Summer Review for Students Entering Algebra Trigonometry

Problems to complete: There are three sections in the PDF: 0.1, 0.2 and 0.3. There is a gray box at the top the page that begins each new section. This box is a summary and review of topics needed to successfully complete the problems in that section. Right below the gray box is green writing of the ONLY problem you need to complete in that section. YOU ARE NOT TO DO ALL PROBLEMS. Only the problems listed in green writing.

The following packet is being given as a review of topics from Algebra 1 and Algebra 2. These are necessary skills for success in Algebra Trigonometry this year. Your packet will be collected during the first week of school and you will receive credit based on completeness and correctness of the problems. Please use scrap paper to work on the problems and make sure you show all relevant work. You will lose points if you fail to show the required work to reach the correct answer.

Please do not wait until the last day of vacation to get started! Break the packet up and do a little each time throughout the summer. This packet is designed to maintain your current knowledge of Algebra so that the topics discussed in the fall will be fresh in your mind.

If you are having difficulties with the packet, use the examples and summary given above each problem set within the PDF file and feel free to search the internet for help on certain topics. This will be extremely beneficial!

Have an enjoyable summer!

I look forward to working with you this fall!

Ms. Prosser

SECTION 0.1 SUMMARY

In this section, real numbers were defined as the set of all rational and irrational numbers. Decimals are approximated by either truncating or rounding.

- *Truncating*: Eliminate all values after a particular digit.
- *Rounding*: Look to the right of a particular digit. If the number is 5 or greater, increase the digit by 1; otherwise, leave it as is and eliminate all digits to the right.

The *order* in which we perform operations is

1. parentheses (grouping); work from inside outward.
2. multiplication/division; work from left to right.
3. addition/subtraction; work from left to right.

The *properties of real numbers* are employed as the basic rules of algebra when dealing with algebraic expressions.

- Commutative property of addition: $a + b = b + a$
- Commutative property of multiplication: $ab = ba$
- Associative property of addition: $(a + b) + c = a + (b + c)$
- Associative property of multiplication: $(ab)c = a(bc)$
- Distributive property: $a(b + c) = ab + ac$ or $a(b - c) = ab - ac$
- Additive identity: $a + 0 = a$
- Multiplicative identity: $a \cdot 1 = a$
- Additive inverse (opposite): $a + (-a) = 0$
- Multiplicative inverse (reciprocal): $a \cdot \frac{1}{a} = 1 \qquad a \neq 0$

Subtraction and division can be defined in terms of addition and multiplication.

- *Subtraction:* $a - b = a + (-b)$ (add the opposite)
- *Division:* $a \div b = a \cdot \frac{1}{b}$, where $b \neq 0$ (multiply by the reciprocal)

Properties of negatives were reviewed. If a and b are positive real numbers, then:

- $(-a)(b) = -ab$
- $(-a)(-b) = ab$
- $-(-a) = a$
- $-(a + b) = -a - b$ and $-(a - b) = -a + b$
- $\frac{-a}{b} = -\frac{a}{b}$
- $\frac{-a}{-b} = \frac{a}{b}$

Absolute value of real numbers: $|a| = a$ if a is nonnegative, and $|a| = -a$ if a is negative.

Properties of zero were reviewed.

- $a \cdot 0 = 0$ and $\frac{0}{a} = 0 \qquad a \neq 0$
- $\frac{a}{0}$ is undefined
- Zero product property: If $ab = 0$, then $a = 0$ or $b = 0$

Properties of fractions were also reviewed.

- $\frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm bc}{bd} \qquad b \neq 0$ and $d \neq 0$
- $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} \qquad b \neq 0, c \neq 0$, and $d \neq 0$

SECTION 0.1 EXERCISES

#22-40 even
42-48 even
57-60 all
69-72 all

SKILLS

In Exercises 1–8, classify the following real numbers as rational or irrational.

