Algebra II Fall Final Exam Review

<u>This review is due the day of your Fall Final Exam!!!</u>

These problems are mostly from the "Chapter Reviews" in the textbook at the end of each Chapter. If you want more practice, you can do the "Chapter Tests" at the end of each chapter in the book – the solutions for the "Chapter Tests" can be found on Mr. Youn's website (www.mryoun.com).

Chapter 1

Page 47: (11, 13, 15, 21, 23, 24-29all, 29-31all, 33, 35, 37, 38, 43, 44-46, 49, 53, 55, 57)

Chapter 2

Page 111: (6, 7, 12, 14, 15, 16, 19, 24, 37, 41, 43, 44)

Chapter 3

Page 159 (#21)
Page 163: (7, 9, 18, 20, 24, 43)

Chapter 4

Page 233: (11, 13, 19, 20, 23, 25, 27, 36, 37, 39 (find the determinant ONLY), 40, 47, 48 (solve for "r" ONLY on 48))

Chapter 5

Page 245: (16, 18);
Page 252 (#29); Page 303: (6, 9, 11, 12, 13, 15, 19, 21, 23, 24-32 all, 39, 45, 47-50 all, 55, 58, 61, 63, 69, 70, 71)
Page 861: (#68)

Chapter Review

Vocabulary Review

- **absolute value** (p. 33)
- **absolute value of a real number** (p. 8)
- **additive inverse** (p. 7)
- **algebraic expression** (p. 12)
- **coefficient** (p. 13)
- **compound inequality** (p. 28)
- **evaluate** (p. 12)
- **experimental probability** (p. 40)
- **extraneous solution** (p. 34)
- **multiplicative inverse** (p. 7)
- **opposite** (p. 7)
- **reciprocal** (p. 7)
- **sample space** (p. 41)
- **simulation** (p. 40)
- **solution of an equation** (p. 18)
- **term** (p. 13)
- **theoretical probability** (p. 41)
- **tolerance** (p. 36)
- **variable** (p. 12)
- **variable expression** (p. 12)

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Choose the correct vocabulary term to complete each sentence.

1. The opposite of a number is also called its ? . **additive inverse**
2. The ? is the set of all possible outcomes of an experiment. **sample space**
3. The ? makes an equation true. **solution of an equation**
4. A pair of inequalities joined by *and* or *or* is called a(n) ? . **compound inequality**
5. ? is another name for a multiplicative inverse of a number. **reciprocal**
6. The ? of an event is the ratio of occurrences to trials. **experimental probability**
7. The ? of an event is the ratio of possible event outcomes to total possible outcomes. **theoretical probability**

8. extraneous solution

8. A possible solution that does not satisfy the original equation is a(n) ? .
9. You can use a(n) ? to find experimental probabilities. **simulation**
10. A number's distance from zero on the number line is its ? . **absolute value**

TEKS ★ TAKS Skills and Concepts

Lesson 1-1 Objectives

- To graph and order real numbers
- To identify and use properties of real numbers

Supports (G.8)(C) TAKS Obj. 8
Supports (A.4)(B) TAKS Obj. 2

The natural numbers, whole numbers, integers, rational numbers, and irrational numbers are all subsets of the real numbers. Each real number corresponds to a point on the number line. A real number's distance from zero on the number line is its absolute value.

For both addition and multiplication, real numbers satisfy the properties of closure, associativity, and commutativity. Real numbers have **additive inverses (opposites)**. Nonzero real numbers have **multiplicative inverses (reciprocals)**. They also have additive and multiplicative identities. Real numbers satisfy the Distributive Property.

To which sets of numbers does each number belong? 11–15. See margin.

11. 8.1π **12.** -79 **13.** $\sqrt{121}$ **14.** $\sqrt{200}$ **15.** $12\frac{7}{8}$

Compare each pair of numbers. Use < or >.

16. $-\frac{2}{3}, -\frac{3}{2}$ > **17.** $\sqrt{6}, 2.\overline{3}$ > **18.** $0.45, 0.405$ > **19.** $-7, |-7|$ <

11. real numbers, irrational numbers
12. real numbers, rational numbers, integers
13. real numbers, rational numbers, integers, whole numbers, natural numbers
14. real numbers, irrational numbers
15. real numbers, rational numbers

TEKS ★ TAKS Resources

Student Edition
Extra Skills, Word Problems, Proof Practice, Ch. 1, p. 850
English/Spanish Glossary, p. 913
Properties and Formulas, p. 907
Table of Symbols, p. 903

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Spanish Vocabulary and Study Skills worksheet 1F
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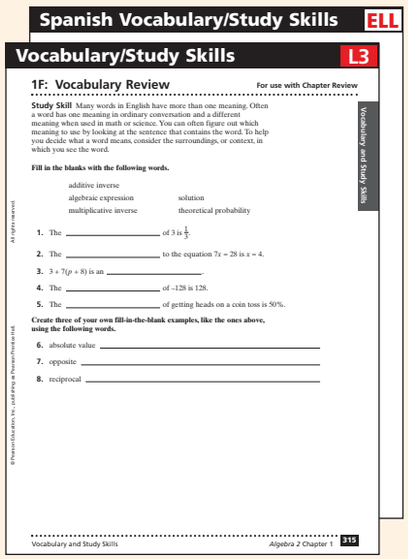
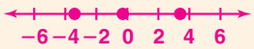

Spanish Vocabulary/Study Skills ELL
Vocabulary/Study Skills L3
1F: Vocabulary Review
For use with Chapter Review
Study Skill Many words in English have more than one meaning. Often a word has one meaning in ordinary conversation and a different meaning when used in math or science. You can often figure out which meaning to use by looking at the sentence that contains the word. To help you decide what a word means, consider the surroundings, or context, in which you see the word.
Fill in the blanks with the following words.
additive inverse
algebraic expression
multiplicative inverse
solution
theoretical probability
1. The _____ of 3 is $\frac{1}{3}$.
2. The _____ to the equation $7x = 28$ is $x = 4$.
3. $3 + 7(p + 8)$ is an _____.
4. The _____ of -128 is 128.
5. The _____ of getting heads on a coin toss is 50%.
Create three of your own fill-in-the-blank examples, like the ones above, using the following words.
6. absolute value _____
7. opposite _____
8. reciprocal _____
Vocabulary and Study Skills
Algebra 2 Chapter 1
215

20. 3.4; $-\frac{1}{3.4}$



21. $-4 - \pi$; $\frac{1}{4 + \pi}$

22. $-1\frac{7}{8}$; $\frac{8}{15}$

23. $-\sqrt{12}$; $\frac{1}{\sqrt{12}}$

Find the opposite and reciprocal of each number. Then graph all three numbers on a number line. 20–23. See margin.

20. -3.4 **21.** $4 + \pi$ **22.** $1\frac{7}{8}$ **23.** $\sqrt{12}$

24–28. Answers may vary.

Open-Ended Write an equation that illustrates each property of real numbers.

24. The Identity Property of Multiplication $(x + 3)(1) = x + 3$

25. The Associative Property of Addition $(2x + 7) + 3y = 2x + (7 + 3y)$

26. The Distributive Property $3(2x - 4) = 6x - 12$

27. The Commutative Property of Multiplication $(5x)(3y) = (3y)(5x)$

28. The Identity Property of Addition $10z + 0 = 10z$

Lessons 1-2 and 1-3

(2A.2)(A) To use tools to transform and solve equations.

Supports (A.3)(A)
TAKS Obj. 2

Supports (A.4)(B)
TAKS Obj. 2

You **evaluate** an **algebraic expression** by substituting numbers for the **variables.** You simplify an algebraic expression by combining like **terms,** using the appropriate properties. To find the **solutions of an equation,** use the properties of equality. To check for **extraneous solutions,** substitute in the original equation. Some equations may have no solutions. Some equations are true for all real numbers.

29. Evaluate $-x^2 + |x - 10|$ for $x = 2$. 4

30. Evaluate $3t(t + 2) - (3t^2 + 5t)$ for $t = 19$. 19

31. Simplify $-(3a - 2b) - 3(-a - b)$. $5b$

Solve each equation for x. State any restrictions.

32. $2x - 5 = 17$ 11 **33.** $8 - \frac{1}{2}x = 3$ 10 **34.** $3x = 4x - 5$ 5

35. $0.1x + 1.4 = 1.2x - 3$ 4 **36.** $\frac{7 - x}{3} = 5$ −8 **37.** $\frac{x + a}{b} = \frac{1}{a}$ $\frac{b - a^2}{a}$, $a \neq 0, b \neq 0$

Write an equation to solve each problem.

