# Algebra 2 Review: Quadratic Functions & Complex Numbers

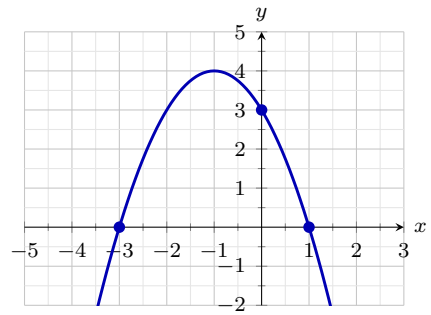
**Station 1 of 4:** Quadratic Functions, Forms, and Graphs

Name: _____ Date: _____

*Match each form to what it shows: vertex form gives the vertex, factored form gives the intercepts. Remember $(x-h)$ means the vertex is at $x=h$.*

**1.** For $f(x) = 2x^2 - 8x + 3$, write $f$ in vertex form, then state the vertex, the axis of symmetry, and the minimum value.

**2.** The parabola shown crosses the axes at the marked points. Write its equation in factored form and in standard form, then find the vertex.




**3.** Describe, in order, the transformations of $y = x^2$ that give $g(x) = -\frac{1}{2}(x+3)^2 - 2$, and state the vertex and whether the parabola opens up or down.

**4.** Factor $f(x) = 2x^2 - 4x - 30$ completely, then find the $x$-intercepts, the axis of symmetry, and the vertex.

**5.** A parabola has $x$-intercepts $-2$ and $5$ and passes through $(1, -24)$. Write its equation in factored form and in standard form.

**6.** A parabola has vertex $(-3, 2)$ and passes through $(-1, -6)$. Write its equation in vertex form.

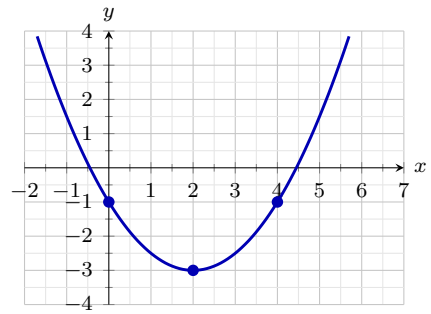
**7.** Let $f(x) = x^2 - 10x + 30$. The table shows a quadratic function $g$. Which function has the greater minimum value? Give each minimum and where it occurs.

| $x$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $g(x)$ | 9 | 3 | 1 | 3 | 9 |

**8.** Find the range of $f(x) = -2x^2 + 12x - 7$ (a) for all real $x$ and (b) on the restricted domain $0 \le x \le 2$.

**9.** Find the quadratic $y = ax^2 + bx + c$ whose graph passes through $(-1, 6)$, $(0, 1)$, and $(2, 3)$.

**10.** The graph shows a parabola with vertex $(2, -3)$ and the points $(0, -1)$ and $(4, -1)$. Write its equation in vertex form and in standard form.



## Algebra 2 Review: Quadratic Functions & Complex Numbers

**Station 2 of 4:** Solving Quadratic Equations and the Discriminant

Name: _____ Date: _____

*Move everything to one side before factoring. Keep the ±, divide the whole numerator, and check for extraneous solutions.*

**1.** Solve $6x^2 - 5x - 4 = 0$ by factoring.

**2.** Solve $2(x+1)^2 = 36$ by taking square roots. Give exact answers in simplest radical form.

**3.** Solve $x^2 + 10x - 3 = 0$ by completing the square.

**4.** Solve $2x^2 - 12x + 7 = 0$ by completing the square. (Factor out the 2 first.)

**5.** Use the quadratic formula to solve $2x^2 + 3x - 7 = 0$.

**6.** Find the discriminant of each equation and describe its solutions. (a) $x^2 - 6x + 9 = 0$ (b) $2x^2 + x + 5 = 0$ (c) $3x^2 - x - 4 = 0$.

**7.** For $x^2 - 4x + k = 0$, find the values of $k$ that give (a) two distinct real solutions, (b) exactly one real solution, (c) two nonreal solutions.

