Name:____Date:___________Period:_______

12-1 Graph Parabolas

Standard

- B.F.IF.C.4 Graph linear, quadratic, absolute value, and piecewise functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated ones.

- B.N.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Objective

- SWBAT graph quadratic functions IOT identify key features of quadratic equations.

Key Concepts

________________________- a function that can be written in the standard form $f(x) = ax^2 + bx + c$, where $a \neq 0$

________________________- the graph of a quadratic function.

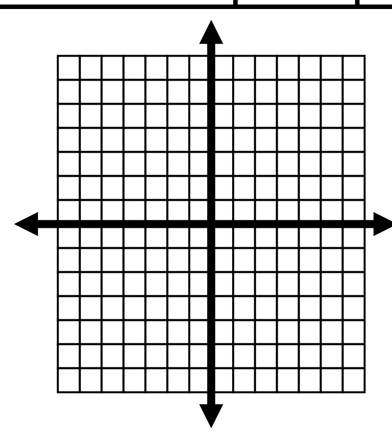
________________________- the line goes through the vertex of a parabola such that the left and right sides are symmetric.

Examples

1. (I do) Graph $f(x) = x^2$
   a. Identify the vertex.

x		y	(x, y)

   b. Identify the axis of symmetry.

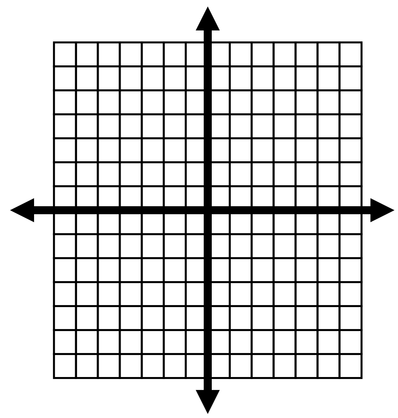


2. (I do) Graph $f(x) = 3x^2 - 2$

c. Identify the vertex.

x		y	(x, y)

d. Identify the axis of symmetry.



3. (We do) Determine whether the following functions are quadratic functions. If it is a quadratic function, determine whether it opens upward or downward.

a. $y = x^3 + 6x^2$

b. $y = 55 - x^2$

c. $y = 4x + 16$

d. $y = 5x^2 - 9x - 1$

4. (They do) A projectile is shot vertically up in the air from the ground level. Its distance d, in feet, after t seconds is given by $d = 96t - 16t^2$. Find the values of *t* when *d* is 96ft.

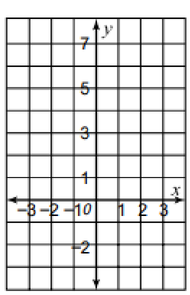
----------------------------Lesson 12-1 Independent Practice/Lesson Check-------------------------

EXERCISES

Graph each function for the domain of real numbers. Then give the coordinates of the vertex for each graph.

1. $y = x^2 + 3$

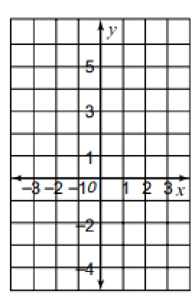
x	y



Vertex ____________

2. $y = -x^2 + 2$

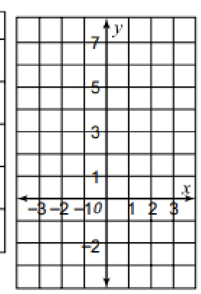
x	y



Vertex ____________

3. $y = 2x^2$

x	y



Vertex ____________

Name:____Date:___________Period:_______

12-2 General Quadratic Function

Standard

- B.A.REI.B.2 Solve quadratic equations in one variable. Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

- B.F.IF.C.4 Graph linear, quadratic, absolute value, and piecewise functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated ones.

- B.N.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Objective

- SWBAT graph general quadratic functions IOT identify key features of quadratics.

Examples

1. (I do) Graph the function $y = x^2 + 2x + 3$

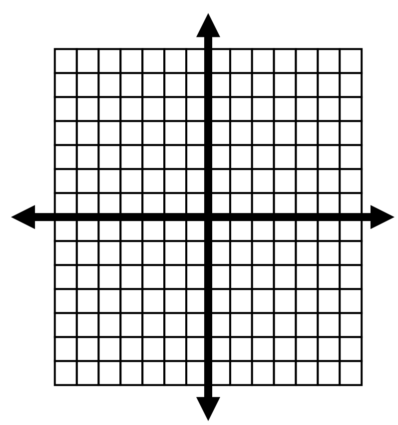
   Step 1: Identify a, b, & c.

   Step 2: Graph the axis of symmetry.

   Step 3: Find the vertex.

