

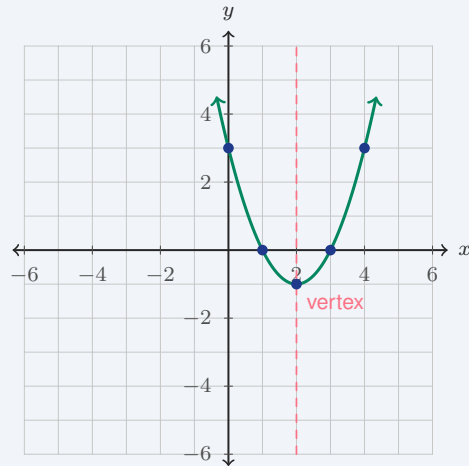
Graphing Quadratic Functions

Name: _____ Date: _____ Score: _____ / 18

Quick Review and Helpful Hints

A quadratic graph is a parabola, so graphing it means more than naming a formula. First find the vertex, then plot a few points on both sides of that vertex. Points on a parabola come in matching pairs across the axis of symmetry, so if $(1, -3)$ is one unit to the left of the axis, the matching point one unit to the right has the same y -value. Use the graph to read the vertex, intercepts, maximum or minimum, and what the answer means in the situation.

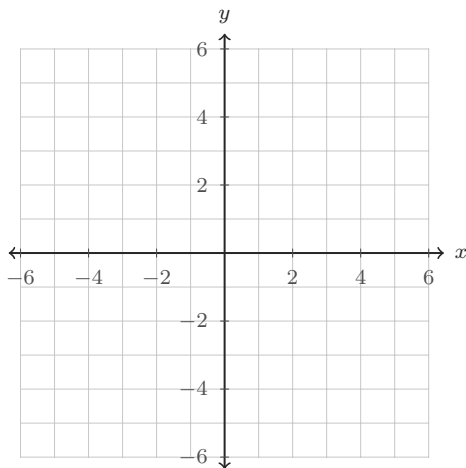
► **Example:** Graph $y = (x - 2)^2 - 1$. The vertex is $(2, -1)$. Plot the vertex, then choose matching x -values: $x = 1$ and $x = 3$ both give $y = 0$; $x = 0$ and $x = 4$ both give $y = 3$. Connect the points with a smooth U-shape.



Practice Problems

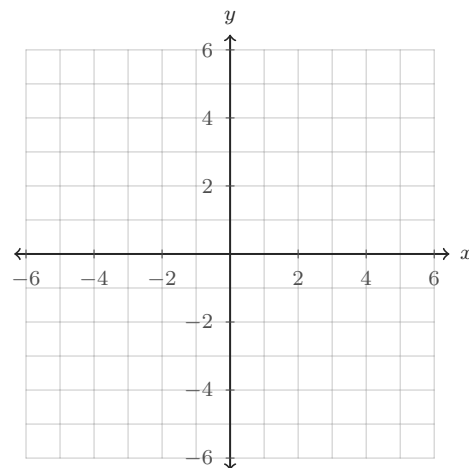
Graph each parabola or answer from the graph. Use the coordinate planes, not mental shortcuts.

1. Graph $y = x^2 - 4$. Then write the vertex.



Use $x = -2, -1, 0, 1, 2$ to make a quick table.

2. Graph $y = (x - 2)^2 - 1$. Then write the axis of symmetry.



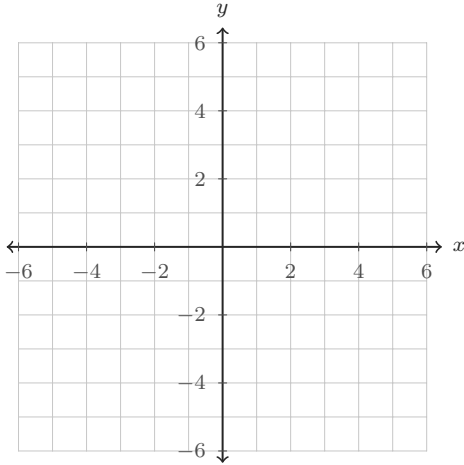
The vertex form already shows the center line.



