Lesson 1.27 - Absolute Value Inequalities

Learning Objectives: SWBAT

1. Solve Absolute Value Inequalities and graph the solution on a number line

Making a connection

- In lesson 1.26 we solved AB equations. As with other equations we have solved, the nature of the solution were single point(s) that satisfied the equation
- As with other inequalities we have solved, the nature of the solutions to AV inequalities is an infinite "range" of points.
- The idea/process of solving for the "boundary" values is exactly the same in lesson 1.26. The difference that the < > signs determine where the "range" of solutions is located

Example 1 **Solving the Absolute Value Inequality $|A| < b$**

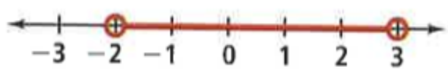
What is the solution of $|2x - 1| < 5$? Graph the solution.

$|2x - 1| < 5$

$-5 < 2x - 1 < 5$ — $2x - 1$ is between -5 and 5.

$-4 < 2x < 6$ — Add 1 to each part.

$-2 < x < 3$ — Divide each part by 2.



- Things to notice:
  > When the problem is a LESS THAN problem, the solutions are between the two boundaries
  > Closed circles would be used if the problem uses a ≤ or ≥ sign

Example 2 **Solving the Absolute Value Inequality $|A| \geq b$**

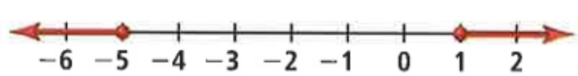
What is the solution of $|2x + 4| \geq 6$? Graph the solution.

$|2x + 4| \geq 6$

$2x + 4 \leq -6$ or $2x + 4 \geq 6$ — Rewrite as a compound inequality.

$2x \leq -10$ | $2x \geq 2$ — Subtract 4 from each side of both inequalities.

$x \leq -5$ or $x \geq 1$ — Divide each side of both inequalities by 2.



- Things to notice:
  > When the problem is a GREATER THAN problem, the solutions are outside the two boundaries
  > Open circles would be used if the problem uses a < or > sign

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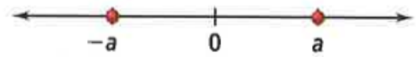
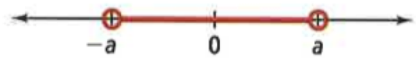
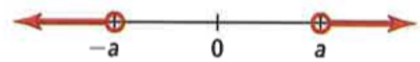
take note

Concept Summary **Solutions of Absolute Value Statements**

Symbols	Definition	Graph
$\lvert x \rvert = a$	The distance from x to 0 is a units.	 $x = -a$ or $x = a$
$\lvert x \rvert < a$ $(\lvert x \rvert \leq a)$	The distance from x to 0 is less than a units.	 $-a < x < a$ $x > -a$ and $x < a$
$\lvert x \rvert > a$ $(\lvert x \rvert \geq a)$	The distance from x to 0 is greater than a units.	 $x < -a$ or $x > a$

Practice **Solve each inequality. Graph the solution.**

25. $3\lvert y - 9 \rvert < 27$

26. $\lvert 6y - 2 \rvert + 4 < 22$

27. $\lvert 3x - 6 \rvert + 3 < 15$

28. $\frac{1}{4}\lvert x - 3 \rvert + 2 < 1$

29. $4\lvert 2w + 3 \rvert - 7 \leq 9$

30. $3\lvert 5t - 1 \rvert + 9 \leq 23$

31. $\lvert x + 3 \rvert > 9$

32. $\lvert x - 5 \rvert \geq 8$

33. $\lvert y - 3 \rvert \geq 12$

34. $\lvert 2x + 1 \rvert \geq -9$

35. $3\lvert 2x - 1 \rvert \geq 21$

36. $\lvert 3z \rvert - 4 > 8$

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Extra Practice: AV Equations and Inequalities

Solve each equation.

43. $-|4 - 8b| = 12$

44. $4|3x + 4| = 4x + 8$

45. $|3x - 1| + 10 = 25$

46. $\frac{1}{2}|3c + 5| = 6c + 4$

47. $5|6 - 5x| = 15x - 35$

48. $7|8 - 3h| = 21h - 49$

Solve each inequality. Graph the solutions.

57. $|3x - 4| + 5 \leq 27$

58. $|2x + 3| - 6 \geq 7$

63. $\frac{1}{9}|5x - 3| - 3 \geq 2$

64. $\frac{1}{11}|2x - 4| + 10 \leq 11$

65. $\left|\frac{x - 3}{2}\right| + 2 < 6$

66. $\left|\frac{x + 5}{3}\right| - 3 > 6$