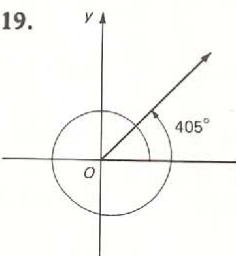
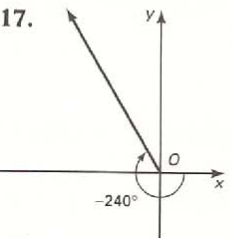
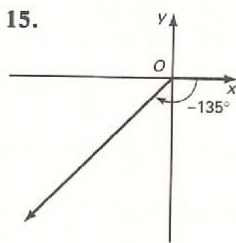
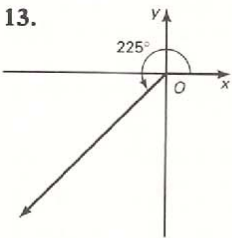
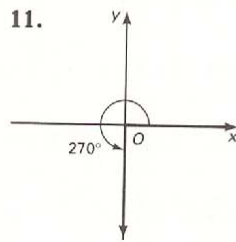
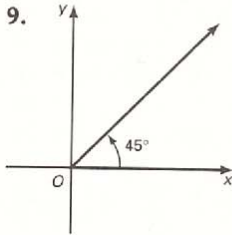


**Selected Answers**

**Chapter 1 Trigonometric Functions**

**Exercises 1-1, pages 4-6**

1.  $60^\circ$  3.  $-45^\circ$  5.  $-120^\circ$  7.  $480^\circ$



21.  $270^\circ$  23.  $-135^\circ$  25.  $-144^\circ$  27.  $600^\circ$   
 29.  $23^\circ 45'$  31.  $15^\circ 25' 48''$  33.  $24^\circ 41' 13''$   
 35.  $9.75^\circ$  37.  $67.375^\circ$  39.  $0.0075^\circ$   
 41-45. Answers may vary.  
 41.  $450^\circ$ ;  $-270^\circ$  43.  $630^\circ$ ;  $-90^\circ$  45.  $120^\circ$ ;  
 $-600^\circ$  47.  $100^\circ$  49.  $300^\circ$  51.  $240^\circ$   
 53.  $30^\circ$  55.  $101.7^\circ$  57.  $276.75^\circ$   
 59.  $41^\circ 42' 20''$  61.  $107^\circ 41' 20''$  63. 25  
 65. 6 67. 24

**Exercises 1-2, pages 9-11**

1.  $\sin \theta = 0.8000$ ;  $\cos \theta = 0.6000$ ;  
 $\tan \theta = 1.3333$

3.  $\sin \theta = 0.2800$ ;  $\cos \theta = 0.9600$ ;  
 $\tan \theta = 0.2917$

5.  $\sin \theta = 0.4472$ ;  $\cos \theta = 0.8944$ ;  
 $\tan \theta = 0.5000$

7.  $\sin \theta = 0.8321$ ;  $\cos \theta = 0.5547$ ;  
 $\tan \theta = 1.5000$

9.  $\sin \theta = 0.8660$ ;  $\cos \theta = 0.5000$ ;  
 $\tan \theta = 1.7321$

11.  $\sin \theta = 0.4000$ ;  $\cos \theta = 0.9165$ ;  
 $\tan \theta = 0.4364$

13.  $\sin \alpha = \frac{3}{5}$ ;  $\tan \alpha = \frac{3}{4}$ ;  $\csc \alpha = \frac{5}{3}$ ;

$\sec \alpha = \frac{5}{4}$ ;  $\cot \alpha = \frac{4}{3}$

15.  $\sin \alpha = \frac{21}{29}$ ;  $\cos \alpha = \frac{20}{29}$ ;  $\csc \alpha = \frac{29}{21}$ ;

$\sec \alpha = \frac{29}{20}$ ;  $\cot \alpha = \frac{20}{21}$

17.  $\sin \alpha = \frac{2\sqrt{10}}{7}$ ;  $\cos \alpha = \frac{3}{7}$ ;  $\tan \alpha = \frac{2\sqrt{10}}{3}$ ;

