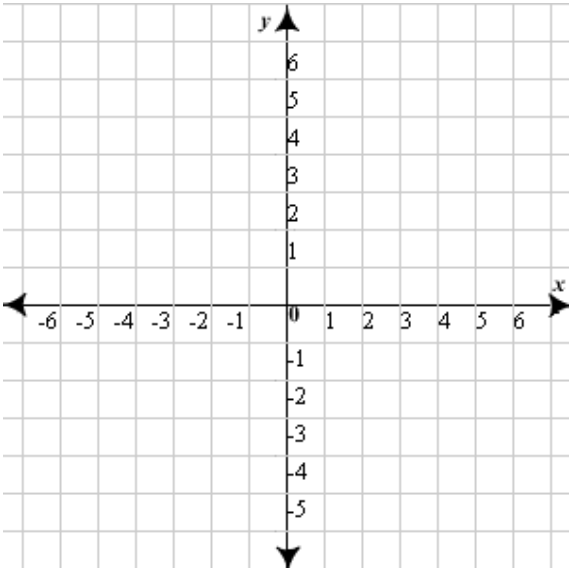
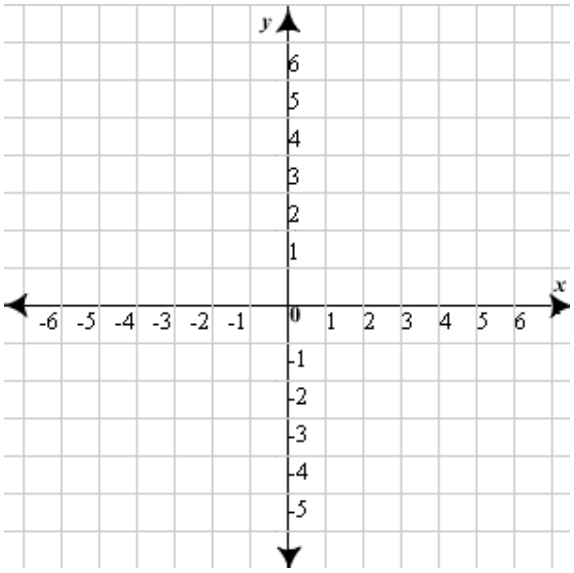
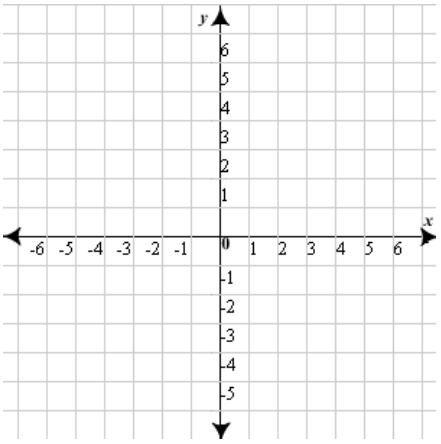
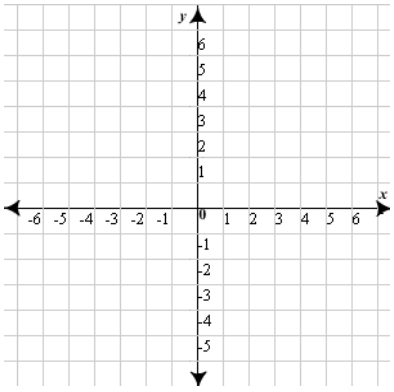
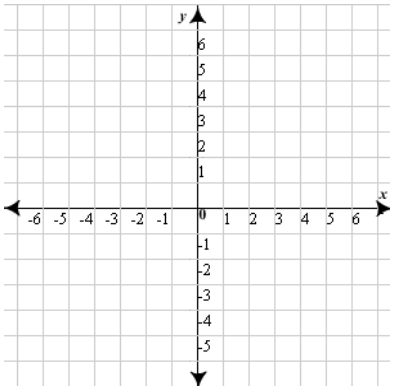
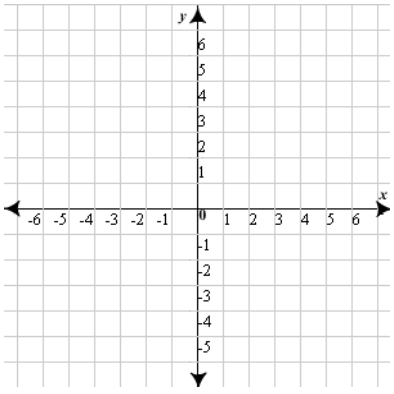
5.1	Graphing Quadratic Functions
Objectives	1. Graph quadratic functions. 2. Use quadratic functions to solve real life problems.
Key Terms	Quadratic Function (standard form) Parabola Vertex Axis of Symmetry
The Graph of a Quadratic Function $y = ax^2 + bx + c$	Opens Up — Opens Down Narrow — Wide Vertex (x-coordinate) — Axis of Symmetry
Graph the quadratic function. Label the vertex and axis of symmetry.	$y = x^2 - 2x - 3$ 

