

Notes for 1.8 Absolute Value Equations and Inequalities (pp. 160 – 163)

Name:
Date:
Instructor:

Topics: Absolute Value Equations, Inequalities, Special Cases, Distance, Tolerance

Recall:

1. The absolute value gives the distance from a value a to zero on a number line.
2. $|a - b|$ or _____ represents the distance between ____ and _____.

I. Rules for Absolute Value Equations:

1. For $b > 0$, $|a| = b$ if and only if $a = b$ or $a = -b$.
2. $|a| = |b|$ if and only if $a = b$ or $a = -b$.

Ex. $|5 - 3x| = 3$ (Must be ___ units from 0 to the left **or** the right)
(Split the problem into 2 separate cases for each possibility.)

Ex. $|2k - 3| = |5k + 4|$
so $2k - 3 = 5k + 4$ OR $2k - 3 = -(5k + 4)$

Ex. $|x + 2| = |3x + 8|$

II. Absolute Value Inequalities (pp. 161 – 162)

Less than indicates values **between** the two values that make the absolute value true.

Greater than indicates values **beyond** the two values that make the absolute value true.

Solving Absolute Value Inequalities: For any positive number b ,

1. $|a| < b$ if and only if $-b < a < b$. (Graph is a segment)
2. $|a| > b$ if and only if $a < -b$ (*left side*) or $a > b$ (*right side*) (Graph is looks like “wings”)

Ex. $|x + 1| \leq 3$ (less than example)

Ex. $|3z + 1| \geq 7$ (greater than example)

*Remember to use \cup to hook the wings together.

* Isolate the absolute value before splitting into 2 equations.

Ex 4 $\left|5x + \frac{1}{2}\right| - 2 < 6$ (Hold the absolute value intact, while moving other values to the other side)

Ex. $5|x - 2| > 20$

III. Special Cases:

Ex.1) $|2x + 3| = -5$

*Absolute values cannot equal a **negative** value, since there are no negative distances (no negative numbers on the ruler)

Ex.2) $\left|\frac{1}{2}x + 6\right| \geq 0$

* **Any** absolute value is greater than 0, no matter what the expression inside, so the solution is the entire number line $(-\infty, \infty)$

Ex. 3) $|6x + 9| = 0$

*This is an equation that = **0**, so there is only one value that makes it true.

IV. Absolute Value Models of Distance and Tolerance (p. 163)

Use absolute value for:

1. Distance

Ex. r is 5 units from 3 $\Rightarrow |r - 3| = 5$

Ex. p is at least 5 units from $-9 \Rightarrow |p + 9| \geq 5$ (Recall “at least” translates \geq)

Ex. m is no more than 8 units from 9 $\Rightarrow |m - 9| \leq 8$ (Recall “no more than” is really “less than or =”)

2. Modeling

Ex. In one winter month in Chicago, the daily low temperatures (in Fahrenheit) satisfied the inequality $|T - 15| \leq 10$. Find the range of low temperatures that month.

Ex. Write the statement as an absolute value inequality:

If x is within .04 units of 2, then y is within .001 units of 7.

Assignments: {optional}

Text: pp. 164 – 165 #1 – 8, 9 – 15 odd, 27, 29, 31, 41, 43, 51, 77, 85, 87, 89