Graphing Functions

Name: _____	Date: _____	Score: _____ / 34

Quick Review

Graphing a function starts with three anchor moves: plot the y-intercept, plot the x-intercept(s), and identify any symmetry or asymptote that constrains the shape. For a line, two points are enough. For a quadratic, the vertex and one intercept lock the shape.

Vertex form $y = a(x-h)^2 + k$ gives the vertex at (h, k) directly. The sign of a tells the opening direction (up if $a > 0$, down if $a < 0$); $|a|$ tells the stretch ($|a| > 1$ narrower, $|a| < 1$ wider). **Slope-intercept** $y = mx + b$ gives intercept b and slope $m = \dfrac{\Delta y}{\Delta x}$.

Slope between two points: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$. Between $(2, 3)$ and $(6, 11)$: $m = \dfrac{8}{4} = 2$.

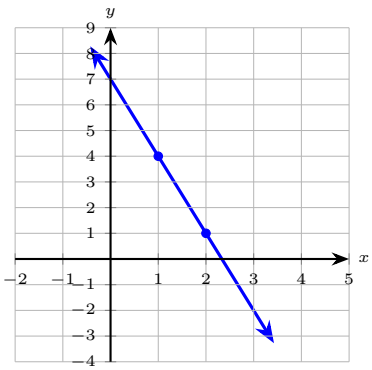
Vertical-line test. A graph is a function only if every vertical line hits it at most once. The sideways parabola $x = y^2$ fails (at $x = 4$, $y = \pm 2$). The upward parabola $y = x^2$ passes.

Reading from a graph. To find $f(c)$, look at the height of the curve at $x = c$. To solve $f(x) = k$, find where the graph crosses the horizontal line $y = k$. The x-intercept is where the graph meets the x-axis; the y-intercept is where it meets the y-axis.

PRACTICE

Read or sketch the graphs. Show the key features.

1. $f(x) = -(x-2)^2 + 9$; quadrant of $(6, f(6))$ _____
2. $f(-1) = 4, f(0) = 1, f(2) = -5$; x with $f(x) = 1$ _____
3. Slope through $(2, 3)$ and $(6, 11)$. _____
4. Read the y-intercept of the line graphed below. _____



5. Parabola with vertex $(0, 0)$, opens up, passes through $(1, 1)$. Equation? _____
6. Which is NOT a function: $x = y^2$, $y = x^2$, a horizontal line, $y = |x|$? _____
7. $f(x) = -2(x-1)^2 + 4$; vertex _____
8. $f(x) = (x+3)^2 - 5$; vertex and direction _____
9. Line with y-intercept -4 passing through $(3, 2)$. Equation? _____

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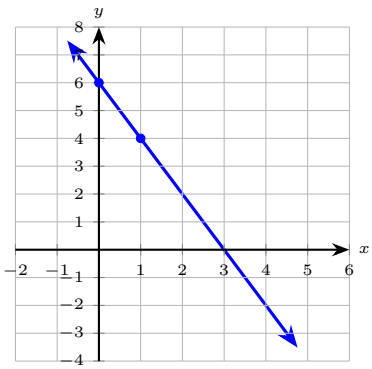
10. Read the x-intercept of the line graphed below. _____



