Greetings 2023 Honors Pre-Calculus Students,

To help ensure your success in this rigorous Honors Pre-Calculus mathematics course, please complete the **mandatory** Summer work and preliminary preparations by the first day of class.
If you have any questions, please email me at adavis@favikings.org

You will be enrolled into Google Classroom

Mandatory Honors Pre-Calculus Summer Work, due 8/7/2023. There will be a test covering this material.

GroundWork

MathXL for School

1. Registering for MathXL for School
   Before you begin, make sure you have:
   (a) Your school email address
   (b) The Temporary Access Code (one word, do NOT type the dashes)
   HSMXLT-GIGLI-BAUTH-SKEAN-LOBBY-TOTES
   (c) Your **Course ID** is XL0C-61KJ-3023-6543

2. To Register, go to www.MathXLforSchool.com and click the Student button under Register.
   Then, follow the instructions on the screen. Create your username & password

   Username: _____

   Password: _____

3. Enrolling in the 2023 Honors PreCalculus course:
   After registering, go to MathXLforSchool.com and log in with your username and password.

   Enter the Course ID: **XL0C-61KJ-3023-6543**

   After enrolling in your course, you are ready to start working in MathXL for School

4. For additional help with MathXL for School, refer to these resources
   a. Download a step-by-step visual walkthrough on registering and enrolling: http://www.mathxlforschool.com/support/marketing/student-visual-walkthrough
   b. Get additional help: http://www.mathxlforschool.com/support/marketing/getting-started-students/

Your summer work is assigned in MathXL which is also listed on the following pages. You may work any additional exercises.

The Sections and Exercise numbers are listed below.

1. Read Chapter **P.1** Real Numbers (on Google Classroom)
   Complete **P.1** Homework (20 Questions): P.1 # 1, 3, 5, 7, 11, 13, 17, 19, 21, 25, 27, 31, 32, 33, 37, 39, 43, 47, 49, 51
   Available Videos: Plotting an inequality example Intro to Rational Exponents, & continue,
2. Read Section **A.1** Radicals & Rational Exponents (on Google Classroom)
   Complete **A.1** Homework (18 Questions): A.1 # 1, 7, 9, 14, 15, 28, 30, 34, 37, 40, 43, 50, 53, 55, 58, 63, 72, 84
3. Read Chapter **P.2** Cartesian Coordinate System (on Google Classroom)
   Complete **P.2** Homework (13 Questions): P.2 # 1, 3, 6, 7, 11, 13, 25, 27, 41, 43, 45, 47, 49
   Available Videos: P.2 Absolute Value, etc, Distance Formula Equation of a Circle
4. Read **P.3** Linear Equations & Inequalities (on Google Classroom)
   Complete **P.3** Homework (11 Questions): P.3 # 1, 5, 13, 17, 19, 21, 32, 33, 35, 39, 45
   Available Videos: P.3 Book Video Solving equations in terms of a variable
   Multi-step equations with distribution Linear Equations 1"
   Solving Linear inequalities Compound inequalities examples
5. Read **P.4** Lines in Planes (on Google Classroom)
   Complete **P.4** Homework (9 Questions): P.4 # 3, 7, 13, 15, 21, 26, 27, 41, 45
   Available Videos: P.4 Book Video Slope from a Graph
   Slope from 2 Points Slope from an Equation
6. Read **A.2** Polynomials & Factoring (on Google Classroom)
   Complete A.2 Homework (20 Questions): A.2 # 10, 15, 19, 21, 25, 31, 39, 41, 45, 51, 53, 56, 59, 64, 66, 69, 73, 78, 86, 89
   Available Videos: Perfect square Factorization, and continue
   Difference of squares Intro and continue Factoring differences of squares
   Intro to factor by Grouping, and continue Factoring polynomials using quadratic methods

A good site for most algebra topics: http://www.purplemath.com/modules/index.htm

Trigonometry: https://www.khanacademy.org/math/trigonometry

Have a Great Summer,

A. Davis, Ph.D.

QUICK REVIEW P.1

1. List the positive integers between −3 and 7.
2. List the integers between −3 and 7.
3. List all negative integers greater than −4.
4. List all positive integers less than 5.

In Exercises 5 and 6, use a calculator to evaluate the expression. Round the value to two decimal places.

5. (a) $4(-3.1)^3 - (-4.2)^5$ (b) $\dfrac{2(-5.5) - 6}{7.4 - 3.8}$
6. (a) $5[3(-1.1)^2 - 4(-0.5)^3]$ (b) $5^{-2} + 2^{-4}$

In Exercises 7 and 8, evaluate the algebraic expression for the given values of the variables.

7. $x^3 - 2x + 1, x = -2, 1.5$
8. $a^2 + ab + b^2, a = -3, b = 2$

In Exercises 9 and 10, list the possible remainders.

9. When the positive integer n is divided by 7
10. When the positive integer n is divided by 13

SECTION P.1 EXERCISES

Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

In Exercises 1–4, find the decimal form for the rational number. State whether it repeats or terminates.

1. $-37/8$ **2.** $15/99$

3. $-13/6$ **4.** $5/37$

In Exercises 5–10, describe and graph the interval of real numbers.

5. $x \le 2$ **6.** $-2 \le x < 5$

7. $(-\infty, 7)$ **8.** $[-3, 3]$

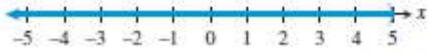
9. x is negative.

10. x is greater than or equal to 2 and less than or equal to 6.

In Exercises 11–16, use an inequality to describe the interval of real numbers.

11. $[-1, 1)$ **12.** $(-\infty, 4]$

13.



14.

15. x is between -1 and 2.

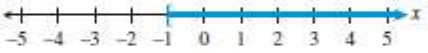
16. x is greater than or equal to 5.

In Exercises 17–22, use interval notation to describe the interval of real numbers.

17. $x > -3$ **18.** $-7 < x < -2$

19.

20.



21. x is greater than -3 and less than or equal to 4.

22. x is positive.

In Exercises 23–28, use words to describe the interval of real numbers.

23. $4 < x \le 9$ **24.** $x \ge -1$

25. $[-3, \infty)$ **26.** $(-5, 7)$

27.

28.

In Exercises 29–32, convert to inequality notation. Find the endpoints and state whether the interval is bounded or unbounded and its type.

