Chapter P

EXERCISES

For more exercises, see *Extra Skill and Word Problem Practice.*

Practice and Problem Solving

A Practice by Example

Example 1 (page 385) — GO for Help

Simplify each expression.

1. $36^{\frac{1}{2}}$
2. $27^{\frac{1}{3}}$
3. $49^{\frac{1}{2}}$
4. $10^{\frac{1}{2}} \cdot 10^{\frac{1}{2}}$
5. $(-3)^{\frac{1}{3}} \cdot (-3)^{\frac{1}{3}} \cdot (-3)^{\frac{1}{3}}$
6. $3^{\frac{1}{2}} \cdot 12^{\frac{1}{2}}$
7. $2^{\frac{1}{2}} \cdot 32^{\frac{1}{2}}$
8. $3^{\frac{1}{3}} \cdot 9^{\frac{1}{3}}$
9. $3^{\frac{1}{4}} \cdot 27^{\frac{1}{4}}$

Example 2 (page 386)

Write each expression in radical form.

10. $x^{\frac{1}{6}}$
11. $x^{\frac{1}{5}}$
12. $x^{\frac{2}{7}}$
13. $y^{\frac{2}{5}}$
14. $y^{-\frac{9}{8}}$
15. $t^{-\frac{3}{4}}$
16. $x^{1.5}$
17. $y^{1.2}$

Write each expression in exponential form.

18. $\sqrt{-10}$
19. $\sqrt{7x^3}$
20. $\sqrt{(7x)^3}$
21. $\left(\sqrt{7x}\right)^3$
22. $\sqrt[3]{a^2}$
23. $\left(\sqrt[3]{a}\right)^2$
24. $\sqrt[4]{e^2}$
25. $\sqrt[3]{(5xy)^6}$

Example 3 (page 386)

The optimal height h of the letters of a message printed on pavement is given by the formula $h = \frac{0.00252d^{2.27}}{e}$. Here d is the distance of the driver from the letters and e is the height of the driver's eye above the pavement. All of the distances are in meters. Find h for the given values of d and e.

26. $d = 100$ m, $e = 1.2$ m
27. $d = 50$ m, $e = 1.2$ m
28. $d = 50$ m, $e = 2.3$ m
29. $d = 25$ m, $e =$

Example 4 (page 387)

Simplify each number.

30. $8^{\frac{2}{3}}$
31. $64^{\frac{2}{3}}$
32. $(-8)^{\frac{2}{3}}$
33. $(-32)^{\frac{6}{5}}$
34. $(32)^{-\frac{4}{5}}$
35. $4^{1.5}$
36. $16^{1.5}$
37. $10{,}000^{0.75}$

Example 5 (page 388)

Write each expression in simplest form. Assume that all variables are posit

38. $\left(x^{\frac{2}{3}}\right)^{-3}$
39. $\left(x^{-\frac{4}{7}}\right)^{7}$
40. $\left(3x^{\frac{2}{5}}\right)^{-1}$
41. $5\left(x^{\frac{2}{5}}\right)^{-}$
42. $\left(-27x^{-9}\right)^{\frac{1}{3}}$
43. $\left(-32y^{15}\right)^{\frac{1}{5}}$
44. $\left(\frac{x^3}{x^{-1}}\right)^{-\frac{1}{4}}$
45. $\left(\frac{x^2}{x^{-11}}\right)^{\frac{1}{3}}$
46. $\left(x^{\frac{1}{2}}y^{-\frac{2}{3}}\right)^{-6}$
47. $\left(x^{\frac{2}{3}}y^{-\frac{1}{6}}\right)^{-12}$
48. $\left(\frac{x^{\frac{1}{4}}}{y^{-\frac{3}{4}}}\right)^{12}$
49. $\left(x^{-\frac{2}{3}}\right)^{15}$

Simplify each expression. Assume that all variables are positive.

