Chapter 5

Chapter Review

Vocabulary Review

absolute value of a complex number (p. 275)
axis of symmetry (p. 239)
completing the square (p. 282)
complex number (p. 275)
complex number plane (p. 275)
difference of two squares (p. 263)
discriminant (p. 291)
factoring (p. 259)
greatest common factor (GCF) of an expression (p. 259)
i (p. 274)
imaginary number (p. 274)
parabola (p. 239)
perfect square trinomial (p. 262)
Quadratic Formula (p. 289)
quadratic function (p. 238)
standard form of a quadratic equation (p. 267)
standard form of a quadratic function (p. 238)
vertex form of a quadratic function (p. 252)
vertex of a parabola (p. 239)
zero of a function (p. 268)
Zero Product Property (p. 267)

Choose the correct vocabulary term to complete each sentence.

1. The square of a binomial is a(n) __?__. **perfect square trinomial**
2. Every quadratic equation can be solved with the __?__. **Quadratic Formula**
3. The __?__ reveals a translation of a parent quadratic function. **vertex form of a quadratic function**
4. A(n) __?__ is also an x-intercept of the graph of the function. **zero of a function**
5. The __?__ completely determines the types of roots of a quadratic function. **discriminant**

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Skills and Concepts

5-1 Objectives

- To identify quadratic functions and graphs (p. 238)
- To model data with quadratic functions (p. 240)

The **standard form of a quadratic function** is $f(x) = ax^2 + bx + c$, where $a \neq 0$. The quadratic term is ax^2. The graph of a **quadratic function** is a **parabola**.

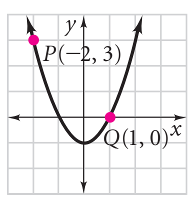
The **axis of symmetry** is a line that divides a parabola into two mirror images. The **vertex of a parabola** is the point at the intersection of the parabola and its axis of symmetry. Corresponding points on the parabola are the same distance from the axis of symmetry.

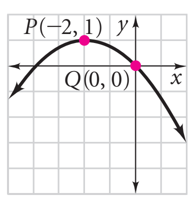
You can find a quadratic model for a set of data by solving a system of three equations for a, b, and c, or by using the quadratic regression feature of a graphing calculator.

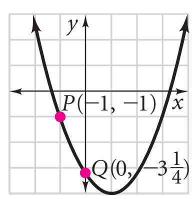
Determine whether each function is linear or quadratic. Identify the quadratic, linear, and constant terms.

6. $y = (3 - x)(2x + 1)$ **quadratic; $-2x^2$, $5x$, 3**
7. $y = x - x^2 + 3$ **quadratic; $-x^2$, x, 3**
8. $y = 3 - 4x$ **linear; none, $-4x$, 3**

Identify the vertex, the axis of symmetry, and the points corresponding to P and Q.

9. 

10. 

11. 

9. $(0, -1)$, $x = 0$, $(2, 3)$ and $(-1, 0)$
10. $(-2, 1)$, $x = -2$, $(-2, 1)$ and $(-4, 0)$
11. $(1, -4)$, $x = 1$, $(3, -1)$ and $\left(2, -3\frac{1}{4}\right)$

5 Chapter Review

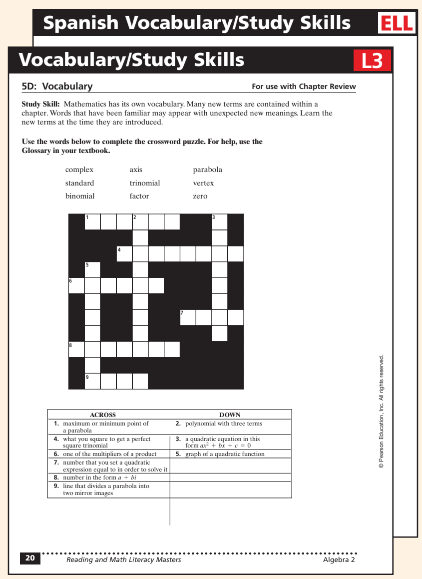
Resources

Student Edition
Extra Skills and Word Problems Practice, Ch. 5, p. 844
English/Spanish Glossary, p. 871
Properties and Formulas, p. 893
Table of Symbols, p. 889