◆ Graph From the Equation

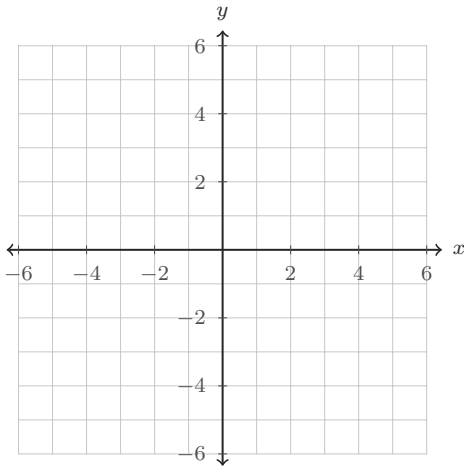
Plot the vertex first, add symmetric points, and sketch a smooth parabola.

3. Graph $y = -(x + 1)^2 + 4$. Is the vertex a maximum or a minimum?



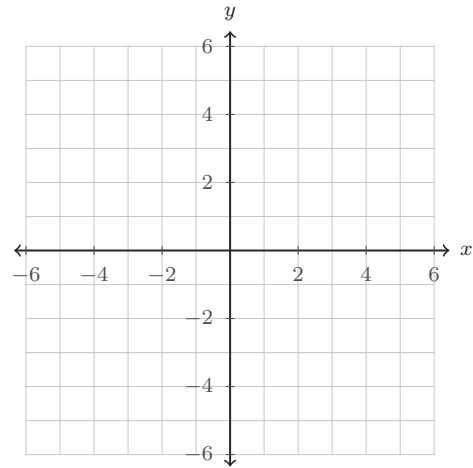
Because the coefficient is negative, the curve opens downward.

4. Graph $y = 2x^2 - 2$. Is it narrower or wider than $y = x^2$?



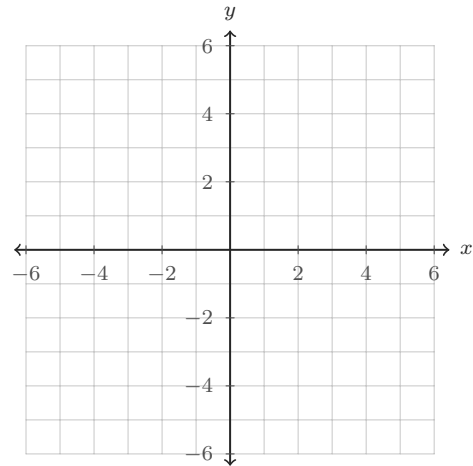
Compare the y -values when $x = 1$ and $x = 2$.

5. Graph $y = x^2 - 2x - 3$. Then write the x -intercepts.



The intercepts are where the graph crosses the x -axis.

6. Graph $y = -x^2 + 4x + 1$. Then write the y -intercept and the maximum value.



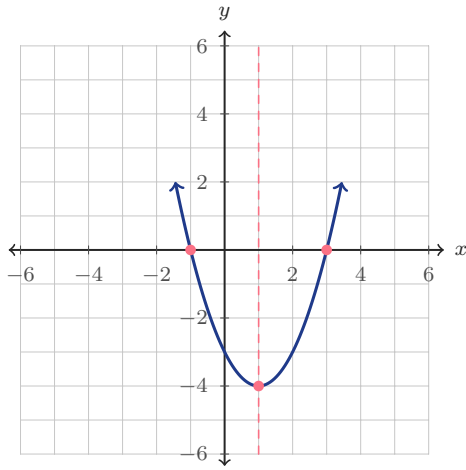
The y -intercept is where $x = 0$.



◆ Read the Graph

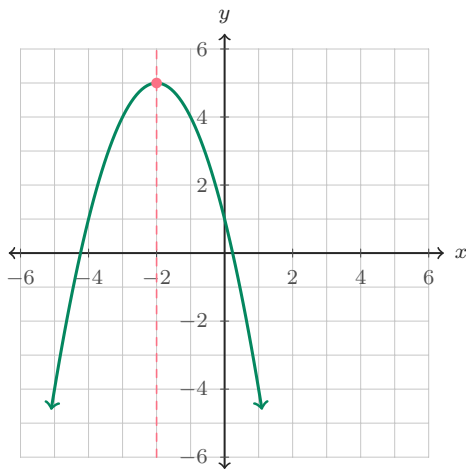
Use the printed graphs to identify key features.

7. Use the graph to find the x -intercepts.



Look for the points where the curve crosses $y = 0$.