65. $x^{\frac{2}{7}} \cdot x^{\frac{3}{14}}$
66. $y^{\frac{1}{2}} \cdot y^{\frac{3}{10}}$
67. $x^{\frac{3}{5}} \div x^{\frac{1}{10}}$
68. $y^{7} \div y^{14}$
69. $\frac{x^{\frac{2}{3}}y^{-\frac{1}{4}}}{x^{\frac{1}{2}}y^{-\frac{1}{2}}}$
70. $\frac{x^{\frac{1}{2}}y^{-\frac{1}{3}}}{x^{\frac{3}{4}}y^{\frac{1}{2}}}$
71. $\left(\frac{16x^{14}}{81y^{18}}\right)^{\frac{1}{2}}$
72. $\left(\frac{81y^{16}}{16x^{12}}\right)^{\frac{1}{2}}$
73. $\left(x^{\frac{1}{2}} \cdot x^{\frac{5}{12}}\right)^{\frac{1}{3}} \div x^{\frac{2}{3}}$
74. $\left(x^{\frac{3}{4}} \div x^{\frac{7}{8}}\right) \cdot x^{-\frac{1}{6}}$
75. $\left[\left(x^{-\frac{1}{2}}\right)^2\right]^{\frac{1}{3}}$
76. $\left[\left(\sqrt{x^3y^3}\right)^{\frac{1}{3}}\right]^{-1}$

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.

EXERCISES

Simplify each expression. Use only positive exponents.

1. $(3a^2)(4a^6)$
2. $(-4x^2)(-2x^{-2})$
3. $(4x^3y^5)^2$
4. $(2x^{-5}y^4)^3$
5. $\frac{8a^5}{2a^2}$
6. $\frac{6x^7y^5}{3x^{-1}}$
7. $\frac{(4x^2)^0}{2xy^5}$
8. $\left(\frac{3x^2}{2}\right)^2$
9. $(-6m^2n^2)(3mn)$
10. $(3x^4y^5)^{-3}$
11. $\frac{(2r^{-1}s^2t^0)^{-2}}{2rs}$
12. $x^5(2x)^3$
13. $\frac{x^4x^{-2}}{x^{-5}}$
14. $\frac{(12x^2y^6)^2}{8x^4y^7}$
15. $(4p^2q)(p^2q^3)$
16. $\frac{4x^3}{2x}$
17. $(p^2)^{-2}$
18. $\frac{-15x^4}{3x}$
19. $\frac{r^2s^3t^4}{r^2s^{-4}t^{-4}}$
20. $\frac{xy^2}{2} \cdot \frac{6x}{y^2}$
21. $(s^2t)^3(st)$
22. $(3x^{-3}y^{-2})^{-2}$
23. $(h^4k^5)^0$
24. $\frac{s^2t^3}{r} \cdot \frac{sr^3}{t}$

APPENDIX A.3 EXERCISES

In Exercises 1–8, rewrite as a single fraction.

1. $\frac{5}{9}+\frac{10}{9}$
2. $\frac{17}{32}-\frac{9}{32}$
3. $\frac{20}{21}\cdot\frac{9}{22}$
4. $\frac{33}{25}\cdot\frac{20}{77}$
5. $\frac{2}{3}\div\frac{4}{5}$
6. $\frac{9}{4}\div\frac{15}{10}$
7. $\frac{1}{14}+\frac{4}{15}-\frac{5}{21}$
8. $\frac{1}{6}+\frac{6}{35}-\frac{4}{15}$

In Exercises 9–18, find the domain of the algebraic expression.

9. $5x^2-3x-7$
10. $2x-5$
11. $\sqrt{x-4}$
12. $\frac{2}{\sqrt{x+3}}$
13. $\frac{2x+1}{x^2+3x}$
14. $\frac{x^2-2}{x^2-4}$
15. $\frac{x}{x-1}, \quad x\neq 2$
16. $\frac{3x-1}{x-2}, \quad x\neq 0$
17. x^2+x^{-1}
18. $x(x+1)^{-2}$

In Exercises 19–26, find the missing numerator or denominator so that the two rational expressions are equal.

19. $\frac{2}{3x}=\frac{?}{12x^3}$
20. $\frac{5}{2y}=\frac{15y}{?}$
21. $\frac{x-4}{x}=\frac{x^2-4x}{?}$
22. $\frac{x}{x+2}=\frac{?}{x^2-4}$
23. $\frac{x+3}{x-2}=\frac{?}{x^2+2x-8}$
24. $\frac{x-4}{x+5}=\frac{x^2-x-12}{?}$
25. $\frac{x^2-3x}{?}=\frac{x-3}{x^2+2x}$
26. $\frac{?}{x^2-9}=\frac{x^2+x-6}{x-3}$

In Exercises 27–32, consider the original fraction and its reduced form from the specified example. Explain why the given restriction is needed on the reduced form.

