Graphing Absolute Value Inequalities

Name: _____	Date: _____	Score: _____ / 33

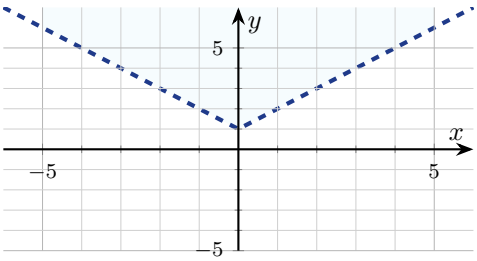
Quick Review

Graphing y-vs-x absolute-value inequalities combines two skills: graphing the V-shaped curve $y = a|x - h| + k$, and shading the right half of the plane. Start with the boundary V-curve, just as if it were an equation. The vertex is (h, k); the slopes of the two arms are $+a$ (right side) and $-a$ (left side). If $a < 0$ the V opens downward; if $|a| > 1$ it's narrower than the parent, $|a| < 1$ wider. Make the boundary **solid** for $\leq$ or $\geq$, **dashed** for strict $<$ or $>$. To decide which side to shade, plug in a test point not on the V. The origin works unless it sits on the curve. If the test makes the inequality true, shade that region; otherwise shade the other side. *Rule of thumb*: $y > |x|$ shades *above* the V (interior); $y < |x|$ shades *below and outside* (everywhere the V doesn't reach).

PRACTICE

Solve, describe, or sketch as directed.

1. Vertex of $y \geq |x - 2| + 1$ _____
2. Solid or dashed: $y > |x| + 3$ _____
3. Shade above or below for $y \geq |x|$ _____
4. Test $(0, 0)$ in $y > |x| - 2$. _____
5. Vertex of $y < -|x + 3| + 4$ _____
6. Is $(2, 5)$ a solution of $y \geq |x| + 1$? _____
7. Direction the V opens for $y = -2|x - 1| + 3$ _____
8. Slope of the right arm of $y = 3|x| - 5$ _____
9. Width: narrower or wider than parent? $y = \frac{1}{2}|x|$ _____
10. Is $(0, -1)$ a solution of $y < -|x| + 2$? _____
11. Vertex of $y \leq |2x - 4|$ _____
12. Boundary line type: $y \leq |x| + 1$ _____
13. Which inequality describes the region above the dashed V with vertex $(0, 1)$ shown below? _____



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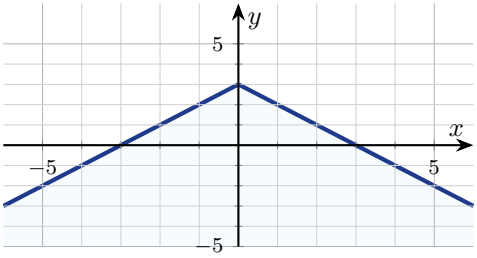
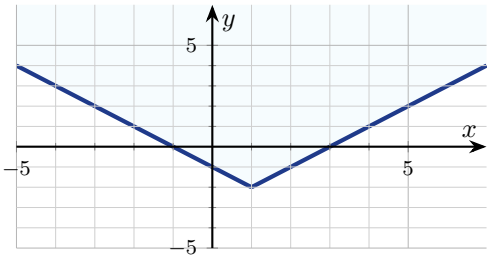
14. Which inequality matches the solid V below opening downward with vertex $(0, 3)$ and shading inside? _____

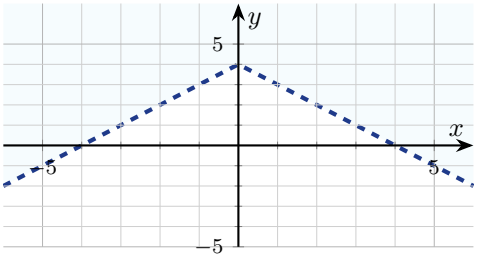


15. Sketch the region for $y \geq |x - 1| - 2$ below, then name the boundary equation. _____



16. Vertex and direction of $y > -|x|$ _____

17. Use the graph to describe the shaded region for $y > -|x| + 4$. _____



18. Is $(1, 0)$ a solution of $y \geq |x| - 2$? _____

19. Boundary slopes of $y > 3|x + 2|$ _____

20. Test $(0, 0)$ in $y > |x - 1| + 2$. _____

♦ Word Problems

21. A drone's altitude y must stay above the path $y \geq |x - 5| + 10$ (with x in horizontal distance, meters). What is the lowest altitude the drone is allowed to reach, and where does that happen? ____