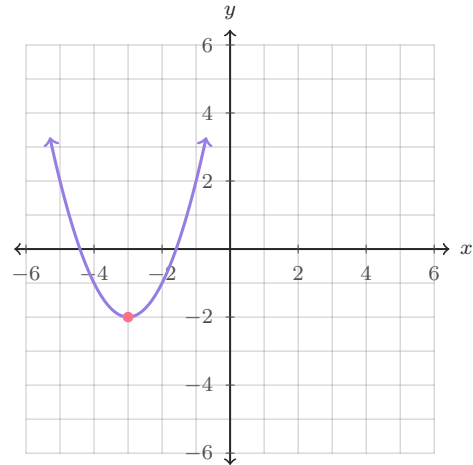
8. Use the graph to find the maximum value.



The maximum value is the highest y -value on the graph.

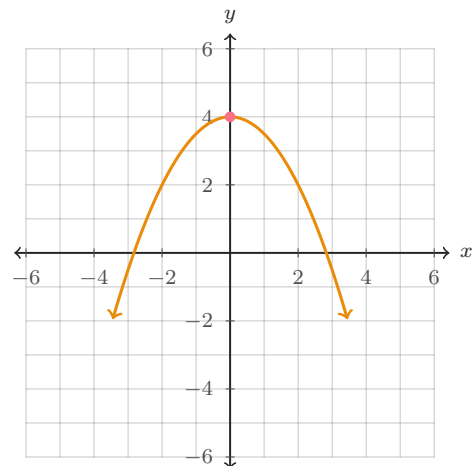
9. Which equation matches this graph?

- A. $y = (x-3)^2 - 2$ B. $y = (x+3)^2 - 2$ C. $y = -(x+3)^2 - 2$



Use the vertex and the opening direction.

10. Use the graph to write the y -intercept.



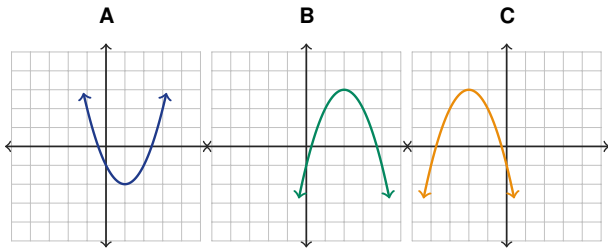
The y -intercept is the point on the vertical axis.



◆ Choose, Plot, and Interpret

These questions mix graph recognition, tables, and real contexts.

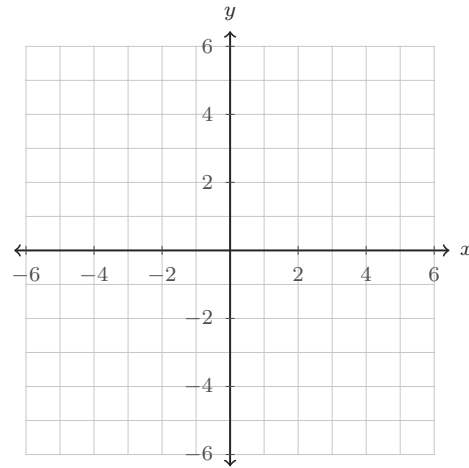
11. Circle the graph that opens down and has vertex $(2, 3)$.



Check both clues: opens down and vertex at $(2, 3)$.

12. Plot the table, sketch the parabola, and write the vertex.

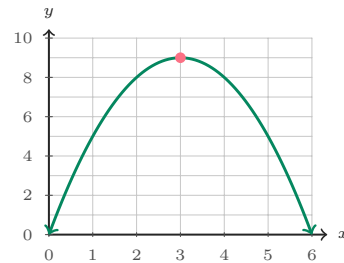
x	-2	-1	0	1	2
y	3	0	-1	0	3



The middle point in the table is often the vertex.

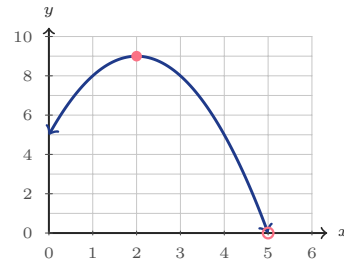
13. A garden arch is modeled by $h = -(x - 3)^2 + 9$, where x is feet from the left side and h is height in feet. What is the maximum height, and where does it happen?

Read the highest point of the arch.



14. A basketball is modeled by $h = -t^2 + 4t + 5$, where t is seconds and h is height in feet. Graph the path. When does the ball hit the ground?

The ground is the x -axis, where $h = 0$.