11. $f(x) = (x-2)^2 - 9;$ x-intercepts _____

12. Line through $(0, 3)$ with slope $-\frac{1}{2}$. Equation? _____

13. Parabola with vertex $(2, -3)$ opening up. Vertex form? _____

14. $f(x) = |x-3|;$ $f(5)$ _____

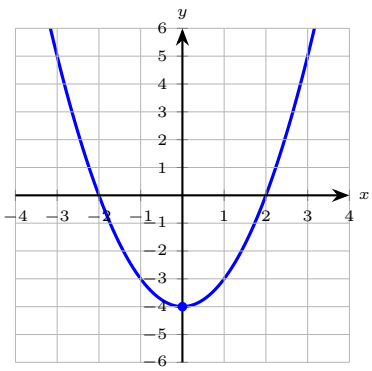
15. $f(x) = x^2 - 4x + 3$; vertex _____

16. Line through $(1, 2), (3, 6), (5, 10)$. Slope? _____

17. To find $f(c)$ from a graph, read what at $x = c$? _____

18. $y = x^2$; value of y at x=-3 _____

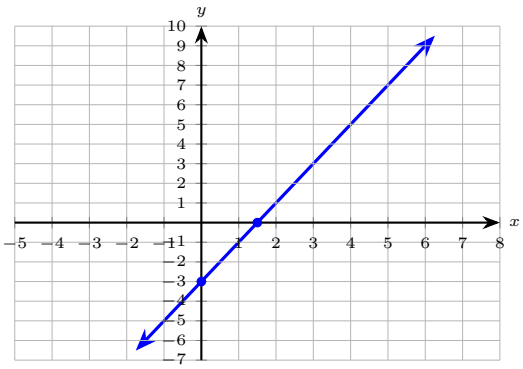
19. Read the x-intercepts of the parabola graphed below. _____



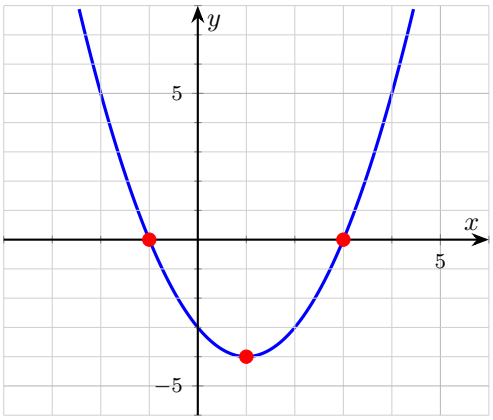
20. $y = -x^2 + 9;$ x-intercepts _____

Word Problems

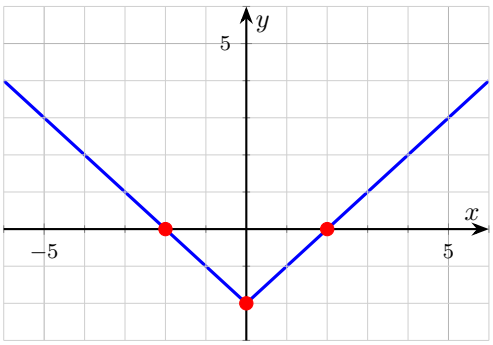
21. Sketch $y = 2x - 3$ on a coordinate plane. Label the intercepts. ____



22. Sketch $y = (x-1)^2 - 4$ and identify the vertex and x-intercepts. ____



23. Sketch $y = |x| - 2$. State the vertex and where it crosses the x-axis. ____



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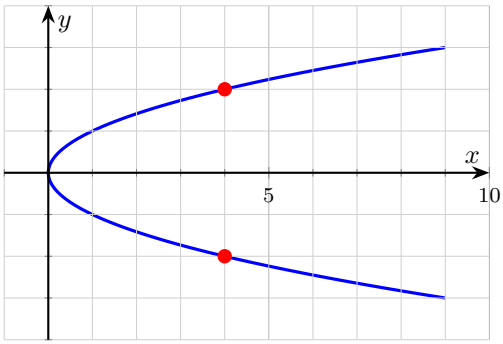
24. Sketch a graph that is NOT a function (so it fails the vertical-line test). One simple choice is $x = y^2$. Sketch it for $-3 \le y \le 3$, and mark the two y-values that map to $x = 4$. ____