Differentiated Instruction

Vocabulary and Study Skills worksheet 5D
Spanish Vocabulary and Study Skills worksheet 5D
Interactive Textbook Audio Glossary
Online Vocabulary Quiz

Success Tracker™
Online at PHSchool.com



Spanish Vocabulary/Study Skills ELL

Vocabulary/Study Skills L3

5D: Vocabulary — For use with Chapter Review

Study Skill: Mathematics has its own vocabulary. Many new terms are contained within a chapter. Words that have been familiar may appear with unexpected new meanings. Learn the new terms at the time they are introduced.

Use the words below to complete the crossword puzzle. For help, use the Glossary in your textbook.

complex, axis, parabola, standard, trinomial, vertex, binomial, factor, zero

ACROSS	DOWN
1. maximum or minimum point of a parabola	2. polynomial with three terms
4. what you square to get a perfect square trinomial	3. a quadratic equation in this form $ax^2 + bx + c = 0$
6. one of the multipliers of a product	5. graph of a quadratic function
7. number that you set a quadratic expression equal to in order to solve it	
8. number in the form $a + bi$	
9. line that divides a parabola into two mirror images	

20 Reading and Math Literacy Masters Algebra 2

12. a. Sports Find a quadratic model for the attendance at women's college basketball games from 1995–1997 by solving three equations in *a*, *b*, and *c*.

b. Predict the year attendance will reach 12,000,000.

c. Use the quadratic regression feature of your calculator to find a model for all the data.

d. What does this regression model predict as the first year attendance will reach 12,000,000?

e. Find the maximum likely attendance.

a–e. See margin.

Year	Attendance (thousands)
1995	4962
1996	5234
1997	6734
1998	7387
1999	8010
2000	8698

SOURCE: National Collegiate Athletic Association

5-2 and 5-3 Objectives

- To graph quadratic functions (p. 245)
- To find maximum and minimum values of quadratic functions (p. 247)
- To use the vertex form of a quadratic function (p. 252)

The parent function for the family of quadratic functions is $f(x) = x^2$. The constants *a*, *b*, and *c* characterize the graph of $y = ax^2 + bx + c$. The axis of symmetry is $x = -\frac{b}{2a}$, the vertex is at $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$, and $f\left(-\frac{b}{2a}\right)$ is the maximum or minimum value. The **vertex form of a quadratic function** is $y = a(x - h)^2 + k$. The vertex is (h, k), the maximum or minimum value is *k*, and the axis of symmetry is the line $x = h$. If $a > 0$, the parabola opens up. If $a < 0$, it opens down.

Graph each function. Identify the vertex, *y*-intercept, and axis of symmetry.

13. $y = 2(x + 1)^2 - 4$ **14.** $y = (x - 5)^2$

15. $y = -(x - 2)^2 + 1$ **16.** $y = -x^2 + 7$

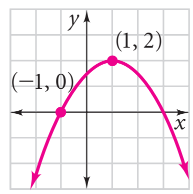
13–23. See margin.

Write each function in vertex form. Find its maximum or minimum value.

17. $y = x^2 + x - 12$ **18.** $y = -x^2 + 2x + 2$

19. $y = 2x^2 + 8x - 3$ **20.** $y = -0.5x^2 + 5$

21.



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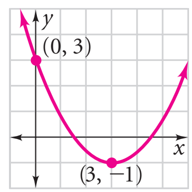
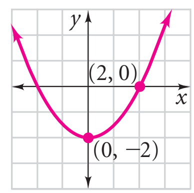


23.



