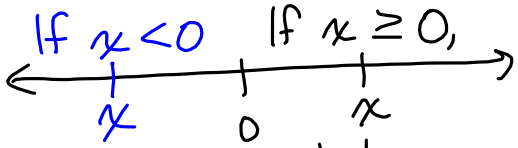
Sec. 3.7 Absolute Value Equations and Inequalities

Absolute Value

$$|x| = \begin{cases} x, & \text{if } x \geq 0 \\ -x, & \text{if } x < 0 \end{cases}$$



$|x| = -x$ $|x| = x$

$|-7| = -(-7) = 7$

To solve $|A| = b$, A → variable expression

$b > 0$

solve $A = b$ and $A = -b$

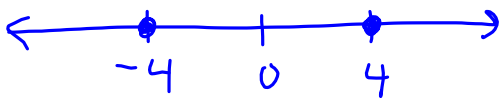
Problem 1: Solve and graph.

a. $|x| + 3 = 7$

① Isolate $|\ |$.

$-3 \quad -3$

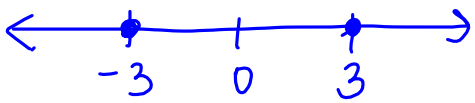
$|x| = 4 \longrightarrow x = 4$ or $x = -4$



b. $|n| - 5 = -2$

$+5 \quad +5$

$|n| = 3 \longrightarrow n = 3$ or $n = -3$



$5a+6=3$

Problem 2:

$5|3x-1|+6=3$

$-6 \quad -6$

$\frac{5|3x-1|}{5} = \frac{-3}{5}$

$|3x-1| = -\frac{3}{5}$

no solution

ISOLATE $|\ |$

Check if $= +/-$

distance

* If $|A| = -b$ then there is no solution

Problem 3:

Starting from 100 feet away, your friend skates toward you and then passes by you at a constant speed of 20 ft/s. Her distance, d, from you in feet after t seconds is given by $d = |100 - 20t|$. At what time is she 40 ft from you?

$d = |100 - 20t|$

$40 = |100 - 20t|$ (-40)

① Isolate $|\ |$. ✓

② Check $|\ | = \ominus$ ✓

$40 = 100 - 20t$

$-100 \quad -100$

$\frac{-60}{-20} = \frac{-20t}{-20}$

$3 = t$

$-40 = 100 - 20t$

$-100 \quad -100$

$\frac{-140}{-20} = \frac{-20t}{-20}$

$7 = t$

3s, 7s

Problem 4: Solve

a. $|4f+1|-2=5$

$+2 \quad +2$

$|4f+1|=7$

$4f+1=7$ $\quad -1 \quad -1$

$\frac{4f}{4}=\frac{6}{4}$

$f=\frac{3}{2}$

$4f+1=-7$ $\quad -1 \quad -1$

$\frac{4f}{4}=\frac{-8}{4}$

$f=-2$

① ISOLATE ||.

② Check for $|| = \ominus$ no solution

③ Write 2 equation $A=b$, $A=-b$

b. $\frac{-2|7d|}{-2}=\frac{14}{-2}$

$|7d|=-7$

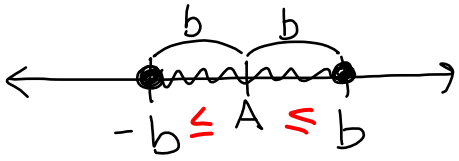
no solution

① ISOLATE ||.

② Check $|| = \ominus$

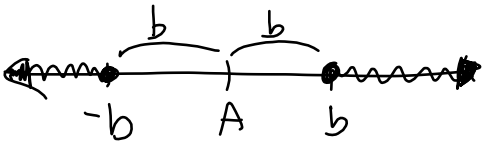
Solve Absolute Value Inequalities

$|A| \leq b$ Less Than AND



$-b \leq A \leq b$

$|A| \geq b$ Great OR



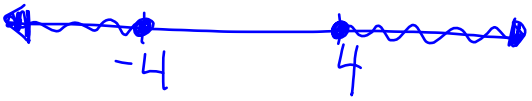
$A \leq -b$ or $A \geq b$

Problem 5: Solve and graph.

a. $|5x| \geq 20$ OR → FLIP & SWITCH

$\frac{5x}{5} \leq -\frac{20}{5}$ or $\frac{5x}{5} \geq \frac{20}{5}$

$x \leq -4$ or $x \geq 4$



b. $|2x+4| \leq 5$ AND

$2x+4 \geq -5$ and $2x+4 \leq 5$

$-5 \leq 2x+4 \leq 5$

$-4 \quad -4 \quad -4$

$-\frac{9}{2} \leq \frac{2x}{2} \leq \frac{1}{2}$

$-\frac{9}{2} \leq x \leq \frac{1}{2}$