27. Example 3a, $x\neq 2, x\neq -7$
28. Example 3b, $x\neq -1, x\neq 2$
29. Example 4, none
30. Example 5, $x\neq 0$
31. Example 6, $x\neq 3$
32. Example 7, $a\neq b$

In Exercises 33–44, write the expression in reduced form.

33. $\frac{18x^3}{15x}$
34. $\frac{75y^2}{9y^4}$
35. $\frac{x^3}{x^2-2x}$
36. $\frac{2y^2+6y}{4y+12}$
37. $\frac{z^2-3z}{9-z^2}$
38. $\frac{x^2+6x+9}{x^2-x-12}$
39. $\frac{y^2-y-30}{y^2-3y-18}$
40. $\frac{y^3+4y^2-21y}{y^2-49}$
41. $\frac{8z^3-1}{2z^2+5z-3}$
42. $\frac{2z^3+6z^2+18z}{z^3-27}$
43. $\frac{x^3+2x^2-3x-6}{x^3+2x^2}$
44. $\frac{y^2+3y}{y^3+3y^2-5y-15}$

In Exercises 45–62, simplify.

45. $\frac{3}{x-1}\cdot\frac{x^2-1}{9}$
46. $\frac{x+3}{7}\cdot\frac{14}{2x+6}$
47. $\frac{x+3}{x-1}\cdot\frac{1-x}{x^2-9}$
48. $\frac{18x^2-3x}{3xy}\cdot\frac{12y^2}{6x-1}$
49. $\frac{x^3-1}{2x^2}\cdot\frac{4x}{x^2+x+1}$
50. $\frac{y^3+2y^2+4y}{y^3+2y^2}\cdot\frac{y^2-4}{y^3-8}$
51. $\frac{2y^2+9y-5}{y^2-25}\cdot\frac{y-5}{2y^2-y}$
52. $\frac{y^2+8y+16}{3y^2-y-2}\cdot\frac{3y^2+2y}{y+4}$
53. $\frac{1}{2x}\div\frac{1}{4}$
54. $\frac{4x}{y}\div\frac{8y}{x}$
55. $\frac{x^2-3x}{14y}\div\frac{2xy}{3y^2}$
56. $\frac{7x-7y}{4y}\div\frac{14x-14y}{3y}$
57. $\frac{\frac{2x^2y}{(x-3)^2}}{\frac{8xy}{x-3}}$
58. $\frac{\frac{x^2-y^2}{2xy}}{\frac{y^2-x^2}{4x^2y}}$
59. $\frac{2x+1}{x+5}-\frac{3}{x+5}$
60. $\frac{3}{x-2}+\frac{x+1}{x-2}$
61. $\frac{3}{x^2+3x}-\frac{1}{x}-\frac{6}{x^2-9}$
62. $\frac{5}{x^2+x-6}-\frac{2}{x-2}+\frac{4}{x^2-4}$

In Exercises 63–70, simplify the compound fraction.

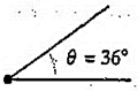
63. $\frac{\frac{x}{y^2}-\frac{y}{x^2}}{\frac{1}{y^2}-\frac{1}{x^2}}$
64. $\frac{\frac{1}{x}+\frac{1}{y}}{\frac{1}{x^2}-\frac{1}{y^2}}$
65. $\frac{2x+\frac{13x-3}{x-4}}{2x+\frac{x+3}{x-4}}$
66. $\frac{2-\frac{13}{x+5}}{2+\frac{3}{x-3}}$
67. $\frac{\frac{1}{(x+h)^2}-\frac{1}{x^2}}{h}$
68. $\frac{\frac{x+h}{x+h+2}-\frac{x}{x+2}}{h}$
69. $\frac{\frac{b}{a}-\frac{a}{b}}{\frac{1}{a}-\frac{1}{b}}$
70. $\frac{\frac{1}{a}+\frac{1}{b}}{\frac{b}{a}-\frac{a}{b}}$

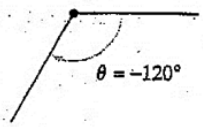
In Exercises 71–74, write with positive exponents and simplify.

