SECTION 6.1

2. (a) $600^0, 960^0, -120^0, -480^0$
   (b) $675^0, 1035^0, -45^0, -405^0$
   (c) $210^0, 570^0, -510^0, -870^0$

8. (a) $27^0\ 47'\ 56''$ (b) 164.1^0

10. (a) $\frac{2\pi}{3}$ (b) $-\frac{3\pi}{4}$ (c) $\frac{7\pi}{6}$

14. (a) 150^0 (b) 240^0 (c) 495^0

18. $85^0\ 56'\ 37''$

22. 83.2833^0

26. $12^0\ 51'\ 50''$

---

30. 8.59 km

32. (a) 18.85 cm (b) 84.82 cm^2

34. (a) 103.13^0 (b) 360 in^2

36. (a) 132 cm (b) 3960 $\mathbf{cm^2}$

38. 1.16 miles

SECTION 6.2

4. $\sin\theta = \frac{2\sqrt{2}}{3}$ $\quad \csc\theta = \frac{3}{2\sqrt{2}}$
   $\cos\theta = \frac{1}{3}$ $\quad \sec\theta = 3$
   $\tan\theta = 2\sqrt{2}$ $\quad \cot\theta = \frac{1}{2\sqrt{2}}$

14. $x = 2\sqrt{2},\ y = 2\sqrt{2}$

24. 1017 feet

30. Be sure your calculator is in radian mode.
   (a) – 0.1098 (b) 2.4380
   (c) – 0.2350 (d) 0.3090

---

50. $\cot\theta\sec\theta = \frac{\cos\theta}{\sin\theta}\ \frac{1}{\cos\theta} = \frac{1}{\sin\theta} = \csc\theta$

54. $(\tan\theta + \cot\theta)\tan\theta = \tan^2\theta + \cot\theta\tan\theta$
   $= \tan^2\theta + 1 = \sec^2\theta$

---

60. $\frac{\sin\theta + \cos\theta}{\cos\theta} = \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\cos\theta}$
   $= \tan\theta + 1 = 1 + \tan\theta$

68. $\sin\theta = -\frac{15}{17}$ $\quad \csc\theta = -\frac{17}{15}$
   $\cos\theta = -\frac{8}{17}$ $\quad \sec\theta = -\frac{17}{8}$
   $\tan\theta = \frac{15}{8}$ $\quad \cot\theta = \frac{8}{15}$

72. $\sin\theta = -\frac{5}{\sqrt{34}}$ $\quad \csc\theta = -\frac{\sqrt{34}}{5}$
   $\cos\theta = \frac{3}{\sqrt{34}}$ $\quad \sec\theta = \frac{\sqrt{34}}{3}$
   $\tan\theta = -\frac{5}{3}$ $\quad \cot\theta = -\frac{3}{5}$

82. $\sin\theta = -\frac{4}{5}$ $\quad \csc\theta = -\frac{5}{4}$
   $\cos\theta = -\frac{3}{5}$ $\quad \sec\theta = -\frac{5}{3}$
   $\tan\theta = \frac{4}{3}$ $\quad \cot\theta = \frac{3}{4}$

84. $\sin\theta = \frac{\sqrt{3}}{2}$ $\quad \csc\theta = \frac{2}{\sqrt{3}}$
   $\cos\theta = -\frac{1}{2}$ $\quad \sec\theta = -2$
   $\tan\theta = -\sqrt{3}$ $\quad \cot\theta = -\frac{1}{\sqrt{3}}$

86. $\sin\theta = \frac{1}{5}$ $\quad \csc\theta = 5$
   $\cos\theta = -\frac{\sqrt{24}}{5}$ $\quad \sec\theta = -\frac{5}{\sqrt{24}}$
   $\tan\theta = -\frac{1}{\sqrt{24}}$ $\quad \cot\theta = -\sqrt{24}$

SECTION 6.3

4. $\sin t = -\frac{12}{13}$ $\quad \csc t = -\frac{13}{12}$
   $\cos t = -\frac{5}{13}$ $\quad \sec t = -\frac{13}{5}$
   $\tan t = \frac{12}{5}$ $\quad \cot t = \frac{5}{12}$

6. $P(t+\pi) = \left(\frac{8}{17}, -\frac{15}{17}\right)$ $\quad P(-t-\pi) = \left(\frac{8}{17}, \frac{15}{17}\right)$
   $P(-t) = \left(\frac{8}{17}, -\frac{15}{17}\right)$ $\quad P(t-\pi) = \left(\frac{8}{17}, -\frac{15}{17}\right)$