22. A safety zone around a fence is described by $y < -|x| + 6$ (with x horizontal and y vertical, meters). Is the point $(2, 3)$ inside the safety zone? ____

23. A landing pad is bounded by $y \leq |x| + 2$ (above the V). If y measures meters above ground and a helicopter hovers at $(0, 1)$, is it inside or outside the bound? ____

24. A V-shaped park trail is described by $y = |x|$ (in miles). A safety boundary requires walking inside the region $y > |x| - 1$. Is the location $(2, 0)$ inside the safe region? ____

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Additional Practice

25. Solve $|x - 4| = 9$. _____

26. Solve $|2x + 1| < 7$. _____

27. Solve $|x + 3| \geq 5$. _____

28. Find the vertex of $y = |x - 2| - 3$. _____

29. Find the axis of symmetry of $y = |x + 5| + 1$. _____

30. Solve $3|x| - 6 = 12$. _____

31. Solve $|x - 1| + 4 \leq 10$. _____

32. State the range of $y = |x + 2| - 8$. _____

33. Solve $|4x - 8| > 12$. _____

Answer Keys

1. $(2, 1)$
2. dashed
3. above (interior of V)
4. true
5. $(-3, 4)$
6. yes
7. downward
8. 3
9. wider
10. yes
11. $(2, 0)$
12. solid
13. $y > |x| + 1$
14. $y \leq -|x| + 3$
15. $y = |x - 1| - 2$
16. $(0, 0)$, downward
17. above the V
18. yes
19. ± 3
20. false
21. $y = 10$ m at $x = 5$
22. yes
23. inside the bound
24. no

Additional Practice Answers

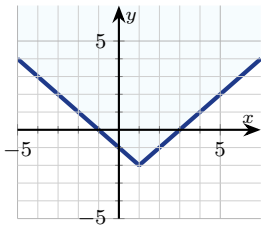
25. $x = -5,\ 13$
26. $-4 < x < 3$
27. $x \leq -8$ or $x \geq 2$
28. $(2, -3)$
29. $x = -5$
30. $x = -6,\ 6$
31. $-5 \leq x \leq 7$
32. $y \geq -8$
33. $x < -1$ or $x > 5$