29. $(-3, 4]$ **30.** $(-3, -1)$

31. $(-\infty, 5)$ **32.** $[-6, \infty)$

In Exercises 33–36, use both inequality and interval notation to describe the set of numbers. State the meaning of any variables you use.

33. Writing to Learn Bill is at least 29 years old.

34. Writing to Learn No item at Sarah's Variety Store costs more than $2.00.

35. Writing to Learn The price of a gallon of gasoline varies from $1.099 to $1.399.

36. Writing to Learn Salary raises at the State University of California at Chico will average between 2% and 6.5%.

In Exercises 37–40, use the distributive property to write the factored form or the expanded form of the given expression.

37. $a(x^2 + b)$ **38.** $(y - z^3)c$

39. $ax^2 + dx^2$ **40.** $a^3z + a^3w$

In Exercises 41 and 42, find the additive inverse of the number.

41. $6 - \pi$ **42.** -7

In Exercises 43 and 44, identify the base of the exponential expression.

43. -5^2 **44.** $(-2)^7$

45. Group Activity Discuss which algebraic property or properties are illustrated by the equation. Try to reach a consensus.

(a) $(3x)y = 3(xy)$ **(b)** $a^2b = ba^2$

(c) $a^2b + (-a^2b) = 0$ **(d)** $(x + 3)^2 + 0 = (x + 3)^2$

(e) $a(x + y) = ax + ay$

46. Group Activity Discuss which algebraic property or properties are illustrated by the equation. Try to reach a consensus.

(a) $(x + 2)\dfrac{1}{x + 2} = 1$ **(b)** $1 \cdot (x + y) = x + y$

(c) $2(x - y) = 2x - 2y$

(d) $2x + (y - z) = 2x + (y + (-z)) = (2x + y) + (-z) = (2x + y) - z$

(e) $\dfrac{1}{a}(ab) = \left(\dfrac{1}{a}a\right)b = 1 \cdot b = b$

In Exercises 47–52, simplify the expression. Assume that the variables in the denominators are nonzero.

47. $\dfrac{x^4y^3}{x^2y^5}$ **48.** $\dfrac{(3x^2)^2y^4}{3y^2}$

49. $\left(\dfrac{4}{x^2}\right)^2$ **50.** $\left(\dfrac{2}{xy}\right)^{-3}$

51. $\dfrac{(x^{-3}y^2)^{-4}}{(y^6x^{-4})^{-2}}$ **52.** $\left(\dfrac{4a^3b}{a^2b^3}\right)\left(\dfrac{3b^2}{2a^2b^4}\right)$

The data in Table P.1 give the expenditures in millions of dollars for U.S. public schools for the 2005–2006 school year.

Table P.1 U.S. Public Schools

Category	Amount (in millions)
Current expenditures	449,595
Capital outlay	57,375
Interest on school debt	14,347
Total	528,735

Source: National Center for Education Statistics, U.S. Department of Education, as reported in The World Almanac and Book of Facts 2009.

In Exercises 53–56, write the amount of expenditures in dollars obtained from the category in scientific notation.

53. Current expenditures

54. Capital outlay

55. Interest on school debt

56. Total

In Exercises 57 and 58, write the number in scientific notation.

57. The mean distance from Jupiter to the Sun is about 483,900,000 miles.

58. The electric charge, in coulombs, of an electron is about $-0.000\,000\,000\,000\,000\,000\,16$.

In Exercises 59–62, write the number in decimal form.

59. 3.33×10^{-8} **60.** 6.73×10^{11}

61. The distance that light travels in 1 year (*one light year*) is about 5.87×10^{12} mi.

62. The mass of a neutron is about 1.6747×10^{-24} g.

In Exercises 63 and 64, use scientific notation to simplify.

63. $\dfrac{(1.3 \times 10^{-7})(2.4 \times 10^{8})}{1.3 \times 10^{9}}$ without using a calculator

64. $\dfrac{(3.7 \times 10^{-7})(4.3 \times 10^{6})}{2.5 \times 10^{7}}$

Explorations

65. Investigating Exponents For positive integers m and n, we can use the definition to show that $a^m a^n = a^{m+n}$.

(a) Examine the equation $a^m a^n = a^{m+n}$ for $n = 0$ and explain why it is reasonable to define $a^0 = 1$ for $a \neq 0$.

(b) Examine the equation $a^m a^n = a^{m+n}$ for $n = -m$ and explain why it is reasonable to define $a^{-m} = 1/a^m$ for $a \neq 0$.

APPENDIX A.1 EXERCISES

In Exercises 1–6, find the indicated real roots.

1. Square roots of 81
2. Fourth roots of 81
3. Cube roots of 64
4. Fifth roots of 243
5. Square roots of 16/9
6. Cube roots of $-27/8$

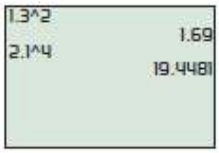
In Exercises 7–12, evaluate the expression without using a calculator.

7. $\sqrt{144}$
8. $\sqrt{-16}$
9. $\sqrt[3]{-216}$
10. $\sqrt[3]{216}$
11. $\sqrt[3]{-\frac{64}{27}}$
12. $\sqrt{\frac{64}{25}}$

In Exercises 13–22, use a calculator to evaluate the expression.

13. $\sqrt[4]{256}$
14. $\sqrt[5]{3125}$
15. $\sqrt[3]{15.625}$
16. $\sqrt{12.25}$
17. $81^{3/2}$
18. $16^{5/4}$
19. $32^{-2/5}$
20. $27^{-4/3}$
21. $\left(-\frac{1}{8}\right)^{-1/3}$
22. $\left(-\frac{125}{64}\right)^{-1/3}$

In Exercises 23–26, use the information from the grapher screens below to evaluate the expression.



23. $\sqrt{1.69}$
24. $\sqrt{19.4481}$
25. $\sqrt[4]{19.4481}$
26. $\sqrt[3]{3.375}$

In Exercises 27–36, simplify by removing factors from the radicand.