12. (a) $\sin t = 1$ $\quad \csc t = 1$
   $\cos t = 0$ $\quad \sec t$ is undefinded
   $\tan t$ is undefinded $\quad \cot t = 0$

   (b) $\sin t = -1$ $\quad \csc t = -1$
   $\cos t = 0$ $\quad \sec t$ is undefinded
   $\tan t$ is undefinded $\quad \cot t = 0$

16. (a) $\sin t = -\frac{1}{\sqrt{2}}$ $\quad \csc t = -\sqrt{2}$

$\cos t = \frac{1}{\sqrt{2}}$ $\quad \sec t = \sqrt{2}$

$\tan t = -1$ $\quad \cot t = -1$

(b) $\sin t = -\frac{1}{\sqrt{2}}$ $\quad \csc t = -\sqrt{2}$

$\cos t = -\frac{1}{\sqrt{2}}$ $\quad \sec t = -\sqrt{2}$

$\tan t = 1$ $\quad \cot t = 1$

18. (a) 1 (b) $-\frac{\sqrt{2}}{2}$ (c) 0

24. $\frac{\sec(-x)}{\tan(-x)} = \frac{\sec x}{-\tan x} = -\frac{\frac{1}{\cos x}}{\frac{\sin x}{\cos x}} = -\frac{1}{\sin x} = -\csc x$

---

32. (a) 0 (b) ∞

34. (a) $\sqrt{3}$ (b) $-\infty$

50. $x = -\frac{\pi}{6}, \frac{5\pi}{6}$

SECTION 6.4

2. (a) 15° (b) 85° (c) 70° (d) 40°

6. (a) $\theta_R = 0.28$ (b) $\theta_R = 0.86$
(c) $\theta_R = 1.36$ (d) $\theta_R = 1.46$

10. (a) $-\frac{\sqrt{2}}{2}$ (b) $\frac{\sqrt{3}}{2}$

12. (a) $-\frac{\sqrt{3}}{3}$ (b) -1

16. (a) $-\sqrt{2}$ (b) $-\frac{2}{\sqrt{3}}$

18. (a) $\sqrt{2}$ (b) $-\frac{2}{\sqrt{3}}$

---

22. (a) 6.197 (b) 0.932

30. (a) 78.49° (b) 78° 29'

36. (a) 55.3°, 124.7° (b) 131.3°, 228.7°
(c) 123.3°, 303.3° (d) 36.0°,216.0°
(e) 45.6°, 314.4° (f) 205.6°, 334.4°

SECTION 6.5

Sorry, the graphs are not sketched at this time.

6. Amp = 1, Period = 2π, Phase Shift = $-\frac{\pi}{4}$

28. Amp = 4, Period = π, Phase Shift = $-\frac{\pi}{6}$

---

32. Amp = 4, Period = 6π, Phase Shift = π

36. Amp = $\sqrt{3}$, Period = 8, Phase Shift = 2

42. (a) Amp = 3, Period = π, Phase Shift = $-\frac{\pi}{4}$

(b) $y = 3\sin\left(2x + \frac{\pi}{2}\right)$

44. (a) Amp = 3, Period = 1, Phase Shift = $-\frac{1}{4}$

(b) $y = 3\sin\left(2\pi x + \frac{\pi}{2}\right)$

46. $I = 510\sin\left(\frac{\pi}{12} t\right)$

54. $f(t) = 5\sin\left(\frac{\pi}{12} t - \pi\right) + 15$

SECTION 6.7

4. $\beta = 30°$, $a = 3\sqrt{3}$, $b = 3$

6. $\alpha = 60°$, $\beta = 30°$, $b = 4$

12. $\beta = 58°\ 50'$, $b = 843$, $c = 985$

18. $b = c \sin \beta$

26. 6.1 meters

28. 76.2 meters

---

34. 108.1 feet

36. $\alpha = 12°$

42. 73.5 cm

46. (a) 7.49 feet (b) 1.51 feet

48. 30.1 meters

---

62. A: N15°E B: N30°W
C: S80°W D: S55°E

64. 2.9 miles

66. (a) 288^0 (b) 1.4 hours (1 hr. 25 min.)