1. $\frac{11}{3}$ **2.** $\frac{22}{3}$ **3.** 2.07172737. . . **4.** π

5. $2.7766776\overline{677}$ **6.** $5.222222\overline{2}$ **7.** $\sqrt{5}$ **8.** $\sqrt{17}$

In Exercises 9–16, approximate the real number to three decimal places by (a) rounding and (b) truncation.

9. 7.3471 **10.** 9.2549 **11.** 2.9949 **12.** 6.9951

13. 0.234492 **14.** 1.327491 **15.** 5.238473 **16.** 2.118465

In Exercises 17–40, perform the indicated operations in the correct order.

17. $5 + 2 \cdot 3 - 7$

18. $2 + 5 \cdot 4 + 3 \cdot 6$

19. $2 \cdot (5 + 7 \cdot 4 - 20)$

20. $-3 \cdot (2 + 7) + 8 \cdot (7 - 2 \cdot 1)$

21. $2 - 3[4(2 \cdot 3 + 5)]$

22. $4 \cdot 6(5 - 9)$

23. $8 - (-2) + 7$

24. $-10 - (-9)$

25. $-3 - (-6)$

26. $-5 + 2 - (-3)$

27. $x - (-y) - z$

28. $-a + b - (-c)$

29. $-(3x + y)$

30. $-(4a - 2b)$

31. $\dfrac{-3}{(5)(-1)}$

32. $-\dfrac{12}{(-3)(-4)}$

33. $-4 - 6[(5 - 8)(4)]$

34. $\dfrac{-14}{5 - (-2)}$

35. $-(6x - 4y) - (3x + 5y)$

36. $\dfrac{-4x}{6 - (-2)}$

37. $-(3 - 4x) - (4x + 7)$

38. $2 - 3[(4x - 5) - 3x - 7]$

39. $\dfrac{-4(5) - 5}{-5}$

40. $-6(2x + 3y) - [3x - (2 - 5y)]$

In Exercises 41–56, write as a single fraction and simplify.

41. $\dfrac{1}{3} + \dfrac{5}{4}$

42. $\dfrac{1}{2} - \dfrac{1}{5}$

43. $\dfrac{5}{6} - \dfrac{1}{3}$

44. $\dfrac{7}{3} - \dfrac{1}{6}$

45. $\dfrac{3}{2} + \dfrac{5}{12}$

46. $\dfrac{1}{3} + \dfrac{5}{9}$

47. $\dfrac{1}{9} - \dfrac{2}{27}$

48. $\dfrac{3}{7} - \dfrac{(-4)}{3} - \dfrac{5}{6}$

49. $\dfrac{x}{5} + \dfrac{2x}{15}$

50. $\dfrac{y}{3} - \dfrac{y}{6}$

51. $\dfrac{x}{3} - \dfrac{2x}{7}$

52. $\dfrac{y}{10} - \dfrac{y}{15}$

53. $\dfrac{4y}{15} - \dfrac{(-3y)}{4}$

54. $\dfrac{6x}{12} - \dfrac{7x}{20}$

55. $\dfrac{3}{40} + \dfrac{7}{24}$

56. $\dfrac{-3}{10} - \left(\dfrac{-7}{12}\right)$

In Exercises 57–68, perform the indicated operation and simplify, if possible.

57. $\dfrac{2}{7} \cdot \dfrac{14}{3}$

58. $\dfrac{2}{3} \cdot \dfrac{9}{10}$

59. $\dfrac{2}{7} \div \dfrac{10}{3}$

60. $\dfrac{4}{5} \div \dfrac{7}{10}$

61. $\dfrac{4b}{9} \div \dfrac{a}{27}$ $\quad a \neq 0$

62. $\dfrac{3a}{7} \div \dfrac{b}{21}$ $\quad b \neq 0$

63. $\dfrac{3x}{10} \div \dfrac{6x}{15}$ $\quad x \neq 0$

64. $4\dfrac{1}{5} \div 7\dfrac{1}{20}$

65. $\dfrac{3x}{4} \div \dfrac{9}{16y}$ $\quad y \neq 0$

66. $\dfrac{14m}{2} \cdot \dfrac{4}{7}$

67. $\dfrac{6x}{7} \div \dfrac{3y}{28}$ $\quad y \neq 0$

68. $2\dfrac{1}{3} \cdot 7\dfrac{5}{6}$

In Exercises 69–72, evaluate the algebraic expression for the specified values.

