

Distance from Zero

Solve and graph absolute value relationships.

HIGH SCHOOL • MA.912.AR.4

MA.912.AR.4 "Write, solve and graph absolute value equations, functions and inequalities in one and two variables."

NAME _____

DATE _____

THE BIG IDEA

After you isolate an absolute value expression, check the number on the other side. If it is positive, write two cases, if it is 0, solve one case, and if it is negative, there is no solution. For absolute value inequalities, think of distance: $<$ or $\leq$ gives values between two endpoints, while $>$ or $\geq$ gives values outside them. In $y=a|x-h|+k$, the vertex is (h, k) , and the graph opens up when a is positive and down when a is negative.

WORKED EXAMPLE

Solve $|17x - 47| = 19$.

1. Write two cases: $17x - 47 = 19$ or $17x - 47 = -19$.
2. Add 47: $17x = 66$ or $17x = 28$.
3. Divide by 17: $x = 66/17$ or $x = 28/17$.

Answer: $x = 66/17$ or $x = 28/17$

PRACTICE 6 problems

1 Solve $|x + 7| = 15$.

ANSWER _____

2 Solve $|5x - 8| = 0$.

ANSWER _____

3 Solve $|x - 11| = -3$.

ANSWER _____

4 Solve and graph on a number line: $|x - 20| < 6$.

ANSWER _____

5 Solve and graph on a number line: $|5x + 1| \geq 6$.

ANSWER _____

6 Graph $y = |x - 10| - 5$. Label the vertex and the x-intercepts.

ANSWER _____

APPLY IT Show your work

- 1** A school esports team accepts a player's ping p only if it is within 18 milliseconds of 42 milliseconds. Write and solve an absolute value inequality for the acceptable p -values.

WORK SPACE

ANSWER _____

- 2** A photo-editing app has a target brightness of 55. A post is flagged when its brightness b is more than 14 units from the target. Write and solve an absolute value inequality for flagged brightness values.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

An absolute value function has vertex $(3, -7)$ and passes through $(8, 3)$. Write its equation in the form $y = a|x - h| + k$. Show how you found a .

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve $ x + 7 = 15$.	$x = 8$ or $x = -22$
2	Solve $ 5x - 8 = 0$.	$x = 8/5$
3	Solve $ x - 11 = -3$.	no solution
4	Solve and graph on a number line: $ x - 20 < 6$.	$14 < x < 26$, with open circles at 14 and 26
5	Solve and graph on a number line: $ 5x + 1 \geq 6$.	$x \leq -7/5$ or $x \geq 1$, with closed circles at $-7/5$ and 1
6	Graph $y = x - 10 - 5$. Label the vertex and the x-intercepts.	vertex (10, -5); x-intercepts (5, 0) and (15, 0)

PART 2 · APPLY IT

1. **$|p - 42| \leq 18$; $24 \leq p \leq 60$** Being within 18 of 42 means the distance between p and 42 is at most 18. Subtract and add 18 to 42 to find the endpoints.
2. **$|b - 55| > 14$; $b < 41$ or $b > 69$** More than 14 units away means the distance from 55 is greater than 14. Values below 41 or above 69 are flagged.

CHALLENGE

$y = 2|x - 3| - 7$; $3 = a|8 - 3| - 7$, so $3 = 5a - 7$, $10 = 5a$, and $a = 2$.

Accept equivalent interval notation for the inequalities. For number-line graphs, accept correct rays or segments with open endpoints for strict inequalities and closed endpoints for inclusive inequalities.