Worksheet 1 Key

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1 First Page

Parts F and G seemed to be the most challenging; one thing that may help is remembering that each "not equals" needs a "union" to go along with it. Here they are:

$$\text{F: } \{x \in \mathbb{R} : x \geq 2,\, x \neq 5\}, \qquad \text{G: } \{x \in \mathbb{R} : x \neq -1,\, x \neq 5\}$$

For G, I frequently saw the answer $(-\infty, -1) \cup (5, \infty)$. These two intervals include everything less than -1 and everything greater than 5. The set we are given only excludes two numbers, which is a problem because the interval doesn't account for all of the numbers *between* -1 and 5. The correct answer is

$$(-\infty, -1) \cup (-1, 5) \cup (5, \infty)$$

For F, I saw $[2, \infty) \cup (5, \infty)$. The first issue is that $[2, \infty)$ already includes everything in $(5, \infty)$, so you don't even need to write it, but the second issue is that it's wrong to begin with: $[2, \infty)$ includes 5, which we don't want. There needs to be a break at 5 and a union to glue things together, so the correct answer is

$$[2, 5) \cup (5, \infty)$$

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Here, C and D had the most problems. Remember that we are *only* looking at what happens for the x-axis! For C, the graph starts (with a hole) at $x = -2$, travels to $x = 2$, then turns around and heads back to $x = -2$. While it's true that this is not a function, we can still find its domain. Think about taking a trip to the store: if you drive there, you're going to take the same road there and back, so you don't need to say "I took 49 to get there and I took 49 to get back". This graph turns around as soon as it touches $x = 2$, so the correct answers would be

$$(-2, 2] \quad \text{and} \quad -2 < x \leq 2$$

For D, remember that the arrows represent going off towards infinity. When these arrows are traveling vertically, that means that you are approaching an x value that you can't actually touch. Here, it's fairly clear that the "infinity" point is at $x = 0$, which means that this point is *not* in the domain. The correct answers would be

$$(-\infty, 0) \cup (0, \infty) \quad \text{and} \quad x \neq 0$$

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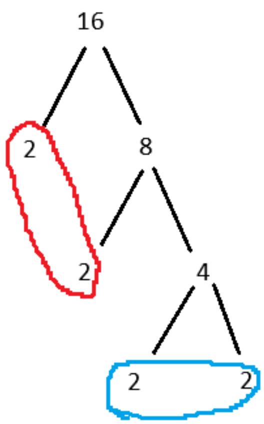
It was strange to see that almost nobody got problems 1-3 or 7-10 wrong, as these are (in my opinion) the more difficult ones because you can get wrong by factoring incorrectly. For 4, 5, and 6, on the other hand, people made the same mistakes. I'll focus on 4, which was to simplify $\sqrt{16}$. I saw two incorrect answers: $2\sqrt{4}$ and $\sqrt{4}$. These issues were likely caused by following the steps without realizing what they mean. Here's a visual aid, a color coded version the math to match the picture, and a narration of what's happening.



$$\begin{aligned}\sqrt{16} &= \sqrt{2 \cdot 2 \cdot 2 \cdot 2} \\ &= \sqrt{2^2 \cdot 2^2} \\ &= \sqrt{2^2} \cdot \sqrt{2^2} \\ &= 2 \cdot 2 \\ &= 4\end{aligned}$$

1. Make a tree: break the number down into its factors using division.
2. Group up factors into matching pairs.
3. Represent these pairs by their square by raising one to the power of 2 and ignoring the other.
4. Separate groups under new radicals.
5. Cancel the power and the radical, leaving only the base.

The only time you should have anything under a radical is if it has no pair to match with. For example, 54 breaks down into $3 \cdot 3 \cdot 3 \cdot 2$, but since there is only one full pair of the number 3 and no pair of the number 2, we have $\sqrt{54} = \sqrt{3^2} \cdot \sqrt{3 \cdot 2} = 3\sqrt{6}$.