5-4 and 5-5 Objectives

- To find common and binomial factors of quadratic expressions (p. 259)
- To factor special quadratic expressions (p. 262)
- To solve quadratic equations by factoring and by finding square roots (p. 267)
- To solve quadratic equations by graphing (p. 268)

You can solve some quadratic equations by finding square roots of both sides or by finding the zeros of the related function. You can solve some quadratic equations in the **standard form of a quadratic equation** $ax^2 + bx + c = 0$ by **factoring** and using the **Zero Product Property**. For a **perfect square trinomial**, $ax^2 \pm 2abx + b^2 = (a \pm b)^2$. For the **difference of two squares,** $a^2 - b^2 = (a + b)(a - b)$. In all cases, first factor out the **greatest common factor (GCF) of the expression.**

24–38. See margin.

Solve by factoring, taking square roots, or, if necessary, by graphing. Give exact radical answers. For answers found by graphing, round to the nearest hundredth.

24. $x^2 - 7x = 0$ **25.** $x^2 + 2x - 8 = 0$ **26.** $(x + 3)^2 = 9$

27. $4(x - 2)^2 = 32$ **28.** $2x^2 - 6x - 8 = 0$ **29.** $x^2 - 5x - 5 = 0$

30. $3x^2 - 14x + 8 = 0$ **31.** $x^2 - 3x - 4 = 0$ **32.** $x^2 + 8x + 16 = 0$

33. $x^2 - 6x + 9 = 0$ **34.** $4x^2 - 12x + 9 = 0$ **35.** $x^2 - 9 = 0$

36. $6x^2 - 13x - 5 = 0$ **37.** $4x^2 + 3 = -8x$ **38.** $3x^2 + 4x - 10 = 0$

12a. $y = 614x^2 - 342x + 4962$, where $x = 0$ corresponds to 1995 and *y* is in thousands.

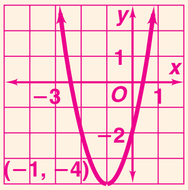
b. around 1999

c. $y = -25.5x^2 + 917.8x + 4776.7$

d. around 2007

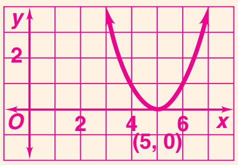
e. ≈13,000,000

13.



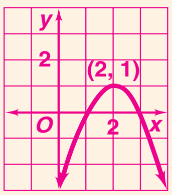
vertex (−1, −4), *y*-intercept: −2; $x = -1$

14.



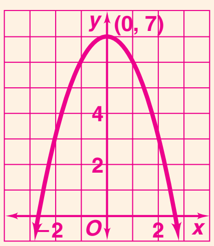
vertex (5, 0), *y*-intercept: 25; $x = 5$

15.



vertex (2, 1), *y*-intercept: −3; $x = 2$

16.



vertex (0, 7), *y*-intercept: 7; $x = 0$

17. $y = \left(x + \frac{1}{2}\right)^2 - 12\frac{1}{4}$; minimum: $-12\frac{1}{4}$

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

19. $y = 2(x + 2)^2 - 11$; minimum: −11

20. $y = -0.5(x - 0)^2 + 5$; maximum: 5

21. $y = -\frac{1}{2}(x - 1)^2 + 2$; maximum: 2

22. $y = \frac{4}{9}(x - 3)^2 - 1$; minimum: −1

23. $y = \frac{1}{2}(x - 0)^2 - 2$; minimum: −2

24. 0, 7

25. −4, 2

26. −6, 0

27. $2 - 2\sqrt{2}, 2 + 2\sqrt{2}$

28. −1, 4

29. −0.85, 5.85 or $\frac{5 \pm 3\sqrt{5}}{2}$

30. $\frac{2}{3}$, 4

31. −1, 4

32. −4

33. 3

34. $\frac{3}{2}$

5-6 Objectives

- To identify and graph complex numbers (p. 274)
- To add, subtract, and multiply complex numbers (p. 276)

An **imaginary number** has the form $a + bi$, where $b \neq 0$. The imaginary number $\boldsymbol{i}$ is defined as $i^2 = -1$. A **complex number** has the form $a + bi$, where a and b are any real numbers. The **absolute value of a complex number** is its distance from the origin in the **complex number plane**. You graph $a + bi$ in the complex plane just as you graphed (a, b) in the coordinate plane. Complex numbers follow rules of operation like those of real numbers. Some quadratic equations have imaginary numbers as roots. Functions of complex numbers may be used to generate fractals.

