BITL3

Worksheet 4

16 September 2021

Math Lab

Recall that the **aboslute value** of a function $f(x)$ is a new function

$$|f(x)| = \begin{cases} f(x) & \text{if } f(x) \geqslant 0, \\ -f(x) & \text{if } f(x) < 0. \end{cases}$$

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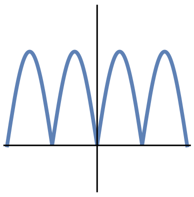
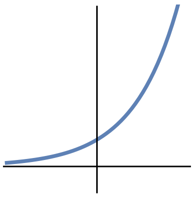
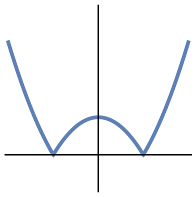
1. **Warm up:** For each of the functions $|f(x)|$ below, identify $f(x)$.



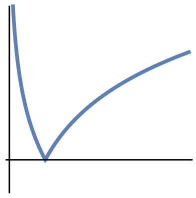
$|f(x)|$



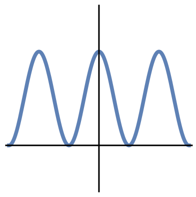
$|g(x)|$



$|h(x)|$

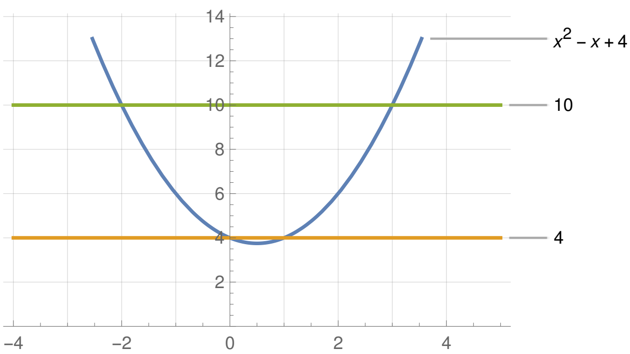


$|k(x)|$

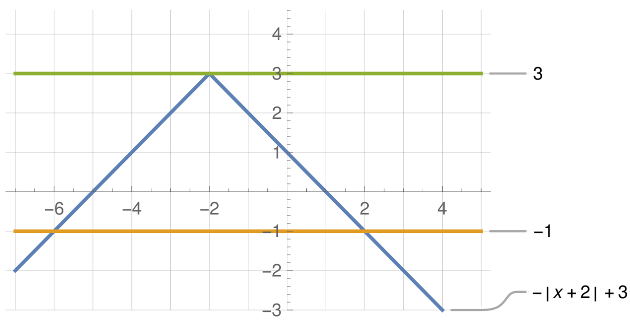


$|\ell(x)|$

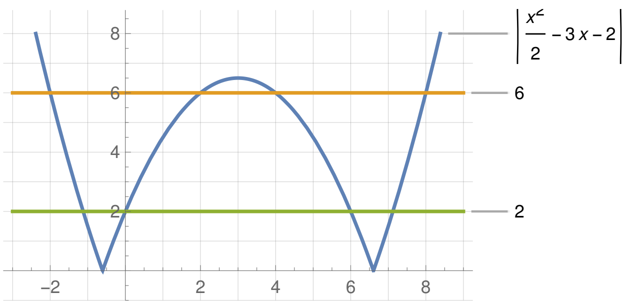
2. For each of the inequalities below, solve it by looking at the plot instead of algebra. Check your answer after you have guessed it from the plot.



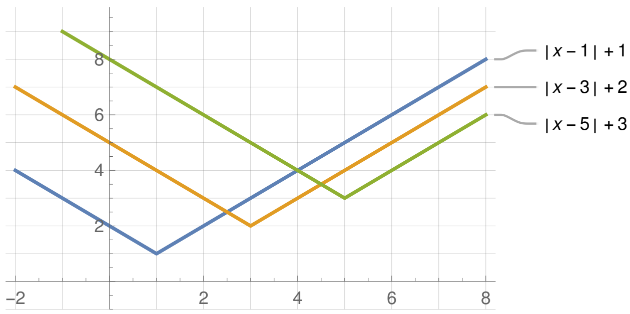
$$4 < x^2 - x + 4 \leqslant 10$$



$$-1 < -|x+2| + 3 < 3$$



$$2 \leqslant |\tfrac{1}{2}x^2 - 3x - 2| \leqslant 6$$



$$|x-1| + 1 < |x-3| + 2 < |x-5| + 3$$

3. Solve each of the inequalities below, draw the plots of each side, and check your solution corresponds with the graphical picture.

   (a) $|x+1| = |\frac{1}{2} - x|$
   (b) $-1 \leqslant |2x+4| < 5$
   (c) $6 \leqslant x^2 + 2 < 18$

4. Consider the equality $|(x-1)^2 - 1| = -|x-1| + 5$.

   (a) At what x-values do the signs of the arugments inside the absolute values $|\cdot|$ change? You should have three different x-values.
   (b) Write the equation without the absolute value signs in four different ways using the x-values from part (a):
       - once when x is less than all of them,
       - twice when x is in between them,
       - once when x is larger than all of them.
   (c) For each of these four equations, solve for x. How many solutions are there?