Additional Practice

25. If $f(x) = 2x - 5$, find $f(4)$. _____

26. If $g(x) = x^2 + 1$, find $g(-3)$. _____

27. For $f(x) = 3x + 2$, solve $f(x) = 14$. _____

28. Find $(f + g)(x)$ if $f = x + 1$, $g = 2x - 5$. _____

29. Find $(fg)(x)$ if $f = x - 2$, $g = x + 3$. _____

30. Find $f(g(x))$ if $f(x) = 2x$, $g(x) = x + 7$. _____

31. Find the inverse of $f(x) = x - 9$. _____

32. Find the inverse of $f(x) = 3x + 1$. _____

33. Domain of $f(x) = \sqrt{x - 4}$. _____

34. Domain of $f(x) = \dfrac{1}{x + 6}$. _____

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Answer Keys

1. IV
2. 0
3. 2
4. 7
5. $f(x) = x^2$
6. $x = y^2$
7. $(1, 4)$
8. $(-3, -5)$, opens up
9. $y = 2x - 4$
10. 3
11. $-1, 5$
12. $y = -\frac{1}{2}x + 3$
13. $y = a(x-2)^2 - 3,\ a > 0$
14. 2
15. $(2, -1)$
16. 2
17. the height (y-value)
18. 9
19. ± 2
20. ± 3
21. y-int -3, x-int $\frac{3}{2}$
22. vertex $(1, -4)$; x-int $-1, 3$
23. vertex $(0, -2)$; x-int ± 2
24. $x = 4 \to y = 2$ and $y = -2$

Additional Practice Answers

25. 3
26. 10
27. $x = 4$
28. $3x - 4$
29. $x^2 + x - 6$
30. $2x + 14$
31. $f^{-1}(x) = x + 9$
32. $f^{-1}(x) = \frac{x-1}{3}$
33. $x \geq 4$
34. $x \neq -6$

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

Step-by-Step Explanations

1. Evaluate at $x = 6$: $f(6) = -(6-2)^2 + 9 = -(4)^2 + 9 = -16 + 9 = -7$. The point $(6, -7)$ has positive x and negative y, which lands in Quadrant IV (bottom-right).

2. You want the input whose output is 1. Scan the given values: $f(-1) = 4$, $f(0) = 1$, $f(2) = -5$. The output 1 appears at $x = 0$, so $f(x) = 1$ when $x = 0$.

3. One steady path is: $\frac{11-3}{6-2} = \frac{8}{4} = 2$. This is the part to check before moving on, because it keeps the answer tied to the original question.

4. The y-intercept is where the line crosses the y-axis ($x = 0$). Following the line to the axis gives height 7.

5. A careful way to see it: That's the parent quadratic. This is the part to check before moving on, because it keeps the answer tied to the original question.

6. Keep the rule visible: Sideways parabola fails vertical-line test. At $x = 4$, $y = \pm 2$. That gives a quick check on the answer.

7. Read off vertex form $a(x-h)^2 + k$, where the vertex is (h, k). Here $x - 1$ gives $h = 1$ and the $+4$ gives $k = 4$, so the vertex is $(1, 4)$.

8. Match to $a(x-h)^2 + k$. Rewrite $x + 3$ as $x - (-3)$, so $h = -3$; the -5 gives $k = -5$. Vertex $(-3, -5)$. Since $a = 1 > 0$, the parabola opens upward.

9. A careful way to see it: y-intercept gives $(0, -4)$. Slope: $\frac{2-(-4)}{3-0} = 2$. This is the part to check before moving on, because it keeps the answer tied to the original question.

10. The x-intercept is where the line crosses the x-axis ($y = 0$). Following the line down to the axis, it crosses at $x = 3$.

11. Set $y = 0$: $(x-2)^2 - 9 = 0$, so $(x-2)^2 = 9$. Take the square root of both sides — remember both signs: $x - 2 = \pm 3$. That gives $x = 2 + 3 = 5$ or $x = 2 - 3 = -1$.

12. Start with the key idea: Plug into $y = mx + b$ directly. This is the part to check before moving on, because it keeps the answer tied to the original question.

13. A careful way to see it: Vertex form $y = a(x-h)^2 + k$ with $h = 2, k = -3$. This is the part to check before moving on, because it keeps the answer tied to the original question.

14. Substitute 5 inside the bars first: $f(5) = |5 - 3| = |2|$. Absolute value makes it nonnegative, so $|2| = 2$.

15. For $ax^2 + bx + c$, the vertex x-coordinate is $x = -\frac{b}{2a} = -\frac{-4}{2(1)} = 2$. Then find the y-coordinate: $f(2) = 2^2 - 4(2) + 3 = 4 - 8 + 3 = -1$. Vertex $(2, -1)$.