$\csc \alpha = \frac{7\sqrt{10}}{20}$ ;  $\cot \alpha = \frac{3\sqrt{10}}{20}$

19.  $\sin \alpha = \frac{3}{7}$ ;  $\cos \alpha = \frac{2\sqrt{10}}{7}$ ;  $\tan \alpha = \frac{3\sqrt{10}}{20}$ ;

$\csc \alpha = \frac{7}{3}$ ;  $\sec \alpha = \frac{7\sqrt{10}}{20}$

21.  $\sin \alpha = \frac{1}{2}$ ;  $\cos \alpha = \frac{\sqrt{3}}{2}$ ;  $\tan \alpha = \frac{\sqrt{3}}{3}$ ;

$\sec \alpha = \frac{2\sqrt{3}}{3}$ ;  $\cot \alpha = \sqrt{3}$

23.  $\cos \alpha = \frac{\sqrt{21}}{5}$ ;  $\tan \alpha = \frac{2\sqrt{21}}{21}$ ;  $\csc \alpha = \frac{5}{2}$ ;

$\sec \alpha = \frac{5\sqrt{21}}{21}$ ;  $\cot \alpha = \frac{\sqrt{21}}{2}$  25.  $45^\circ$

27.  $30^\circ$  29.  $\angle B = 30^\circ$ ;  $a = 6\sqrt{3}$ ;  $b = 6$

31.  $\angle A = 45^\circ$ ;  $a = 4$ ;  $c = 4\sqrt{2}$

33.  $\angle A = 60^\circ$ ;  $\angle B = 30^\circ$ ;  $c = 2$  35.  $65^\circ$

37.  $10^\circ$  39.  $20^\circ$  41.  $\frac{\sqrt{6} - \sqrt{2}}{4}$

43.  $\frac{\sqrt{6} + \sqrt{2}}{4}$  45.  $\sqrt{6} - \sqrt{2}$  47.  $\sqrt{6} + \sqrt{2}$

49.  $\frac{15\sqrt{2} + 5\sqrt{6}}{2}$  51.  $24 - 8\sqrt{3}$

### Exercises 1-3, pages 14-16

1. 0.0310   3. 0.00400   5. 21.00  
 7. (a)  $1.060 \times 10^2$    (b) 4   9. (a)  $3.40 \times 10^{-2}$   
 (b) 3   11. (a)  $1.0230 \times 10^2$    (b) 5  
 13. (a)  $3.21 \times 10^2$    (b) 3   15. 0.5000  
 17. 0.8693   19. 0.2368   21. 1.074   23. 3.018  
 25. 0.9171   27.  $17^\circ$    29.  $68^\circ$    31.  $21.6^\circ$   
 33.  $57.6^\circ$    35.  $70.5^\circ$    37. 62.1   39. 98.8  
 41.  $67.7^\circ$    43.  $65.4^\circ$ ; 3.82 m   45. 166 m  
 47.  $2.26 \times 10^8$  m/s   51. (a)  $\frac{\sqrt{5} + 1}{4}$   
 (b) 0.8090

### Self Quiz 1-1 / 1-2 / 1-3, page 17

1.  $63.4^\circ$    2.  $10\sqrt{2}$   
 3.  $\sin A = \frac{7}{25}$ ;  $\cos A = \frac{24}{25}$ ;  $\tan A = \frac{7}{24}$ ;  
 $\csc A = \frac{25}{7}$ ;  $\sec A = \frac{25}{24}$ ;  $\cot A = \frac{24}{7}$   
 4. (a)  $190^\circ$    (b)  $220^\circ$    5.  $25^\circ$   
 6. (a)  $6.50 \times 10^{-3}$    (b)  $3.0400 \times 10^2$   
 7. (a)  $1.54^\circ$    (b)  $32^\circ 40' 12''$