SECTION 7.2

2. $t = \pi + 2\pi n$ or $t = \pi(2n + 1)$
4. $\alpha = \frac{2\pi}{3} + \pi n$
6. $\gamma = \frac{\pi}{4} + 2\pi n, \frac{3\pi}{4} + 2\pi n$
8. No Solution

---

12. $\theta = \frac{5\pi}{12} + \frac{2\pi}{3}n, \frac{7\pi}{12} + \frac{2\pi}{3}n$
16. $x = \frac{4\pi}{3} + 2\pi n$
20. $\theta = \frac{3\pi}{4} + \pi n$
28. $x = \frac{\pi}{3} + \pi n, \ \frac{2\pi}{3} + \pi n$
30. $t = \frac{\pi}{2} + \pi n$

---

42. $t = \frac{2\pi}{3}, \frac{4\pi}{3}, \pi$
48. No solutions
50. $\theta = 0, \frac{3\pi}{2}$ (π is an extraneous solution

SECTION 7.3

2. (a) cot 65° 48' (b) cos 0° 19'
   (c) $\sin\frac{\pi}{6}$ (d) tan 28.13°
6. (a) $\frac{\sqrt{2}+\sqrt{3}}{2}$, (b) $\frac{\sqrt{6}-\sqrt{2}}{4}$
10. (a) $\frac{-3-\sqrt{3}}{3}$, (b) $-2-\sqrt{3}$
12. $\cos 63^\circ$
14. $\sin 61^\circ$
18. (a) $\frac{63}{65}$ (b) $-\frac{63}{16}$ (c) *QII*

---

20. (a) $\frac{3}{5}$ (b) $\frac{4}{5}$ (c) $\frac{3}{4}$
    (d) $-\frac{117}{125}$ (e) $\frac{44}{125}$ (f) $-\frac{117}{44}$
22. (a) – 0.92 (b) 2.43 (c) QIII
40. Use the sum of two angles and the difference of two angles formulas and simplify.

SECTION 7.4

2. $\sin 2\theta = \frac{24}{25}$, $\cos 2\theta = \frac{7}{25}$, $\tan 2\theta \ \frac{24}{7}$
4. $\sin 2\theta = -\frac{24}{25}$, $\cos 2\theta = -\frac{7}{25}$, $\tan 2\theta \ \frac{24}{7}$
14. Substitute the double angle formula for $\sin 2\alpha$ and then square the numerator. You are now off to the races.
22. Factor using the difference of squares. One of the factors simplifies using a Phyagorean Identity. You should now recognize the final step.

---

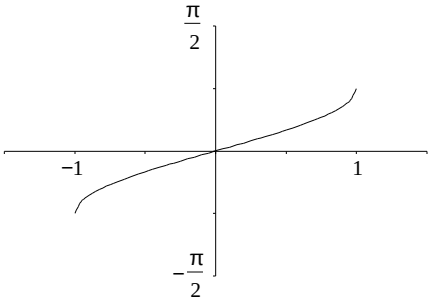
44. (a) *from* $\cos x = 0$: $-\frac{3\pi}{2}, -\frac{\pi}{2}, \frac{\pi}{2}, \frac{3\pi}{2}$
    from $\sin x = \frac{1}{2}$: $-\frac{11\pi}{6}, -\frac{7\pi}{6}, \frac{\pi}{6}, \frac{5\pi}{6}$
    (b) $x \approx 1.00, -5.28, 2.14, -4.14, -0.63, 5.65, 3.78, -2.51$
48. $\theta \approx 24.30^\circ$ or 65.70°

SECTION 7.6

4. (a) 0 (b) π (c) 0
12. (a) $\frac{\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) $\frac{\pi}{6}$
14. (a) $\frac{\sqrt{3}}{2}$ (b) 0 (c) Not Defined

---

20. (a) $\frac{120}{169}$ (b) $-\frac{1519}{1681}$ (c) $-\frac{240}{161}$
24. $\tan\alpha = \frac{\sqrt{1-x^2}}{x}$
32. (a) $\frac{\pi}{2}$ (b) π (c) $-\frac{\pi}{2}$
34.



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54. $x \approx 3.8078, 5.6170$
56. $x \approx -0.6013$
62. $x \approx 0.7297, 2.4119, 3.6652, 5.7596$
64. $x \approx 1.5708, 4.7124, 5.4351, 3.9897$

SECTION 8.1

8. No triangle exists
10. There are two triangles possible:
    (Angles rounded to the nearest 10 minutes)
    $\gamma = 60^\circ\ 10'$, $\beta = 92^\circ\ 20'$, $b = 60.8$
    $\gamma = 119^\circ\ 50'$, $\beta = 32^\circ\ 40'$, $b = 32.8$
12 There are two triangles possible:
    $\beta = 55.09^\circ$, $\gamma = 82.74^\circ$, $c = 7.40$
    $\beta = 124.91^\circ$, $\gamma = 12.92^\circ$, $c = 1.67$
16. $\alpha = 54.88^\circ$, $\beta = 52.11^\circ$, $b = 16.70$
    ($\alpha \neq 125.12^\circ$ because then $\alpha + \gamma \geq 180^\circ$)