69. $\dfrac{-c}{2d}$ for $c = -4, d = 3$

70. $2l + 2w$ for $l = 5, w = 10$

71. $\dfrac{m_1 \cdot m_2}{r^2}$ for $m_1 = 3, m_2 = 4, r = 10$

72. $\dfrac{x - \mu}{\sigma}$ for $x = 100, \mu = 70, \sigma = 15$

APPLICATIONS

On December 16, 2007, the United States debt was estimated at $9,176,366,494,947, and at that time the estimated population was 303,818,361 citizens.

73. U.S. National Debt. Round the debt to the nearest million.

74. U.S. Population. Round the number of citizens to the nearest thousand.

75. U.S. Debt. If the debt is distributed evenly to all citizens, what is the national debt per citizen? Round your answer to the nearest dollar.

76. U.S. Debt. If the debt is distributed evenly to all citizens, what is the national debt per citizen? Round your answer to the nearest cent.

CATCH THE MISTAKE

In Exercises 77–80, explain the mistake that is made.

77. Round 13.2749 to two decimal places.

Solution:

The 9, to the right of the 4, causes the 4 to round to 5. 13.275

The 5, to the right of the 7, causes the 7 to be rounded to 8. 13.28

This is incorrect. What mistake was made?

78. Simplify the expression $\frac{2}{3} + \frac{1}{9}$.

Solution:

Add the numerators and denominators. $\frac{2+1}{3+9} = \frac{3}{12}$

Reduce. $= \frac{1}{4}$

This is incorrect. What mistake was made?

79. Simplify the expression $3(x + 5) - 2(4 + y)$.

Solution:

Eliminate parentheses. $3x + 15 - 8 + y$

Simplify. $3x + 7 + y$

This is incorrect. What mistake was made?

80. Simplify the expression $-3(x + 2) - (1 - y)$.

Solution:

Eliminate parentheses. $-3x - 6 - 1 - y$

Simplify. $-3x - 7 - y$

This is incorrect. What mistake was made?

CONCEPTUAL

In Exercises 81–84, determine whether each of the following statements is true or false.

81. Student athletes are a subset of the students in the honors program.

82. The students who are members of fraternities or sororities are a subset of the entire student population.

83. Every integer is a rational number.

84. A real number can be both rational and irrational.

85. What restrictions are there on x for the following to be true:

$$\frac{3}{x} \div \frac{5}{x} = \frac{3}{5}$$

86. What restrictions are there on x for the following to be true:

$$\frac{x}{2} \div \frac{x}{6} = 3$$

CHALLENGE

In Exercises 87 and 88, simplify the expressions.

87. $-2[3(x - 2y) + 7] + [3(2 - 5x) + 10] - 7[-2(x - 3) + 5]$

88. $-2\{-5(y - x) - 2[3(2x - 5) + 7(2) - 4] + 3\} + 7$

TECHNOLOGY

89. Use your calculator to evaluate $\sqrt{1260}$. Does the answer appear to be a rational or an irrational number? Why?

90. Use your calculator to evaluate $\sqrt{\frac{144}{25}}$. Does the answer appear to be a rational or an irrational number? Why?

91. Use your calculator to evaluate $\sqrt{4489}$. Does the answer appear to be a rational or an irrational number? Why?

92. Use your calculator to evaluate $\sqrt{\frac{882}{49}}$. Does the answer appear to be a rational or an irrational number? Why?

SECTION 0.2 SUMMARY

In this section we discussed properties of exponents.