Simplify each expression.

39. $\sqrt{-25}$ **$5i$** **40.** $\sqrt{-2} - 1$ **$-1 + i\sqrt{2}$** **41.** $-4 - \sqrt{-1}$ **$-4 - i$** **42.** $\sqrt{-27}$ **$3i\sqrt{3}$**

43. $2\sqrt{-32} + 4$ **44.** $|3 - i|$ **$\sqrt{10}$** **45.** $|-2 + 3i|$ **$\sqrt{13}$** **46.** $|4i|$ **4**

43. $4 + 8i\sqrt{2}$

47. $(3 + 4i) - (7 - 2i)$ **$-4 + 6i$** **48.** $(5 - i)(9 + 6i)$ **$51 + 21i$**

49. $(3 + 8i) + (5 - 2i)$ **$8 + 6i$** **50.** $(4 + 6i)(2 + i)$ **$2 + 16i$**

Find the additive inverse of each number. Graph the number and its inverse.

51. $2 - i$ **52.** $-4 + 3i$ **53.** $-7 - 4i$ **54.** $-2i$

51–54. See margin.

Solve each equation.

55. $x^2 + 2 = 0$ **$-i\sqrt{2}, i\sqrt{2}$** **56.** $x^2 = -5$ **$-i\sqrt{5}, i\sqrt{5}$**

57. $3x^2 + 12 = 0$ **$-2i, 2i$** **58.** $6x^2 + 4 = 0$ **$\frac{-i\sqrt{6}}{3}, \frac{i\sqrt{6}}{3}$**

Find the first three outputs of each fractal-generating function. Begin with $z = 0$.

59. $f(z) = z^2 - i$ **$-i, -1 - i, i$** **60.** $f(z) = i - z^2$ **$i, 1 + i, -i$**

5-7 and 5-8 Objectives

- To solve equations by completing the square (p. 282)
- To rewrite functions in vertex form by completing the square (p. 284)
- To solve quadratic equations by using the Quadratic Formula (p. 289)
- To determine types of solutions by using the discriminant (p. 291)

Completing the square is based on the relationship $x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$. You can use it to write a quadratic function in vertex form. If the coefficient of the quadratic term is not 1, you must factor out the coefficient from the variable terms.

You can solve any quadratic equation by using the Quadratic Formula.

If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

The discriminant $b^2 - 4ac$ determines the number and type of solutions of the equation. If $b^2 - 4ac > 0$, the equation has two real solutions. If $b^2 - 4ac = 0$, the equation has one real solution. If $b^2 - 4ac < 0$, the equation has no real solutions and two imaginary solutions.

Solve each equation by completing the square. **61–72. See margin.**

61. $9x^2 + 6x + 1 = 4$ **62.** $x^2 + 3x = -25$ **63.** $x^2 - 2x + 4 = 0$

64. $-x^2 + x - 7 = 0$ **65.** $2x^2 + 3x = 8$ **66.** $4x^2 - x - 3 = 0$

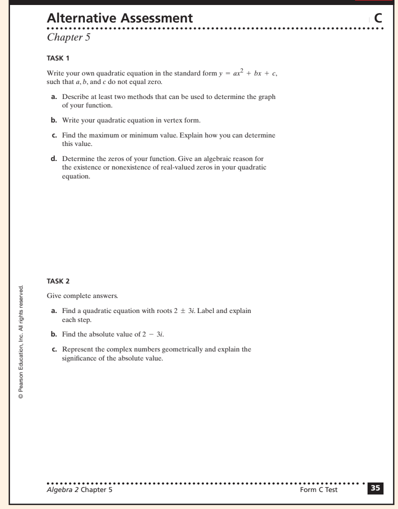
Rewrite the equation in vertex form by completing the square. Find the vertex.

