

### Problem Set 3.2

1. 3    3.  $1/2$     5.  $3\pi$     7. 2    9.  $\theta = s/r = 450/4,000 = 0.1125$  radians

	Angle In Radians		Reference Angle	
	Exact Value	Approximation	In degrees	In radians
11.	$\frac{\pi}{6} \approx$	0.52	$30^\circ =$	$\frac{\pi}{6}$
13.	$\frac{\pi}{2} \approx$	1.57	$90^\circ =$	$\frac{\pi}{2}$
15.	$\frac{13\pi}{9} \approx$	4.54	$80^\circ =$	$\frac{4\pi}{9}$
17.	$-\frac{5\pi}{6} \approx$	-2.62	$30^\circ =$	$\frac{\pi}{6}$
19.	$\frac{7\pi}{3} \approx$	7.33	$60^\circ =$	$\frac{\pi}{3}$
21.	$-\frac{3\pi}{4} \approx$	-2.36	$45^\circ =$	$\frac{\pi}{4}$

23. 2.11    25. 0.000291

27. Use the answer to Problem 25 to write  $\theta = 1' = 0.000291$  radians, then substitute this value of  $\theta$  into  $\theta = s/r$  along with  $r = 4,000$  and solve for  $s$ .  $s = 1.16$  mi

29.  $60^\circ, \hat{\theta} = 60^\circ = \pi/3$     31.  $120^\circ, \hat{\theta} = 60^\circ = \pi/3$     33.  $-210^\circ, \hat{\theta} = 30^\circ = \pi/6$

35.  $300^\circ, \hat{\theta} = 60^\circ = \pi/3$     37.  $720^\circ, \hat{\theta} = 0^\circ = 0$     39.  $15^\circ, \hat{\theta} = 15^\circ = \pi/12$     41.  $57.3^\circ$     43.  $74.5^\circ$

45.  $43.0^\circ$     47.  $286.5^\circ$     49.  $-\sqrt{3}/2$     51.  $1/\sqrt{3}$     53. -2    55. 2    57.  $-2\sqrt{2}$     59.  $-1/\sqrt{2}$

61.  $\sqrt{3}$     63.  $\sqrt{3}/2$     65. 0    67.  $\sqrt{3}/2$     69. -2    71.  $(0, 0) \left(\frac{\pi}{4}, \frac{1}{\sqrt{2}}\right) \left(\frac{\pi}{2}, 1\right) \left(\frac{3\pi}{4}, \frac{1}{\sqrt{2}}\right) (\pi, 0)$

73.  $(0, 0) \left(\frac{\pi}{2}, 2\right) (\pi, 0) \left(\frac{3\pi}{2}, -2\right) (2\pi, 0)$     75.  $(0, 0) \left(\frac{\pi}{4}, 1\right) \left(\frac{\pi}{2}, 0\right) \left(\frac{3\pi}{4}, -1\right) (\pi, 0)$

77.  $\left(\frac{\pi}{2}, 0\right) (\pi, 1) \left(\frac{3\pi}{2}, 0\right) (2\pi, -1) \left(\frac{5\pi}{2}, 0\right)$     79.  $\left(-\frac{\pi}{4}, 0\right) (0, 3) \left(\frac{\pi}{4}, 0\right) \left(\frac{\pi}{2}, -3\right) \left(\frac{3\pi}{4}, 0\right)$

	$\sin \theta$	$\cos \theta$	$\tan \theta$	$\cot \theta$	$\sec \theta$	$\csc \theta$
81.	$-\frac{3}{\sqrt{10}}$	$\frac{1}{\sqrt{10}}$	-3	$-\frac{1}{3}$	$\sqrt{10}$	$-\frac{\sqrt{10}}{3}$

83.  $\frac{n}{r}$      $\frac{m}{r}$      $\frac{n}{m}$      $\frac{m}{n}$      $\frac{r}{m}$      $\frac{r}{n}$  where  $r = \sqrt{m^2 + n^2}$

85.  $\frac{1}{2}$      $-\frac{\sqrt{3}}{2}$      $-\frac{1}{\sqrt{3}}$      $-\sqrt{3}$      $-\frac{2}{\sqrt{3}}$     2

87.  $\frac{2}{\sqrt{5}}$      $\frac{1}{\sqrt{5}}$     2     $\frac{1}{2}$      $\sqrt{5}$      $\frac{\sqrt{5}}{2}$

### Problem Set 3.4

1. 6 inches    3. 2.25 ft    5.  $2\pi$  cm  $\approx$  6.28 cm    7.  $4\pi/3$  mm  $\approx$  4.19 mm  
9.  $40\pi/3$  inches  $\approx$  41.9 inches    11. 5.03 cm    13.  $1,400\pi$  mi  $\approx$  4,400 mi    15.  $4\pi/9$  ft  $\approx$  1.40 ft  
17. 2,100 mi    19.  $\frac{125\pi}{6} = 65.4$  ft to the nearest tenth    21. 480.0 ft to the nearest tenth  
23. a. 103.1 ft to the nearest tenth    b. 361.0 ft to the nearest tenth    c. 490.0 ft to the nearest tenth    25. 0.5 ft  
27. 3 inches    29. 4 cm    31. 1 m    33.  $16/5\pi$  km  $\approx$  1.02 km    35.  $9\text{ cm}^2$     37.  $19.2\text{ inches}^2$   
39.  $9\pi/10\text{ m}^2 \approx 2.83\text{ m}^2$     41.  $25\pi/24\text{ m}^2 \approx 3.27\text{ m}^2$     43.  $4\text{ inches}^2$     45. 2 cm  
47.  $4/\sqrt{3}$  inches  $\approx$  2.31 inches    49.  $900\pi\text{ ft}^2 \approx 2,830\text{ ft}^2$     51.  $60^\circ$     53. 2.3 ft    55.  $74.0^\circ$     57. 62.3 ft