---

24. 577 yards
28. (a) 836 feet (b) 5468 feet

SECTION 8.2

8. 41°40', 85°30', 52°50'

---

16. 150 miles
18. 272 feet
20. 60°
24. (a) 74.9 miles (b) N62°E

SECTION 8.3

2. $\langle 0,9\rangle, \langle -4,3\rangle, \langle 2,3\rangle, \langle -18,\rangle$
8. Terminal points of the vectors are:
(-5, 2), (1, -3), (-4, -1), (-10, 4), (-3, 9)
12. $-3\mathbf{d}$
14. **e**
16. $2\mathbf{f}$
30. $\|a\| = 4$, $\tan\theta = \frac{4\pi}{3}$
38. 10.1 lb.

---

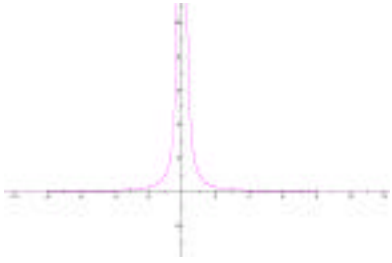
46. H: 15.32, V: 12.86
58. (a) $\langle 0,0\rangle$ (b) None
68. 7.76 mi/hr

SECTION 8.4

2. (a) – 29 (b) 176° 3'
10. Vectors are orthogonal
12. Vectors are orthogonal
14. *a* and *b* have the same direction
16. *a* and *b* have opposite direction
18. $\pm\frac{5}{6}$
20. $-\frac{21}{10}$

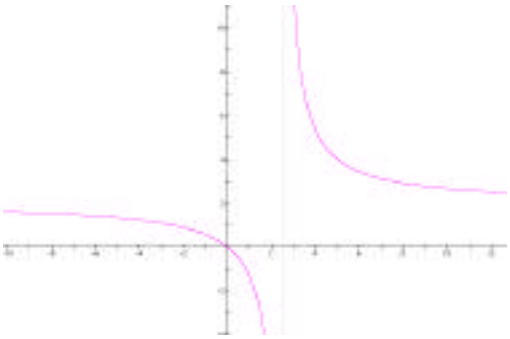
SECTION 4.5

2.



D: (–∞,0) (0, ∞) R: (0, ∞)
Increasing (–∞,0) Decreasing (0, ∞)

6.



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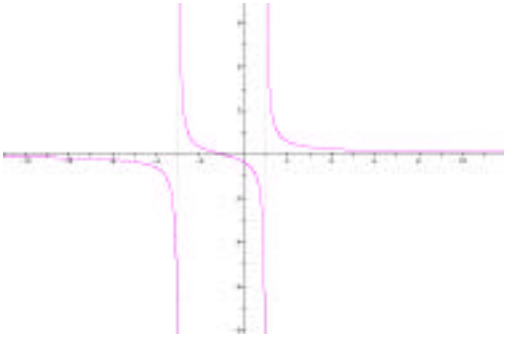
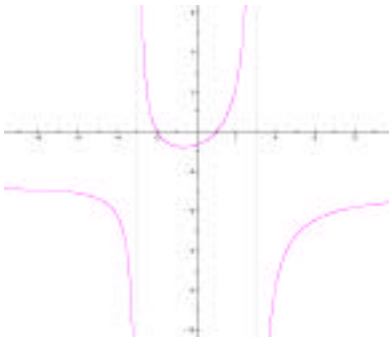


14.

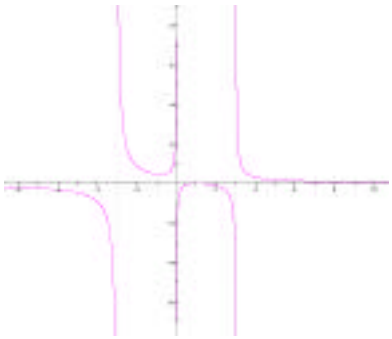
16.

18.



22.

26.