27. $\sqrt{288}$
28. $\sqrt[3]{500}$
29. $\sqrt[3]{-250}$
30. $\sqrt[4]{192}$
31. $\sqrt{2x^3y^4}$
32. $\sqrt[3]{-27x^3y^6}$
33. $\sqrt[4]{3x^8y^6}$
34. $\sqrt[3]{8x^6y^4}$
35. $\sqrt[5]{96x^{10}}$
36. $\sqrt{108x^4y^9}$

In Exercises 37–42, rationalize the denominator.

37. $\frac{4}{\sqrt[3]{2}}$
38. $\frac{1}{\sqrt{5}}$
39. $\frac{1}{\sqrt[5]{x^2}}$
40. $\frac{2}{\sqrt[4]{y}}$
41. $\sqrt[3]{\frac{x^2}{y}}$
42. $\sqrt[5]{\frac{a^3}{b^2}}$

In Exercises 43–46, convert to exponential form.

43. $\sqrt[3]{(a+2b)^2}$
44. $\sqrt[5]{x^2y^3}$
45. $2x\sqrt[3]{x^2y}$
46. $xy\sqrt[4]{xy^3}$

In Exercises 47–50, convert to radical form.

47. $a^{3/4}b^{1/4}$
48. $x^{2/3}y^{1/3}$
49. $x^{-5/3}$
50. $(xy)^{-3/4}$

In Exercises 51–56, write using a single radical.

51. $\sqrt{\sqrt{2x}}$
52. $\sqrt{\sqrt[3]{3x^2}}$
53. $\sqrt[4]{\sqrt{xy}}$
54. $\sqrt[3]{\sqrt{ab}}$
55. $\frac{\sqrt[5]{a^2}}{\sqrt[3]{a}}$
56. $\sqrt{a}\sqrt[3]{a^2}$

In Exercises 57–64, simplify the exponential expression.

57. $\frac{a^{3/5}a^{1/3}}{a^{3/2}}$
58. $(x^2y^4)^{1/2}$
59. $(a^{5/3}b^{3/4})(3a^{1/3}b^{5/4})$
60. $\left(\frac{x^{1/2}}{y^{2/3}}\right)^6$
61. $\left(\frac{-8x^6}{y^{-3}}\right)^{2/3}$
62. $\frac{(p^2q^4)^{1/2}}{(27q^3p^6)^{1/3}}$
63. $\frac{(x^9y^6)^{-1/3}}{(x^6y^2)^{-1/2}}$
64. $\left(\frac{2x^{1/2}}{y^{2/3}}\right)\left(\frac{3x^{-2/3}}{y^{1/2}}\right)$

In Exercises 65–74, simplify the radical expression.

65. $\sqrt{9x^{-6}y^4}$
66. $\sqrt{16y^8z^{-2}}$
67. $\sqrt[4]{\frac{3x^8y^2}{8x^2}}$
68. $\sqrt[5]{\frac{4x^6y}{9x^3}}$
69. $\sqrt[3]{\frac{4x^2}{y^2}}\cdot\sqrt[3]{\frac{2x^2}{y}}$
70. $\sqrt[5]{9ab^6}\cdot\sqrt[5]{27a^2b^{-1}}$
71. $3\sqrt{48}-2\sqrt{108}$
72. $2\sqrt{175}-4\sqrt{28}$
73. $\sqrt{x^3}-\sqrt{4xy^2}$
74. $\sqrt{18x^2y}+\sqrt{2y^3}$

In Exercises 75–82, replace ○ with $<$, $=$, or $>$ to make a true statement.

75. $\sqrt{2+6}\ \bigcirc\ \sqrt{2}+\sqrt{6}$
76. $\sqrt{4}+\sqrt{9}\ \bigcirc\ \sqrt{4+9}$
77. $(3^{-2})^{-1/2}\ \bigcirc\ 3$
78. $(2^{-3})^{1/3}\ \bigcirc\ 2$
79. $\sqrt[4]{(-2)^4}\ \bigcirc\ -2$
80. $\sqrt[3]{(-2)^3}\ \bigcirc\ -2$
81. $2^{2/3}\ \bigcirc\ 3^{3/4}$
82. $4^{-2/3}\ \bigcirc\ 3^{-3/4}$

83. The time t (in seconds) that it takes for a pendulum to complete one cycle is approximately $t = 1.1\sqrt{L}$, where L is the length (in feet) of the pendulum. How long is the period of a pendulum of length 10 ft?

84. The time t (in seconds) that it takes for a rock to fall a distance d (in meters) is approximately $t = 0.45\sqrt{d}$. How long does it take for the rock to fall a distance of 200 m?

85. **Writing to Learn** Explain why $\sqrt[n]{a}$ and a real nth root of a need not have the same value.

QUICK REVIEW P.2

In Exercises 1 and 2, plot the two numbers on a number line. Then find the distance between them.

1. $\sqrt{7}, \sqrt{2}$ **2.** $-\frac{5}{3}, -\frac{9}{5}$

In Exercises 3 and 4, plot the real numbers on a number line.

3. $-3, 4, 2.5, 0, -1.5$ **4.** $-\frac{5}{2}, -\frac{1}{2}, \frac{2}{3}, 0, -1$

In Exercises 5 and 6, plot the points.

5. $A(3, 5), B(-2, 4), C(3, 0), D(0, -3)$

6. $A(-3, -5), B(2, -4), C(0, 5), D(-4, 0)$

In Exercises 7–10, use a calculator to evaluate the expression. Round your answer to two decimal places.

7. $\frac{-17 + 28}{2}$ **8.** $\sqrt{13^2 + 17^2}$

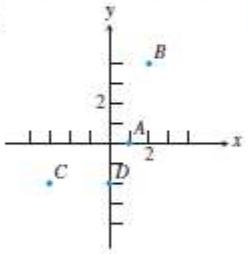
9. $\sqrt{6^2 + 8^2}$ **10.** $\sqrt{(17 - 3)^2 + (-4 - 8)^2}$

SECTION P.2 EXERCISES

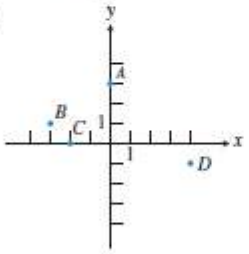
Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

In Exercises 1 and 2, estimate the coordinates of the points.

1.



2.



In Exercises 3 and 4, name the quadrants containing the points.