38. Geometry The lengths of the sides of a rectangle are in the ratio 5 : 3. The perimeter of the rectangle is 32 cm. Find the length of each side. 10 cm, 6 cm

39. Two planes left St. Louis for Los Angeles at the same time. After 4 h they were 700 mi apart. The slower plane traveled at 350 mi/h. What was the speed of the faster plane? 525 mi/h

40. Geometry The measures of an angle and its supplement differ by 40°. Find the measures of the angles. 70°, 110°

Lesson 1-4 Objectives

- To solve and graph inequalities
- To solve and write compound inequalities

Supports (A.7)(A), (A.7)(B)
TAKS Obj. 4

Supports (G.7)(A)
TAKS Obj. 7

You can solve inequalities using properties that are similar to the properties for equations. An important difference is that multiplying or dividing each side of an inequality by a negative number reverses the inequality symbol. Just as with equations, some inequalities are true for all real numbers, and some have no solutions. If a **compound inequality** uses *and*, the solutions must satisfy both inequalities. If a compound inequality uses *or*, the solutions satisfy either one or both of the inequalities.

Solve each inequality. Graph the solution. 41–46. See margin for graphs.

41. $4 - 5z \geq 2$ $z \leq \frac{2}{5}$

42. $2(5 - 3x) < x - 4(3 - x)$ $x > 2$

43. $0.3(y - 2) > \frac{1}{2}(6 - y)$ $y > 4.5$

Solve each compound inequality. Graph the solution.

44. $5 \leq 9 - 4x \leq 13$ $-1 \leq x \leq 1$

45. $3 \geq 2x$ or $x - 4 > 2$ $x \leq \frac{3}{2}$ or $x > 6$

46. $6y > 2$ and $y - 5 \geq -2y$ $y \geq \frac{5}{3}$

47. A publisher estimates that the cost of publishing a book is from \$980,000 to \$1,240,000. So far, \$824,150 has been spent. Use a compound inequality to describe the amount A that the publisher can still spend while remaining within the estimate. $155,850 \leq A \leq \$415,850$

Lesson 1-5 Objectives

- To solve absolute value equations
- To solve absolute value inequalities

Prepares for (2A.4)(A) To identify and sketch absolute value functions by solving absolute value equations

You can rewrite an equation or inequality that involves the absolute value of an **algebraic expression** as a compound sentence. You must consider both cases of the definition of absolute value. Check for **extraneous solutions.**

Solve each equation. Check for extraneous solutions.

48. $|2x + 8| = 3x + 7$ 1

49. $|3x - 5| = 4 + 2x$ $\frac{1}{5}$, 9

50. $|x - 4| + 3 = 1$ no solution

Solve each inequality. Graph the solution. 51–53. See margin for graphs.

51. $|3x - 2| + 4 \leq 7$ $-\frac{1}{3} \leq x \leq \frac{5}{3}$

52. $4|y - 9| > 36$ $y < 0$ or $y > 18$

53. $\frac{2}{5}|3x - 3| - 4 > 2$ $x < -4$ or $x > 6$

54. The specification for a length x is 43.6 cm with a tolerance of 0.1 cm. Write the specification as an absolute value inequality. $|x - 43.6| \leq 0.1$

Lesson 1-6 Objectives

- To find experimental probabilities
- To find theoretical probabilities

Supports (8.3)(B), (8.11)(B) TAKS Obj. 9

The probability of an event can be expressed as a number from 0% (impossible) to 100% (certain).

Experimental probability is the ratio of two numbers. The first is the observed number of times an experiment results in a particular event. The second is the number of trials. **Simulation** uses random numbers or other models to determine an experimental probability.

Theoretical probability in a sample space of equally likely outcomes is also the ratio of two numbers. The first is the number of outcomes corresponding to the particular event. The second is the number of elements in the sample space, which is the set of all possible outcomes. Geometric probability is computed as a ratio of areas.

Suppose you select a number at random from the sample space {−3, −2, −1, 0, 1, 2, 3, 4}. Find each probability.

55. P(a positive number) $\frac{1}{2}$

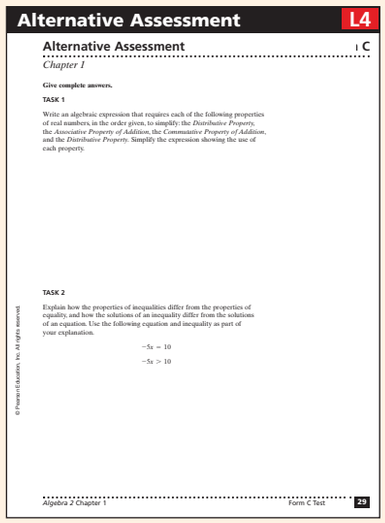
56. P(a number less than 2) $\frac{5}{8}$

57. P(an even number) $\frac{1}{2}$

58. P(a multiple of 3) $\frac{3}{8}$

59. Games You have won five games of checkers and your opponent has won three. What is the experimental probability of your winning? $\frac{5}{8}$

60. Tests A five-question multiple-choice quiz has four choices for each answer. Find the experimental probability of getting exactly three correct answers if you guess the answers at random. Define a simulation using the random number table on page 43. Use your simulation to find the experimental probability. about 9%


Alternative Assessment L4

Alternative Assessment 1 C

Chapter 1

Give complete answers.

TASK 1

Write an algebraic expression that requires each of the following properties of real numbers, in the order given, to simplify: the *Distributive Property*, the *Associative Property of Addition*, the *Commutative Property of Addition*, and the *Distributive Property*. Simplify the expression showing the use of each property.

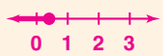
TASK 2

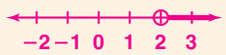
Explain how the properties of inequalities differ from the properties of equality, and how the solutions of an inequality differ from the solutions of an equation. Use the following equation and inequality as part of your explanation.

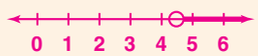
$-5x = 10$

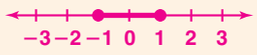
$-5x > 10$

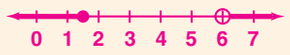
Algebra 2 Chapter 1 Form C Test 29

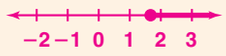
41. 

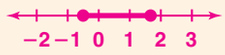
42. 

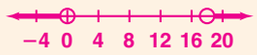
43. 

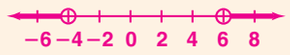
44. 

45. 

46. 

51. 

52. 

53. 

Chapter Review

Vocabulary Review

- absolute value function (p. 90)
- constant of variation (p. 74)
- dependent variable (p. 64)
- direct variation (p. 74)
- domain (p. 58)
- function (p. 59)
- function notation (p. 60)
- independent variable (p. 64)
- linear equation (p. 64)
- linear function (p. 64)
- linear inequality (p. 103)
- mapping diagram (p. 58)
- parameter (p. 99)
- parent function (p. 95)
- point-slope form (p. 67)
- range (p. 58)
- reflection (p. 98)
- relation (p. 57)
- scatter plot (p. 82)
- shrink (p. 98)
- slope (p. 66)
- slope-intercept form (p. 67)
- standard form (p. 65)
- stretch (p. 98)
- transformation (p. 99)
- translation (p. 95)
- trend line (p. 82)
- vertex (p. 90)
- vertical-line test (p. 59)
- *x*-intercept (p. 65)
- *y*-intercept (p. 65)

Choose the correct term to complete each sentence.

1. In the function $y = f(x)$, y is the (*dependent, independent*) variable. **dependent**
2. All functions are (*relations, domains*). **relations**
3. The graph of a function is (*always, sometimes*) a line. **sometimes**
4. An equation of the form $y - y_1 = m(x - x_1)$ is in (*point-slope, slope-intercept*) form. **point-slope**
5. The vertex of the graph of an absolute value function is (*always, sometimes*) the lowest point on the graph. **sometimes**

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TEKS ★ TAKS Skills and Concepts

Lesson 2-1 Objectives

- To graph relations
- To identify functions
- To identify the mathematical domains and ranges of functions

A **relation** is a set of ordered pairs that can be represented by points in the coordinate plane or by a **mapping diagram.** The **domain** of a relation is the set of *x*-coordinates. The **range** is the set of *y*-coordinates.

When each element of the domain of a relation is paired with exactly one element of the range, the relation is a **function.** You can write a function using the notation $f(x)$, called **function notation.**

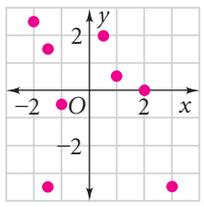
6–10. See margin.

Determine whether each relation is a function. Find the domain and range.

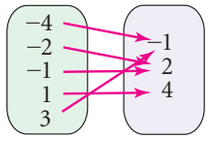
6. {(5, 0), (8, 1), (1, 3), (5, 2), (3, 8)}

7. {(10, 2), (−10, 2), (6, 4), (5, 3), (−6, 7)}

8.



9.



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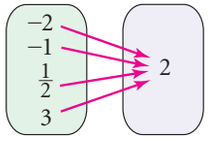

For each function, find $f(-2)$, $f(-0.5)$, and $f(3)$.