Graph the quadratic function. Label the vertex and axis of symmetry.	$y = - x^2 + 2x - 2$ 
	Vertex Form $y = a(x - h)^2 + k$ Vertex (h, k) Axis of Symmetry $x = h$
Graph the quadratic function. Label the vertex and axis of symmetry.	$y = 2(x - 3)^2 - 2$  $y = - (x + 1)^2 + 3$ 

The path of a ball that you kicked is modeled by $Y = -0.1x^2 + 4x$. X is the horizontal distance and y is the height in feet. What was the highest point of the ball? When will it hit the ground?	
	Intercept Form $y = a(x - p)(x - q)$ X-intercepts are p and q. Axis of symmetry half way between p and q. X- coordinate of vertex half way between p and q.
Graph the quadratic function. Label the vertex and axis of symmetry.	$y = (x - 3)(x - 1)$  $y = -(x - 4)(x + 2)$ 
Write the equation in standard form.	$y = 2(x - 2)(x + 3)$ $y = -3(x - 4)^2 + 2$

5.2	Solving Quadratic Equations by Factoring
Objectives	1. Factor quadratic expressions and solve quadratic equations by factoring. 2. Find zeros of quadratic functions.
Key Terms	Monomial Binomial Trinomial Factoring
Factoring a trinomial in the form of $x^2 + bx + c$	Factor: $x^2 + 14x + 24$ $x^2 - 4x - 21$ $x^2 + 5x - 14$ $x^2 - 8x + 15$
Factoring a trinomial in the form of $ax^2 + bx + c$	Factor: $2x^2 + 13x + 6$ $4x^2 - 4x - 3$ $15x^2 + 7x - 2$
Factoring with Special Patterns: Difference of two Squares $a^2 - b^2 = (a + b)(a - b)$	Factor: $9x^2 - 16$ $49 - 64x^2$

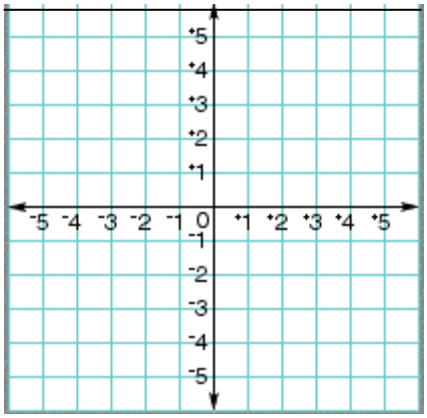
Factoring with Special Patterns: Perfect Square Trinomial **$a^2 + 2ab + b^2 = (a+b)^2$** **$a^2 – 2ab + b^2 = (a – b)^2$**	Factor: $16x^2 + 40x + 25$	$64x^2 – 32x + 4$
Factoring the common monomial term first, then factor the rest if possible.	Factor: $12x^2 – 3$	$3x^2 – 9x + 6$
	$7x^2 – 42x$	$2x^2 + 8x + 2$
	Zero Product Property Let A and B be real numbers or algebraic expressions. If AB = 0, then A = 0 or B = 0.	
	Solving a Quadratic Equation by Factoring 1. Write the equation in Standard Form ($ax^2 + bx + c = 0$) 2. Factor the left side of the equation. 3. Use the Zero Product Property to find the solutions.	
Solve the equations by factoring.	$x^2 + 8x + 15 = 0$	$9x^2 – 12x + 4 = 0$
	$3x – 6 = x^2 – 10$	$4x^2 + 13x + 11 = -3 – 5x$