3. **(a)** $(2, 4)$ **(b)** $(0, 3)$ **(c)** $(-2, 3)$ **(d)** $(-1, -4)$

4. **(a)** $\left(\frac{1}{2}, \frac{3}{2}\right)$ **(b)** $(-2, 0)$ **(c)** $(-1, -2)$ **(d)** $\left(-\frac{3}{2}, -\frac{7}{3}\right)$

In Exercises 5–8, evaluate the expression.

5. $3 + |-3|$ **6.** $2 - |-2|$

7. $|(-2)3|$ **8.** $\frac{-2}{|-2|}$

In Exercises 9 and 10, rewrite the expression without using absolute value symbols.

9. $|\pi - 4|$ **10.** $|\sqrt{5} - 5/2|$

In Exercises 11–18, find the distance between the points.

11. $-9.3, 10.6$ **12.** $-5, -17$

13. $(-3, -1), (5, -1)$ **14.** $(-4, -3), (1, 1)$

15. $(0, 0), (3, 4)$ **16.** $(-1, 2), (2, -3)$

17. $(-2, 0), (5, 0)$ **18.** $(0, -8), (0, -1)$

In Exercises 19–22, find the area and perimeter of the figure determined by the points.

19. $(-5, 3), (0, -1), (4, 4)$

20. $(-2, -2), (-2, 2), (2, 2), (2, -2)$

21. $(-3, -1), (-1, 3), (7, 3), (5, -1)$

22. $(-2, 1), (-2, 6), (4, 6), (4, 1)$

In Exercises 23–28, find the midpoint of the line segment with the given endpoints.

23. $-9.3, 10.6$ **24.** $-5, -17$

25. $(-1, 3), (5, 9)$

26. $(3, \sqrt{2}), (6, 2)$

27. $(-7/3, 3/4), (5/3, -9/4)$

28. $(5, -2), (-1, -4)$

In Exercises 29–34, draw a scatter plot of the data given in the table.

29. U.S. Motor Vehicle Production The total number of motor vehicles in thousands (y) produced by the United States each year from 2001 to 2007 is given in the table. *(Source: Automotive News Data Center and R. L. Polk Marketing Systems as reported in The World Almanac and Book of Facts 2009.)*

x	2001	2002	2003	2004	2005	2006	2007
y	11,518	12,328	12,145	12,021	12,018	11,351	10,611

30. World Motor Vehicle Production The total number of motor vehicles in thousands (y) produced in the world each year from 2001 to 2007 is given in the table. *(Source: American Automobile Manufacturers Association as reported in The World Almanac and Book of Facts 2009.)*

x	2001	2002	2003	2004	2005	2006	2007
y	57,705	59,587	61,562	65,654	67,892	70,992	74,647

31. U.S. Imports from Mexico The total in billions of dollars of U.S. imports from Mexico from 2000 to 2007 is given in Table P.3.

Table P.3 U.S. Imports from Mexico

Year	U.S. Imports (billions of dollars)
2000	135.0
2001	131.3
2002	134.6
2003	138.1
2004	155.9
2005	170.1
2006	188.2
2007	210.7

Source: U.S. Census Bureau, The World Almanac and Book of Facts 2009.

32. U.S. Agricultural Exports The total in billions of dollars of U.S. agricultural exports from 2000 to 2007 is given in Table P.4.

Table P.4 U.S. Agricultural Exports

Year	U.S. Agricultural Exports (billions of dollars)
2000	51.2
2001	53.7
2002	53.1
2003	56.0
2004	62.4
2005	62.5
2006	68.7
2007	89.2

Source: U.S. Department of Agriculture, The World Almanac and Book of Facts 2009.

33. U.S. Agricultural Trade Surplus The total in billions of dollars of U.S. agricultural trade surplus from 2000 to 2007 is given in Table P.5.

Table P.5 U.S. Agricultural Trade Surplus

Year	U.S. Agricultural Trade Surplus (billions of dollars)
2000	12.2
2001	14.3
2002	11.2
2003	10.3
2004	9.7
2005	4.8
2006	4.7
2007	12.1

Source: U.S. Department of Agriculture, The World Almanac and Book of Facts 2009.

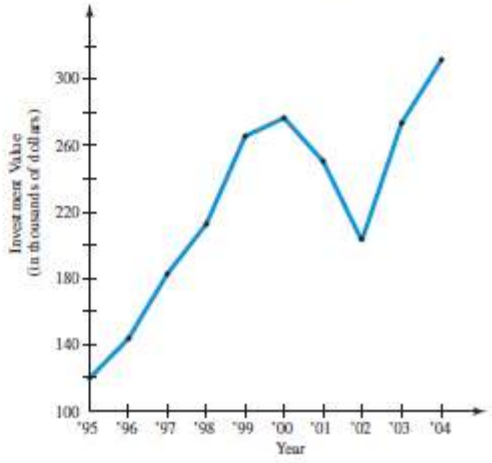
34. U.S. Exports to Canada The total in billions of dollars of U.S. exports to Canada from 2000 to 2007 is given in Table P.6.

Table P.6 U.S. Exports to Canada

Year	U.S. Exports (billions of dollars)
2000	178.9
2001	163.4
2002	160.9
2003	169.9
2004	189.9
2005	211.9
2006	230.6
2007	248.9

Source: U.S. Census Bureau, The World Almanac and Book of Facts 2009.

In Exercises 35 and 36, use the graph of the investment value of a $10,000 investment made in 1978 in Fundamental Investors™ of the American Funds™. The value as of January is shown for a few recent years in the graph below. *(Source: Annual report of Fundamental Investors for the year ending December 31, 2004.)*



35. Reading from Graphs Use the graph to estimate the value of the investment as of

(a) January 1997 and **(b)** January 2000.

36. Percent Increase Estimate the percent increase in the value of the $10,000 investment from

(a) January 1996 to January 1997.

(b) January 2000 to January 2001.

(c) January 1995 to January 2004.