11. $f(x) = -x + 4$
6, 4.5, 1

12. $f(x) = \frac{3}{8}x - 3$
$-3\frac{3}{4}, -3\frac{3}{16}, -1\frac{7}{8}$

13. $f(x) = -\frac{5}{12}x + 2$
$2\frac{5}{6}, 2\frac{5}{24}, \frac{3}{4}$

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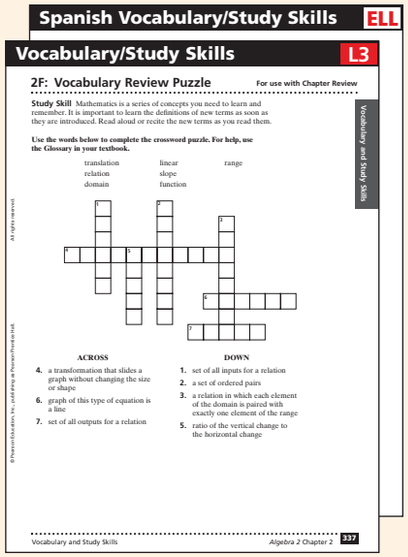
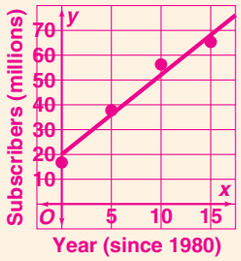


Chapter Review

6. not a function; domain {1, 3, 5, 8}, range {0, 1, 2, 3, 8}
7. function; domain {−10, −6, 5, 6, 10}, range {2, 3, 4, 7}
8. not a function; domain $\{-2, -\frac{3}{2}, -1, \frac{1}{2}, 1, 2, 3\}$, range $\{-\frac{7}{2}, -\frac{1}{2}, 0, \frac{1}{2}, \frac{3}{2}, 2, \frac{5}{2}\}$
9. function; domain {−4, −2, −1, 1, 3}, range {−1, 2, 4}
10. function; domain $\{-2, -1, \frac{1}{2}, 3\}$, range {2}

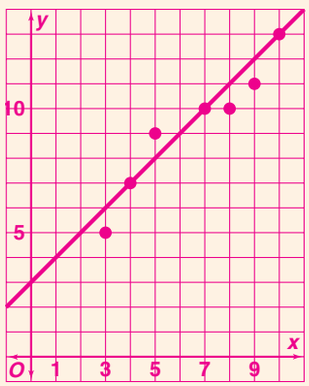
26a, b.



Answers may vary. Sample:

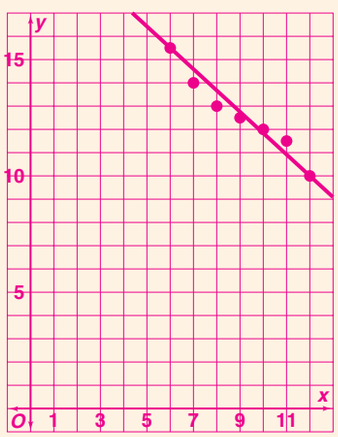
$y = x + 21$

27.



Answers may vary. Sample: reasonable; $y = x + 3$; 18

28.



Answers may vary. Sample: reasonable; $y = -0.92x + 21$; 7.2

Lesson 2-2 Objectives

- To graph linear equations
- To write equations of lines
- To determine reasonable domain and range values for continuous and discrete situations

The graph of a **linear function** is a line. You can represent a linear function with a **linear equation.** In a function, the value of y depends on the value of x, so y is the **dependent variable** and x is the **independent variable.**

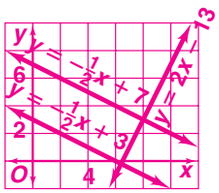
Given two points on a line, the **slope** of the line is the ratio of the difference of the y-coordinates to the corresponding difference of the x-coordinates. The slope equals the coefficient of x when you write a linear equation in **slope-intercept form.** You can also write a linear equation in **point-slope form** or **standard form.** You can use the slopes of lines to determine whether or not they are parallel, perpendicular, or horizontal. A vertical line has no slope.

Write in standard form an equation for each line.

14. slope $= -3$, through $(4, 0)$
$3x + y = 12$

15. through $(2, 3)$ and $(3, 5)$
$2x - y = 1$

19c.



Find the slope, x-intercept, and y-intercept of each line.

16. $4x - 2y = 3$
2; $\left(\frac{3}{4}, 0\right)$, $\left(0, -\frac{3}{2}\right)$

17. $Mx = Ny + P$
$\frac{M}{N}$; $\left(\frac{P}{M}, 0\right)$, $\left(0, -\frac{P}{N}\right)$

18. $5 - x = y$
-1; (5, 0), (0, 5)

19. a. Write an equation of the line parallel to $x + 2y = 6$ through $(8, 3)$.
b. Write an equation of the line perpendicular to $x + 2y = 6$ through $(8, 3)$.
c. Graph the three lines on the same coordinate plane.
a. $y = -\frac{1}{2}x + 7$ **b.** $y = 2x - 13$

Lesson 2-3

(2A.10)(G) To use functions to model and make predictions in problem situations involving direct variation

A linear equation of the form $y = kx$ represents a **direct variation.** The **constant of variation** is k. You can use proportions to solve some direct variation problems.

For each function, determine whether y varies directly with x. If so, find the constant of variation and write the equation.

20.

x	y
-2	3
0	4
2	7

no

21.

x	y
4	5
6	9
10	17

no

22.

x	y
0	0
1	1
5	5

yes; 1, $y = x$

Find each constant of variation. Then find the value of y when $x = -0.3$.

23. $y = 2$ when $x = -\frac{1}{2}$
-4; 1.2

24. $y = \frac{2}{3}$ when $x = 0.2$
$\frac{10}{3}$; -1

25. $y = 7$ when $x = 2$
$\frac{7}{2}$; $-1\frac{1}{20}$

Lesson 2-4

(2A.1)(B) To make and interpret scatter plots, fit the graph of a function to the data, interpret the results, and proceed to model, predict, and make critical judgments

Supports (A.2)(D) TAKS Obj. 2

Supports (A.5)(C), (A.6)(A), (A.6)(B) TAKS Obj. 3

You can use mathematical models such as **scatter plots** to show relationships between data sets. You can use the models to make predictions about the data set. Sometimes you can draw a **trend line** to model the relation and make predictions.

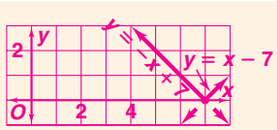
26. a. Data Analysis Draw a scatter plot of the data below. a–b. See margin.
b. Draw a trend line. Write its equation.
c. Estimate the number of cable TV subscribers in 2010. Answers may vary. Sample: about 111 million

Cable TV Subscribers

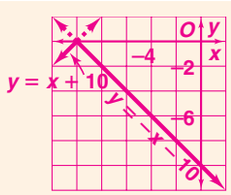
Year	1980	1985	1990	1995	2000
Millions of Subscribers	17.5	35.4	50.5	60.6	66.3

SOURCE: Television Bureau of Advertising

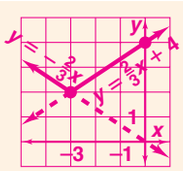
29.



30.



31.



Draw a scatter plot of each set of data. Decide whether a linear model is reasonable. If so, draw a trend line and write its equation. Then predict the value of y when x is 15. 27–28. See margin p. 112.

27.

x	3	4	5	7	8	9	10
y	5	7	9	10	10	11	13

28.

x	6	7	8	9	10	11	12
y	15.5	14.0	13.0	12.5	12.0	11.5	10.0

Lessons 2-5, 2-6

(2A.4)(A) To identify and sketch the graph of the parent absolute value function ($f(x) = |x|$)

(2A.1)(A) To identify the mathematical domains and ranges of functions

(2A.4)(B) To extend the parent function with parameters and describe the effects of the parameter changes on the graph of the parent function

The **absolute value function** $y = |x|$ has a graph in the shape of a V. It is the **parent function** for the family of functions of the form $y = a|x - h| + k$. The maximum or minimum point of the V is the **vertex** of the graph.

The value of h represents a horizontal translation of the parent graph by h units left (h is positive) or right (h is negative). The k represents a vertical translation of the graph by k units up (k is positive) or down (k is negative). The a represents a vertical stretch for $a > 1$; a vertical shrink for $0 < a < 1$. $y = -a|x|$ is a reflection of $y = a|x|$ in the x-axis.

Graph each equation by writing two linear equations. 29–31. See margin p. 112.

29. $y = |x - 7|$ **30.** $y = -|x + 10|$ **31.** $y = \frac{1}{3}|2x + 6| + 2$

Write an equation for each translation of the graph of $y = |x|$.

32. 4 units up, 2 units right $y = |x - 2| + 4$ **33.** vertex $(-3, 0)$ $y = |x + 3|$

34. vertex $(5, 2)$ $y = |x - 5| + 2$ **35.** vertex $(4, 1)$ $y = |x - 4| + 1$

Graph each function. 36–38. See margin. 39–41. See back of book.