   Step 4: Plot the y-intercept and its reflection.

   Step 5: Draw the graph through the points. Label the points.



2. Determine the vertex and axis of symmetry of the quadratic function. $y = -x^2 + 4x - 5$

3. Use technology to graph $y = x^2 - 4x - 4$. Determine its' key features.

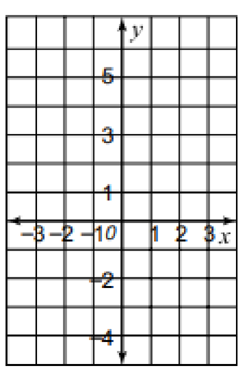
4. The sales projections for a company can be represented by a quadratic equation in the form of $y = ax^2 + bx + c$ for which c = 3, and the axis of symmetry is $x = \frac{5}{6}$. Find the equation.

----------------------------Lesson 12-2 Independent Practice/Lesson Check-------------------------

EXERCISES

Find the vertex and identify the axis of symmetry. Then graph each function.

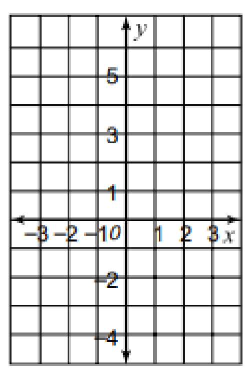
1. $y = x^2 + 2x + 3$



Vertex ____________________

Axis of symmetry __________

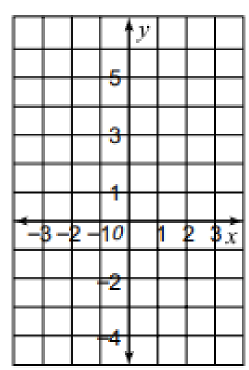
2. $y = -2x^2 + 3$



Vertex ____________________

Axis of symmetry __________

3. $y = x^2 + 2x - 3$



Vertex ____________________

Axis of symmetry __________

Name:____Date:____________Period:________

12-3 Factor & Solve Quadratic Equations

Standard

- B.A.REI.B.2 Solve quadratic equations in one variable. Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

Objective

- SWBAT use a variety of methods IOT solve quadratic functions.

Key Concepts

________________________-a solution of a quadratic equation.

________________________-a solution of a quadratic equation.

________________________-a solution of a quadratic equation.

* These solutions can be found by _______________________, ________________________,

___________________________________ or using the _________________________________.

Examples

1. (I do/ We do) Solve the quadratic by factoring. Verify your solutions with the graph.

   a. $y = 3x^2 - 6x$

   b. $y = x^2 + 8x + 16$

   c. $y = -x^2 - x - 1$

   d. $y = x^2 + 8x - 48$

2. Suppose a projectile is launched from ground level. If you know the velocity with which the projectile is launched, you can find the time between launch and landing using the equation $vt - 16t^2 = 0$, where v = velocity in feet per second and t = time in seconds. A football is thrown with the initial velocity of 64 ft/sec. How long does it remain in the air?

----------------------------**Lesson 12-3 Independent Practice/Lesson Check**-------------------------

Exercises

Use a graphing calculator to determine the number of solutions for each equation. For equations with one or two solutions, find the exact solutions by factoring.

1. $y = x^2 - 81$ ____________

2. $y = x^2 - 5x - 6$ ____________

3. $y = x^2 - 2x + 1$ ____________

4. $y = x^2 + 6x - 27$ ____________

5. $y = x^2 + 2x - 15$ ____________

6. $y = x^2 - 2x - 35$ ____________

7. $x^2 = x + 56 + y$ ____________

8. $y = x^2 - x - 6$ ____________

9. $2x^2 = y - x$ ____________

10. $y + x = x^2 + 1$ ____________

11. $y + 9x = 3x^2$ ____________

12. $x^2 + 8x = 9 + y$ ____________

13. $y = \frac{1}{2}x^2 + 5x$ ____________

14. $y = \frac{1}{4}x^2 - 4$ ____________

Name:____Date:___________Period:_______

12-4 Complex Numbers Factor & Solve Quadratic Equations

Standard

- B.N.CN.A.1 Know there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi with a and b real.

- B.N.CN.A.2 Know and use the relation $i^2 = -1$ and the commutative, associative and distributive properties to add, subtract, and multiply complex numbers.

Objective

- SWBAT perform operations with complex numbers IOT find non-real solutions.

