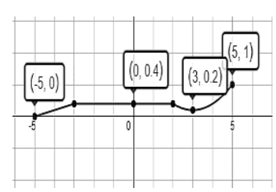
Secondary Math II Notes

{ 7.2 }

OBJECTIVE: Determine the effect on the original function $f(x)$ if it were replaced with either $kf(x)$ *or* $f(x)+k$ where k is a real number.

The effect of $kf(x)$

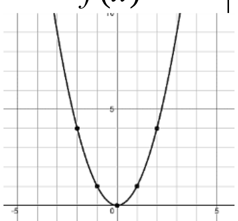
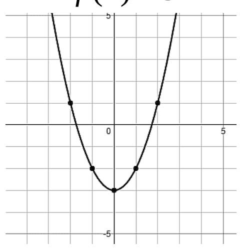
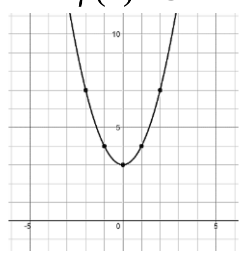
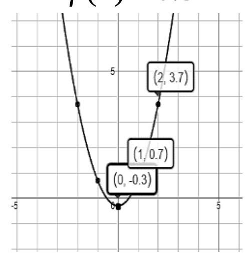
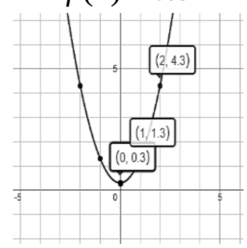
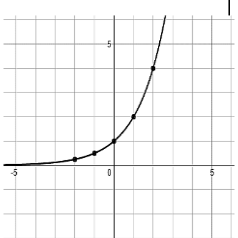
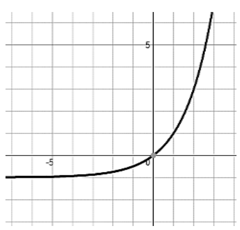
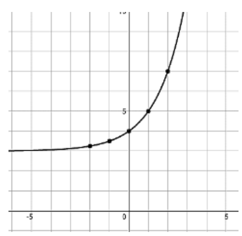
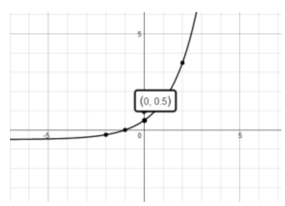
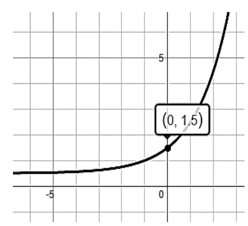
for f(x) play https://www.desmos.com/calculator/nqxx2mhknn and only focus on “k”. Change f(x) to $f(x)=x^2$. Then change g(x) to g(x)=kf(x) and watch the transformation. Have students begin to make hypothesis about the effect of the constant “k”. Then change the equation to $f(x) = x^3$ to verify their hypothesis. Have students then sketch the transformations of p(x). The parent function always occurs when k=1

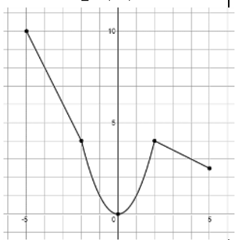
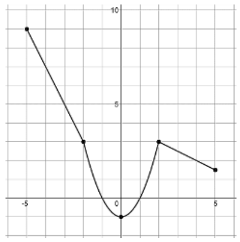
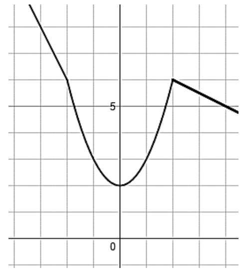
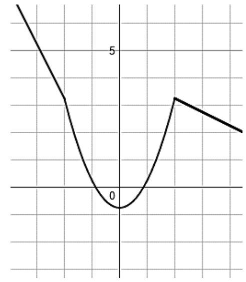
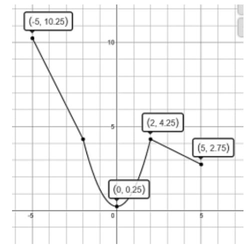
$f(x)$	$-3f(x)$	$3f(x)$	$-0.3f(x)$	$0.3f(x)$
				
$f(x) = x^2$	$k(x) = -3x^2$	$k(x) = 3x^2$	$k(x) = -0.3x^2$	$k(x) = 0.3x^2$
$g(x)$	$-3g(x)$	$4g(x)$	$-0.6g(x)$	$0.5g(x)$
				
$g(x) = \lvert x\rvert$	$r(x) = -3\lvert x\rvert$	$r(x) = 4\lvert x\rvert$ $-0.6g(x)$	$t(r) = -0.6\lvert r\rvert$	$r(x) = 0.5\lvert x\rvert$
$p(x)$	$-2p(x)$	$2p(x)$	$-.4p(x)$	$.2p(x)$
				