36. $f(x) = |x| - 8$ **37.** $f(x) = 2|x - 5|$ **38.** $f(x) = \frac{1}{2}|x - 3| + 3$

39. $y = 3|x + 4|$ **40.** $y = -\frac{1}{4}|x - 2| + \frac{1}{2}$ **41.** $y = -2|x + 1| - 1$

Lesson 2-7 Objectives

- To graph linear inequalities
- To graph absolute value inequalities
- To identify reasonable domain and range values for continuous and discrete situations

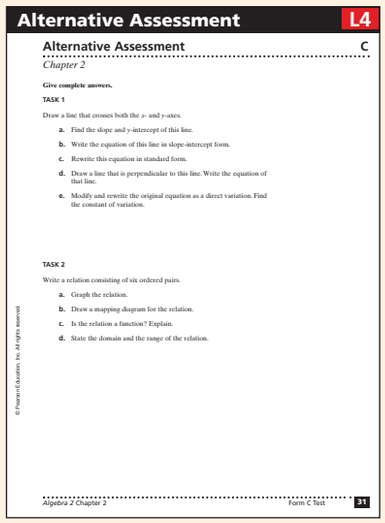
A **linear inequality** describes a region of the coordinate plane that has a boundary. To graph an inequality involving two variables, first graph the boundary. Then decide which side of the boundary contains solutions. Points on a dashed boundary are not solutions. Points on a solid boundary are solutions.

Graph each inequality. 42–46. See margin.

42. $y \geq -2$ **43.** $y < 3x + 1$ **44.** $y \leq -|x - 5|$ **45.** $y > |2x + 1|$

46. Transportation An air cargo plane can transport as many as 15 regular shipping containers. One super-size container takes up the space of 3 regular containers.
a. Write an inequality to model the situation.
b. Describe the domain and range.
c. Graph the inequality you wrote in part (a).

47. Open-Ended Write an absolute value inequality with a solid boundary that has solutions below the x-axis only. Answers may vary. Sample: $y \leq -|x| - 1$


Alternative Assessment L4

Alternative Assessment C
Chapter 2

Give complete answers.

TASK 1

Draw a line that crosses both the x- and y-axes.

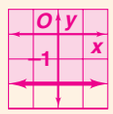
a. Find the slope and y-intercept of this line.
b. Write the equation of this line in slope-intercept form.
c. Rewrite this equation in standard form.
d. Draw a line that is perpendicular to this line. Write the equation of that line.
e. Modify and rewrite the original equation as a direct variation. Find the constant of variation.

TASK 2

Write a relation consisting of six ordered pairs.

a. Graph the relation.
b. Draw a mapping diagram for the relation.
c. Is the relation a function? Explain.
d. State the domain and the range of the relation.

Algebra 2 Chapter 2 Form C Test 31

42.


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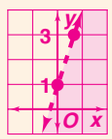

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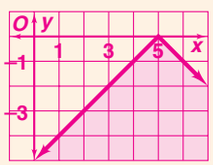
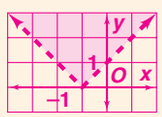
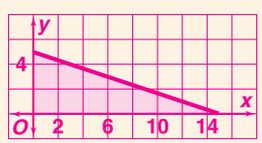


45.


46a. Answers may vary. Sample: $x + 3y \leq 15$

b. Answers may vary. Sample: domain {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}, range {0, 1, 2, 3, 4, 5}

c.


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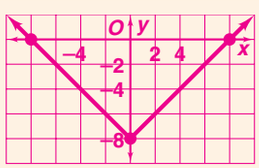

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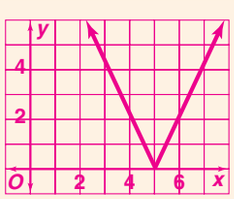

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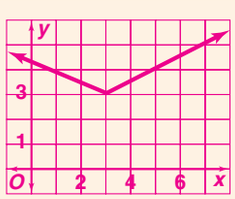


Chapter Review

Vocabulary Review

constraints (p. 141)
coordinate space (p. 148)
dependent system (p. 122)
equivalent systems (p. 129)
feasible region (p. 142)
inconsistent system (p. 122)
independent system (p. 122)
linear programming (p. 141)
linear system (p. 120)
objective function (p. 141)
ordered triples (p. 148)
system of equations (p. 120)
trace (p. 150)

Match the vocabulary term in Column 1 with the most appropriate phrase in Column 2.

Column 1	Column 2
1. dependent linear systems **A**	**A.** have many solutions
2. equivalent systems **D**	**B.** have no solutions
3. inconsistent linear systems **B**	**C.** have solutions that can be shown as the intersection of planes
4. independent linear systems **E**	**D.** have the same solutions
5. three-variable systems **C**	**E.** have unique solutions

Go Online PHSchool.com
For: Vocabulary quiz
Web Code: agj-0351

TEKS ★ TAKS Skills and Concepts

Lesson 3-1

(2A.3)(A) To analyze situations and formulate systems of linear equations in two unknowns to solve problems

(2A.3)(B) To solve systems of linear equations using graphs

Supports **(A.8)(A), (A.8)(B)** TAKS **Obj. 4**

A **system of equations** is a set of two or more equations that use the same variables. The points where all the graphs intersect represent solutions. You must check the coordinates of the points of intersection in the original equations to be sure you have a solution. A **linear system** consists of linear equations.

An **independent system** has a unique solution while a **dependent system** does not have a unique solution. An **inconsistent system** has no solutions.

Solve each system by graphing.

6. $\begin{cases} y = 2x + 1 \\ y = 4x + 5 \end{cases}$ **(−2, −3)** **7.** $\begin{cases} y = 3x - 2 \\ y = -2x + 8 \end{cases}$ **(2, 4)** **8.** $\begin{cases} y = 3x - 5 \\ 2y = 6x + 4 \end{cases}$ **no solution**

9. $\begin{cases} 3x + 2y = -6 \\ x - y = -2 \end{cases}$ **(−2, 0)** **10.** $\begin{cases} 4x - y = 6 \\ -2x + 3y = 12 \end{cases}$ **(3, 6)** **11.** $\begin{cases} 12x + 3y = -9 \\ 4x + y = 7 \end{cases}$ **no solution**

Without graphing, classify each system as *independent*, *dependent*, or *inconsistent*.

12. $\begin{cases} 6x + 3y = 12 \\ y = -2x + 4 \end{cases}$ **13.** $\begin{cases} y = -x + 5 \\ x - y = -3 \end{cases}$ **14.** $\begin{cases} x + 2y = 2 \\ y = -0.5x - 2 \end{cases}$

12. consistent and dependent
13. consistent and independent
14. inconsistent

15. Banking Suppose a bank charges a monthly rate of $10 for your checking account. You can switch to a different account that charges $6 plus $.20 per check. For what number of checks is the cost of the two accounts the same?
20 checks

TEKS ★ TAKS Resources

Student Edition
Extra Skills, Word Problems, Proof Practice, Ch. 1, p. 854
English/Spanish Glossary, p. 913
Properties and Formulas, p. 907
Table of Symbols, p. 903

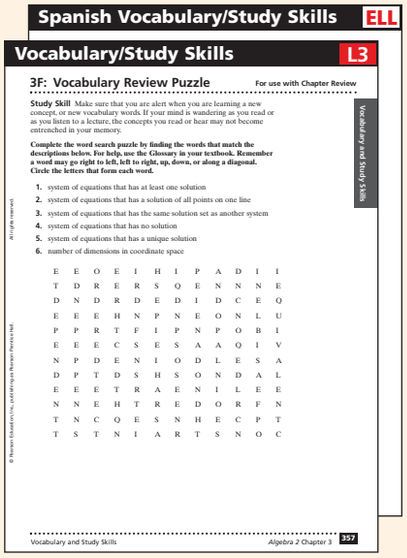
TAKS Tune-Up Kit
- TAKS Daily Review Transparencies
- TAKS Review and Preparation Workbook
- TAKS Strategies with Transparencies
- Texas Progress Monitoring
- Texas ExamView CD-ROM

Differentiated Instruction

Vocabulary and Study Skills worksheet 3F
Spanish Vocabulary and Study Skills worksheet 3F
Texas Interactive Textbook Audio Glossary
Online Vocabulary Quiz

Success Tracker™ Online at PHSchool.com

Exercises 6–11 Alternative Method
Have students make tables for values of x from −5 to 5. Have them determine the solutions from the tables or explain how they can tell that there are no solutions.

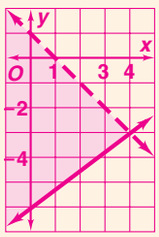

Spanish Vocabulary/Study Skills ELL
Vocabulary/Study Skills L3
3F: Vocabulary Review Puzzle
For use with Chapter Review

Exercises 23–25 Inequalities

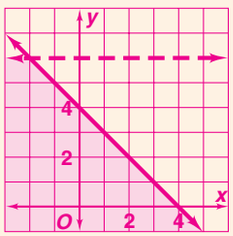
Exercise 23 Have students use algebraic methods to solve $\frac{3}{4}x - 6 < -x + 1$ and relate this to the solution of the system of inequalities.