Integer Exponents

The following table summarizes integer exponents. Let a be any real number and n be a natural number.

NAME	DESCRIPTION	MATH
Natural-number exponent	Multiply n factors of a.	$a^n = \underbrace{a \cdot a \cdot a \cdots a}_{n \text{ factors}}$
Negative-integer exponent property	A negative exponent implies a reciprocal.	$a^{-n} = \dfrac{1}{a^n} \quad a \neq 0$
Zero-exponent property	Any nonzero real number raised to the zero power is equal to one.	$a^0 = 1 \quad a \neq 0$

Properties of Integer Exponents

The following table summarizes properties of integer exponents. Let a and b be nonzero real numbers and m and n be integers.

NAME	DESCRIPTION	MATH
Product property	When multiplying exponentials with the same base, **add** exponents.	$a^m \cdot a^n = a^{m+n}$
Quotient property	When dividing exponentials with the same base, **subtract** the exponents (numerator − denominator).	$\dfrac{a^m}{a^n} = a^{m-n}$
Power property	When raising an exponential to a power, **multiply** exponents.	$(a^m)^n = a^{mn}$
Product to a power property	A product raised to a power is equal to the product of each factor raised to the power.	$(ab)^n = a^n b^n$
Quotient to a power property	A quotient raised to a power is equal to the quotient of the factors raised to the power.	$\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$

Scientific Notation

Scientific notation is a convenient way of using exponents to represent either very small or very large numbers. Real numbers greater than 1 correspond to positive exponents in scientific notation, whereas real numbers greater than 0 but less than 1 correspond to negative exponents in scientific notation. Scientific notation offers the convenience of multiplying and dividing real numbers by applying properties of exponents.

REAL NUMBER (DECIMAL FORM)	PROCESS	SCIENTIFIC NOTATION
2,357,000,000	Move the implied decimal point to the *left* 9 places	2.357×10^9
0.00000465	Move the decimal point to the *right* 6 places	4.65×10^{-6}

SECTION 0.2 EXERCISES

#1-10 all
29-35 all

SKILLS

In Exercises 1–20, evaluate each expression.

1. 4^4 **2.** 5^3 **3.** $(-3)^5$ **4.** $(-4)^2$ **5.** -5^2

6. -7^2 **7.** $-2^2 \cdot 4$ **8.** $-3^2 \cdot 5$ **9.** 9^0 **10.** $-8x^0$

11. 10^{-1} **12.** a^{-1} **13.** 8^{-2} **14.** 3^{-4} **15.** $-6 \cdot 5^2$

16. $-2 \cdot 4^2$ **17.** $8 \cdot 2^{-3} \cdot 5$ **18.** $5 \cdot 2^{-4} \cdot 32$ **19.** $-6 \cdot 3^{-2} \cdot 81$ **20.** $6 \cdot 4^2 \cdot 4^{-4}$

In Exercises 21–50, simplify and write the resulting expression with only positive exponents.

21. $x^2 \cdot x^3$ **22.** $y^3 \cdot y^5$ **23.** $x^2 x^{-3}$ **24.** $y^3 \cdot y^{-7}$

25. $(x^2)^3$ **26.** $(y^3)^2$ **27.** $(4a)^3$ **28.** $(4x^2)^3$

29. $(-2t)^3$ **30.** $(-3b)^4$ **31.** $(5xy^2)^2(3x^3y)$ **32.** $(4x^2y)(2xy^3)^2$

33. $\dfrac{x^5y^3}{x^7y}$ **34.** $\dfrac{y^5x^2}{y^{-2}x^{-5}}$ **35.** $\dfrac{(2xy)^2}{(-2xy)^3}$ **36.** $\dfrac{(-3x^3y)}{-4(x^2y^3)^3}$

37. $\left(\dfrac{b}{2}\right)^{-4}$ **38.** $\left(\dfrac{c}{3}\right)^{-2}$ **39.** $(9a^{-2}b^3)^{-2}$ **40.** $(-9x^{-3}y^2)^{-4}$