### Exercises 1-4, pages 20-23

1.  $\angle B = 58.5^\circ$ ;  $a = 132$ ;  $b = 215$   
 3.  $\angle A = 25^\circ 20'$ ;  $b = 75.2$ ;  $c = 83.2$   
 5.  $\angle B = 18^\circ$ ;  $b = 0.15$ ;  $c = 0.49$   
 7.  $c = 4.38$ ;  $\angle B = 34.8^\circ$ ;  $\angle A = 55.2^\circ$   
 9.  $a = 43.0$ ;  $\angle B = 46.9^\circ$ ;  $\angle A = 43.1^\circ$   
 11.  $a = 3\sqrt{3}$ ;  $\angle A = \angle B = 45^\circ$   
 13.  $\angle B = 43^\circ$ ;  $\angle C = 94^\circ$ ;  $b = 27$ ;  $c = 39$   
 15.  $\angle A = \angle B = 51.8^\circ$ ;  $b = 16.8$ ;  $c = 20.8$   
 17.  $45^\circ 30'$    19.  $35.4^\circ$    21. 1960 m   23. 21 ft  
 25. 1.4 m   27.  $30.1^\circ$    29. 71.7 cm; 45.7 cm  
 31.  $25.8^\circ$    33. 4.0 cm   35. 146 m  
 37.  $x = y(\cot \alpha + \cot \beta)$    39. 130 ft  
 41.  $y = \frac{x \tan \alpha \tan \beta}{\tan \beta - \tan \alpha}$    43. 869 m; 3070 m  
 45.  $FA = 1.87$  km;  $FB = 1.70$  km   47. 12 ft

### Exercises 1-5, pages 27-29

1. Quadrant I   3. Quadrant III  
 5. Quadrant IV   7. -0.8192   9. -1.0724  
 11. -1.6064   13. 0.5544  
 15.  $\sin 240^\circ = \frac{-\sqrt{3}}{2}$ ;  $\cos 240^\circ = \frac{-1}{2}$ ;  
 $\tan 240^\circ = \sqrt{3}$ ;  $\csc 240^\circ = \frac{-2\sqrt{3}}{3}$ ;

- $\sec 240^\circ = -2$ ;  $\cot 240^\circ = \frac{\sqrt{3}}{3}$   
 17.  $\sin 225^\circ = \cos 225^\circ = \frac{-\sqrt{2}}{2}$ ;  $\tan 225^\circ =$   
 $\cot 225^\circ = 1$ ;  $\csc 225^\circ = \sec 225^\circ = -\sqrt{2}$   
 19.  $\sin(-240^\circ) = \frac{\sqrt{3}}{2}$ ;  $\cos(-240^\circ) = \frac{-1}{2}$ ;  
 $\tan(-240^\circ) = -\sqrt{3}$ ;  $\csc(-240^\circ) = \frac{2\sqrt{3}}{3}$ ;  
 $\sec(-240^\circ) = -2$ ;  $\cot(-240^\circ) = -\frac{\sqrt{3}}{3}$   
 21.  $\sin 480^\circ = \frac{\sqrt{3}}{2}$ ;  $\cos 480^\circ = \frac{-1}{2}$ ;  $\tan 480^\circ =$   
 $-\sqrt{3}$ ;  $\csc 480^\circ = \frac{2\sqrt{3}}{3}$ ;  $\sec 480^\circ = -2$ ;  
 $\cot 480^\circ = -\frac{\sqrt{3}}{3}$    23. (a)  $\sin \theta = \frac{4}{5}$ ;  
 $\cos \theta = \frac{-3}{5}$    (b)  $126.9^\circ$   
 25. (a)  $\sin \theta = \frac{-15}{17}$ ;  
 $\cos \theta = \frac{-8}{17}$    (b)  $241.9^\circ$    27. (a)  $\sin \theta = \frac{-2}{3}$ ;  
 $\cos \theta = \frac{\sqrt{5}}{3}$    (b)  $318.2^\circ$   
 29. (a)  $\sin \theta = \frac{-\sqrt{6}}{3}$ ;  
 $\cos \theta = \frac{\sqrt{3}}{3}$    (b)  $305.3^\circ$    31.  $\sin \theta = \frac{-3}{5}$ ;  
 $\tan \theta = \frac{-3}{4}$    33.  $\cos \theta = \frac{-2\sqrt{2}}{3}$ ;  $\tan \theta = \frac{\sqrt{2}}{4}$   
 35.  $\sin \theta = \frac{-\sqrt{5}}{5}$ ;  $\cos \theta = \frac{-2\sqrt{5}}{5}$   
 37.  $\sin \theta = \frac{\sqrt{15}}{4}$ ;  $\tan \theta = \sqrt{15}$   
 39.  $\sin 0^\circ = 0$ ;  $\cos 0^\circ = 1$ ;  $\tan 0^\circ = 0$ ;  $\cot 0^\circ$   
 is undefined;  $\sec 0^\circ = 1$ ;  $\csc 0^\circ$  is undefined.  
 41.  $\sin 180^\circ = 0$ ;  $\cos 180^\circ = -1$ ;  $\tan 180^\circ = 0$ ;  
 $\cot 180^\circ$  is undefined;  $\sec 180^\circ = -1$ ;  
 $\csc 180^\circ$  is undefined.   43. (a)  $\alpha$   
 (b)  $180^\circ - \alpha$    (c)  $180^\circ + \alpha$    (d)  $360^\circ - \alpha$   
 45. IV; II; I   47. II; I; IV   49.  $90^\circ$ ,  $270^\circ$   
 51.  $0^\circ$ ,  $180^\circ$    53.  $90^\circ$    55.  $180^\circ$   
 57.  $50^\circ$ ,  $130^\circ$    59.  $40^\circ$ ,  $320^\circ$

