

Chapter 3: Absolute Values

November 3, 2021

1 Absolute Values

Definition

$$|x| = \begin{cases} x & \text{for } x \geq 0 \\ -x & \text{for } x < 0 \end{cases} \quad (1)$$

Understanding Absolute Value

1. Distance
2. different value range for the term inside of the absolute sign: condition – the value range that x can take on a number line;
3. Two right answers to make equation hold

It is like the absolute value on the left side is your soccer goal; two forwards can score a goal (positive number and negative number).

Q 1. If $x > 0$, $|x| = ?$
If $x < 0$, $|x| = ?$
If $x = 0$, $|x| = ?$

2 Equations with one absolute value

equation with one absolute value [Example 2](#) [Example 3](#) [Example 4](#)

1. Isolate the absolute value all by itself on the left side (why? because the rest terms can be calculated for sure (only one single case)).
2. List two cases.
3. Check!!!

1. treat any term(s)/expression inside the absolute signs as a cluster Y . Y has three value ranges: $Y < 0$, $Y = 0$;
2. always simplify other terms outside the absolute signs first, then work on the absolute signs.
3. if there are more than two absolute clusters, you need figure out each one's value range, then combine them into exclusive value ranges, then drop the absolute signs for each value range.

Q 1. Solve. $6|x - 4| - 15 = 27$

Q 2. Solve. $|3m - 1| + 8 = 19$

Q 3. Solve. $-5|6a + 2| = -15$

Q 4. Solve. $3|x + 8| - 4 = 26$

Q 5. Solve. $\frac{2}{3}|3x - 6| = 4(x - 2)$

Q 6. Solve. $|x - 2| = 4x + 8$ **extraneous**

Q 7. Solve. $|x + 2| = 7$

Q 8. Solve. $|2a + 1| = 5$

Q 9. Solve. $4|c| - 3 = 1$

Q 10. Solve. $7|m| - 51 = 2|m| + 4$

Q 11. Mathematical Reasoning: Is the statement sometimes true, always true, or never true? Explain.

1. $|x| > x$
2. $|x^2| = x^2$
3. $|xy| = |x||y|$

3 Advanced

examples up to 30 minutes

Q 1. Solve. $|x - 4| = x - 4$

Q 2. Solve. $|3x| = |4x - 1|$

Q 3. Solve. $|2y| = |3y + 2| + 1$

Q 4. Solve. $|x - 1| + |3x - 1| = 5$

Q 5. Solve. $|5x + 3| - |2x - 7| = 21$

Q 6. Solve. $||5x - 2| - 6| = 2$