41. $\dfrac{a^{-2}b^3}{a^4b^5}$ **42.** $\dfrac{x^{-3}y^2}{y^{-4}x^5}$ **43.** $\dfrac{(x^3y^{-1})^2}{(xy^2)^{-2}}$ **44.** $\dfrac{(x^3y^{-2})^2}{(x^4y^3)^{-3}}$

45. $\dfrac{3(x^2y)^3}{12(x^{-2}y)^4}$ **46.** $\dfrac{(-4x^{-2})^2y^3z}{(2x^3)^{-2}(y^{-1}z)^4}$ **47.** $\dfrac{(x^{-4}y^5)^{-2}}{[-2(x^3)^2y^{-4}]^5}$ **48.** $-2x^2(-2x^3)^5$

49. $\left[\dfrac{a^2(-xy^4)^3}{x^4(-a^3y^2)^2}\right]^3$ **50.** $\left[\dfrac{b^{-3}(-x^3y^2)^4}{y^2(-b^2x^5)^3}\right]^5$ **51.** Write $2^8 \cdot 16^3 \cdot (64)$ as a power of $2 : 2^?$ **52.** Write $3^9 \cdot 81^5 \cdot (9)$ as a power of $3 : 3^?$

In Exercises 53–60, express the given number in scientific notation.

53. 27,600,000 **54.** 144,000,000,000 **55.** 93,000,000 **56.** 1,234,500,000

57. 0.0000000567 **58.** 0.00000828 **59.** 0.000000123 **60.** 0.000000005

In Exercises 61–66, write the number as a decimal.

61. 4.7×10^7 **62.** 3.9×10^5 **63.** 2.3×10^4 **64.** 7.8×10^{-3}

65. 4.1×10^{-5} **66.** 9.2×10^{-8}

APPLICATIONS

In Exercises 67 and 68, refer to the following:

It is estimated that there are currently 5.0×10^9 cell phones being used worldwide. Assume that the average cell phone measures 5 inches in length and there are 5280 feet in a mile.

67. Cell Phones Spanning the Earth.

a. If all of the cell phones currently in use were to be lined up next to each other tip to tip, how many *feet* would the line of cell phones span? Write the answer in scientific notation.

b. The circumference of the Earth (measured at the equator) is approximately 25,000 miles. If the cell phones in part (a) were to be wrapped around the Earth at the equator, would they circle the Earth completely? If so, approximately how many times?

68. Cell Phones Reaching the Moon.

a. If all of the cell phones currently in use were to be lined up next to each other tip to tip, how many *miles* would the line of cell phones span? Write the answer in scientific notation.

b. The Moon traces an elliptical path around the Earth, with the average distance between them being approximately 239,000 miles. Would the line of cell phones in part (a) reach the Moon?

69. Astronomy. The distance from Earth to Mars on a particular day can be 200 million miles. Express this distance in scientific notation.

70. Astronomy. The distance from Mars to the Sun on a particular day can be 142 million miles. Express this distance in scientific notation.

71. Lasers. The wavelength of a typical laser used for communication systems is 1.55 microns (or 1.55×10^{-6} meters). Express the wavelength in decimal representation in terms of meters.

72. Lasers. A ruby-red laser has a wavelength of 694 nanometers (or 6.93×10^{-7} meters). Express the wavelength in decimal representation in terms of meters.

SECTION 0.3 SUMMARY

In this section, polynomials were defined. Polynomials with one, two, and three terms are called monomials, binomials, and trinomials, respectively. Polynomials are added and subtracted by combining like terms. Polynomials are multiplied by distributing the monomials in the first polynomial throughout the second polynomial. In the special case of the product of two binomials, the FOIL method can also be used. The following are special products of binomials.