16. Start with the key idea: Output rises 4 for every $\Delta x = 2$. Slope 2. This is the part to check before moving on, because it keeps the answer tied to the original question.

17. A careful way to see it: $f(c)$ is the height of the curve at horizontal position c. That gives a quick check on the answer.

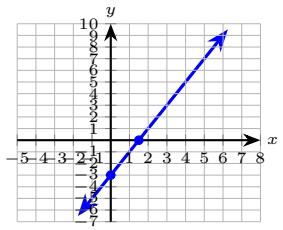
18. Keep the rule visible: $(-3)^2 = 9$. (Plot the point $(-3, 9)$.) This is the part to check before moving on, because it keeps the answer tied to the original question.

19. The parabola $y = x^2 - 4$ has vertex $(0, -4)$ and opens upward. It crosses the x-axis where $y = 0$, at $x = -2$ and $x = 2$.

20. Set $y = 0$: $-x^2 + 9 = 0$, so $x^2 = 9$. Take both square roots: $x = \pm 3$. The parabola opens downward and crosses the axis at -3 and 3.

21. Slope 2, y-intercept -3. x-intercept from $2x - 3 = 0$: $x = \frac{3}{2}$. The red points mark these crossings. The line rises 2 for every step right of 1 — count that on the grid and the slope is visible.

Answer graph



22. Vertex form $a(x-h)^2 + k$ with $h = 1, k = -4$. Set $y = 0$: $(x-1)^2 = 4 \Rightarrow x - 1 = \pm 2 \Rightarrow x = -1$ or 3. The parabola opens upward (since $a = 1 > 0$) and is symmetric across $x = 1$. The marked red points are the vertex and the two x-intercepts.

Answer graph

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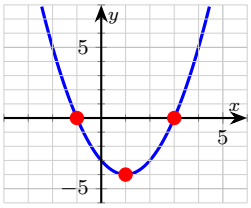
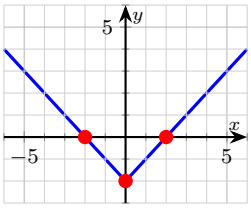


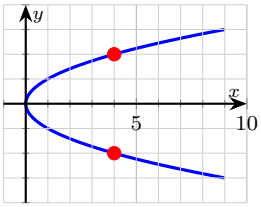
23. One steady path is: $|x| - 2$ is the parent absolute-value V shifted down 2. Vertex at $(0, -2)$. Set $|x| - 2 = 0$: $|x| = 2$, so $x = \pm 2$. The V opens upward with slopes ± 1 on the two sides. That gives a quick check on the answer.

Answer graph



24. At $x = 4$, $y^2 = 4$ so $y = \pm 2$. One input, two outputs $\Rightarrow$ not a function. The vertical line $x = 4$ hits the sideways parabola twice (at the two red dots). Any sideways opening curve like this will fail the vertical-line test.

Answer graph



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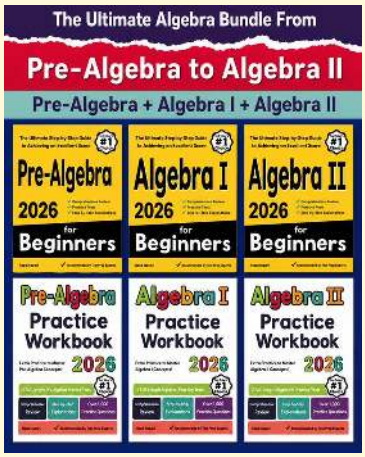

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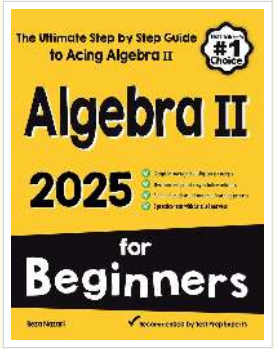

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