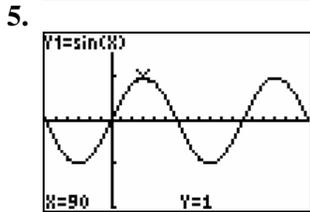
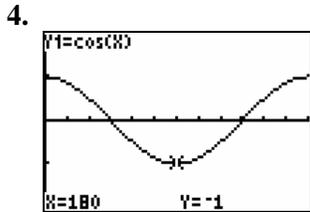
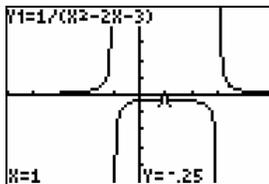


Prerequisite Skills

1. a) 0.4816 b) 0.9511
 c) -0.7660 d) -0.2679
 2. a) 46.3156 b) 1.5950
 c) -1.4843 d) 1.0861
 3. a) $\frac{1}{\sqrt{2}}$ b) $-\frac{1}{\sqrt{3}}$ c) -1
 d) $\frac{2}{\sqrt{3}}$ e) $\frac{2}{\sqrt{3}}$ f) 1



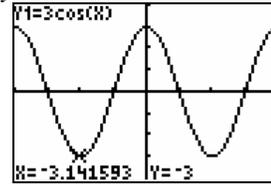
6. a) amplitude 2, period 360° , phase shift 180° to the right, 3 units upward
 b) maximum 5, minimum 1
 c) none
 d) 1
 7. a) amplitude 0.5, period 120° , phase shift 360° to the left, 1 unit downward
 b) maximum -0.5, minimum -1.5
 c) -1
 8. a) 57.7° b) 47.9°
 c) 54.3° d) 69.9°
 9. a) 0.77 b) 1.17
 c) 1.30 d) 0.54
 10. a) $x = 3, x = -1$ b) $y = 0$
 c)



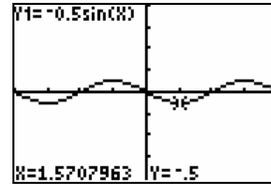
11. a) 0.8°C/h b) 0.6°C/h

5.1 Graphs of Sine, Cosine, and Tangent Functions

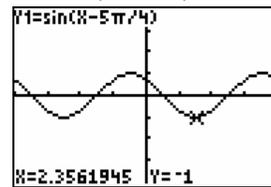
1. a) $y = 3 \cos x$



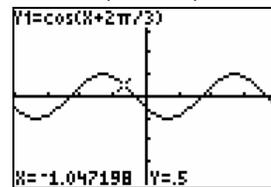
b) $y = -\frac{1}{2} \sin x$



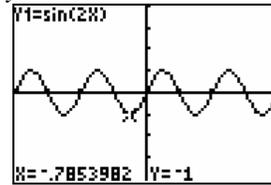
c) $y = \sin\left(x - \frac{5\pi}{4}\right)$



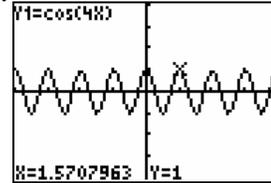
d) $y = \cos\left(x + \frac{2\pi}{3}\right)$

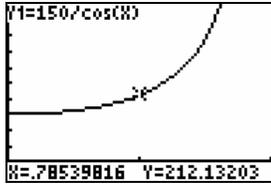


e) $y = \sin 2x$



f) $y = \cos 4x$

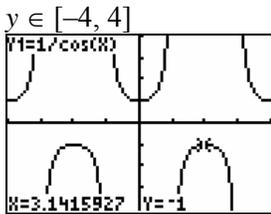




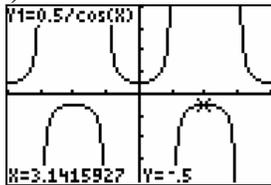
8. a) Answers may vary. Sample answer:

$$\sec^2 x = \csc^2 \left(x - \frac{\pi}{2} \right)$$

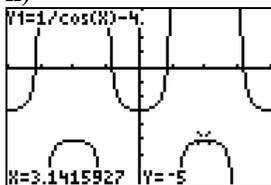
9. a) Window: $x \in [2\pi, 2\pi]$, Xscl = $\frac{\pi}{2}$,



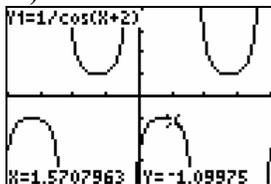
b) i)