67. $y = x^2 + 3x - 1$ **68.** $y = 2x^2 - x - 1$ **69.** $y = x^2 + x + 2$

Determine the number and type of solutions. Solve using the Quadratic Formula.

70. $x^2 - 6x + 2 = 0$ **71.** $-2x^2 + 7x = 10$ **72.** $x^2 + 4 = 6x$

Alternative Assessment L4



Alternative Assessment C

Chapter 5

TASK 1

Write your own quadratic equation in the standard form $y = ax^2 + bx + c$, such that a, b, and c do not equal zero.

a. Describe at least two methods that can be used to determine the graph of your function.

b. Write your quadratic equation in vertex form.

c. Find the maximum or minimum value. Explain how you can determine this value.

d. Determine the zeros of your function. Give an algebraic reason for the existence or nonexistence of real-valued zeros in your quadratic equation.

TASK 2

Give complete answers.

a. Find a quadratic equation with roots $2 \pm 3i$. Label and explain each step.

b. Find the absolute value of $2 - 3i$.

c. Represent the complex numbers geometrically and explain the significance of the absolute value.

Algebra 2 Chapter 5 Form C Test 35

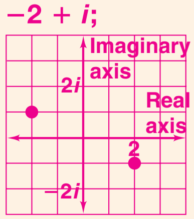
35. $-3, 3$

36. $-\frac{1}{3}, \frac{5}{2}$

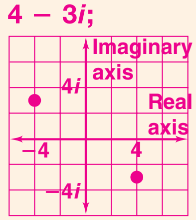
37. $-\frac{3}{2}, -\frac{1}{2}$

38. $-2.61, 1.28$ or $\frac{-2 \pm \sqrt{34}}{3}$

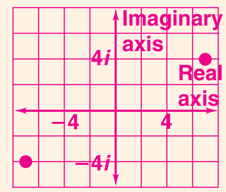
51. $-2 + i$;



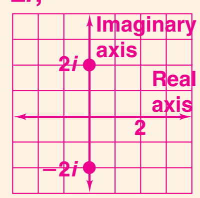
52. $4 - 3i$;



53. $7 + 4i$;



54. $2i$;



61. $-1, \frac{1}{3}$

62. $-\frac{3}{2} + \frac{i\sqrt{91}}{2}, -\frac{3}{2} - \frac{i\sqrt{91}}{2}$

63. $1 + i\sqrt{3}, 1 - i\sqrt{3}$

64. $\frac{1}{2} + \frac{3i\sqrt{3}}{2}, \frac{1}{2} - \frac{3i\sqrt{3}}{2}$

65. $-\frac{3}{4} + \frac{\sqrt{73}}{4}, -\frac{3}{4} - \frac{\sqrt{73}}{4}$

66. $-\frac{3}{4}, 1$

67. $y = \left(x + \frac{3}{2}\right)^2 - \frac{13}{4}$; $\left(-\frac{3}{2}, -\frac{13}{4}\right)$

68. $y = 2\left(x - \frac{1}{4}\right)^2 - \frac{9}{8}$; $\left(\frac{1}{4}, -\frac{9}{8}\right)$

69. $y = \left(x + \frac{1}{2}\right)^2 + \frac{7}{4}$; $\left(-\frac{1}{2}, \frac{7}{4}\right)$

70. 2 real solutions; $3 + \sqrt{7}$, $3 - \sqrt{7}$

71. 2 imaginary solutions; $\frac{7}{4} + \frac{i\sqrt{31}}{4}, \frac{7}{4} - \frac{i\sqrt{31}}{4}$

72. 2 real solutions; $3 + \sqrt{5}$, $3 - \sqrt{5}$