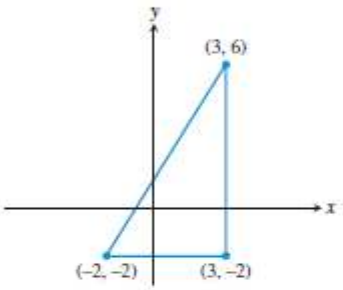
37. Prove that the figure determined by the points is an isosceles triangle: (1, 3), (4, 7), (8, 4)

38. Group Activity Prove that the diagonals of the figure determined by the points bisect each other.

(a) Square (−7, −1), (−2, 4), (3, −1), (−2, −6)

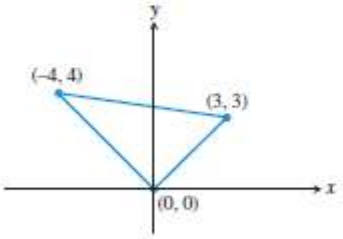
(b) Parallelogram (−2, −3), (0, 1), (6, 7), (4, 3)

39. (a) Find the lengths of the sides of the triangle in the figure.



(b) Writing to Learn Show that the triangle is a right triangle.

40. (a) Find the lengths of the sides of the triangle in the figure.



(b) Writing to Learn Show that the triangle is a right triangle.

In Exercises 41–44, find the standard form equation for the circle.

41. Center (1, 2), radius 5

42. Center (−3, 2), radius 1

43. Center (−1, −4), radius 3

44. Center (0, 0), radius $\sqrt{3}$

In Exercises 45–48, find the center and radius of the circle.

45. $(x - 3)^2 + (y - 1)^2 = 36$

46. $(x + 4)^2 + (y - 2)^2 = 121$

47. $x^2 + y^2 = 5$

48. $(x - 2)^2 + (y + 6)^2 = 25$

In Exercises 49–52, write the statement using absolute value notation.

49. The distance between x and 4 is 3.

50. The distance between y and −2 is greater than or equal to 4.

51. The distance between x and c is less than d units.

52. y is more than d units from c.

53. Determining a Line Segment with Given Midpoint Let (4, 4) be the midpoint of the line segment determined by the points (1, 2) and (a, b). Determine a and b.

54. Writing to Learn Isosceles but Not Equilateral Triangle Prove that the triangle determined by the points (3, 0), (−1, 2), and (5, 4) is isosceles but not equilateral.

55. Writing to Learn Equidistant Point from Vertices of a Right Triangle Prove that the midpoint of the hypotenuse of the right triangle with vertices (0, 0), (5, 0), and (0, 7) is equidistant from the three vertices.

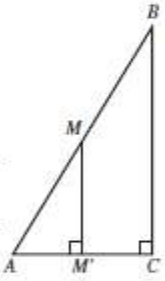
56. Writing to Learn Describe the set of real numbers that satisfy $|x - 2| < 3$.

57. Writing to Learn Describe the set of real numbers that satisfy $|x + 3| \geq 5$.

Standardized Test Questions

58. True or False If a is a real number, then $|a| \geq 0$. Justify your answer.

59. True or False Consider the right triangle ABC shown at the right. If M is the midpoint of the segment AB, then M' is the midpoint of the segment AC. Justify your answer.



In Exercises 60–63, solve these problems without using a calculator.

60. Multiple Choice Which of the following is equal to $|1 - \sqrt{3}|$?

(A) $1 - \sqrt{3}$ **(B)** $\sqrt{3} - 1$

(C) $(1 - \sqrt{3})^2$ **(D)** $\sqrt{2}$

(E) $\sqrt{1/3}$

61. Multiple Choice Which of the following is the midpoint of the line segment with endpoints −3 and 2?

(A) 5/2 **(B)** 1

(C) −1/2 **(D)** −1

(E) −5/2

QUICK REVIEW P.3

In Exercises 1 and 2, simplify the expression by combining like terms.

1. $2x + 5x + 7 + y - 3x + 4y + 2$
2. $4 + 2x - 3z + 5y - x + 2y - z - 2$

In Exercises 3 and 4, use the distributive property to expand the products. Simplify the resulting expression by combining like terms.

3. $3(2x - y) + 4(y - x) + x + y$
4. $5(2x + y - 1) + 4(y - 3x + 2) + 1$

In Exercises 5–10, use the LCD to combine the fractions. Simplify the resulting fraction.

5. $\frac{2}{y} + \frac{3}{y}$
6. $\frac{1}{y-1} + \frac{3}{y-2}$
7. $2 + \frac{1}{x}$
8. $\frac{1}{x} + \frac{1}{y} - x$
9. $\frac{x+4}{2} + \frac{3x-1}{5}$
10. $\frac{x}{3} + \frac{x}{4}$

SECTION P.3 EXERCISES

Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

In Exercises 1–4, find which values of x are solutions of the equation.

1. $2x^2 + 5x = 3$

   (a) $x = -3$ (b) $x = -\frac{1}{2}$ (c) $x = \frac{1}{2}$

2. $\frac{x}{2} + \frac{1}{6} = \frac{x}{3}$

   (a) $x = -1$ (b) $x = 0$ (c) $x = 1$

3. $\sqrt{1 - x^2} + 2 = 3$

   (a) $x = -2$ (b) $x = 0$ (c) $x = 2$

4. $(x - 2)^{1/3} = 2$

   (a) $x = -6$ (b) $x = 8$ (c) $x = 10$

In Exercises 5–10, determine whether the equation is linear in x.

5. $5 - 3x = 0$
6. $5 = 10/2$
7. $x + 3 = x - 5$
8. $x - 3 = x^2$
9. $2\sqrt{x} + 5 = 10$
10. $x + \frac{1}{x} = 1$

In Exercises 11–24, solve the equation without using a calculator.

11. $3x = 24$
12. $4x = -16$
13. $3t - 4 = 8$
14. $2t - 9 = 3$
15. $2x - 3 = 4x - 5$
16. $4 - 2x = 3x - 6$
17. $4 - 3y = 2(y + 4)$
18. $4(y - 2) = 5y$
19. $\frac{1}{2}x = \frac{7}{8}$
20. $\frac{2}{3}x = \frac{4}{5}$

21. $\frac{1}{2}x + \frac{1}{3} = 1$ **22.** $\frac{1}{3}x + \frac{1}{4} = 1$

23. $2(3 - 4z) - 5(2z + 3) = z - 17$

24. $3(5z - 3) - 4(2z + 1) = 5z - 2$

In Exercises 25–28, solve the equation. Support your answer with a calculator.