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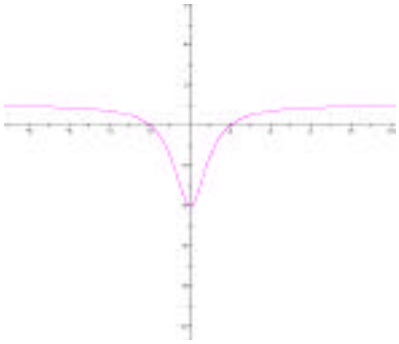
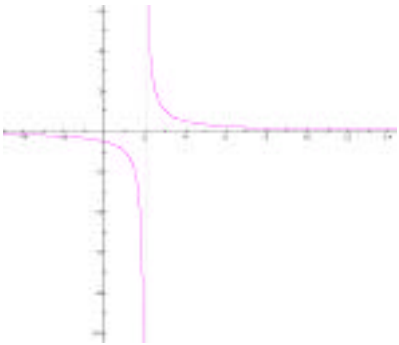
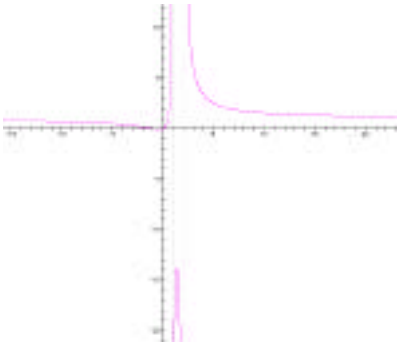


36.



38.

40.



42. $f(x) = \dfrac{15x - 30}{x(x+2)}$

44. $f(x) = \dfrac{2(x+2)(x-1)x}{(x+1)(x-3)x}$

SECTION 11.1

6. V(3, –1); $F\left(3, -\frac{7}{8}\right)$; l: $y = -\frac{9}{8}$

12. V(–4, 2); $F\left(-\frac{7}{2}, 2\right)$; l: $x = -\frac{9}{2}$

14. $x^2 = 12(y+2)$

---

16. $(y+2)^2 = -2(x-3)$

18. $x^2 = -16y$

22. $(x+2)^2 = -8(y-3)$

24. $(x-1)^2 = 8(y+2)$

SECTION 11.2

Let *C*, *V*, *F*, and *M* denote the center, the vertices the foci, and the end points of the minor axis respectively.

2. $V(\pm 5,0); F(\pm 3,0); M(0,\pm 4)$
8. $V(\pm\sqrt{5},0); F\left(\pm\frac{3}{2}\sqrt{2},0\right); M\left(0,\pm\frac{1}{2}\sqrt{2}\right)$
10. $C(-2,3); V(-2\pm\sqrt{5},3); F(-2\pm\sqrt{21},3); M(-2,3\pm 2)$
12. $C(-1,5); V(-1\pm 2\sqrt{2},5); F(-1\pm 2,5); M(-1,5\pm 2)$
16. $\frac{x^2}{16}+\frac{y^2}{9}=1$
18. $\frac{(x-1)^2}{4}+\frac{(y+2)^2}{16}=1$

---

26. $\frac{x^2}{13}+\frac{4y^2}{39}=1$
30. $\frac{x^2}{9}+\frac{4y^2}{49}=1$
32. The four points of intersection are $(\pm 2,\pm 2\sqrt{2})$
46. a) $y=\sqrt{960\left(1-\frac{x^2}{10{,}000}\right)}$

    b) about 31 ft.

SECTION 11.3

Let *C*, *V*, *F*, and *W* denote the center, the vertices the foci, and the end points of the conjugate axis respectively.

6. $V(0,\pm 1); F(0,\pm 4); W(\pm\sqrt{15},0); y=\pm\frac{1}{\sqrt{15}}x$
8. $V(\pm 2\sqrt{2},0); F(\pm 2\sqrt{3},0); W(0,\pm 2); y=\pm\frac{1}{2}\sqrt{2}x$
12. $C(3,1); V(3\pm 5,1); F(3\pm\sqrt{29},1)$
    $W(3,1\pm 2); (y-1)=\pm\frac{2}{5}(x-3)$
14. $C(-2,6); V(-2,6\pm 2); F(-2,6\pm\sqrt{5})$
    $W(-2\pm 1,6); (y-6)=\pm 2(x+2)$
16. $C(-2,-3); V\left(-2\pm\frac{3}{5},-3\right); F\left(-2\pm\frac{1}{5}\sqrt{34},-3\right)$
    $W(-2,-3\pm 1); (y+3)=\pm\frac{5}{3}(x+2)$
20. $(x-1)^2-\frac{(y-2)^2}{8}=1$

---

22. $\frac{x^2}{25}-\frac{y^2}{39}=1$
26. $\frac{x^2}{16}-\frac{3y^2}{4}=1$
34. Circle
36. Ellipse
40. Parabola (with a horizontal axis)
44. The two points of intersection are $(4,\pm 2\sqrt{3})$

Note: If you find any mistakes, and I am sure you will, please tell me, Tim Delworth at delworth@math.purdue.edu.

Thanks,