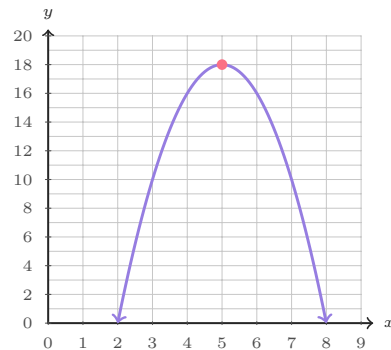


◆ Application Graphs

Each situation has a graph. Use the graph and the equation together.

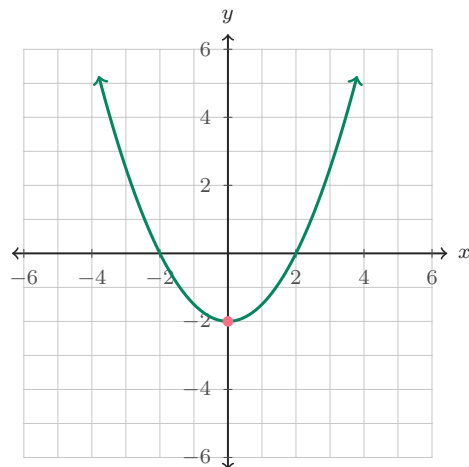
15. A school club models profit, in tens of dollars, by $P = -2p^2 + 20p - 32$, where p is the ticket price in dollars. Which ticket price gives the greatest profit?

The best price is the x -value at the top of the parabola.



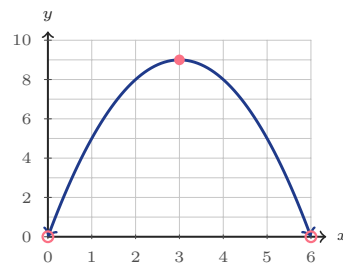
16. A satellite dish cross-section is modeled by $y = 0.5x^2 - 2$. What point is the lowest part of the dish?

The lowest point of an upward-opening parabola is its vertex.



17. A fountain stream is modeled by $h = -x^2 + 6x$, where x is horizontal distance in feet. How far from the nozzle does the water land?

The water lands where the height returns to 0.



18. A bridge cable is modeled by $h = 0.25(x - 4)^2 + 2$, where h is height in feet. What is the lowest height, and how far from the left support is it?

For an upward-opening cable model, the vertex gives the lowest point.



Answer Keys

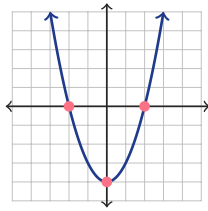
1. $(0, -4)$
2. $x = 2$
3. maximum at $(-1, 4)$
4. narrower; vertex $(0, -2)$
5. $(-1, 0)$ and $(3, 0)$
6. y -int $(0, 1)$; max 5
7. $(-1, 0)$ and $(3, 0)$
8. 5
9. B
10. $(0, 4)$
11. B
12. $(0, -1)$
13. 9 ft at $x = 3$ ft
14. 5 seconds
15. \$5
16. $(0, -2)$
17. 6 ft
18. 2 ft at $x = 4$ ft



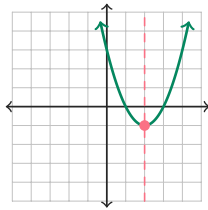
Graph Answer Sketches

These sketches match the questions that ask students to graph, plot, or sketch a parabola.

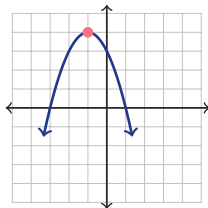
1. $y = x^2 - 4$; vertex $(0, -4)$



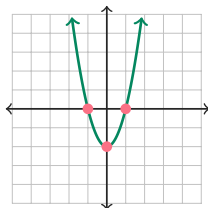
2. $y = (x - 2)^2 - 1$; axis $x = 2$



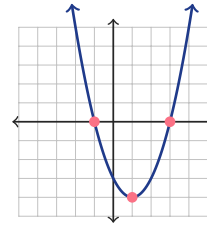
3. $y = -(x + 1)^2 + 4$; maximum



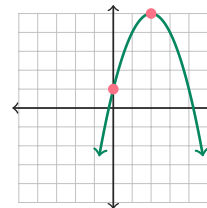
4. $y = 2x^2 - 2$; narrower



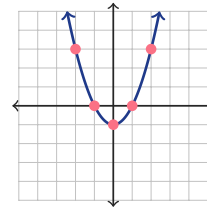
5. $y = x^2 - 2x - 3$; x -ints $(-1, 0), (3, 0)$