Exercises 23–25 Have students use the TABLE feature on their graphing calculators to find the point of intersection of the related equations. Using this point in the given inequalities can serve as a check on their work.

23.



24.



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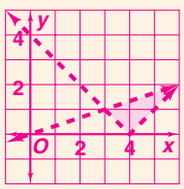
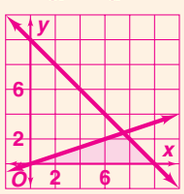
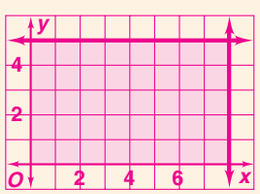


26. Let r = number of gallons of regular coffee, and d = number of gallons of decaffeinated coffee.
$r + d \leq 10$
$3r \geq d$



27.



vertices: (0, 0), (8, 0), (8, 5), (0, 5)
c = 0 at (0, 0)

Lesson 3-2

(2A.3)(A) To analyze situations and formulate systems of linear equations in two unknowns to solve problems

(2A.3)(B) To solve systems of linear equations using algebraic methods

Supports (A.8)(A), (A.8)(B)
TAKS Obj. 4

If you can easily solve one equation in a system of two equations for one of the variables, you can substitute that expression in the other equation. Then you can find the value of the other variable.

Otherwise, you can multiply one or both equations by a nonzero quantity to create two terms that are additive inverses. This creates an **equivalent system** of equations. Adding the two equations then eliminates one variable. Again, you can solve for the other variable.

In either case, you substitute the value of this second variable into either of the original equations to find the value of the first variable. Recall that some systems have an infinite number of solutions and some have no solutions.

Solve using substitution.

16. $\begin{cases} 3x + 5y = 10 \\ y = -4 \end{cases}$ **(10, −4)**

17. $\begin{cases} 4x + 3y = 12 \\ x = 5y - 20 \end{cases}$ **(0, 4)**

18. $\begin{cases} 8x + y = 17 \\ x + 4y = 37 \end{cases}$ **(1, 9)**

Solve using elimination.

19. $\begin{cases} 2x + y = 13 \\ x - y = -4 \end{cases}$ **(3, 7)**

20. $\begin{cases} 2x + 3y = 4 \\ 4x + 6y = 9 \end{cases}$ **no solution**

21. $\begin{cases} a + b = \frac{1}{3} \\ a - b = \frac{1}{4} \end{cases}$ $\left(\frac{7}{24}, \frac{1}{24}\right)$

22. Nutrition Roast beef has 25 g of protein and 11 g of calcium per serving. A serving of mashed potatoes has 2 g of protein and 25 g of calcium. How many servings of each are needed to supply exactly 29 g of protein and 61 g of calcium?
1 serving of roast beef and 2 servings of mashed potatoes

Lesson 3-3

(2A.3)(A) To analyze situations and formulate systems of inequalities in two unknowns to solve problems

(2A.3)(B) To use graphs or tables to solve systems of inequalities

The solution of a system of inequalities is represented on a graph by the region of overlap of the inequalities. To solve a system by graphing, first graph the boundaries for each inequality. Then shade the regions of the plane containing the solutions for both inequalities.

Solve each system by graphing. **23–25. See margin.**

23. $\begin{cases} y < -x + 1 \\ y \geq \frac{3}{4}x - 6 \end{cases}$

24. $\begin{cases} x + y \leq 4 \\ y < 6 \end{cases}$

25. $\begin{cases} y > |x - 4| \\ y < \frac{1}{3}x \end{cases}$

26. For a community breakfast there should be at least three times as much regular coffee as decaffeinated coffee. A total of ten gallons is sufficient for the breakfast. Model this situation with a system of inequalities. Graph to solve the system. **See margin.**

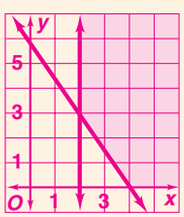
Lesson 3-4 Objectives

- To find maximum and minimum values.
- To solve problems with linear programming

Supports (2A.3)(A), (2A.3)(B)

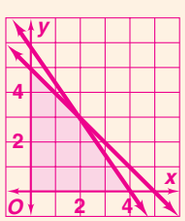
Linear programming is a technique used to find the maximum or minimum value of an **objective function**. Linear inequalities are **constraints** on the variables of the objective function. The solutions to the system of constraints are contained in the **feasible region**. The maximum or minimum value of the objective function occurs at a vertex of the feasible region.

28.



vertices: (4, 0) (2, 3)
c = 11 at (2, 3)

29.



vertices: (0, 0), (4, 0), (2, 3), (0, 5)
P = 25 at (0, 5)

Graph each system of constraints. Find all vertices. Then find the variable values that maximize or minimize the objective function. 27–29. See margin pp. 162–163.

27. $\begin{cases} x \le 8 \\ y \le 5 \\ x \ge 0,\ y \ge 0 \end{cases}$

Minimum for $C = x + 5y$

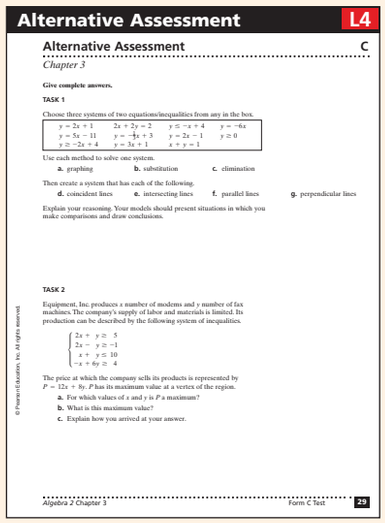
28. $\begin{cases} x \ge 2 \\ y \ge 0 \\ 3x + 2y \ge 12 \end{cases}$

Minimum for $C = 4x + y$

29. $\begin{cases} 3x + 2y \le 12 \\ x + y \le 5 \\ x \ge 0,\ y \ge 0 \end{cases}$

Maximum for $P = 3x + 5y$

30. Profit A lunch stand makes \$.75 profit on each chef's salad and \$1.20 profit on each Caesar salad. On a typical weekday, it sells between 40 and 60 chef's salads and between 35 and 50 Caesar salads. The total number sold has never exceeded 100 salads. How many of each type should be prepared in order to maximize profit? 50 of each type



Lesson 3-5 Objectives

- To graph points in three dimensions
- To graph equations in three dimensions

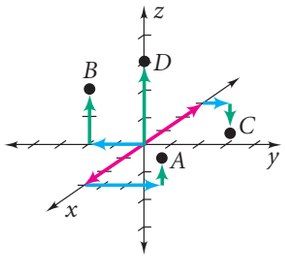
Prepares for (2A.3)(A)

You can plot **ordered triples** in **coordinate space.** To sketch a plane that is the graph of an equation in three variables, find the intercepts. To find the x-intercept, substitute 0 for y and z. Then find the other two intercepts. If the plane does not pass through the origin, connect the resulting intercepts on the three axes. These lines are called the **traces** of the plane. 31–35. See margin.

Graph each point in coordinate space.

31. $(0, 2, 0)$ **32.** $(1, 0, 0)$ **33.** $(0, 0, 3)$ **34.** $(2, 3, 0)$ **35.** $(1, 0, 4)$

Find the coordinates of each point in the diagram at the right.



36. A (3, 3, 1)

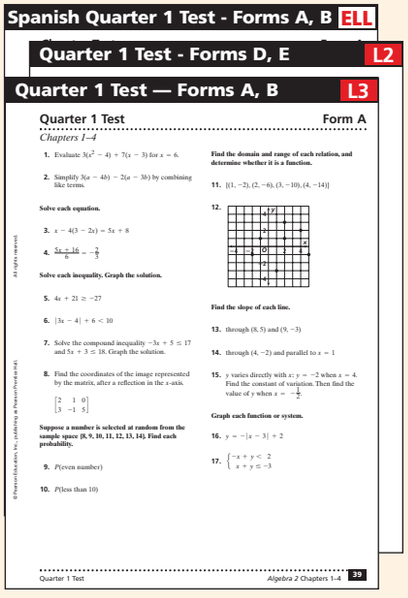
37. B (0, −2, 2)

38. C (−3, 1, −1)

39. D (0, 0, 3)

Sketch the graph of each equation. 40–42. See back of book.

40. $x - 2y + z = 4$ **41.** $10x - 4y - 5z = 20$ **42.** $2x + 6y + 3z = 18$



Lesson 3-6

(2A.3)(A) To analyze situations and formulate systems of equations in two or more unknowns to solve problems

(2A.3)(B) To use algebraic methods to solve systems of equations

You can solve systems of three equations in three variables using the technique of substitution you learned in Lesson 3-2.

Elimination with three equations in three variables involves pairing the equations. Use one equation twice. Then eliminate the same variable in both pairs. The result is a system of two equations in two variables. Proceed using the methods you learned in Lesson 3-2.

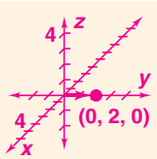
Solve each system.