Finding the zeros of a quadratic function.	For a quadratic function $y = ax^2 + bx + c$, let $y = 0$. **Zeros of a function** are the **same** as the **x-intercepts** of the graph.
Find the zeros of the function.	$y = x^2 + 4x + 3$ $y = 3x^2 – x – 2$
You own an amusement park that averages 75,000 visitors per year who pay $12 admission. You plan to lower the admission price to attract new customers. It has been shown that a $1 decrease in price results in 15,000 new visitors. **What admission price should you charge to maximize your revenue?** **What is your new attendance?** **What is your maximum revenue?**	

5.3	Solving Quadratic Equations by Finding Square Roots
Objectives	1. Solve quadratic equations by finding square roots. 2. Use quadratic to solve real life problems.
Key Terms	Square Root Radical Sign Radicand
Properties of Square Roots	Product Property $\sqrt{a}\sqrt{b} = \sqrt{ab}$ Quotient Property $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ To Simplify a radical: 1. No radicand has a perfect square factor other than 1. 2. There is NO radical in the denominator.
Simplify	$\sqrt{24}$ $\sqrt{27}$ $\sqrt{500}$ $\sqrt{48}$ $\sqrt{6}\sqrt{15}$ $\sqrt{5}\sqrt{15}$ $3\sqrt{12}\sqrt{6}$

Rationalizing the Denominator	Multiplying the numerator and denominator of a fraction by the radical from the denominator. That process removes the radical from the denominator.
Simplify.	$\sqrt{\frac{3}{5}}$ $\sqrt{\frac{5}{36}}$ $\sqrt{\frac{13}{3}}$ $\frac{2}{\sqrt{3}}$ $\sqrt{\frac{15}{7}} \cdot \sqrt{\frac{4}{3}}$
Solve the equation.	$3x^2 = 108$ $3 - 5x^2 = -9$ $\frac{3}{5}(x-2)^2 = 21$ $\frac{1}{3}(x+7)^2 = 8$

Falling Object Model	$\boldsymbol{h = -16t^2 + h_0}$ $\boldsymbol{h_0}$ *is the inital height* $\boldsymbol{h}$ *is the inital height* $\boldsymbol{t}$ *is time* $\boldsymbol{-16}$ *is the gravitational pull on earth based in feet/second*
You drop a ball out of a window 50 feet above the ground. How long will it take to hit the ground? **What if you drop it from 100 feet above the ground?** **What if you drop it from 100 feet above the ground and someone catches it 4 feet above the ground?**	

5.4	Complex Numbers
Objective	1. Solve quadratic equations with complex solutions and perform operations with complex numbers.
Key Terms	Imaginary Unit Complex Number is Standard Form Complex Plane
The Square Root of a Negative Number	1. If r is a positive real number then $\sqrt{-r} = i\sqrt{r}$ 2. $\left(i\sqrt{r}\right)^2 = -r$ 3. $i^2 = -1$
Solving Quadratic Equations	Solve: $2x^2 + 3 = -15$ $5x^2 + 2 = -8$
Plotting Complex Numbers	Plot in the complex plane. 3 – 2i -4 + i 3i 4 

