Quiz #10 Solution

1. If the point P is on the graph of a function $y = f(x)$, find the corresponding point on the graph of the transformed function given below. **Keep in mind order of operation.**

$$P(-7, 9); \quad y = 4f\left(-\frac{1}{3}x\right) - 1$$

When transforming the graph of a function, look at whether the changes are taking place inside the parentheses or outside the parentheses. In this case we have both. Inside the parentheses we have $-\frac{1}{3}x$, which means we will take the inputs of the function f and **DIVIDE** them by $-\frac{1}{3}$ (or multiply them by -3). $-\frac{1}{3}x$ indicates that we need to use inputs that 3 times larger than our original inputs in order to produce the same outputs; we also need to use inputs with the opposite sign of the original inputs. Since -7 is the input in the ordered pair $(-7, 9)$, I will take -7 and divide it by $-\frac{1}{3}$. This will produce the same result as multiplying by -3.

$$\text{new input} = \frac{\text{old input}}{-\frac{1}{3}}$$

$$\text{new input} = \frac{-7}{-\frac{1}{3}}$$

$$\text{new input} = -7 \cdot -3$$

$$\text{new input} = 21$$

To find the new output, I will perform the operations that are outside the parentheses on the original output of 9. Outside the parentheses we have $4f\left(-\frac{1}{3}x\right) - 1$, which means we will take the output and multiply by 4 first, then subtract 1 from the product. Keep in mind that order of operation states that multiplication is completed before addition or subtraction.

$$\text{new output} = 4(\text{old output}) - 1$$

$$\text{new output} = 4(9) - 1$$

$$\text{new output} = 36 - 1$$

$$\text{new output} = 35$$

<u>So our new ordered pair will be $(21, 35)$.</u>

2. Let $y = f(x)$ be a function with domain $D = [-10, 10]$ and range $R = [-5, 7]$. Find the domain D and range R for the following transformation of the function $f(x)$. **<u>Keep in mind order of operation.</u>**

$$y = -\frac{3}{2}f(x+4) - \frac{1}{2}$$

When transforming the graph of a function, look at whether the changes are taking place inside the parentheses or outside the parentheses. In this case we have both. Inside the parentheses we have $x + 4$, which means we will take the inputs of the function f and **<u>SUBTRACT</u>** 4 from each of them. Since the domain of a function represents the set of inputs, I will subtract 4 from each element of the domain.

$$\text{new inputs} = (\text{old inputs}) - 4$$

$$\text{new Domain} = [-10 - 4, 10 - 4]$$

$$\text{new Domain} = [-14,6]$$

Outside the parentheses we have $-\frac{3}{2} \cdot f$, and then that product $-\frac{1}{2}$, which means we will take the outputs of the function f, multiply them by $-\frac{3}{2}$, and then subtract $\frac{1}{2}$ from them. Since the range of a function represents the set of outputs, I will multiply each element of the range by $-\frac{3}{2}$, and then subtract $\frac{1}{2}$.

$$\text{new outputs} = -\frac{3}{2}(\text{old outputs}) - \frac{1}{2}$$

$$\text{new Range} = \left[-\frac{3}{2}(-5) - \frac{1}{2}, -\frac{3}{2}(7) - \frac{1}{2}\right]$$

$$\text{new Range} = \left[\frac{15}{2} - \frac{1}{2}, -\frac{21}{2} - \frac{1}{2}\right]$$

$$\text{new Range} = [7, -11]$$

Remember that just like a number line, an interval must go from smallest to largest when going from left to right. So the new range should be $[-11, 7]$.

$$\text{new Range} = [-11, 7]$$

<u>So the new domain is</u> $[-14, 6]$ <u>and the new range is</u> $[-11, 7]$<u>.</u>