### Exercises 1-6, pages 32-34

1.  $\frac{7\pi}{6}$  3.  $\frac{5\pi}{3}$  5.  $-\frac{\pi}{2}$  7.  $\frac{\pi}{5}$  9.  $\frac{7\pi}{12}$  11.  $\frac{19\pi}{6}$   
 13.  $225^\circ$  15.  $270^\circ$  17.  $-120^\circ$  19.  $330^\circ$   
 21.  $900^\circ$  23.  $390^\circ$  25. 0.7549 27. 1.745  
 29.  $45.84^\circ$  31.  $136.42^\circ$  33.  $-\frac{\sqrt{2}}{2}$  35.  $\sqrt{3}$   
 37. 0.8415 39. 0.2553  
 41.  $s = 6.00$  cm;  $A = 9.00$  cm<sup>2</sup>  
 43.  $\theta = 1.50 = 85.9^\circ$ ;  $A = 2700$  m<sup>2</sup>  
 45.  $r = 3.00$  m;  $A = 3.60$  m<sup>2</sup>  
 47.  $\theta = 1.33 = 76.4^\circ$ ;  $s = 8.00$  cm  
 49.  $r = 1.20$  m;  $s = 1.80$  m 51. 4706 km  
 53. 36 km 55. 40,000 km, or 25,000 miles  
 57. 250 cm

### Self Quiz 1-4 / 1-5 / 1-6, pages 34-35

1.  $\sin \theta = \frac{-4}{5}$ ;  $\cos \theta = \frac{3}{5}$ ;  $\tan \theta = \frac{-4}{3}$ ;  
 $\csc \theta = \frac{-5}{4}$ ;  $\sec \theta = \frac{5}{3}$ ;  $\cot \theta = \frac{-3}{4}$   
 2.  $\angle R = 33.5^\circ$ ;  $r = 28.2$ ;  $q = 51.1$   
 3. (a)  $\widehat{AB} = 9\pi$  (b)  $A = 54\pi$   
 4.  $\cos \theta = \frac{7}{25}$ ;  $\tan \theta = \frac{-24}{7}$  5. (a)  $\frac{1}{2}$   
 (b) -1

### Additional Problems, pages 35-36

1. 1.38 m 3.  $15^\circ$  5. 2100 7.  $36\pi$  cm<sup>2</sup>  
 9. 1.178  
 11.  $\sin \phi = \frac{21}{29}$ ;  $\cos \phi = \frac{20}{29}$ ;  $\tan \phi = \frac{21}{20}$ ;  
 $\csc \phi = \frac{29}{21}$ ;  $\sec \phi = \frac{29}{20}$  13. -0.80  
 15.  $3\sqrt{3}$  17.  $40.3^\circ$  and  $49.7^\circ$   
 19.  $x = d \sin \alpha \tan \beta$