Key Concepts

_______________________- the imaginary unit defined as the number whose square is -1. $\boldsymbol{i} = \sqrt{-1}$, __________ = -1

_______________________- a number defined as $a + bi$, where a is real and bi is imaginary.

_______________________- number pairs of the form $a + bi$ and $a - bi$

Examples

1. (I do) Simplify

   a. $\sqrt{-27}$ b. $\sqrt{-216}$ c. $\sqrt{-20}$

2. (I do) Simplify

   a. $-5i \cdot 3i$ b. $\sqrt{-6} \cdot \sqrt{-15}$

3. (I do) Simplify

   a. $(5 - 7i) + (2 + 4i)$ b. $(4 - 8i) - (3 - 6i)$

4. (We do) Simplify

   a. $(7i)(3i)$

   b. $(4+3i)(-1-2i)$

5. (We do) Simplify.

   a. $\frac{2i}{3+6i}$

   b. $\frac{4+i}{5i}$

6. (They do) Find the values of x and y that make $3x - 5 + (y - 3)i = 7 + 6i$

7. (They do) Solve $4x^2 + 256 = 0$

8. (They do) In an AC circuit, the voltage V, current C and impedance I are related by the formula $V = C \cdot I$, Find the voltage in a circuit with current $2 + 4j$ amps and impedance $9 - 3j$ ohms

-----------------------------Lesson 12-4 Independent Practice/Lesson Check-------------------------

1. Simplify

a. $\sqrt{-75}$

b. $\sqrt{-216}$

c. $(4-2i)-(3+i)$

d. $(2+i)(4-5i)$

e. $\frac{4-i}{6i}$

f. $(9+4i)^2$

2. Solve

a. $x^2 + 16 = 0$

b. $2x^2 - 4x = -7$

3. Error Analysis. Describe and correct the error made in simplifying $(4+7i)(4-7i)$.

$$\begin{aligned}(4+7i)(4-7i) &= 16 + 28i - 28i + 49i^2 \\ &= 16 - 49 \\ &= -33\end{aligned}$$

Name:____Date:___________Period:_______

12-5 Completing the Square (Optional)

Standard

- B.A.REI.B.2 Solve quadratic equations in one variable. Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

Objective

- SWBAT use a variety of methods IOT solve quadratic functions.

Key Concepts

________________________-a solution of a quadratic equation.

________________________-a solution of a quadratic equation.

________________________-a solution of a quadratic equation.

* These solutions can be found by _______________________, ________________________,

___________________________________ or using the _________________________________.

Examples

1. (I do) Solve using square roots.
   a. $x^2 + 6x + 9 = 36$
   b. $x^2 - 10x + 25 = 27$

2. (I do) Find the value of c that makes $x^2 + 16x + c$ a perfect square. Then write the trinomial as a perfect square.

3. (I do) Solve by completing the square.
   a. $x^2 + 10x - 11 = 0$ b. $x^2 + 8x + 22 = 0$

4. (We do) Solve by completing the square $2x^2 - 7x + 5 = 0$

5. (They do) An architect's blueprints call for a dining room measuring 13 ft by 13 ft. The customer would like the dining room to be a square, but with the area of 250 square feet. How much will this add to the dimensions of the room?

-----------------------------Lesson 12-5 Independent Practice/Lesson Check--------------------------

Exercises

Complete the square.

1. $x^2 + 8x$ ______________ **2.** $x^2 - 4x$ ______________

3. $x^2 + 10x$ ______________ **4.** $x^2 + 2x$ ______________

5. $x^2 - 12x$ ______________ **6.** $x^2 - 14x$ ______________

Solve by completing the square.

7. $x^2 + 6x - 7 = 0$ ______________ **8.** $x^2 - 4x - 5= 0$ ______________

9. $x^2 - 16x - 17 = 0$ ______________ **10.** $x^2 + 10x + 9= 0$ ______________

Name:____Date:____________Period:_______

12-6 Quadratic Formula

Standard

- B.A.REI.B.2 Solve quadratic equations in one variable. Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

Objective

- SWBAT use a variety of methods IOT solve quadratic functions.

Key Concepts

________________________- the value of the expression $b^2 - 4ac$

________________________- expressed as $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ can be used to solve quadratic.

Discriminant Rules

- If $b^2 - 4ac > 0$, there are 2 real solutions.
- If $b^2 - 4ac = 0$, there is 1 real solution.
- If $b^2 - 4ac < 0$, there are 0 real solutions.

Examples

1. (I do) Find the value of the discriminant for each quadratic equation. Then describe the number and type of roots.

   a. $7x^2 - 11x + 5 = 0$ b. $x^2 + 22x + 121 = 0$

2. (We do) Solve using the quadratic formula.

   a. $x^2 + 5x + 6 = 0$ b. $x^2 - 10x - 11 = 0$

3. (We do) Solve using the quadratic formula.
   a. $2x^2 + 6x - 7 = 0$ b. $x^2 - 6x = -10$

4. (They do) A rocket is launched with an initial upward velocity of 250 feet per second from a 3 foot launch pad. The equation $h = -5t^2 + 250t + 3$ gives the rocket's height in at any given time t.
   a. Analyze the function. What does the vertex represent in the context of this problem?
   b. Predict the maximum height of the rocket.
   c. How long will the rocket be in the air?