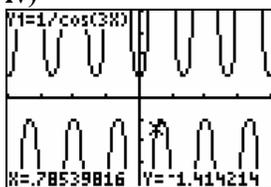
ii)



iii)



iv)



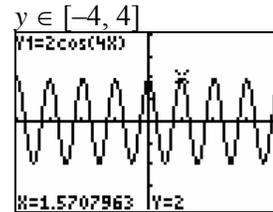
5.3 Sinusoidal Functions of the Form

$$f(x) = a \sin[k(x - d)] + c \text{ and}$$

$$f(x) = a \cos[k(x - d)] + c$$

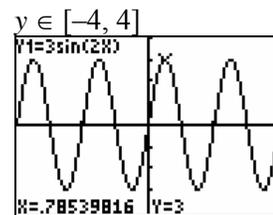
1. a) amplitude 2, period $\frac{\pi}{2}$

Window: $x \in [2\pi, 2\pi]$, Xscl = $\frac{\pi}{2}$,



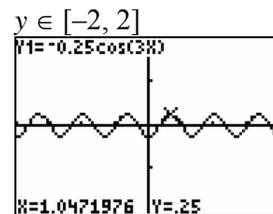
b) amplitude 3, period π

Window: $x \in [2\pi, 2\pi]$, Xscl = $\frac{\pi}{2}$,



c) amplitude $\frac{1}{4}$, period $\frac{2\pi}{3}$

Window: $x \in [2\pi, 2\pi]$, Xscl = $\frac{\pi}{2}$,



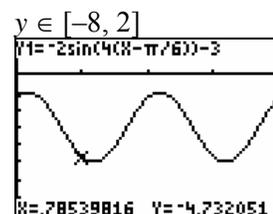
2. a) 2

b) $\frac{\pi}{2}$

c) $\frac{\pi}{6}$ rad to the right

d) 3 units downward

e) Window: $x \in [0, \pi]$, Xscl = $\frac{\pi}{4}$,

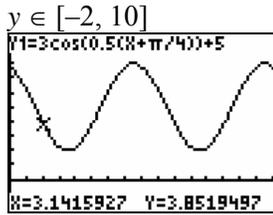


3. a) 3 b) 4π

c) $\frac{\pi}{4}$ rad to the left

d) 5 units upward

e) Window: $x \in [0, 8\pi]$, $Xscl = \frac{\pi}{2}$,



4. a) amplitude 1, period $\frac{2\pi}{3}$, phase shift

$\frac{2\pi}{3}$ rad to the right, no vertical translation

b) amplitude $\frac{1}{2}$, period π , phase shift

$\frac{5\pi}{6}$ rad to the left, vertical translation 1 unit downward

c) amplitude 2, period 8π , phase shift

$\frac{3\pi}{4}$ rad to the right, vertical translation 3.5 units upward

d) amplitude 4, period $\frac{2}{3}$, phase shift

2 rad to the right, vertical translation 2 units upward

5. a) amplitude 3, period 2π , phase shift

$\frac{\pi}{3}$ rad to the right, vertical translation 2 units upward

b) amplitude $\frac{1}{4}$, period π , phase shift

$\frac{5\pi}{4}$ rad to the left, no vertical translation

c) amplitude 1, period $\frac{\pi}{2}$, phase shift

$\frac{\pi}{6}$ rad to the right, vertical translation 3 units downward

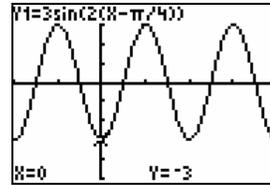
d) amplitude 1, period 1, phase shift 3 rad to the left, vertical translation 1 unit upward

6. a) amplitude 3, period π , phase shift

$\frac{\pi}{4}$ rad to the right, no vertical translation

b) $y = 3 \sin \left[2 \left(x - \frac{\pi}{4} \right) \right]$

c)

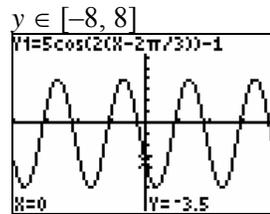


d) Answers may vary. Sample answer:

$y = 3 \cos \left[2 \left(x - \frac{\pi}{2} \right) \right]$

7. a) $y = 5 \cos \left[2 \left(x - \frac{2\pi}{3} \right) \right] - 1$

b) Window: $x \in [-2\pi, 2\pi]$, $Xscl = \frac{\pi}{2}$,



8. a) amplitude 8 m, period 40 s

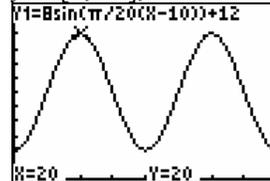
b) 12 m upward

c) 10 m to the right

d) $y = 8 \sin \left[\frac{\pi}{20} (t - 10) \right] + 12$

e) Window: $x \in [0, 80]$, $Xscl = 10$,

$y \in [0, 24]$, $Yscl = 2$



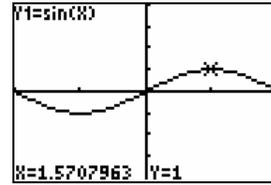
9. $y = a \sec[k(x-d)] + c$; a : multiply y -value by a ; k : changes the period to $\frac{2\pi}{k}$; d : phase shifts work the same as for sinusoidal functions; c : vertical translations work the same as for sinusoidal functions.

5.4 Solve Trigonometric Equations

1. a) 2.21, 4.07 b) no solutions
 c) 3.48, 5.94 d) 0.35, 3.49
 e) 1.16, 5.12
3. a) $\frac{3\pi}{4}, \frac{7\pi}{4}$ b) $\frac{\pi}{6}, \frac{5\pi}{6}$
 c) $\frac{5\pi}{6}, \frac{11\pi}{6}$ d) $\frac{\pi}{4}, \frac{7\pi}{4}$
 e) $\frac{5\pi}{6}, \frac{7\pi}{6}$
5. a) 0.52, 2.62, 3.66, 5.76
 b) 0.83, 2.31, 3.97, 5.45
 c) 0.80, 2.35, 3.94, 5.49
 d) 0.64, 2.50, 3.79, 5.64
 e) 0.69, 2.45, 3.83, 5.59
7. $\frac{\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$
8. 1.33, 1.71, 4.47, 4.85
9. $\frac{\pi}{3}$ or 1.05, 1.23, 5.05, $\frac{5\pi}{3}$ or 5.24
10. a) $\frac{\pi}{12}, \frac{5\pi}{12}$ b) $\frac{5\pi}{12}$
11. $\frac{\pi}{2}, \frac{3\pi}{2}$
12. exact solutions: $\frac{\pi}{8}, \frac{5\pi}{8}, \frac{9\pi}{8}, \frac{13\pi}{8}$
 approximate solutions: 0.39, 1.96, 3.53, 5.11
13. 0.73, 2.41
14. $\frac{\pi}{6}, \frac{5\pi}{6}, 3.48, 5.94$
15. 0.58, 2.29, 3.72, 5.43
17. a) $\left[0, \frac{\pi}{2}\right]$ b) 0.21, 1.37
18. $-\pi, -\frac{3\pi}{4}, -\frac{\pi}{4}, 0, \frac{\pi}{4}, \frac{3\pi}{4}, \pi, \frac{5\pi}{4}$

5.5 Making Connections and Instantaneous Rate of Change

1. a)



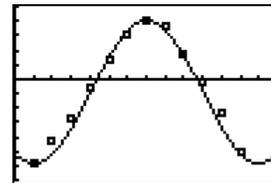
b) $-\frac{\pi}{2}, \frac{\pi}{2}$

c) maximum 0, minimum $-\pi$ or π

2. a) i) 0.542 ii) 0.529
 iii) 0.526 iv) 0.526
 b) 0.526 m/s c) no

3. a) $T = 9.85 \sin\left[\frac{\pi}{6}(m-4)\right] - 1.85$

b) Window: $x \in [0, 14], y \in [-14, 10], Y_{\text{scl}} = 2$

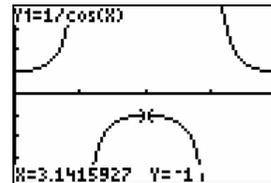


c) $T = 9.75 \sin[0.49(m-3.80)] - 1.97$

d) phase shift

4. -4.4°C/day

5. a)



b) $0, \pi, 2\pi$

2. B

3. D

4. D

5. B

6. a) The secant function is the reciprocal of the cosine function and \cos^{-1} is the opposite operation of cosine.

b) $\sec \frac{1}{\sqrt{2}} \approx 1.3154$, $\cos^{-1}x\left(\frac{1}{\sqrt{2}}\right) = \frac{\pi}{4}$

7. $\frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}$

8. a) 3

b) π

c) $\frac{5\pi}{6}$ rad to the right

d) 4.75 units down

e) Window: $x \in [-\pi, \pi]$, $Xscl = \frac{\pi}{2}$,