Difference of Two Squares

$$(a + b)(a - b) = a^2 - b^2$$

Perfect Squares

Square of a binomial sum.

$$(a + b)^2 = (a + b)(a + b) = a^2 + 2ab + b^2$$

Square of a binomial difference.

$$(a - b)^2 = (a - b)(a - b) = a^2 - 2ab + b^2$$

Perfect Cubes

Cube of a binomial sum.

$$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

Cube of a binomial difference.

$$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

SECTION 0.3 EXERCISES

#1-12 all
25-29 all
43-47 all

SKILLS

In Exercises 1–8, write the polynomial in standard form and state the degree of the polynomial.

1. $5x^2 - 2x^3 + 16 - 7x^4$
2. $7x^3 - 9x^2 + 5x - 4$
3. $4x + 3 - 6x^3$
4. $5x^5 - 7x^3 + 8x^4 - x^2 + 10$
5. 15
6. -14
7. $y - 2$
8. $x - 5$

In Exercises 9–24, add or subtract the polynomials, gather like terms, and write the simplified expression in standard form.

9. $(2x^2 - x + 7) + (-3x^2 + 6x - 2)$
10. $(3x^2 + 5x + 2) + (2x^2 - 4x - 9)$
11. $(-7x^2 - 5x - 8) - (-4x - 9x^2 + 10)$
12. $(8x^3 - 7x^2 - 10) - (7x^3 + 8x^2 - 9x)$
13. $(2x^4 - 7x^2 + 8) - (3x^2 - 2x^4 + 9)$
14. $(4x^2 - 9x - 2) - (5 - 3x - 5x^2)$
15. $(7z^2 - 2) - (5z^2 - 2z + 1)$
16. $(25y^3 - 7y^2 + 9y) - (14y^2 - 7y + 2)$
17. $(3y^3 - 7y^2 + 8y - 4) - (14y^3 - 8y + 9y^2)$
18. $(2x^2 + 3xy) - (x^2 + 8xy - 7y^2)$
19. $(6x - 2y) - 2(5x - 7y)$
20. $3a - [2a^2 - (5a - 4a^2 + 3)]$
21. $(2x^2 - 2) - (x + 1) - (x^2 - 5)$
22. $(3x^3 + 1) - (3x^2 - 1) - (5x - 3)$
23. $(4t - t^2 - t^3) - (3t^2 - 2t + 2t^3) + (3t^3 - 1)$
24. $(-z^3 - 2z^2) + (z^2 - 7z + 1) - (4z^3 + 3z^2 - 3z + 2)$

In Exercises 25–64, multiply the polynomials and write the expressions in standard form.

25. $5xy^2(7xy)$
26. $6z(4z^3)$
27. $2x^3(1 - x + x^2)$
28. $-4z^2(2 + z - z^2)$
29. $-2x^2(5 + x - 5x^2)$
30. $-\frac{1}{2}z(2z + 4z^2 - 10)$
31. $(x^2 + x - 2)2x^3$
32. $(x^2 - x + 2)3x^3$
33. $2ab^2(a^2 + 2ab - 3b^2)$
34. $bc^3d^2(b^2c + cd^3 - b^2d^4)$
35. $(2x + 1)(3x - 4)$
36. $(3z - 1)(4z + 7)$
37. $(x + 2)(x - 2)$
38. $(y - 5)(y + 5)$
39. $(2x + 3)(2x - 3)$
40. $(5y + 1)(5y - 1)$
41. $(2x - 1)(1 - 2x)$
42. $(4b - 5y)(4b + 5y)$
43. $(2x^2 - 3)(2x^2 + 3)$
44. $(4xy - 9)(4xy + 9)$
45. $(7y - 2y^2)(y - y^2 + 1)$
46. $(4 - t^2)(6t + 1 - t^2)$
47. $(x + 1)(x^2 - 2x + 3)$
48. $(x + 3)(x^2 - 3x + 9)$