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

1. The boundary V is $y = |x - 2| + 1$. Read the shifts: $x - 2$ inside moves the vertex right 2, and $+1$ outside moves it up 1. So the vertex lands at $(2, 1)$.
2. The symbol is a strict $>$, so points exactly on the V are not solutions. Draw the boundary dashed (solid is only for $\leq$ or $\geq$).
3. One steady path is: $y \geq$ stuff shades on or above the curve — the region inside the upward-opening V. That gives a quick check on the answer.
4. Start with the key idea: $0 > |0| - 2 = -2$ is true. Origin is in the shaded region. This is the part to check before moving on, because it keeps the answer tied to the original question.
5. Compare to $y = a|x - h| + k$: the $+3$ inside means $h = -3$ (left 3), and $+4$ outside means $k = 4$ (up 4), so the vertex is $(-3, 4)$. The leading negative just flips the V downward — it doesn't move the vertex.
6. Keep the rule visible: $|2| + 1 = 3$, and $5 \geq 3$ is true. This is the part to check before moving on, because it keeps the answer tied to the original question.
7. Coefficient -2 is negative $\Rightarrow$ V opens downward. The narrow shape comes from the $|-2| = 2 > 1$ steepness.
8. For $x > 0$, $|x| = x$, so the right arm is $y = 3x - 5$ — slope 3. (The left arm, where $|x| = -x$, has slope -3. The two arms always have opposite slopes $\pm a$.)
9. A careful way to see it: $|a| = \frac{1}{2} < 1$ flattens the V $\Rightarrow$ wider than $y = |x|$. This is the part to check before moving on, because it keeps the answer tied to the original question.
10. Keep the rule visible: $-|0| + 2 = 2$, and $-1 < 2$ is true. This is the part to check before moving on, because it keeps the answer tied to the original question.
11. One steady path is: Rewrite: $|2x - 4| = |2(x - 2)| = 2|x - 2|$. Vertex at $(2, 0)$, slope 2 on each side. That gives a quick check on the answer.
12. The $\leq$ includes "or equal to," so points on the V *are* solutions. Draw the boundary solid (dashed is only for strict $<$ or $>$).
13. Vertex at $(0, 1)$ with arms going up at slope ± 1 gives boundary $y = |x| + 1$. Dashed $\Rightarrow$ strict; above the V $\Rightarrow y >$.
14. Vertex $(0, 3)$, downward arms with slope ∓ 1 give boundary $y = -|x| + 3$. Solid $\Rightarrow$ inclusive; inside (below) $\Rightarrow y \leq$.
15. The boundary is $y = |x - 1| - 2$: vertex at $(1, -2)$ with arms of slope ± 1. Draw it solid since the symbol is $\geq$. Because y is at-or-above the V, shade the interior (everything on or above the curve).

Answer graph



16. Start with the key idea: Vertex at origin, arms going down (coefficient -1). Strict, so dashed. That gives a quick check on the answer.
17. A careful way to see it: $y >$ stuff $\Rightarrow$ shade above the downward V. (The shaded region is the wide area above the inverted V.) That gives a quick check on the answer.
18. Keep the rule visible: $|1| - 2 = -1$, and $0 \geq -1$ is true. This is the part to check before moving on, because it keeps the answer tied to the original question.
19. The coefficient 3 sets the steepness of both arms: the right arm has slope $+3$ and the left arm -3. The $+2$ inside puts the vertex at $(-2, 0)$, but the slopes are still ± 3.
20. Start with the key idea: $|0 - 1| + 2 = 3$, and $0 > 3$ is false. Origin is below the V. This is the part to check before moving on, because it keeps the answer tied to the original question.
21. The vertex of $y = |x - 5| + 10$ is at $(5, 10)$ — the lowest point of the V. The drone must stay above (or on) the curve, so the floor is 10 m, reached at $x = 5$.
22. Keep the rule visible: $-|2| + 6 = 4$, and $3 < 4$ is true. The point lies strictly below the boundary $\Rightarrow$ inside the zone. That gives a quick check on the answer.
23. At $x = 0$, the boundary is $y = |0| + 2 = 2$. The inequality $y \leq 2$ holds for the hovering point $(0, 1)$. So it's inside (below the V).
24. Start with the key idea: $|2| - 1 = 1$, and $0 > 1$ is false. Point $(2, 0)$ lies below the boundary V $y = |x| - 1$, so it's not in the safe region. That gives a quick check on the answer.

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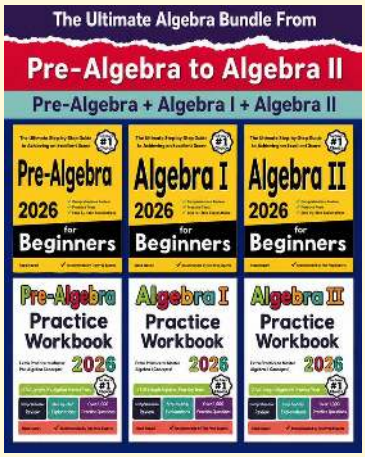

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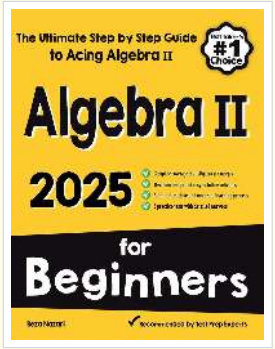

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