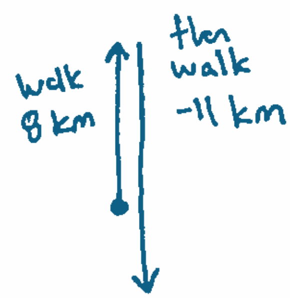
Ch 11 Absolute Value Functions

Review (see section 1.3 of the book)

Ex $|5| = 5$ $\qquad$ $|-12| = 12$

signals to take the positive version of whatever one number is in there

In context,



How much distance was that in total?

Everyday English
$8 + 11 = 19$

Alternatively:
$|8| + |-11| = 19$

addition because two legs

keep track of the existence of neg. direction

Also look at

$$|8 + (-11)|$$
$$= |-3|$$
$$= 3$$

In the end this person is 3 km away from where they started.

Ex Let f be defined by $f(x) = |x|$.

$f(12) = 12$ $\quad$ $f(-8) = 8$ $\quad$ $f(0) = 0$

Ex Let g be defined by $g(x) = |4x+3|$

$$g(5) = |4(5)+3| = |23| = 23$$

$$g(-5) = |4(-5)+3| = |-17| = 17$$

Plot with GGB

$f(x) = |x|$

$f(x) = |x+3|$

$f(x) = -|x+3|$

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

$f(x) = 4-2|x+3|$

Let $f(x) = \sqrt{x^2}$

$f(3) = \sqrt{3^2} = \sqrt{9} = 3$

$f(2) = \sqrt{2^2} = \sqrt{4} = 2$

$f(1) = \sqrt{1^2} = \sqrt{1} = 1$

$f(0) = \sqrt{0^2} = \sqrt{0} = 0$

$f(-1) = \sqrt{(-1)^2} = \sqrt{1} = 1$

now input and output are different!

$f(-2) = \sqrt{(-2)^2} = \sqrt{4} = 2$

again

Fact

$\sqrt{x^2} = |x|$

(do you feel that $\sqrt{x^2} = x$?

only true if x is positive, because $|x| = x$.

Ex Simplify $\sqrt{(x-2)^2}$.

$= |x-2|$

radical and squaring sort of cancel... but they leave abs value bars in the aftermath

Ex Simplify $\sqrt{x^2 + 10x + 25}$.

$= \sqrt{(x+5)^2}$

$= |x+5|$

$x^2 + 10x + 25$

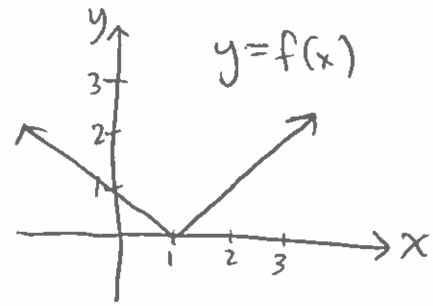
$2 \cdot 5$ $\quad 5^2$

$(x+5)^2$

Simplify $\sqrt{x^6} = \sqrt{(x^3)^2}$

$= |x^3|$

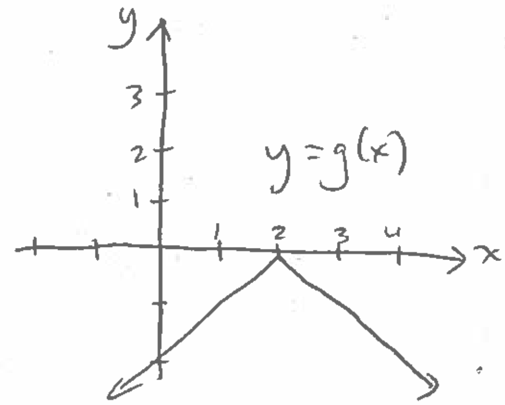
Ex Given a graph, can we reverse engineer a formula?



absolute value shape ✓
turns at $x=1$

$\Rightarrow$ try $f(x)=|x-1|$

and it works!
(test by plotting with technology)



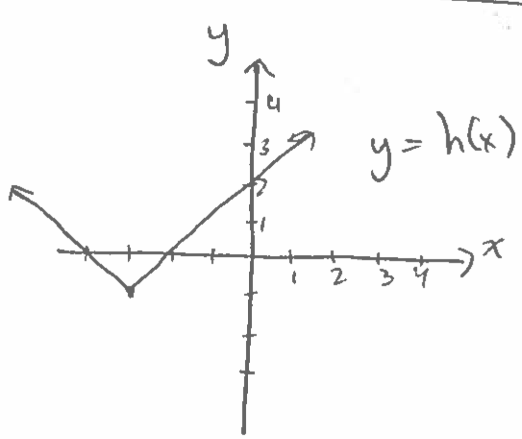
abs value shape ✓
turns at $x=2$

$\Rightarrow$ try $g(x)=|x-2|$

gives  upside down!

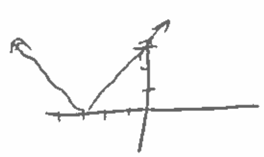
$\Rightarrow$ try $g(x)=-|x-2|$

(test by plotting with technology and it works!)



abs. val. shape ✓
turns at $x=-3$.

$\Rightarrow$ try $h(x)=|x+3|$

gives  (up too high by 1)

$\Rightarrow$ try $h(x)=|x+3|-1$ and it works!