Absolute Value Functions

Work within a small group to answer these questions. Do not race through the exercises on your own. Always make sure that your entire group feels good about a question and answer before you move to the next exercise. Ask your group mates for explanations if you feel uncertain about something, and offer your explanations to others when you understand an exercise but someone else may not.

1. Evaluate each of these expressions.

a) $|-4-7|$

$=|-11|$

$=11$

b) $-|4-7|$

$=-|-3|$

$=-3$

c) $|7-4|+3$

$=|3|+3$

$=3+3$

$=6$

d) $3-6\left|-1+(3-5)^3\right|$

$=3-6\left|-1+(-2)^3\right|$

$=3-6|-1+-8|$

$=3-6|-9|$

$=3-6\cdot 9$

$=3-54$

$=-51$

2. Given h defined by $h(x)=|-2x-22|$, find and simplify:

a) $h(17)$

$=|-2(17)-22|$

$=|-34-22|$

$=|-56|$

$=56$

b) $h(-17)$

$=|-2(-17)-22|$

$=|34-22|$

$=|12|$

$=12$

c) $h(0.3)$

$=|-2(0.3)-22|$

$=|-0.6-22|$

$=|-22.6|$

$=22.6$

d) $h\left(-\frac{40}{3}\right)$

$=\left|-2\left(-\frac{40}{3}\right)-22\right|$

$=\left|\frac{80}{3}-22\right|$

$=\left|\frac{80}{3}-\frac{66}{3}\right|$

$=\left|\frac{14}{3}\right|$

$=\frac{14}{3}$

3. Find the domain of these functions just using your head.

a) $H(x)=|3x+4|$

$(-\infty,\infty)$

b) $K(x)=5x-|-4x-8|$

$(-\infty,\infty)$

c) $Z(x)=\dfrac{5}{|x|-2}$

Worry about $|x|-2=0$

$|x|=2$

Could happen for $x=-2$ or $x=2$.

$(-\infty,-2)\cup(-2,2)\cup(2,\infty)$

4. Make a table of values for each function.

a) g where $g(x) = |x-2|$

turning pt at $x=2$

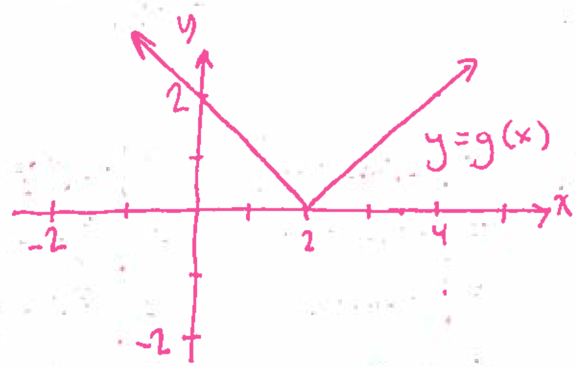
x	$g(x)$
0	2
1	1
2	0
3	1
4	2

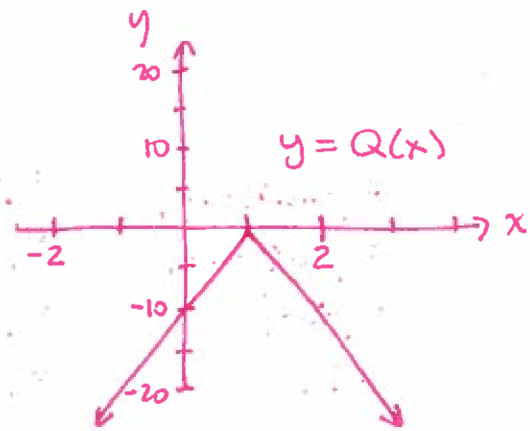
b) Q where $Q(x) = -3\,|3x-3|-1$

turning pt. at $x=1$

x	$Q(x)$
-1	-19
0	-10
1	-1
2	-10
3	-19

5. For each function from question 4, use technology to make a graph in a good viewing window. *Part of the point is to use graphing technology. Don't just plot your points from the previous question's tables.*