25. $\frac{2x - 3}{4} + 5 = 3x$ **26.** $2x - 4 = \frac{4x - 5}{3}$

27. $\frac{t + 5}{8} - \frac{t - 2}{2} = \frac{1}{3}$ **28.** $\frac{t - 1}{3} + \frac{t + 5}{4} = \frac{1}{2}$

29. Writing to Learn Write a statement about solutions of equations suggested by the computations in the figure.

(a)
```
-2→X
              -2
2X²+X-6
               0
```

(b)
```
3/2→X
             1.5
2X²+X-6
               0
```

30. Writing to Learn Write a statement about solutions of equations suggested by the computations in the figure.

(a)
```
2→X
               2
7X+5
              19
4X-7
               1
```

(b)
```
-4→X
              -4
7X+5
             -23
4X-7
             -23
```

In Exercises 31–34, find which values of x are solutions of the inequality.

31. $2x - 3 < 7$

(a) $x = 0$ (b) $x = 5$ (c) $x = 6$

32. $3x - 4 \geq 5$

(a) $x = 0$ (b) $x = 3$ (c) $x = 4$

33. $-1 < 4x - 1 \leq 11$

(a) $x = 0$ (b) $x = 2$ (c) $x = 3$

34. $-3 \leq 1 - 2x \leq 3$

(a) $x = -1$ (b) $x = 0$ (c) $x = 2$

In Exercises 35–42, solve the inequality, and draw a number line graph of the solution set.

35. $x - 4 < 2$ **36.** $x + 3 > 5$

37. $2x - 1 \leq 4x + 3$ **38.** $3x - 1 \geq 6x + 8$

39. $2 \leq x + 6 < 9$ **40.** $-1 \leq 3x - 2 < 7$

41. $2(5 - 3x) + 3(2x - 1) \leq 2x + 1$

42. $4(1 - x) + 5(1 + x) > 3x - 1$

In Exercises 43–54, solve the inequality.

43. $\frac{5x + 7}{4} \leq -3$ **44.** $\frac{3x - 2}{5} > -1$

45. $4 \geq \frac{2y - 5}{3} \geq -2$ **46.** $1 > \frac{3y - 1}{4} > -1$

47. $0 \leq 2z + 5 < 8$ **48.** $-6 < 5t - 1 < 0$

49. $\frac{x - 5}{4} + \frac{3 - 2x}{3} < -2$ **50.** $\frac{3 - x}{2} + \frac{5x - 2}{3} < -1$

51. $\frac{2y - 3}{2} + \frac{3y - 1}{5} < y - 1$

52. $\frac{3 - 4y}{6} - \frac{2y - 3}{8} \geq 2 - y$

53. $\frac{1}{2}(x - 4) - 2x \leq 5(3 - x)$

54. $\frac{1}{2}(x + 3) + 2(x - 4) < \frac{1}{3}(x - 3)$

In Exercises 55–58, find the solutions of the equation or inequality displayed in Figure P.20.

55. $x^2 - 2x < 0$ **56.** $x^2 - 2x = 0$

57. $x^2 - 2x > 0$ **58.** $x^2 - 2x \leq 0$

X	Y1	
0	0	
1	-1	
2	0	
3	3	
4	8	
5	15	
6	24	

Y1 = X²-2X

FIGURE P.20 The second column gives values of $y_1 = x^2 - 2x$ for $x = 0, 1, 2, 3, 4, 5$, and 6.

59. Writing to Learn Explain how the second equation was obtained from the first.

$$x - 3 = 2x + 3, \quad 2x - 6 = 4x + 6$$

60. Writing to Learn Explain how the second equation was obtained from the first.

$$2x - 1 = 2x - 4, \quad x - \frac{1}{2} = x - 2$$

61. Group Activity Determine whether the two equations are equivalent.

(a) $3x = 6x + 9, \quad x = 2x + 9$

(b) $6x + 2 = 4x + 10, \quad 3x + 1 = 2x + 5$

62. Group Activity Determine whether the two equations are equivalent.

(a) $3x + 2 = 5x - 7, \quad -2x + 2 = -7$

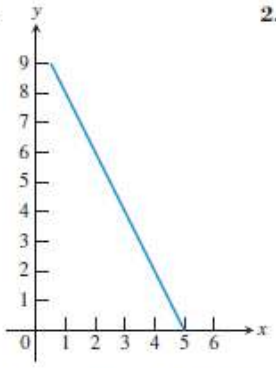
(b) $2x + 5 = x - 7, \quad 2x = x - 7$

SECTION P.4 EXERCISES

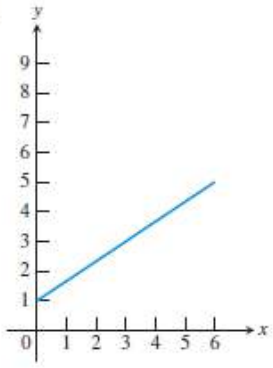
Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

In Exercises 1 and 2, estimate the slope of the line.

1.



2.



In Exercises 3–6, find the slope of the line through the pair of points.

3. $(-3, 5)$ and $(4, 9)$

4. $(-2, 1)$ and $(5, -3)$

5. $(-2, -5)$ and $(-1, 3)$

6. $(5, -3)$ and $(-4, 12)$

In Exercises 7–10, find the value of x or y so that the line through the pair of points has the given slope.

	Points	Slope
7.	$(x, 3)$ and $(5, 9)$	$m = 2$
8.	$(-2, 3)$ and $(4, y)$	$m = -3$
9.	$(-3, -5)$ and $(4, y)$	$m = 3$
10.	$(-8, -2)$ and $(x, 2)$	$m = 1/2$

In Exercises 11–14, find a *point-slope form* equation for the line through the point with given slope.

	Point	Slope		Point	Slope
11.	$(1, 4)$	$m = 2$	**12.**	$(-4, 3)$	$m = -2/3$
13.	$(5, -4)$	$m = -2$	**14.**	$(-3, 4)$	$m = 3$

In Exercises 15–20, find a *general form equation* for the line through the pair of points.

15. $(-7, -2)$ and $(1, 6)$

16. $(-3, -8)$ and $(4, -1)$

17. $(1, -3)$ and $(5, -3)$

18. $(-1, -5)$ and $(-4, -2)$

19. $(-1, 2)$ and $(2, 5)$

20. $(4, -1)$ and $(4, 5)$

In Exercises 21–26, find a slope-intercept form equation for the line.