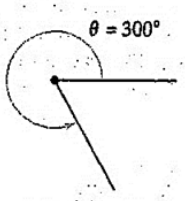
71. $\left(\frac{1}{x}+\frac{1}{y}\right)(x+y)^{-1}$
72. $\frac{(x+y)^{-1}}{(x-y)^{-1}}$
73. $x^{-1}+y^{-1}$
74. $(x^{-1}+y^{-1})^{-1}$

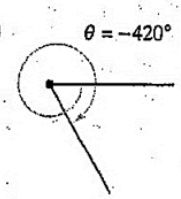
EXERCISES FOR APPENDIX A.3

In Exercises 1 and 2, determine two coterminal angles (one positive and one negative) for each given angle. Express your answers in degrees.

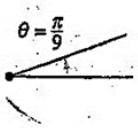
1. (a) 

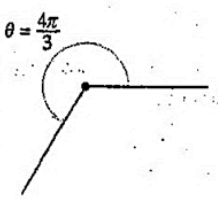
(b) 

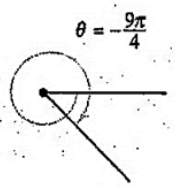
2. (a) 

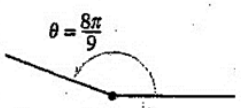
(b) 

In Exercises 3 and 4, determine two coterminal angles (one positive and one negative) for each given angle. Express your answers in radians.

3. (a) 

(b) 

4. (a) 

(b) 

In Exercises 5 and 6, express the angles in radian measure as multiples of π and as decimals accurate to three decimal places.

5. (a) 30° (b) 150° (c) 315° (d) 120°

6. (a) −20° (b) −240° (c) −270° (d) 144°

In Exercises 7 and 8, express the angles in degree measure.

7. (a) $\frac{3\pi}{2}$ (b) $\frac{7\pi}{6}$ (c) $-\frac{7\pi}{12}$ (d) −2.367

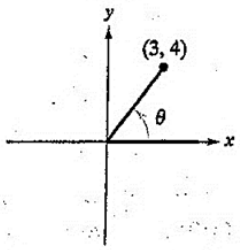
8. (a) $\frac{7\pi}{3}$ (b) $-\frac{11\pi}{30}$ (c) $\frac{11\pi}{6}$ (d) 0.438

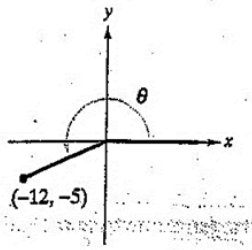
9. Let r represent the radius of a circle, θ the central angle (measured in radians), and s the length of the arc subtended by the angle. Use the relationship $s = r\theta$ to complete the table.

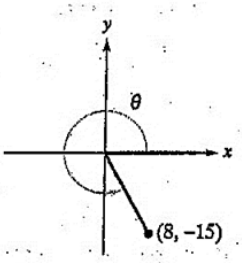
r	8 ft	15 in.	85 cm		
s	12 ft			96 in.	8642 mi
θ		1.6	$\frac{3\pi}{4}$	4	$\frac{2\pi}{3}$

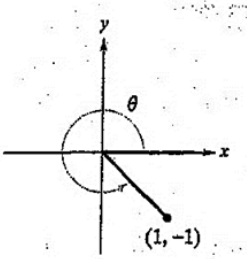
10. *Angular Speed* A car is moving at the rate of 50 miles per hour, and the diameter of its wheels is 2.5 feet.
(a) Find the number of revolutions per minute that the wheels are rotating.
(b) Find the angular speed of the wheels in radians per minute.

In Exercises 11 and 12, determine all six trigonometric functions for the angle θ.

11. (a) 

(b) 

12. (a) 

(b) 

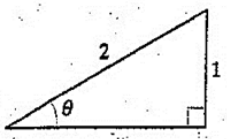
In Exercises 13 and 14, determine the quadrant in which θ lies.

13. (a) $\sin\theta < 0$ and $\cos\theta < 0$
(b) $\sec\theta > 0$ and $\cot\theta < 0$

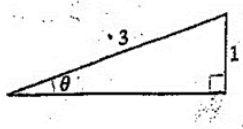
14. (a) $\sin\theta > 0$ and $\cos\theta < 0$
(b) $\csc\theta < 0$ and $\tan\theta > 0$

In Exercises 15–18, evaluate the trigonometric function.