----------------------------Lesson 12-6 Independent Practice/Lesson Check-------------------------

Exercises

Use the quadrataic formula to solve each equation. Remember, some equations may have only one solution.

1. $x^2 - 7x + 10 = 0$ ________________ **2.** $6x^2 - 4x - 10 = 0$ ________________

3. $10x^2 - 6x - 4 = 0$ ________________ **4.** $x^2 + 20x + 100 = 0$ ________________

5. $x^2 - 4x - 12 = 0$ ________________ **6.** $2x^2 + 10x + 12 = 0$ ________________

7. $x^2 + 10x - 12 = 0$ ________________ **8.** $x^2 - 6x - 2 = 0$ ________________

9. $x^2 - 14x - 12 = 0$ ________________ **10.** $x^2 + 4x - 1 = 0$ ________________

Name:____Date:___________Period:_______

12-7 Roots & Zeros

Standard

- B.A.APR.B.2 Identify zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph of the function as defined by the polynomial.

Objective

- SWBAT analyze the graphs of polynomials using properties of zeros IOT determine the number and types of roots for a polynomial equation use a variety of methods IOT solve quadratic functions.
- SWBAT use factorizations IOT find the roots for polynomial equations.

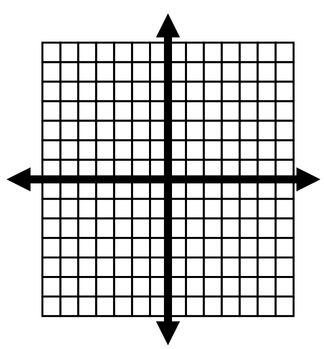
Key Concepts

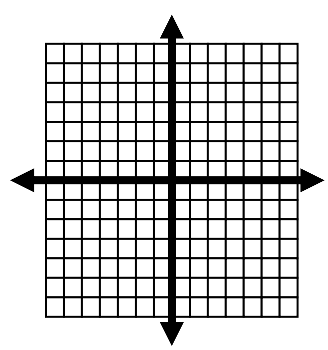
The following are equivalent statements about a real number b and a polynomial P(x)

- $x - b$ is a ______________________of the polynomial P(x)
- b is a _________________of the polynomial function y = f(x)
- b is a ______________________________of the polynomial equation f(x) = 0
- b is an __________________________of the graph y = f(x)

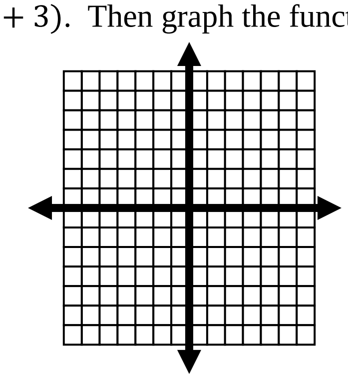
Examples

1. (I do) Describe the shape, turning points, end behavior, domain and range on the following graphs. Check using the calculator.
   a. $y = 4x^3 - 3x$
   b. $y = -2x^4 + 8x^3 - 8x^2 + 2$





2. (We do) Find the zeros for $y = (x - 1)(x + 1)(x + 3)$. Then graph the function. State the domain and range.



3. (We do) Factor. Then find the zeros.
   a. $y = x^3 - 2x^2 - 15x$
   b. $y = 2x^3 - 5x^2 - 3x$

4. (They do) Write a polynomial with the given zeros.
   a. -2, 2
   b. -3, 1 and 2

5. (They do) The volume in cubic feet of a book holder can be expressed as

   $V(x) = -x^3 - x^2 + 6x$. The length is expressed as $x - 2$. Assume the height is greater than the width. Factor and find the linear expressions for the height and width.

----------------------------Lesson 12-7 Independent Practice/Lesson Check-------------------------

1. Find the zeros for each function.
   a. $y = x(x - 6)$
   b. $y = (2x + 3)(x - 1)$
   c. $y = x^3 - 4x^2 - 21x$

2. Write a polynomial function in standard form with the zeros -2, 1 and -1.

3. Error Analysis. Your friend says a function with zeros 3 and -1 is $f(x) = x^2 + 2x - 3$. Is your friend correct? If not find and correct the error.

4. A rectangular box is $2x + 3$ units long and $2x - 3$ units wide, and $3x$ units high. What is the volume expressed as a polynomial in standard form.