43. $\begin{cases} x + y + z = 10 \\ 2x - y + z = 2 \\ -x + 2y - z = 5 \end{cases}$ (2, 5, 3)

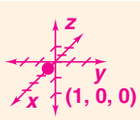
44. $\begin{cases} x + 2y + z = 14 \\ y = z + 1 \\ x = -3z + 6 \end{cases}$ no solution

45. $\begin{cases} 3x + y - 2z = 22 \\ x + 5y + z = 4 \\ x = -3z \end{cases}$ (6, 0, −2)

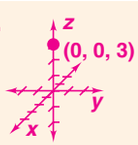
31.



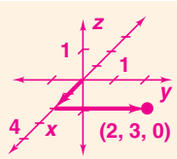
32.



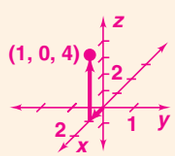
33.



34.



35.



Chapter 4

Chapter Review

Vocabulary Review

augmented matrix (p. 226)
center of rotation (p. 198)
coefficient matrix (p. 218)
constant matrix (p. 218)
Cramer's Rule (p. 225)
determinant (p. 204)
dilation (p. 196)
equal matrices (p. 181)
image (p. 196)
matrix (p. 172)
matrix addition (p. 178)
matrix element (p. 173)
matrix equation (p. 180)
matrix multiplication (p. 188)
multiplicative identity matrix (p. 203)
multiplicative inverse matrix (p. 203)
preimage (p. 196)
rotation (p. 198)
row operations (p. 227)
scalar (p. 186)
scalar multiplication (p. 186)
square matrix (p. 203)
variable matrix (p. 218)
zero matrix (p. 179)

Choose the correct vocabulary term to complete each sentence.

1. A ? is a rectangular array of numbers. **matrix**
2. Translations, dilations, reflections, and rotations are all ? . **transformations**
3. Cramer's Rule uses ? to solve a system of equations. **determinants**
4. If corresponding elements of matrices are equal, the matrices are ? . **equal matrices**
5. The additive identity of a matrix is the ? . **zero matrix**
6. A ? consists of a coefficient matrix, a variable matrix, and a constant matrix. **matrix equation**
7. An $n \times n$ matrix is called a ? . **square matrix**
8. The image of a figure is a transformation of the ? . **preimage**
9. The product of a real number and a matrix is called a ? . **scalar product**
10. A matrix is the inverse of another matrix if their product is the ? . **multiplicative identity matrix**

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TEKS ★ TAKS Skills and Concepts

Lesson 4-1 Objectives

- To identify matrices and their elements
- To organize data into matrices

It is often useful to organize data into matrices. A **matrix** is a rectangular array of numbers classified by its dimensions. An $m \times n$ matrix has m rows and n columns. A **matrix element** a_{ij} is in the ith row and jth column of matrix A.

State the dimensions of each matrix A. Identify the indicated element.

11. $\begin{bmatrix} 5 & 8 & -7 \\ 1 & 11 & 3 \end{bmatrix}; a_{13}$ **2 × 3; −7**

12. $\begin{bmatrix} 3 & 1 \\ -5 & 0 \\ 7 & 6 \end{bmatrix}; a_{21}$ **3 × 2; −5**

13. $\begin{bmatrix} 5 & 1 & -2 \\ 4 & -7 & 12 \\ 0 & 78 & 3 \end{bmatrix}; a_{32}$ **3 × 3; 78**

Use the matrix at the right for Exercises 14–16.

	1-pt Shots	2-pt Shots	3-pt Shots
Tamika	22	30	48
Johanna	21	31	48
Tran	21	29	50

14. How many points has Tamika scored? **226**

15. How many three-point shots has Tran made? **50**

16. What percent of Johanna's points were from one-point shots? **about 9%**

TEKS ★ TAKS Resources

Student Edition
Extra Skills, Word Problems, Proof Practice, Ch. 4, p. 856
English/Spanish Glossary, p. 913
Properties and Formulas, p. 907
Table of Symbols, p. 903

TAKS Tune-Up Kit
- TAKS Daily Review Transparencies
- TAKS Review and Preparation Workbook
- TAKS Strategies with Transparencies
- Texas Progress Monitoring
- Texas ExamView CD-ROM

Differentiated Instruction
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Spanish Vocabulary and Study Skills worksheet 4F
Texas Interactive Textbook Audio Glossary
Online Vocabulary Quiz

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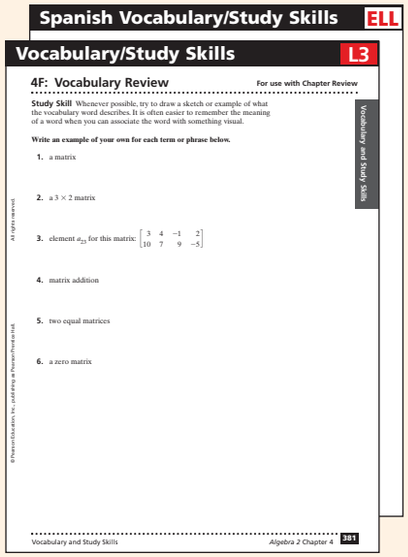


23. $\begin{bmatrix} 18 & 3 & 0 & 24 \\ -12 & 9 & 21 & 33 \end{bmatrix}$

24. $\begin{bmatrix} -9 & 7 \\ -8 & -8 \end{bmatrix}$

25. does not exist

26. $\begin{bmatrix} -6 & 10 & 21 & 41 \\ -28 & 10 & 28 & 28 \end{bmatrix}$

27. $\begin{bmatrix} -14 & -2 \\ 43 & -7 \end{bmatrix}$

28. $\begin{bmatrix} 4 & -1 & 2 \\ -1 & -2 & 3 \end{bmatrix}$

29. $\begin{bmatrix} 0 & -5 & -2 \\ 5 & 4 & 9 \end{bmatrix}$

30. $\begin{bmatrix} -3 & 2 & -1 \\ 1 & 0 & 5 \end{bmatrix}$

31. $\begin{bmatrix} 1 & 0 & 5 \\ 3 & -2 & 1 \end{bmatrix}$

32. $\begin{bmatrix} 1 & 0 & 5 \\ -3 & 2 & -1 \end{bmatrix}$

33. $\begin{bmatrix} 1.5 & -1 & 0.5 \\ 0.5 & 0 & 2.5 \end{bmatrix}$

34. $\begin{bmatrix} 6 & -4 & 2 \\ 2 & 0 & 10 \end{bmatrix}$

35. $\begin{bmatrix} -1 & 0 & -5 \\ 3 & -2 & 1 \end{bmatrix}$

Lessons 4-2 and 4-3 Objectives

- To organize data into matrices
- To add and subtract matrices
- To multiply a matrix by a scalar
- To multiply two matrices

Prepares for (2A.3)(B) To use matrices to solve systems of equations

To perform **matrix addition** or subtraction, add or subtract the corresponding elements in the matrices. To obtain the product of a matrix and a **scalar,** multiply each matrix element by the scalar. **Matrix multiplication** uses both multiplication and addition. The element in the *i*th row and *j*th column of the product of two matrices is the sum of the products of each element of the *i*th row of the first matrix and the corresponding element of the *j*th column of the second matrix. The first matrix must have the same number of columns as the second has rows.

Two matrices are **equal matrices** when they have the same dimensions and corresponding elements are equal. This principle is used to solve a **matrix equation.**

Solve each matrix equation for matrix *X*.

17. $[2 \quad -6 \quad 8] + [-1 \quad -2 \quad 4] = X$ $[1 \quad -8 \quad 12]$

18. $\begin{bmatrix} t \\ 6 \end{bmatrix} - \begin{bmatrix} 1 \\ 3 \end{bmatrix} = X$ $\begin{bmatrix} t-1 \\ 3 \end{bmatrix}$

19. $\begin{bmatrix} 7 & -1 \\ 0 & 8 \end{bmatrix} + X = \begin{bmatrix} 4 & 9 \\ -3 & 11 \end{bmatrix}$ $\begin{bmatrix} -3 & 10 \\ -3 & 3 \end{bmatrix}$

20. $X - \begin{bmatrix} -7 & 13 & 5 \\ 31 & 0 & -4 \end{bmatrix} = \begin{bmatrix} 9 & -5 & 8 \\ 2 & 0 & -3 \end{bmatrix}$ $\begin{bmatrix} 2 & 8 & 13 \\ 33 & 0 & -7 \end{bmatrix}$

Solve for each variable.

21. $\begin{bmatrix} x-5 & 9 \\ 4 & t+2 \end{bmatrix} = \begin{bmatrix} -7 & w+1 \\ 8-r & 1 \end{bmatrix}$ $x = -2, w = 8, r = 4, t = -1$

22. $\begin{bmatrix} -4+t & 2y \\ r & w+4 \end{bmatrix} = \begin{bmatrix} 2t & 11 \\ -2r+12 & 9 \end{bmatrix}$ $t = -4, y = \frac{11}{2}, r = 4, w = 5$

Use matrices *A*, *B*, *C*, and *D*. Find each scalar product, sum, or difference, if possible. If an operation is not defined, label it *undefined.* 23–27. See margin.