21. The line through $(0, 5)$ with slope $m = -3$

22. The line through $(1, 2)$ with slope $m = 1/2$

23. The line through the points $(-4, 5)$ and $(4, 3)$

24. The line through the points $(4, 2)$ and $(-3, 1)$

25. The line $2x + 5y = 12$

26. The line $7x - 12y = 96$

In Exercises 27–30, graph the linear equation on a grapher. Choose a viewing window that shows the line intersecting both the x- and y-axes.

27. $8x + y = 49$

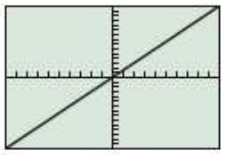
28. $2x + y = 35$

29. $123x + 7y = 429$

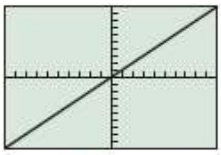
30. $2100x + 12y = 3540$

In Exercises 31 and 32, the line contains the origin and the point in the upper right corner of the grapher screen.

31. Writing to Learn Which line shown here has the greater slope? Explain.

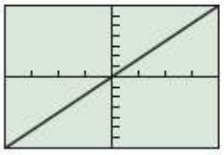


[–10, 10] by [–15, 15]
(a)

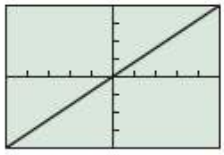


[–10, 10] by [–10, 10]
(b)

32. Writing to Learn Which line shown here has the greater slope? Explain.



[–20, 20] by [–35, 35]
(a)



[–5, 5] by [–20, 20]
(b)

In Exercises 33–36, find the value of x and the value of y for which $(x, 14)$ and $(18, y)$ are points on the graph.

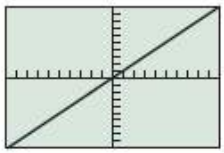
33. $y = 0.5x + 12$

34. $y = -2x + 18$

35. $3x + 4y = 26$

36. $3x - 2y = 14$

In Exercises 37–40, find the values for Ymin, Ymax, and Yscl that will make the graph of the line appear in the viewing window as shown here.



37. $y = 3x$

38. $y = 5x$

39. $y = \frac{2}{3}x$

40. $y = \frac{5}{4}x$

In Exercises 41–44, (a) find an equation for the line passing through the point and parallel to the given line, and (b) find an equation for the line passing through the point and perpendicular to the given line. Support your work graphically.

	Point	Line
41.	$(1, 2)$	$y = 3x - 2$
42.	$(-2, 3)$	$y = -2x + 4$
43.	$(3, 1)$	$2x + 3y = 12$
44.	$(6, 1)$	$3x - 5y = 15$

45. Real Estate Appreciation Bob Michaels purchased a house 8 years ago for $42,000. This year it was appraised at $67,500.

(a) A linear equation $V = mt + b$, $0 \le t \le 15$, represents the value V of the house for 15 years after it was purchased. Determine m and b.

(b) Graph the equation and trace to estimate in how many years after purchase this house will be worth $72,500.

(c) Write and solve an equation algebraically to determine how many years after purchase this house will be worth $74,000.

(d) Determine how many years after purchase this house will be worth $80,250.

46. Investment Planning Mary Ellen plans to invest $18,000, putting part of the money x into a savings that pays 5% annually and the rest into an account that pays 8% annually.

(a) What are the possible values of x in this situation?

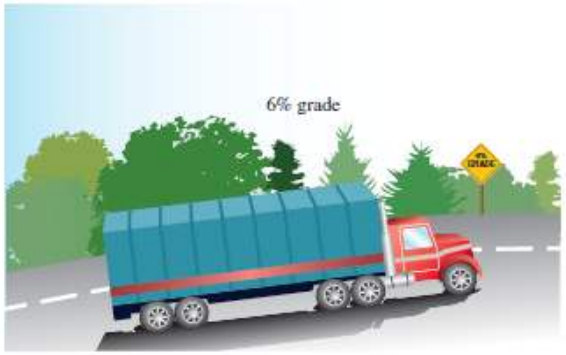
(b) If Mary Ellen invests x dollars at 5%, write an equation that describes the total interest I received from both accounts at the end of one year.

(c) Graph and trace to estimate how much Mary Ellen invested at 5% if she earned $1020 in total interest at the end of the first year.

(d) Use your grapher to generate a table of values for I to find out how much Mary Ellen should invest at 5% to earn $1185 in total interest in one year.

47. Navigation A commercial jet airplane climbs at takeoff with slope $m = 3/8$. How far in the horizontal direction will the airplane fly to reach an altitude of 12,000 ft above the takeoff point?

48. Grade of a Highway Interstate 70 west of Denver, Colorado, has a section posted as a 6% grade. This means that for a horizontal change of 100 ft there is a 6-ft vertical change.



(a) Find the slope of this section of the highway.

(b) On a highway with a 6% grade what is the horizontal distance required to climb 250 ft?

(c) A sign along the highway says 6% grade for the next 7 mi. Estimate how many feet of vertical change there are along those next 7 mi. (There are 5280 ft in 1 mile.)

49. Writing to Learn Building Specifications Asphalt shingles do not meet code specifications on a roof that has less than a 4-12 pitch. A 4-12 pitch means there are 4 ft of vertical change in 12 ft of horizontal change. A certain roof has slope $m = 3/8$. Could asphalt shingles be used on that roof? Explain.

50. Revisiting Example 8 Use the linear equation found in Example 8 to estimate Americans' income in 2004, 2006, 2007 displayed in Figure P.30.

51. Americans' Spending Americans' personal consumption expenditures for several years from 1990 to 2007 in trillions of dollars are shown in the table. (*Source: U.S. Bureau of Economic Analysis as reported in The World Almanac and Book of Facts 2009.*)

x	1990	1995	2000	2005	2006	2007
y	3.8	5.0	6.7	8.7	9.2	9.7

(a) Write a linear equation for Americans' spending y in terms of the year x, using the points (1990, 3.8) and (1995, 5.0).

(b) Use the equation in (a) to estimate Americans' expenditures in 2006.

(c) Use the equation in (a) to predict Americans' expenditures in 2010.

(d) Superimpose a graph of the linear equation in (a) on a scatter plot of the data.