**8.** Solve $x^4 - 13x^2 + 36 = 0$. (Let $u = x^2$.)

**9.** Solve $(x+2)(x-3) = 14$. Explain why you cannot set each factor equal to 14.

**10.** Solve $\sqrt{x+6} = x$ and check for extraneous solutions.

## Algebra 2 Review: Quadratic Functions & Complex Numbers

**Station 3 of 4:** Complex Numbers

Name: _____ Date: _____

*Use $i^2 = -1$ and the powers of $i$ repeat every 4. To divide, multiply the top and bottom by the conjugate of the denominator.*

**1.** Simplify (a) $\sqrt{-48}$ (b) $\sqrt{-9} \cdot \sqrt{-4}$. Why is (b) not $\sqrt{36}$?

**2.** Simplify (a) $i^{37}$ (b) $i^{102}$ (c) $\dfrac{1}{i^3}$.

**3.** Simplify $(7 - 3i) - (2 - 8i) + (-4 + i)$.

**4.** Multiply $(2 + 5i)(3 - 4i)$ and write the result as $a + bi$.

**5.** Simplify $(4 - 3i)^2$.

**6.** Write the conjugate of $-2 - 7i$ and find the product of the number and its conjugate.

**7.** Write $\dfrac{4 + 7i}{3 - 2i}$ in the form $a + bi$.

**8.** Solve $x^2 - 4x + 9 = 0$ over the complex numbers.

**9.** Solve $3x^2 + 2x + 5 = 0$. Write each solution as $a + bi$.

**10.** A quadratic with real coefficients has the root $3 - 4i$. State the other root, then write the monic quadratic in standard form.

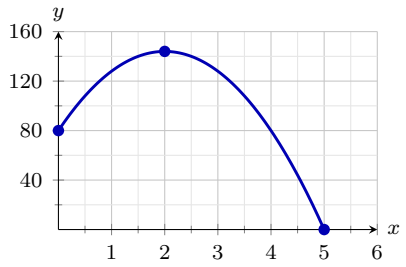
# Algebra 2 Review: Quadratic Functions & Complex Numbers

**Station 4 of 4:** Quadratic Models, Inequalities, and Systems

Name: _____ Date: _____

*Interpret the vertex in context, reject impossible values such as negative time, and test a point to choose the region of an inequality.*

**1.** A ball is thrown upward from a platform. Its height is $h(t) = -16t^2 + 64t + 80$ feet after $t$ seconds. Find the maximum height, when it occurs, and when the ball lands.



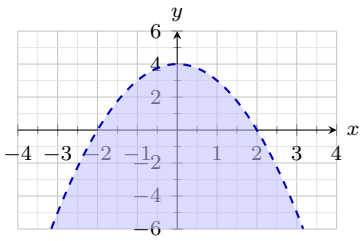

**2.** A theater sells $500 - 20p$ tickets when the price is $p$ dollars. Write the revenue $R(p)$ and find the price that maximizes it and the maximum revenue.

**3.** A rancher has 240 ft of fence for a rectangular field divided into two pens by one fence parallel to the width. Find the dimensions and the largest area.

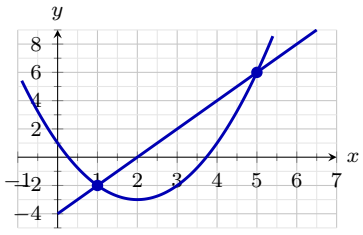
**4.** A company's profit is $P(x) = -2x^2 + 28x - 66$ thousand dollars when $x$ hundred items are sold. For which values of $x$ is the profit positive?

**5.** Solve each inequality and write the solution in interval notation. (a) $x^2 - 3x - 10 \geq 0$ (b) $-x^2 + 4x + 5 > 0$.

**6.** The shaded region (dashed boundary) is the graph of a quadratic inequality. Write the inequality. Is $(0, 0)$ a solution? Is $(3, 0)$?




**7.** The graph shows $y = x^2 - 4x + 1$ and $y = 2x - 4$. Solve the system algebraically and confirm that your solutions match the intersections.




**8.** How many solutions does $y = x^2 - 4x + 5$ have with each line? (a) $y = 2x - 4$ (b) $y = 2x - 10$ (c) $y = 2x$. Find any solutions.

**9.** A sprinkler's water is at height $y$ feet when it is $x$ feet away horizontally. Use quadratic regression, rounding coefficients to the nearest tenth, then find the maximum height and where it occurs (nearest tenth).

| $x$ | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| $y$ | 5 | 13 | 18 | 19 | 16 | 9 |

**10.** An arch has its vertex at $(0, 30)$ and meets the ground at $x = \pm 20$ (feet). Write its equation, find its height 10 ft from the center, and find its width at a height of 15 ft (nearest tenth).