Section 2.7: Piecewise functions

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Algebra 2 Lv 1

1 Warmup

1. Welcome/expectations signatures on desk
2. Got calculators?
3. Write down homework: Read Chap 2.7 (p. 114-116). Problems (p. 117-119): 1-39 odd, 50-53, 56-57.
4. Graph $y = 2|x - (-3)| - 2$.

Piecewise functions are functions defined differently for different pieces of the domain. For example:

$$f(x) = \begin{cases} 2x - 1, \text{if } x \leqslant 1 \\ (x-3)^2, \text{if } x > 1 \end{cases}$$

2 Evaluating piecewise functions

Basic plan: Look at input (usually x), decide which "piece" applies, and evaluate that. For example:

Evaluate $f(0)$.

We note that $0 \leqslant 1$ so we use the first piece:

$$\begin{aligned} f(x) &= 2x - 1 \\ f(0) &= 2 \cdot 0 - 1 \\ &= -1 \end{aligned}$$

3 Aside: multiple inequalities

A shorthand for

$$2 < x \text{ and } x \leqslant 5$$

is

$$2 < x \leqslant 5$$

4 Graphing piecewise functions

- Graph each piece separately
- Be conscious of open points (not in the function) and closed points (in the function)
- Each x value in the domain should correspond to *only one* of the pieces

For example, graph

$$f(x) = \begin{cases} 1, \text{if } 0 \leqslant x < 1 \\ 2, \text{if } 1 \leqslant x < 2 \\ 3, \text{if } 2 \leqslant x < 3 \\ 4, \text{if } 3 \leqslant x < 4 \end{cases}$$

This is called a "step function." Why?

5 Determining piecewise function definition from graph

- Use what you already know to figure out the definition of each piece
- Determine domain of each piece by looking at the x values

Example: consider the displayed function. We see that it looks like two pieces. Use what we already know to determine the functions for each one

- On the left side, we see a line of slope -1 and a y-intercept of -2 so we can use the slope-intercept form to decide that its equation is

$$y = -x - 2$$

- On the right side, we see a line of slope $\frac{1}{2}$ but we do not see a y-intercept. We do see some points, like $(2, -2)$. So ywe can use the point-slope form:

$$y - (-2) = \frac{1}{2}(x - 2)$$

To make this equation into a function, we add -2 to both sides to isolate y and then simplify:

$$\begin{aligned} y &= \frac{1}{2}(x-2) + (-2) \\ &= \frac{1}{2}x - 3 \end{aligned}$$

- Then we figure out the domains and write it up:

$$f(x) = \begin{cases} -x - 2, x < 32 \\ \frac{1}{2}x - 3, 2 \leqslant x < 8 \end{cases}$$