### Problem Set 3.5

1. 1.5 ft/min    3. 3 cm/sec    5. 15 mph    7. 80 ft    9. 22.5 mi  
11. 7 mi (first change 20 min to  $1/3$  hr)    13.  $2\pi/15$  rad/sec  $\approx$  0.419 rad/sec    15. 4 rad/min  
17.  $8/3$  rad/sec  $\approx$  2.67 rad/sec    19.  $37.5\pi$  rad/hr  $\approx$  118 rad/hr  
21.  $d = 100 \tan \frac{1}{2}\pi t$ ; when  $t = 1/2$ ,  $d = 100$  ft; when  $t = 3/2$ ,  $d = -100$  ft; when  $t = 1$ ,  $d$  is undefined because the light rays are parallel to the wall.    23. 40 inches    25.  $180\pi$  m  $\approx$  565 m    27. 4,500 ft  
29.  $20\pi$  rad/min  $\approx$  62.8 rad/min    31.  $200\pi/3$  rad/min  $\approx$  209 rad/min    33.  $11.6\pi$  rad/min  $\approx$  36.4 rad/min  
35. 10 inches/sec    37. 0.5 rad/sec    39.  $80\pi$  ft/min  $\approx$  251 ft/min    41.  $\pi/12$  rad/hr  $\approx$  0.262 rad/hr  
43.  $10\pi$  ft  $\approx$  31.4 ft    45.  $33,000/\pi$  rpm  $\approx$  10,500 rpm  
47. 2.5 inches from the center  $v = 1,800\pi$  inches/min  $\approx$  5,655 inches/min; 1.25 inches from the center  $v = 900\pi$  inches/min  $\approx$  2,827 inches/min    49. 0.47 mi/hr to the nearest hundredth  
51.  $576\pi$  cm/day  $\approx$  1,810 cm/day    53. 889 rad/min (53,300 rad/hr)    55. 10.4 mi/hr at N  $24.1^\circ$  W  
57. 182 mph at  $54.5^\circ$  clockwise from due north    59.  $|\mathbf{V}_x| = 54$  ft/sec,  $|\mathbf{V}_y| = 41$  ft/sec    61. 46.2 mi S, 71.9 mi W

### Chapter 3 Test

1.  $55^\circ$     2.  $62.2^\circ$     3.  $50^\circ 20'$     4.  $45^\circ$     5. -1.1918    6. -2.1445    7. 1.1964    8. 1.2639  
9. -1.2991    10. -6.5121    11.  $174^\circ$     12.  $241^\circ 30'$  or  $241.5^\circ$     13.  $226^\circ$     14.  $310^\circ 20'$  or  $310.3^\circ$   
15.  $-1/\sqrt{2}$     16.  $-1/\sqrt{2}$     17.  $-1/\sqrt{3}$     18.  $2/\sqrt{3}$     19.  $25\pi/18$     20.  $-13\pi/6$     21.  $240^\circ$   
22.  $105^\circ$     23.  $\sqrt{3}/2$     24.  $-1/2$     25.  $-2\sqrt{2}$     26. 1    27.  $-2/\sqrt{3}$     28. 2    29. 0  
30.  $2\sqrt{2}$     31.  $\cot(-\theta) = \frac{\cos(-\theta)}{\sin(-\theta)} = \frac{\cos\theta}{-\sin\theta} = -\cot\theta$   
32. First use odd and even functions to write everything in terms of  $\theta$  instead of  $-\theta$ .    33.  $2\pi$  m  $\approx$  6.28 m  
34.  $2\pi$  ft  $\approx$  6.28 ft    35. 4 cm    36.  $3/8$  cm = 0.375 cm    37.  $4\pi$  inches $^2 \approx$  12.6 inches $^2$     38.  $10.8\text{ cm}^2$   
39.  $2\pi$  cm    40.  $8\text{ inches}^2$     41. 90 ft    42. 3,960 ft    43. 72 inches    44.  $120\pi$  ft  $\approx$  377 ft  
45.  $12\pi$  rad/min  $\approx$  37.7 rad/min    46.  $4\pi$  rad/min  $\approx$  12.6 rad/min    47. 0.5 rad/sec    48.  $5/3$  rad/sec  
49.  $80\pi$  ft/min  $\approx$  251 ft/min    50.  $20\pi$  ft/min  $\approx$  62.8 ft/min  
51. 4 rad/sec for the 6-cm pulley and 3 rad/sec for the 8-cm pulley    52.  $2,700\pi$  ft/min  $\approx$  8,480 ft/min