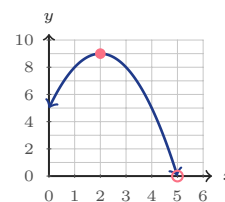
6. $y = -x^2 + 4x + 1$; y -int $(0, 1)$, max 5



12. table graph; vertex $(0, -1)$



14. $h = -t^2 + 4t + 5$; ground at $t = 5$



Step-by-Step Explanations

1. Start with the equation $y = x^2 - 4$. When $x = 0$, $y = -4$, so the vertex is $(0, -4)$. Plot matching pairs such as $(-1, -3)$ and $(1, -3)$, then $(-2, 0)$ and $(2, 0)$, and connect them with a smooth U-shape.

2. The equation is in vertex form, $y = (x - 2)^2 - 1$, so the vertex is $(2, -1)$. The vertical line through the vertex is the axis of symmetry, which means the graph balances on $x = 2$.

3. For $y = -(x + 1)^2 + 4$, the vertex is $(-1, 4)$ because the expression is shifted left 1 and up 4. The negative sign makes the parabola open down, so the vertex is the highest point, a maximum.

4. The vertex of $y = 2x^2 - 2$ is $(0, -2)$. The coefficient 2 makes the y -values grow twice as fast as in $y = x^2$, so the graph is narrower than the parent parabola.

5. For $y = x^2 - 2x - 3$, the graph crosses the x -axis where $y = 0$. Factoring gives $x^2 - 2x - 3 = (x - 3)(x + 1)$, so the crossings are $x = 3$ and $x = -1$, written as $(3, 0)$ and $(-1, 0)$.

6. The y -intercept happens when $x = 0$, and $y = -0^2 + 4(0) + 1 = 1$, so the point is $(0, 1)$. The vertex is halfway across the parabola at $x = 2$, and the graph shows the highest value is 5.

7. The x -intercepts are the places where the curve touches or crosses the horizontal axis. On this graph, those points are one unit left of 0 and three units right of 0, so they are $(-1, 0)$ and $(3, 0)$.

8. A downward-opening parabola has its maximum at the vertex. The highest point on the graph is at $(-2, 5)$, so the maximum value is the y -value, 5.

9. The graphed parabola opens up and has vertex $(-3, -2)$. In vertex form, $y = (x - h)^2 + k$, that means $h = -3$ and $k = -2$, so the matching equation is $y = (x + 3)^2 - 2$.

10. The y -intercept is where the graph meets the vertical axis. The marked point is on the y -axis at $y = 4$, so the intercept is $(0, 4)$.

11. Graph B is the only choice that opens downward and has its turning point at $(2, 3)$. Graph A opens upward, and Graph C opens downward but its vertex is on the left side of the plane.



12. Plot each table pair as a point: $(-2, 3)$, $(-1, 0)$, $(0, -1)$, $(1, 0)$, and $(2, 3)$. The lowest and middle point is $(0, -1)$, so that is the vertex.

13. The garden arch graph reaches its highest point at the vertex. The top of the graph is at $(3, 9)$, so the arch is 9 feet high at a point 3 feet from the left side.

14. The ball is on the ground when its height is 0, which is the x -axis on this graph. The path crosses the axis at $t = 5$, so the ball hits the ground after 5 seconds.

15. The greatest profit is found at the highest point of the profit graph. The vertex occurs at ticket price $p = 5$, so the club should charge \$5 to get the modeled maximum profit.

16. This graph opens upward, so its lowest point is the vertex. The vertex is on the vertical axis at $(0, -2)$, which is the lowest part of the dish model.

17. The water lands when its height returns to 0. The graph starts at $(0, 0)$ and crosses the ground again at $(6, 0)$, so the water lands 6 feet from the nozzle.

18. The cable graph opens upward, so its lowest point is the vertex. The marked vertex is $(4, 2)$, meaning the lowest height is 2 feet and it occurs 4 feet from the left support.



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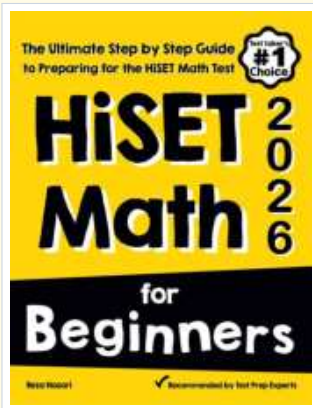
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