$A = \begin{bmatrix} 6 & 1 & 0 & 8 \\ -4 & 3 & 7 & 11 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 3 \\ -2 & 4 \end{bmatrix} \quad C = \begin{bmatrix} -2 & 1 \\ 4 & 0 \\ 2 & 2 \\ 1 & 1 \end{bmatrix} \quad D = \begin{bmatrix} 5 & -2 \\ 3 & 6 \end{bmatrix}$

23. $3A$ **24.** $B - 2D$ **25.** AB **26.** BA **27.** $AC - BD$

Lesson 4-4 Objectives

- To represent transformations with matrices
- To use properties of transformations and their compositions to make connections between mathematics and the real world

A change made to a figure is a transformation. The original figure is the **preimage,** and the transformed figure is the **image.** A translation slides a figure without changing its size or shape. A **dilation** changes the size of a figure. You can use matrix addition to translate a figure and scalar multiplication to dilate a figure.

You can use multiplication by the appropriate matrix to perform transformations that are specific reflections or **rotations.** For example, to reflect a figure in the *y*-axis, multiply by $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$. To rotate a figure 180°, multiply by $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$.

For Exercises 28–35, use $\triangle ABC$ with vertices $A(3, 1)$, $B(-2, 0)$, and $C(1, 5)$. Write the coordinates of each image in matrix form. 28–35. See margin.

28. a translation 1 unit right and 2 units down

29. a translation 3 units left and 4 units up

30. a reflection in the *y*-axis

31. a reflection in the line $y = x$

32. a rotation of 270°

33. a dilation half the original size

34. a dilation twice the original size

35. a rotation of 90°

Lessons 4-5, 4-6 and 4-7

(2A.3)(A) To analyze situations and formulate systems of equations in two or more unknowns to solve problems

(2A.3)(B) To use matrices to solve systems of equations

Supports (A.8)(A) TAKS Obj. 4

A **square matrix** with 1's along its main diagonal and 0's elsewhere is the **multiplicative identity matrix,** I. If A and X are square matrices such that $AX = I$, then X is the **multiplicative inverse matrix** of A, A^{-1}.

You can use formulas to evaluate the determinants of 2×2 and 3×3 matrices.

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc \qquad \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = a_1b_2c_3 + a_2b_3c_1 + a_3b_1c_2 - a_1b_3c_2 - a_2b_1c_3 - a_3b_2c_1$$

You can use a calculator to find the inverse of a matrix. The inverse of a 2×2 matrix can be found by using its determinant. $\begin{bmatrix} a & b \\ c & d \end{bmatrix}^{-1} = \frac{1}{ad - bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

You can use inverse matrices to solve some matrix equations.

You can also use inverse matrices to solve some systems of equations. When equations in a system are in standard form, the product of the **coefficient matrix** and the **variable matrix** equals the **constant matrix.** You solve the equation by multiplying both sides of the equation by the inverse of the coefficient matrix. If that inverse does not exist, the system does not have a unique solution.

Evaluate the determinant of each matrix, and find the inverse, if possible.
36–39. See margin.

36. $\begin{bmatrix} 6 & 1 \\ 0 & 4 \end{bmatrix}$ **37.** $\begin{bmatrix} 5 & -2 \\ 10 & -4 \end{bmatrix}$ **38.** $\begin{bmatrix} 10 & 1 \\ 8 & 5 \end{bmatrix}$ **39.** $\begin{bmatrix} 1 & 0 & 2 \\ -1 & 0 & 1 \\ -1 & -2 & 0 \end{bmatrix}$

Use an inverse matrix to solve each equation or system. 40–43. See margin.

40. $\begin{bmatrix} 3 & 5 \\ 6 & 2 \end{bmatrix}X = \begin{bmatrix} -2 & 6 \\ 4 & 12 \end{bmatrix}$ **41.** $\begin{cases} x - y = 3 \\ 2x - y = -1 \end{cases}$ **42.** $\begin{bmatrix} 4 & 1 \\ 2 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 10 \\ 6 \end{bmatrix}$

43. $\begin{bmatrix} -6 & 0 \\ 7 & 1 \end{bmatrix}X = \begin{bmatrix} -12 & -6 \\ 17 & 9 \end{bmatrix}$ **44.** $\begin{cases} x + 2y = 15 \\ 2x + 4y = 30 \end{cases}$ **45.** $\begin{cases} a + 2b + c = 14 \\ b = c + 1 \\ a = -3c + 6 \end{cases}$

no unique solution — no unique solution

46. Physical Fitness A club of 17 students is going on a canoe trip. The group of people on the trip includes 5 chaperones, one for each canoe. Some canoes hold 5 people, while some hold 4 people. How many of each kind of canoe should the group rent? **3 small canoes, 2 large canoes**

Lesson 4-8

(2A.3)(A) To analyze situations and formulate systems of equations in two or more unknowns to solve problems

(2A.3)(B) To use matrices to solve systems of equations

Supports (A.8)(A) TAKS Obj. 4

Cramer's Rule for solving systems of equations uses determinants to solve for each variable. D is the determinant of the coefficient matrix. D_y is the determinant formed by replacing the coefficients of y in D with the constant terms.

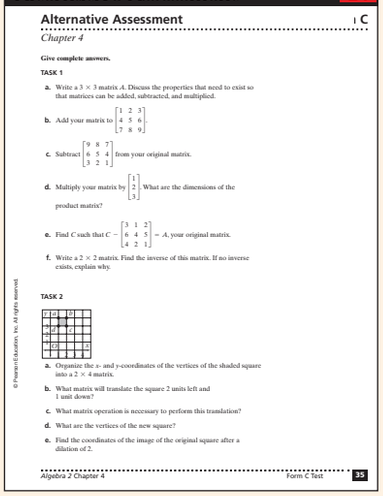
You can also use **row operations** on an augmented matrix to solve a system.

Solve each system using Cramer's Rule. Check your answers by solving each system using an augmented matrix.

47. $\begin{cases} 2x - y = 15 \\ x + 3y = -17 \end{cases}$
(4, −7)

48. $\begin{cases} 3r + s - 2t = 22 \\ r + 5s + t = 4 \\ r = -3t \end{cases}$
(6, 0, −2)

Alternative Assessment L4



Alternative Assessment
Chapter 4
Give complete answers.
TASK 1
a. Write a 3 × 3 matrix A. Discuss the properties that need to exist so that matrices can be added, subtracted, and multiplied.
b. Add your matrix to $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$.
c. Subtract $\begin{bmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{bmatrix}$ from your original matrix.
d. Multiply your matrix by $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$. What are the dimensions of the product matrix?
e. Find C such that $C - \begin{bmatrix} 3 & 1 & 2 \\ 6 & 4 & 5 \\ 4 & 2 & 1 \end{bmatrix} = A$, your original matrix.
f. Write a 2 × 2 matrix. Find the inverse of this matrix. If no inverse exists, explain why.
TASK 2
a. Organize the x- and y-coordinates of the vertices of the shaded square into a 2 × 4 matrix.
b. What matrix will translate the square 2 units left and 1 unit down?
c. What matrix operation is necessary to perform this translation?
d. What are the vertices of the new square?
e. Find the coordinates of the image of the original square after a dilation of 2.
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Algebra 2 Chapter 4 Form C Test 35

Exercise 47 Inequalities
Have students describe what information matrices give them in solving the system of inequalities, $2x - y \geq 15$ and $x + 3y \leq -17$.

36. 24; $\begin{bmatrix} \frac{1}{6} & -\frac{1}{24} \\ 0 & \frac{1}{4} \end{bmatrix}$

37. 0; does not exist

38. 42; $\begin{bmatrix} \frac{5}{42} & -\frac{1}{42} \\ -\frac{4}{21} & \frac{5}{21} \end{bmatrix}$

39. 6; $\begin{bmatrix} \frac{1}{3} & -\frac{2}{3} & 0 \\ -\frac{1}{6} & \frac{1}{3} & -\frac{1}{2} \\ \frac{1}{3} & \frac{1}{3} & 0 \end{bmatrix}$

40. $\begin{bmatrix} 1 & 2 \\ -1 & 0 \end{bmatrix}$

41. (−4, −7)

42. $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$

43. $\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$

Chapter Review

Vocabulary Review

- **absolute value of a complex number** (p. 279)
- **axis of symmetry** (p. 243)
- **completing the square** (p. 286)
- **complex number** (p. 279)
- **complex number plane** (p. 279)
- **difference of two squares** (p. 267)
- **discriminant** (p. 295)
- **factoring** (p. 263)
- **greatest common factor (GCF) of an expression** (p. 263)
- ***i*** (p. 278)
- **imaginary number** (p. 278)
- **parabola** (p. 243)
- **perfect square trinomial** (p. 266)
- **Quadratic Formula** (p. 293)
- **quadratic function** (p. 242)
- **standard form of a quadratic equation** (p. 271)
- **standard form of a quadratic function** (p. 242)
- **vertex form of a quadratic function** (p. 256)
- **vertex of a parabola** (p. 243)
- **zero of a function** (p. 272)
- **Zero Product Property** (p. 271)

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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

Skills and Concepts

Lesson 5-1

(2A.1)(B) To fit the graph of a function to data and proceed to model, predict, and make decisions and critical judgments

(2A.5)(C) To identify symmetries from graphs of parabolas

(2A.6)(B) To relate representations of quadratic functions, such as algebraic, tabular, graphical, and verbal descriptions

(2A.8)(A) To analyze situations involving quadratic functions and formulate quadratic equations to solve problems

Supports (A.2)(D) TAKS Obj. 2

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.**

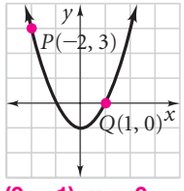
The **axis of symmetry** is a line that divides a parabola into two mirror images. The **vertex of a parabola** is the point at the intersection of the parabola and its axis of symmetry. Corresponding points on the parabola are the same distance from the axis of symmetry.