## Chapter 2 Circular Functions, Graphs, and Inverses

### Exercises 2-1, pages 46-47

1.  $\sin \frac{2\pi}{3} = \frac{\sqrt{3}}{2}$ ;  $\cos \frac{2\pi}{3} = \frac{-1}{2}$ ;  
 $\tan \frac{2\pi}{3} = -\sqrt{3}$

$$3. \sin \frac{7\pi}{6} = \frac{-1}{2}; \cos \frac{7\pi}{6} = \frac{-\sqrt{3}}{2};$$

$$\tan \frac{7\pi}{6} = \frac{\sqrt{3}}{3}$$

$$5. \sin \frac{-4\pi}{3} = \frac{\sqrt{3}}{2}; \cos \frac{-4\pi}{3} = \frac{-1}{2};$$

$$\tan \frac{-4\pi}{3} = -\sqrt{3}$$

$$7. \sin \frac{3\pi}{2} = -1; \cos \frac{3\pi}{2} = 0; \tan \frac{3\pi}{2} \text{ is undefined.}$$

$$9. \sin \frac{11\pi}{4} = \frac{\sqrt{2}}{2}; \cos \frac{11\pi}{4} = \frac{-\sqrt{2}}{2};$$

$$\tan \frac{11\pi}{4} = -1$$

$$11. \sin \frac{14\pi}{3} = \frac{\sqrt{3}}{2}; \cos \frac{14\pi}{3} = \frac{-1}{2};$$

$$\tan \frac{14\pi}{3} = -\sqrt{3}$$

$$13. \cot \frac{2\pi}{3} = \frac{-\sqrt{3}}{3}; \sec \frac{2\pi}{3} = -2;$$

$$\csc \frac{2\pi}{3} = \frac{2\sqrt{3}}{3}$$

$$15. \cot \frac{7\pi}{6} = \sqrt{3}; \sec \frac{7\pi}{6} = \frac{-2\sqrt{3}}{3};$$

$$\csc \frac{7\pi}{6} = -2$$

$$17. \cot \frac{-4\pi}{3} = \frac{-\sqrt{3}}{3}; \sec \frac{-4\pi}{3} = -2;$$

$$\csc \frac{-4\pi}{3} = \frac{2\sqrt{3}}{3}$$

$$19. \cot \frac{3\pi}{2} = 0; \sec \frac{3\pi}{2} \text{ is undefined;}$$

$$\csc \frac{3\pi}{2} = -1 \quad 21. 0.3624 \quad 23. 1.557$$

$$25. 0.8314 \quad 27. -1.158 \quad 29. 0.8637$$

$$31. 1.522 \quad 33. 0.71 \quad 35. 2.25 \quad 37. 3.86$$

$$39. 2.67 \quad 41. \cos t = 0.69; \tan t = 1.0$$

$$43. \sin t = -0.97; \tan t = 3.9 \quad 49. 1$$

$$51. (s + \cos(-s), \sin(-s))$$

### Exercises 2-2, pages 50-52

$$1. 48 \text{ cm/s} \quad 3. 72 \text{ rad/min} \quad 5. 4.8\pi \text{ cm/min}$$

$$7. 5 \text{ ft} \quad 9. 33\frac{1}{3} \text{ rpm} \quad 11. 42 \text{ m/s}$$

$$13. 36,000\pi \text{ cm/min, or } 113,097 \text{ cm/min}$$

15.  $(-3, 3\sqrt{3})$  17.  $\left(\frac{-9}{2}, \frac{-9\sqrt{3}}{2}\right)$   
19.  $(2.93, 2.73)$  21.  $(-2\sqrt{3}, 2)$   
23.  $(5\sqrt{2}, -5\sqrt{2})$  25.  $(0, 7)$  27.  $(1, \sqrt{3})$   
29.  $(-2\sqrt{3}, 2)$  31.  $(4, -4)$   
33. 10.9 miles/min 35. 194 rpm  
37.  $F = mr\omega^2$  39.  $\frac{\pi}{21,600}$  rad/s;  $\frac{\pi}{360}$  mm/s  
41. 105 km/h clockwise