1.3 Piecewise Functions

Ok, let’s just take a look at a piece-wise graph.

Now a piece-wise function is just one large function \( f(x) \) made up of smaller functions on different parts of the domain.

**Example 1.3.**

\[
f(x) = \begin{cases} 
\frac{1}{x^2}, & x < 0 \\
\frac{1}{x}, & 0 < x < 1 \\
2x - 4, & [1, 3) \cup (3, \infty)
\end{cases}
\]

There are a couple of ways of graphing a piece-wise function. If it’s your first time or you haven’t done it in a while, just graph all the functions and then erase the part that doesn’t count (i.e. when it’s not in its part of the domain).

**Example 1.4.** Graph \( f(x) = \)

\[
\begin{cases} 
(x + 2)^2 - 1, & x < -1 \\
2, & x = -1 \\
-2x + 3, & -1 < x < 1 \\
\sqrt{x}, & x \geq 1
\end{cases}
\]
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We need to take this one piece at a time. Get it... one 'piece.' You know... because it's a piece-wise function. Ok moving on!

1. Let's start with \((x + 2)^2 - 1\). We haven't covered transformations yet, but you probably remember a little bit about transforming \(f(x) = x^2\). Let's start with graphing the whole thing.

\[\text{Graph of } f(x) = x^2\]

Now erase what we don't need.

\[\text{Graph after restriction} \quad x < -1\]

Note the open dot at \((-1, 0)\). It’s open because the interval does not include \(x = -1\).

2. Next up...2?. What this really means is when \(x = -1\), the \(y\)-value is 2. It’s just a closed point on the graph.
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All we did here is add the point \((-1, 2)\).

3. On to \(-2x + 3\). Let’s add that to the graph.

Now erase what we don’t need.

The graph only shows \(-2x + 3\) when \(-1 < x < -1\).

4. Finally we add \(\sqrt{x}\).
Now erase what we don’t need.

We are finally done. Notice how that open dot at $(1,1)$ is now a closed dot.