## Algebra II

## Lesson 5: Inverse Functions

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A function, as we know, takes a situation described by an equation, plugs in a number for $x$, the independent variable and creates an output. Well, an inverse function takes this output answer performs some operations on it such that we arrive back at our original starting value of $x$. A function can be described as a "DO" and the inverse can be described as the "UNDO." Put another way, an inverse relation is an exact opposite of what a function does and has a special symbol; $\boldsymbol{f}^{-1}(\boldsymbol{x})$. There are 2 basic steps to formulating an inverse relation.

- Step 1 Switch the $x$ and $y$
- Step 2 Solve for the new " y ", and replace y with $f^{-1}(x)$

Example: Find the inverse function for

$$
\begin{gathered}
y=x+3 \\
x=y+3 \\
x-3=y \\
x-3=f^{-1}(x)
\end{gathered}
$$

Step 1: switch x and y solve
Step 2: replace $y$ with $f^{-1}(x)$

Find the inverse of the function and graph and its inverse

$$
y=x^{2}+3
$$

$$
y=3 x+10
$$

Sometimes you will be asked to plot a set of $(x, y)$ coordinates and then graph the inverse. Understand, the inverse of a function has all the same points as the original function, except that the $\boldsymbol{x}$ 's and $\boldsymbol{y}$ 's have been switched. For instance, supposing your function is made up of these points: $\{(1,0),(-3,5),(0,4)\}$. Then the inverse is given by this set of point: $\{(0,1),(5,-3),(4,0)\}$. In this case simply switch the order of the $x$ and $y$ values.

Graph the inverse of the function $f(x)$ graphed below. Is the inverse a function? Explain


For each of the following functions -1 ) find the inverse, 2) find the domain and range of the inverse, 3) determine whether the inverse is a function, and 4) then evaluate it for $\boldsymbol{f}^{\mathbf{- 1}}(-\mathbf{1}), f(\mathbf{2})$, and $\boldsymbol{f}^{\mathbf{- 1}}(\mathbf{3})$.