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.

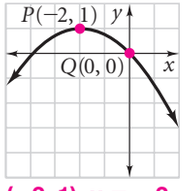
Determine whether each function is linear or quadratic. Identify the quadratic, linear, and constant terms.

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

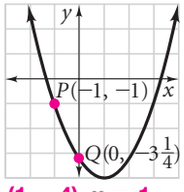
Identify the vertex, the axis of symmetry, and the points corresponding to P and Q.

9. 

(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 $\left(2, -3\frac{1}{4}\right)$

TEKS ★ TAKS Resources

Student Edition
Extra Skills and Word Problems Practice, Ch. 5, p. 858
English/Spanish Glossary, p. 913
Properties and Formulas, p. 907
Table of Symbols, p. 903

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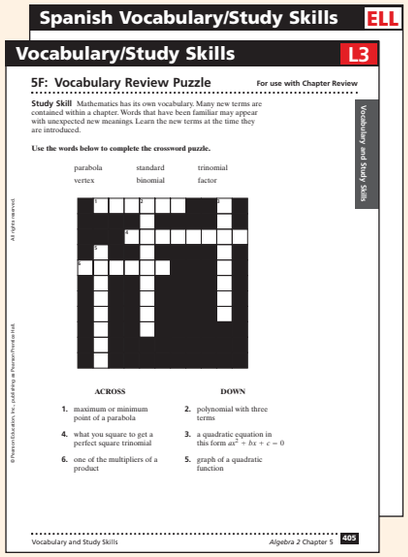

Spanish Vocabulary/Study Skills ELL
Vocabulary/Study Skills L3
5F: Vocabulary Review Puzzle
For use with Chapter Review
Study Skill Mathematics has its own vocabulary. Many new terms are contained within a chapter. Words that have been familiar may appear with unexpected new meanings. Learn the new terms at the time they are introduced.
Use the words below to complete the crossword puzzle.
parabola standard trinomial
vertex binomial factor
ACROSS
1. maximum or minimum point of a parabola
4. what you square to get a perfect square trinomial
6. one of the multipliers of a product
DOWN
2. polynomial with three terms
3. a quadratic equation in this form $ax^2 + bx + c = 0$
5. graph of a quadratic function
Vocabulary and Study Skills
Algebra 2 Chapter 5 405

Exercises 24–26 Alternative Method Have students solve these equations using tables and by using factoring techniques. Ask students which method they prefer.

Exercise 28 Have students choose tables, graphs, or algebraic methods to solve the inequality $2x^2 - 6x - 8 > 0$. $x < -1$ or $x > 4$

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

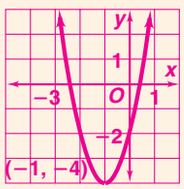
b. around 1999

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

d. around 2007

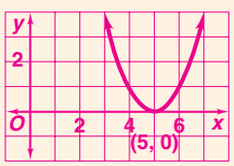
e. ≈13,000,000

13.



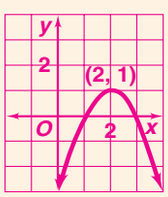
vertex $(-1, -4)$, y-intercept: -2; $x = -1$

14.



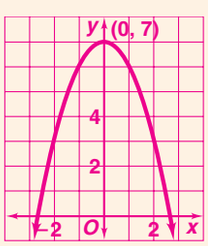
vertex $(5, 0)$, y-intercept: 25; $x = 5$

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

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

Lessons 5-2 and 5-3

(2A.1)(A) To identify the mathematical ranges of functions and determine reasonable domain and range values for continuous situations

(2A.4)(A) To identify and sketch the graph of the parent function $f(x) = x^2$

(2A.4)(B) To extend parent functions with parameters and describe the effects of the parameter changes on the graph of the parent functions

Supports (A.2)(A), (A.2)(B) TAKS Obj. 2

Supports (A.9)(B), (A.9)(C) TAKS Obj. 5

Also supports (2A.5)(C), (2A.6)(B), (2A.6)(C), (2A.7)(A), (2A.7)(B), (2A.8)(A)

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.** $y = -x^2 + 7$

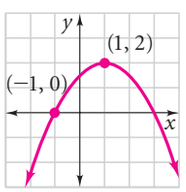
13–23. See margin.

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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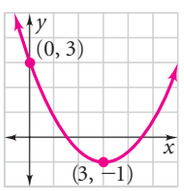

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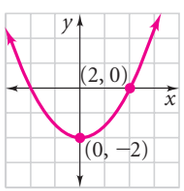


Lessons 5-4 and 5-5

(2A.2)(A) To use factoring to simplify expressions

(2A.8)(A) To analyze situations involving quadratic functions and formulate quadratic equations to solve problems

(2A.8)(C) To compare and translate between algebraic and graphical solutions of quadratic equations

(2A.8)(D) To solve quadratic equations using graphs, tables, and algebraic methods

Supports (A.4)(A) TAKS Obj. 2

Supports (A.10)(A), (A.10)(B) TAKS Obj. 5

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.** $3x^2 + 4x - 10 = 0$

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

Lesson 5-6 Objectives

- To identify and graph complex numbers
- To add, subtract, and multiply complex numbers

Supports (2A.2)(B) To use complex numbers to describe the solutions of quadratic equations

An **imaginary number** has the form $a + bi$, where $b \neq 0$. The imaginary number 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. $2\sqrt{-32} + 4$ $4 + 8i\sqrt{2}$ **44.** $|3 - i|$ $\sqrt{10}$ **45.** $|-2 + 3i|$ $\sqrt{13}$ **46.** $|4i|$ 4

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

Lessons 5-7 and 5-8

(2A.2)(B) To use complex numbers to describe the solutions of quadratic equations

(2A.5)(E) To use the method of completing the square

(2A.6)(A) To determine the reasonable domain and range values of quadratic functions

(2A.7)(A) To connect between the $y = ax^2 + bx + c$ and the $y = a(x - h)^2 + k$ symbolic representations of quadratic functions

(2A.8)(B) To analyze and interpret the solutions of quadratic equations using discriminants and solve quadratic equations using the quadratic formula

(2A.8)(D) To solve quadratic equations using algebraic methods

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.** $x^2 - 2x + 4 = 0$

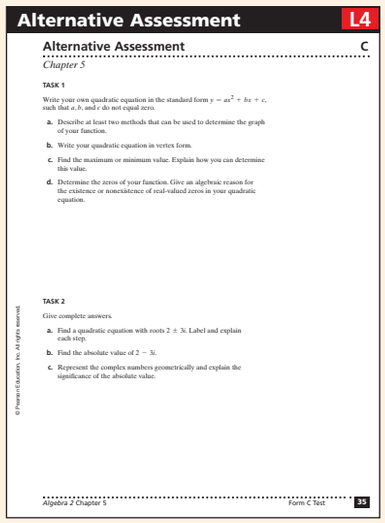
64. $-x^2 + x - 7 = 0$ **65.** $2x^2 + 3x = 8$ **66.** $4x^2 - x - 3 = 0$

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

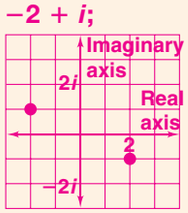
35. $-3, 3$

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

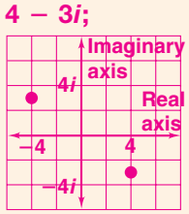
37. $-\frac{3}{2}, -\frac{1}{2}$

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

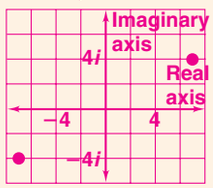
51. $-2 + i$;



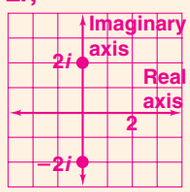
52. $4 - 3i$;



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; $3 + \sqrt{5}$, $3 - \sqrt{5}$