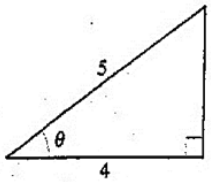
15. $\sin\theta = \frac{1}{2}$
$\cos\theta =$ [redacted]



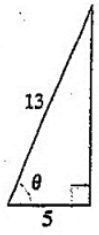
16. $\sin\theta = \frac{1}{3}$
$\tan\theta =$ [redacted]



17. $\cos\theta = \frac{4}{5}$
$\cot\theta =$ [redacted]



18. $\sec\theta = \frac{13}{5}$
$\csc\theta =$ [redacted]



In Exercises 19–22, evaluate the sine, cosine, and tangent of each angle *without* using a calculator.

19. (a) $60°$
(b) $120°$
(c) $\frac{\pi}{4}$
(d) $\frac{5\pi}{4}$

20. (a) $-30°$
(b) $150°$
(c) $-\frac{\pi}{6}$
(d) $\frac{\pi}{2}$

21. (a) $225°$
(b) $-225°$
(c) $\frac{5\pi}{3}$
(d) $\frac{11\pi}{6}$

22. (a) $750°$
(b) $510°$
(c) $\frac{10\pi}{3}$
(d) $\frac{17\pi}{3}$

In Exercises 23–26, use a calculator to evaluate the trigonometric functions to four significant digits.

23. (a) $\sin 10°$
(b) $\csc 10°$

24. (a) $\sec 225°$
(b) $\sec 135°$

25. (a) $\tan \frac{\pi}{9}$
(b) $\tan \frac{10\pi}{9}$

26. (a) $\cot(1.35)$
(b) $\tan(1.35)$

In Exercises 27–30, find two solutions of each equation. Express the results in radians ($0 \le \theta < 2\pi$). Do not use a calculator.

27. (a) $\cos\theta = \frac{\sqrt{2}}{2}$
(b) $\cos\theta = -\frac{\sqrt{2}}{2}$

28. (a) $\sec\theta = 2$
(b) $\sec\theta = -2$

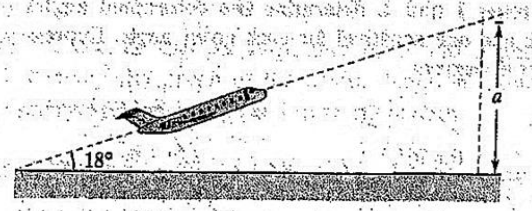
29. (a) $\tan\theta = 1$
(b) $\cot\theta = -\sqrt{3}$

30. (a) $\sin\theta = \frac{\sqrt{3}}{2}$
(b) $\sin\theta = -\frac{\sqrt{3}}{2}$

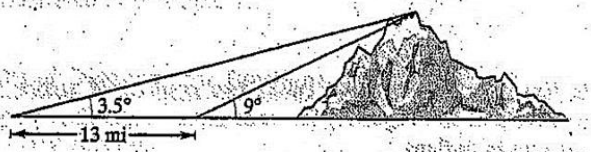
In Exercises 31–38, solve the equation for θ ($0 \le \theta < 2\pi$).

31. $2\sin^2\theta = 1$
32. $\tan^2\theta = 3$
33. $\tan^2\theta - \tan\theta = 0$
34. $2\cos^2\theta - \cos\theta = 1$
35. $\sec\theta\csc\theta = 2\csc\theta$
36. $\sin\theta = \cos\theta$
37. $\cos^2\theta + \sin\theta = 1$
38. $\cos\frac{\theta}{2} - \cos\theta = 1$

39. ***Airplane Ascent*** An airplane leaves the runway climbing at $18°$ with a speed of 275 feet per second (see figure). Find the altitude a of the plane after 1 minute.



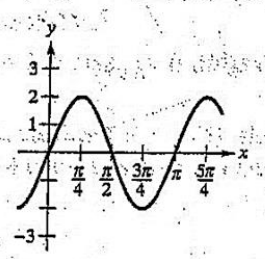
40. ***Height of a Mountain*** In traveling across flat land, you notice a mountain directly in front of you. Its angle of elevation (to the peak) is $3.5°$. After you drive 13 miles closer to the mountain, the angle of elevation is $9°$. Approximate the height of the mountain.