49. $(t - 2)^2$

50. $(t - 3)^2$

51. $(z + 2)^2$

52. $(z + 3)^2$

53. $[(x + y) - 3]^2$

54. $(2x^2 + 3y)^2$

55. $(5x - 2)^2$

56. $(x + 1)(x^2 + x + 1)$

57. $y(3y + 4)(2y - 1)$

58. $p^2(p + 1)(p - 2)$

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

60. $(t - 5)^2(t + 5)^2$

61. $(b - 3a)(a + 2b)(b + 3a)$

62. $(x - 2y)(x^2 + 2xy + 4y^2)$

63. $(x + y - z)(2x - 3y + 5z)$

64. $(5b^2 - 2b + 1)(3b - b^2 + 2)$

APPLICATIONS

In Exercises 65–68, profit is equal to revenue minus cost: $P = R - C$.

65. Profit. Donna decides to sell fabric cord covers on eBay for \$20 a piece. The material for each cord cover costs \$9, and it costs her \$100 a month to advertise on eBay. Let x be the number of cord covers sold. Write a polynomial representing her monthly profit.

66. Profit. Calculators are sold for \$25 each. Advertising costs are \$75 per month. Let x be the number of calculators sold. Write a polynomial representing the monthly profit earned by selling x calculators.

67. Profit. If the revenue associated with selling x units of a product is $R = -x^2 + 100x$, and the cost associated with producing x units of the product is $C = -100x + 7500$, find the polynomial that represents the profit of making and selling x units.

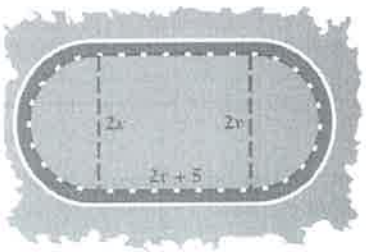
68. Profit. A business sells a certain quantity x of items. The revenue generated by selling x items is given by the equation $R = -\frac{1}{2}x^2 + 50x$. The costs are given by $C = 8000 - 150x$. Find a polynomial representing the net profit of this business when x items are sold.

69. Volume of a Box. A rectangular sheet of cardboard is to be used in the construction of a box by cutting out squares of side length x from each corner and turning up the sides. Suppose the dimensions of the original rectangle are 15 inches by 8 inches. Determine a polynomial in x that would give the volume of the box.

70. Volume of a Box. Suppose a box is to be constructed from a square piece of material of side length x by cutting out a 2-inch square from each corner and turning up the sides. Express the volume of the box as a polynomial in the variable x.

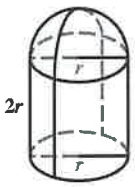
71. Geometry. Suppose a running track is constructed of a rectangular portion that measures $2x$ feet wide by $2x + 5$ feet long. Each end of the rectangular portion consists of a semicircle whose diameter is $2x$. Write a polynomial that determines the

a. perimeter of the track in terms of the variable x.
b. area of the track in terms of x.



72. Geometry. A right circular cylinder whose radius is r and whose height is $2r$ is surmounted by a hemisphere of radius r.

a. Find a polynomial in the variable r that represents the volume of the "silo" shape.
b. Find a polynomial in r that represents the total surface area of the "silo."



73. Engineering. The force of an electrical field is given by the equation $F = k\frac{q_1q_2}{r^2}$. Suppose $q_1 = x$, $q_2 = 3x$, and $r = 10x$. Find a polynomial representing the force of the electrical field in terms of the variable x.

74. Engineering. If a football (or other projectile) is thrown upward, its height above the ground is given by the equation $s = 16t^2 + v_0t + s_0$, where v_0 and s_0 are the initial velocity and initial height of the football, respectively, and t is the time in seconds. Suppose the football is thrown from the top of a building that is 192 feet tall, with an initial speed of 96 feet per second.

a. Write the polynomial that gives the height of the football in terms of the variable t (time).
b. What is the height of the football after 2 seconds have elapsed? Will the football hit the ground after 2 seconds?