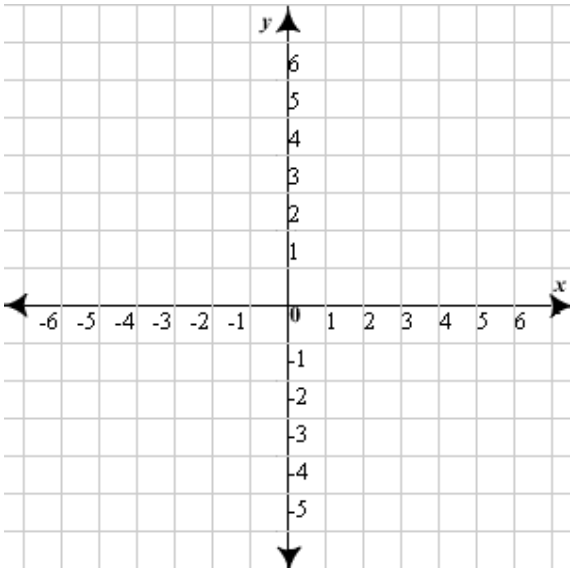
Adding and Subtracting Complex Numbers	1. Add/subtract real part 2. Add/subtract imaginary part Perform the indicated operation. Write the answer as a complex number in standard form. (5 – i) + (2 + 3i) (2 – 3i) – (3 + 7i) 2i – (3 + i) + (8 – 3i) 7 – (-4 + 5i) – (3 – 2i)
Multiplying Complex Numbers	Use the foil method or distributive property. Multiply. -4i(7 + 3i) (2 + 3i)(6 – 2i) (4 – 5i)(4 + 5i)
Complex Conjugates	Expressions in the form of a+bi and a – bi. Their product is always a real number. Ex: (5 – 3i)(5 + 3i)
Dividing Complex Numbers	Write in standard form. $\frac{5-4i}{3+2i}$ $\frac{3+5i}{2-i}$
Absolute Value of a Complex Number	If z = a +bi then, $\|z\| = \sqrt{a^2 + b^2}$ Find the absolute value of the complex number. -2 – 3i 2 + i -1 + 3i

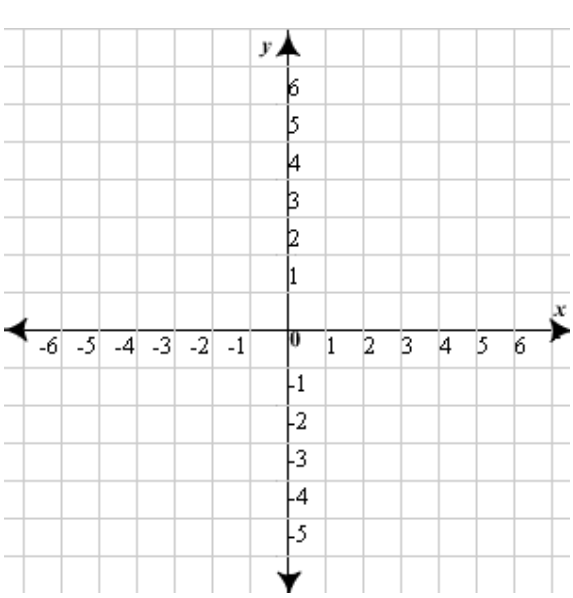
5.5	**Completing the Square**
Objectives	1. Solve quadratic equations by completing the square. 2. Use completing the square to write quadratic functions in vertex form.
Key Term	Vertex Form
Section 5.2 Review	Factor the perfect square trinomials $x^2 + 10x + 25$ $\qquad$ $x^2 - 24x + 144$ $x^2 - \frac{6}{5}x + \frac{9}{25}$ $\qquad$ $x^2 - \frac{7}{2}x + \frac{49}{16}$
Completing the Square	Find the value of c that makes the expression a perfect square trinomial. Write the expression as the square of a binomial. $\boldsymbol{x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2}$ Trinomial $\qquad$ Binomial **Complete the Square then factor.** $x^2 - 6x + c$ $\qquad$ $x^2 - 3x + c$ $x^2 + 8x + c$ $\qquad$ $x^2 + 5x + c$ $x^2 + 18x + c$ $\qquad$ $x^2 - 7x + c$