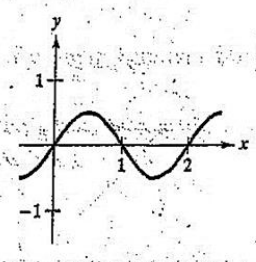


(not to scale)

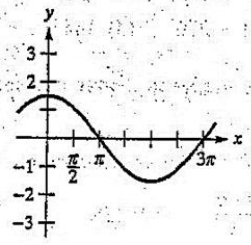
In Exercises 41–44, determine the period and amplitude of each function.

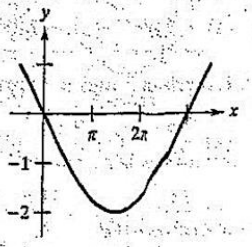
41. (a) $y = 2\sin 2x$
(b) $y = \frac{1}{2}\sin \pi x$





42. (a) $y = \frac{3}{2}\cos\frac{x}{2}$
(b) $y = -2\sin\frac{x}{3}$





43. $y = 3\sin 4\pi x$

44. $y = \frac{2}{3}\cos\frac{\pi x}{10}$

Evaluate each of the following. Find the letter which corresponds to each answer and write that letter in the appropriate space provided.

Why do so many students study Trigonometry?

1. $\csc \frac{\pi}{6}$ =
2. $\sin \frac{11\pi}{6}$ =
3. $\tan \frac{4\pi}{3}$ =
4. $\cos \frac{11\pi}{6}$ =
5. $\sec \frac{5\pi}{3}$ =
6. $\sin \frac{3\pi}{4}$ =
7. $\csc \frac{7\pi}{6}$ =
8. $\cos \frac{4\pi}{3}$ =
9. $\sin \frac{\pi}{2}$ =
10. $\sec \frac{7\pi}{4}$ =

Because

___	___	___	___	___	___	___	___	___	___
1	2	3	4	5	6	7	8	9	10

I = 2	T = $-\frac{1}{2}$	O = 1	C = $\frac{1}{\sqrt{3}}$
R = $\frac{\sqrt{3}}{2}$	G = $\frac{1}{\sqrt{2}}$	F = $\frac{1}{2}$	S = $\sqrt{3}$
H = -2	N = $\sqrt{2}$	A = $\frac{-1}{\sqrt{2}}$	E = $\frac{-\sqrt{3}}{2}$

Did you hear about the girl who backed into a fan?

1. sin 240° =
2. cos 315° =
3. tan 135° =
4. cot 225° =
5. tan 315° =
6. sec 210° =
7. sin 150° =
8. csc 120° =

___	___	___	___	___	___	___	___
1	2	3	4	5	6	7	8

E = $\frac{1}{2}$	D = $\frac{-\sqrt{3}}{2}$	T = $\frac{-2}{\sqrt{3}}$
B = $-\frac{1}{2}$	C = $\sqrt{3}$	S = -1
I = $\frac{1}{\sqrt{2}}$	A = 1	R = $\frac{2}{\sqrt{3}}$

Find θ ($0 \le \theta < 2\pi$):

1. cos θ = ½

2. sin θ = - 1

3. tan θ = $\sqrt{3}$

4. cos 30° =

5. cos 45° =

6. csc 315° =

7. sin 0° =

8. cos 90° =

9. csc210° =

10. cot 0° =

11. tan 120° =

12. sec 330° =

13. csc 270° =

14. cot 135° =

15. tan $\frac{\pi}{6}$ =

16. cot $\frac{5\pi}{4}$ =

17. sin $\frac{5\pi}{4}$ =

18. sin $\frac{5\pi}{6}$ =

19. cos $\frac{\pi}{4}$ =

20. tan $\frac{5\pi}{3}$ =

21. sec $\frac{7\pi}{4}$ =

22. sec π =

23. sec $-\frac{\pi}{3}$ =

25. cot $-\frac{3\pi}{2}$ =

26. cos $\frac{7\pi}{4}$ =

27.csc $\frac{5\pi}{6}$ =

28. tan $\frac{2\pi}{3}$ =

Find θ ($0 \le \theta < 2\pi$):

29. csc θ = 3.256

30. cot θ = .21686

31. cos θ = -.782

32. tan θ = - 1.212