$p(x) = \begin{cases} x+5 & -5 \le x < -2 \\ 2 & -2 \le x < 2 \\ (x-3)^2+1 & 2 \le x < 5 \end{cases}$	$(x) = \begin{cases} -2x-10 & -5 \le x < -2 \\ -4 & -2 \le x < 2 \\ -2((x-3)^2+1) & 2 \le x < 5 \end{cases}$	$(x) = \begin{cases} 2x+10 & -5 \le x < -2 \\ 4 & -2 \le x < 2 \\ 2((x-3)^2+1) & 2 \le x < 5 \end{cases}$	$(x) = \begin{cases} -.4x-2 & -5 \le x < -2 \\ -.8 & -2 \le x < 2 \\ -.4((x-3)^2+1) & 2 \le x < 5 \end{cases}$	$(x) = \begin{cases} .2x+1 & -5 \le x < -2 \\ .4 & -2 \le x < 2 \\ 0.2((x-3)^2+1) & 2 \le x < 5 \end{cases}$

Answer the following four questions for each column 1. What type of transformation occurred. Be specific. 2.How did this transformation affect the x-values? 3.How did this transformation affect the y-values? 4. Did it affect the domain or the range? Explain why.	1.Reflection over the x-axis because k<0 and a vertical stretch because k>1 2. The x-values were not affected 3. The y-values were "stretched vertically" by a factor of k units. 4. This affects the range because the y-values were affected.	1.A vertical stretch because k>1 2. The x-values were not affected 3. The y-values were "stretched vertically" by a factor of k units. 4. This affects the range because the y-values were affected.	1. Reflection over the x-axis because k<0 and a vertical compression because 0<k<1. 2. The x-values were not affected 3. The y-values were "compressed vertically" by a factor of k units. 4. This affects the range because the y-values were affected.	1. A vertical compression because 0<k<1. 2. The x-values were not affected 3. The y-values were "compressed vertically" by a factor of k units. 4. This affects the range because the y-values were affected.

The effect of $f(x)+k$

for f(x) play https://www.desmos.com/calculator/nqxx2mhknn and only focus on "k". Change f(x) to $f(x)=x^2$. Then change g(x) to g(x)=f(x)+k and watch the transformation. Have students begin to make hypothesis about the effect of the constant "k". Then change the equation to $f(x) = x^3$ to verify their hypothesis. Have students then sketch the transformations of p(x). The parent function always occurs when k=1

$f(x)$	$f(x)-3$	$f(x)+3$	$f(x)-0.3$	$f(x)+0.3$
				
$f(x) = x^2$	$f(x) = x^2 - 3$	$f(x) = x^2 + 3$	$f(x) = x^2 - 0.3$	$f(x) = x^2 + 0.3$
$g(x)$	$g(x) - 1$	$g(x) + 3$	$g(x) - 0.5$	$g(x) + 0.5$
				
$g(x) = 2^x$	$p(x) = 2^x - 1$	$p(a) = 2^a + 3$	$p(a) = 2^a - 0.5$	$p(x) = 2^x + 0.5$

$p(x)$	$p(x) - 1$	$p(x) + 2$	$p(x) - .75$	$p(x) + .25$
 $p(x) = \begin{cases} -2x & -5 \le x < -2 \\ x^2 & -2 \le x < 2 \\ -.5x + 5 & 2 \le x < 5 \end{cases}$	 $p(x) = \begin{cases} -2x - 1 & -5 \le x < -2 \\ x^2 - 1 & -2 \le x < 2 \\ -.5x + 4 & 2 \le x < 5 \end{cases}$	 $p(x) = \begin{cases} -2x + 2 & -5 \le x < -2 \\ x^2 + 2 & -2 \le x < 2 \\ -.5x + 7 & 2 \le x < 5 \end{cases}$	 $p(x) = \begin{cases} -2x - 0.75 & -5 \le x < -2 \\ x^2 - 0.75 & -2 \le x < 2 \\ -.5x + 4.25 & 2 \le x < 5 \end{cases}$	 $p(x) = \begin{cases} -2x + .25 & -5 \le x < -2 \\ x^2 + .25 & -2 \le x < 2 \\ -.5x + .25 & 2 \le x < 5 \end{cases}$
Answer the following four questions for each column 1. What type of transformation occurred. Be specific. 2.How did this transformation affect the x-values? 3.How did this transformation affect the y-values? 4. Did it affect the domain or the range? Explain why.	1.Vertical shift down k units because k<0 2. The x-values were not affected 3. The y-values were "vertically shifted" down k units. 4. This affects the range because the y-values were affected. That is why we do not change the boundaries set in the piecewise functions.	1.Vertical shift up k units because k>0 2. The x-values were not affected 3. The y-values were "vertically shifted" down k units. 4. This affects the range because the y-values were affected. That is why we do not change the boundaries set in the piecewise functions.	1.Vertical shift down k units because k<0 2. The x-values were not affected 3. The y-values were "vertically shifted" down k units. 4. This affects the range because the y-values were affected. That is why we do not change the boundaries set in the piecewise functions.	1.Vertical shift up k units because k>0 2. The x-values were not affected 3. The y-values were "vertically shifted" down k units. 4. This affects the range because the y-values were affected. That is why we do not change the boundaries set in the piecewise functions.