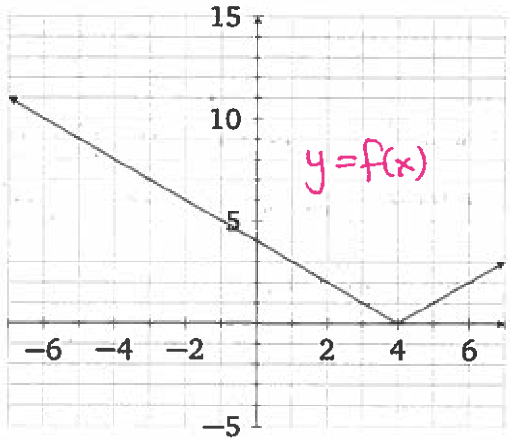
6. What are the domain and range of the functions in question 4? Use your graphs from question 5 to help.

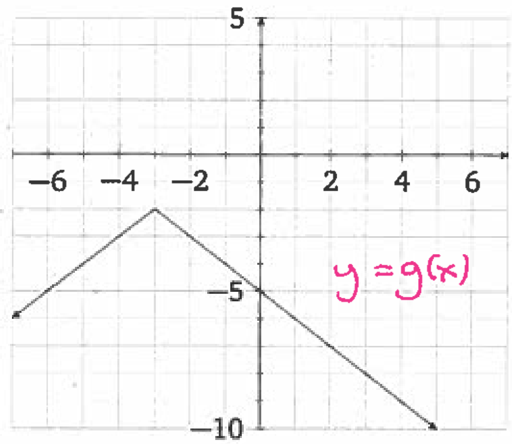
$(-\infty,\infty)$ in both cases

$[0,\infty)$ for g's range

$(-\infty,0]$ for Q's range

7. Find a formula for the functions plotted in each graph. You are encouraged to use graphing technology to experiment until you find a formula whose graph matches the given graph.

a) 

b) 

$f(x) = |x-4|$

$g(x) = -|x+3| - 2$

8. Simplify these expressions.

a) $\sqrt{(-20)^2}$
$= |-20|$
$= 20$

b) $\sqrt{(-9599)^2}$
$= |-9599|$
$= 9599$

c) $\sqrt{(a+3)^2}$
$= |a+3|$

d) $\sqrt{x^2+4x+4}$
$= \sqrt{(x+2)^2}$
$= |x+2$

9. Describe the differences (if there are any) between the graphs of f and g, where

$$f(x) = x^2 + 1 \qquad g(x) = \left|x^2 + 1\right|$$

No differences! x^2+1 is positive no matter what x is. So $|x^2+1|$ is the same as x^2+1.

10. Write two numbers so that

- The first number is less than the second number, and
- The absolute value of the first number is greater than the absolute value of the second number.

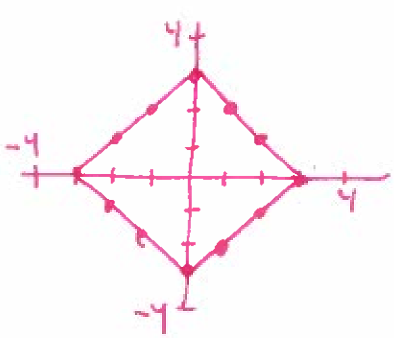
For example, -7 and 3.

Because $-7 < 3$

And $|-7| > |3|$

11. If your graphing tool is GeoGebra or Desmos, then it is capable of making graphs of things called *implicitly defined curves*. These are when you have an equation in x and y but you do not have the ability to isolate y. One example is $|x|+|y| = 3$. You cannot solve for y explicitly.

Find at least eight points on the graph of $|x|+|y| = 3$. In other words, find eight ordered pairs (x, y) that make $|x| + |y| = 3$ true. You could just use your understanding of how absolute value works, or you could use a graphing tool to see the graph of $|x| + |y| = 3$ and find points that way.



Some points:

$(3,0)$	$(-1,2)$	$(-1,-2)$
$(2,1)$	$(-2,1)$	$(0,-3)$
$(1,2)$	$(-3,0)$	$(1,-2)$
$(0,3)$	$(-2,-1)$	$(2,-1)$