52. U.S. Imports from Mexico The total y in billions of dollars of U.S. imports from Mexico for each year x from 2000 to 2007 is given in the table. (*Source: U.S. Census Bureau as reported in The World Almanac and Book of Facts 2009.*)

x	2000	2001	2002	2003	2004	2005	2006	2007
y	135	131.3	134.6	138.1	155.9	170.1	198.2	210.7

(a) Use the pairs (2001, 131.3) and (2005, 170.1) to write a linear equation for x and y.

(b) Superimpose the graph of the linear equation in (a) on a scatter plot of the data.

(c) Use the equation in (a) to predict the total U.S. imports from Mexico in 2010.

53. The midyear world population in millions for some of the years from 1980 to 2008 is shown in Table P.7.

APPENDIX A.2 EXERCISES

In Exercises 1–4, write the polynomial in standard form and state its degree.

1. $2x - 1 + 3x^2$ **2.** $x^2 - 2x - 2x^3 + 1$

3. $1 - x^7$ **4.** $x^2 - x^4 + x - 3$

In Exercises 5–8, state whether the expression is a polynomial.

5. $x^3 - 2x^2 + x^{-1}$ **6.** $\dfrac{2x - 4}{x}$

7. $(x^2 + x + 1)^2$ **8.** $1 - 3x + x^4$

In Exercises 9–18, simplify the expression. Write your answer in standard form.

9. $(x^2 - 3x + 7) + (3x^2 + 5x - 3)$

10. $(-3x^2 - 5) - (x^2 + 7x + 12)$

11. $(4x^3 - x^2 + 3x) - (x^3 + 12x - 3)$

12. $-(y^2 + 2y - 3) + (5y^2 + 3y + 4)$

13. $2x(x^2 - x + 3)$ **14.** $y^2(2y^2 + 3y - 4)$

15. $-3u(4u - 1)$ **16.** $-4v(2 - 3v^3)$

17. $(2 - x - 3x^2)(5x)$ **18.** $(1 - x^2 + x^4)(2x)$

In Exercises 19–40, expand the product. Use vertical alignment in Exercises 33 and 34.

19. $(x - 2)(x + 5)$

20. $(2x + 3)(4x + 1)$

21. $(3x - 5)(x + 2)$

22. $(2x - 3)(2x + 3)$

23. $(3x - y)(3x + y)$

24. $(3 - 5x)^2$

25. $(3x + 4y)^2$ **26.** $(x - 1)^3$

27. $(2u - v)^3$ **28.** $(u + 3v)^3$

29. $(2x^3 - 3y)(2x^3 + 3y)$ **30.** $(5x^3 - 1)^2$

31. $(x^2 - 2x + 3)(x + 4)$ **32.** $(x^2 + 3x - 2)(x - 3)$

33. $(x^2 + x - 3)(x^2 + x + 1)$

34. $(2x^2 - 3x + 1)(x^2 - x + 2)$

35. $(x - \sqrt{2})(x + \sqrt{2})$

36. $(x^{1/2} - y^{1/2})(x^{1/2} + y^{1/2})$

37. $(\sqrt{u} + \sqrt{v})(\sqrt{u} - \sqrt{v})$

38. $(x^2 - \sqrt{3})(x^2 + \sqrt{3})$

39. $(x - 2)(x^2 + 2x + 4)$

40. $(x + 1)(x^2 - x + 1)$

In Exercises 41–44, factor out the common factor.

41. $5x - 15$ **42.** $5x^3 - 20x$

43. $yz^3 - 3yz^2 + 2yz$ **44.** $2x(x + 3) - 5(x + 3)$

In Exercises 45–48, factor the difference of two squares.

45. $z^2 - 49$

46. $9y^2 - 16$

47. $64 - 25y^2$

48. $16 - (x + 2)^2$

In Exercises 49–52, factor the perfect square trinomial.

49. $y^2 + 8y + 16$ **50.** $36y^2 + 12y + 1$

51. $4z^2 - 4z + 1$ **52.** $9z^2 - 24z + 16$

In Exercises 53–58, factor the sum or difference of two cubes.

53. $y^3 - 8$

54. $z^3 + 64$

55. $27y^3 - 8$

56. $64z^3 + 27$

57. $1 - x^3$

58. $27 - y^3$

In Exercises 59–68, factor the trinomial.

59. $x^2 + 9x + 14$

60. $y^2 - 11y + 30$

61. $z^2 - 5z - 24$

62. $6t^2 + 5t + 1$

63. $14u^2 - 33u - 5$ **64.** $10v^2 + 23v + 12$

65. $12x^2 + 11x - 15$ **66.** $2x^2 - 3xy + y^2$

67. $6x^2 + 11xy - 10y^2$ **68.** $15x^2 + 29xy - 14y^2$

In Exercises 69–74, factor by grouping.

69. $x^3 - 4x^2 + 5x - 20$ **70.** $2x^3 - 3x^2 + 2x - 3$

71. $x^6 - 3x^4 + x^2 - 3$ **72.** $x^6 + 2x^4 + x^2 + 2$

73. $2ac + 6ad - bc - 3bd$

74. $3uw + 12uz - 2vw - 8vz$

In Exercises 75–90, factor completely.

75. $x^3 + x$ **76.** $4y^3 - 20y^2 + 25y$

77. $18y^3 + 48y^2 + 32y$ **78.** $2x^3 - 16x^2 + 14x$

79. $16y - y^3$ **80.** $3x^4 + 24x$

81. $5y + 3y^2 - 2y^3$ **82.** $z - 8z^4$

83. $2(5x + 1)^2 - 18$ **84.** $5(2x - 3)^2 - 20$

85. $12x^2 + 22x - 20$ **86.** $3x^2 + 13xy - 10y^2$

87. $2ac - 2bd + 4ad - bc$ **88.** $6ac - 2bd + 4bc - 3ad$

89. $x^3 - 3x^2 - 4x + 12$ **90.** $x^4 - 4x^3 - x^2 + 4x$

91. Writing to Learn Show that the grouping

$$(2ac + bc) - (2ad + bd)$$

leads to the same factorization as in Example 11b. Explain why the third possibility,

$$(2ac - bd) + (-2ad + bc)$$

does not lead to a factorization.