Solve the equation by completing the square. **x^2 coefficient is one.**	$x^2 + 10x + 3 = 0$	$x^2 + 6x - 8 = 0$
	$x^2 - 8x - 3 = 0$	$x^2 + 3x - 4 = 0$
Solve the equation by completing the square. **x^2 coefficient is NOT one.**	$5x^2 + 10x - 30 = 0$	$3x^2 - 12x = -93$
Write the quadratic function in vertex form. State the vertex. **$y = a(x - h)^2 + k$**	$y = x^2 + 6x + 7$	$y = x^2 - 2x - 4$

5.6	The Quadratic Formula and the Discriminant
Objectives	1. Solve quadratic equations using the quadratic formula. 2. Use the quadratic formula in real life situations.
	The Quadratic Formula Let a, b, and c be real numbers such that a ≠ 0. The solutions of the quadratic equation **$ax^2 + bx + c = 0$** are: $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
Use the quadratic formula to solve the equation.	$3x^2 + 8x - 35 = 0$ $\quad\quad$ $-x^2 + 8x = 1$ $12x - 5 = 2x^2 + 13$ $\quad\quad$ $x^2 - 4x = -8$

	The **discriminant** is the value under the radical (**$b^2 - 4ac$**) in the quadratic formula.
	Number and Type of Solutions of a Quadratic Equation Consider the quadratic equation $ax^2 + bx + c = 0$. • **If** $b^2 - 4ac > 0$, **then** the equation has **two solutions**. • **If** $b^2 - 4ac = 0$, **then** the equation has **one solution**. • **If** $b^2 - 4ac < 0$, **then** the equation has **two imaginary solutions.**
Find the discriminant of the quadratic equation and give the number and type of solutions.	$3x^2 + 8x - 35 = 0$ $2x^2 - 12x + 18 = 0$ $x^2 - 4x + 8 = 0$
Vertical Motion Problem	$$h = -16t^2 + v_o t + h_o$$ h = height t = time in motion h_o = initial height v_o = initial vertical velocity
A ball is thrown from a height of 6 feet with an initial velocity of 32 feet per second. If the ball is caught at a height of 2 feet. How many seconds was the ball in the air?	

5.7	Graphing and Solving Quadratic Inequalities
Objectives	1. Graph quadratic inequalities in two variables. 2. Solve quadratic inequalities in one variable.
Key Terms	Quadratic Inequalities in Two Variables Quadratic Inequalities in One Variable
Graphing Quadratic Inequalities in Two Variables	1. Draw the parabola $y = ax^2 + bx + c$. Use a **solid** parabola for ≤ or ≥. Use a **dashed** parabola for < or >. 2. Choose a point (x, y) inside the parabola and check whether it is a solution to the inequality. 3. If the point chosen in Step Two **is** a solution, shade **inside** the parabola. If it **is not**, shade the region **outside** the parabola.
Graph the inequality.	$y \leq -x^2 + x + 5$ 

Graph the system of inequalities.	$y \leq -x^2 - 3x + 1$ $y > x^2 - 3$ 
Quadratic Inequalities in One Variable	1. Find the x-intercepts of the parabola. 2. Shade between the points for < or ≤ on the x-axis. 3. Shade to the outside of the points for > or ≥ on the x-axis. 4. Write the solution to the quadratic inequality as a compound inequality.
Solve the inequality.	$x^2 - 5x + 6 \geq 0$ $x^2 - 11x + 5 < 0$