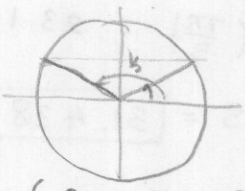
Homework 7 Solutions

Section 9.4

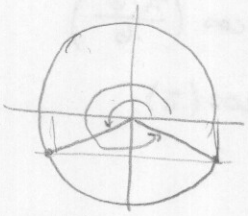
Odds.

87 a) $\sin\theta = \frac{1}{2}$



$\theta = \frac{\pi}{6}$ or $\theta = \frac{5\pi}{6}$ $\quad (\theta = 30° \text{ or } \theta = 150°)$

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

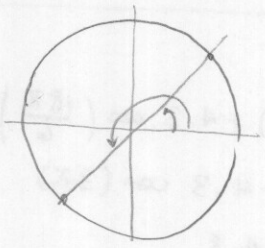


$\theta = \frac{7\pi}{6}$ or $\theta = \frac{11\pi}{6}$

$(\theta = 210° \text{ or } \theta = 330°)$

91. a) $\tan\theta = 1$

Then $\sin\theta = \cos\theta$



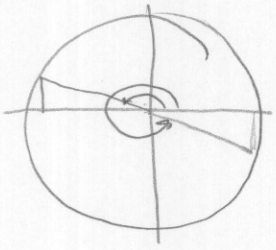
$\theta = \frac{\pi}{4}$ or $\theta = \frac{5\pi}{4}$

$(\theta = 45° \text{ or } \theta = 225°)$

b) $\cot\theta = -\sqrt{3}$

$\cot\theta = \frac{\cos\theta}{\sin\theta}$, so we want $\cos\theta = \frac{\sqrt{3}}{2}$, $\sin\theta = -\frac{1}{2}$

or $\cos\theta = -\frac{\sqrt{3}}{2}$, $\sin\theta = \frac{1}{2}$



So $\theta = \frac{5\pi}{6}$ or $\theta = \frac{11\pi}{6}$

$(\theta = 150° \text{ or } \theta = 330°)$

95. $S = 23.1 + 0.442t + 4.3\cos\left(\frac{\pi t}{6}\right)$

(S measured in thousands, t in months with t=1 representing Jan. 2010).

a) Feb. 2010: $t = 2$.

$S = 23.1 + 0.442(2) + 4.3\cos\left(\frac{\pi \cdot 2}{6}\right)$

$= 23.1 + 0.884 + 4.3\cos\left(\frac{\pi}{3}\right) = 23.1 + 0.884 + 4.3\left(\frac{1}{2}\right)$

$= 23.1 + 0.884 + 2.15$

$= \boxed{26.134 \text{ thousand snowboards}}$

95 cont.

b) Feb. 2011: $t=14$.

$$S = 23.1 + 0.442(14) + 4.3\cos\left(\frac{\pi \cdot 14}{6}\right)$$

$$= 23.1 + 6.188 + 4.3\cos\left(\frac{7\pi}{3}\right) = 23.1 + 6.188 + 4.3\cos\left(\frac{\pi}{3}\right)$$

$$= 23.1 + 6.188 + 2.15 = \boxed{31.438 \text{ thousand snowboards}}$$

c) June 2010: $t=6$

$$S = 23.1 + 0.442(6) + 4.3\cos\left(\frac{\pi \cdot 6}{6}\right)$$

$$= 23.1 + 2.652 + 4.3\cos(\pi)$$

$$= 23.1 + 2.652 - 4.3$$

$$= \boxed{21.452 \text{ thousand snowboards}}$$

d) June 2011: $t=18$

$$S = 23.1 + 0.442(18) + 4.3\cos\left(\frac{18\pi}{6}\right)$$

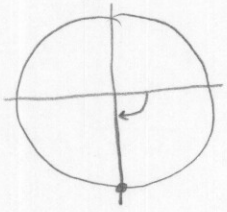
$$= 23.1 + 7.956 + 4.3\cos(3\pi)$$

$$= 23.1 + 7.956 - 4.3$$

$$= \boxed{26.756 \text{ thousand snowboards}}$$

Evens

64. $\theta = -\frac{\pi}{2}$



$\sin\theta = -1$

$\cos\theta = 0$

$\tan\theta$ is undefined.

68. $\theta = \frac{-23\pi}{4}$

$$-\frac{23\pi}{4} + 2\pi = -\frac{15\pi}{4}$$

$$-\frac{15\pi}{4} + 2\pi = -\frac{7\pi}{4}$$

$$-\frac{7\pi}{4} + 2\pi = \frac{\pi}{4}$$

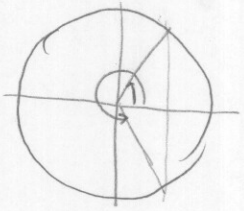
So $\sin\frac{-23\pi}{4} = \sin\frac{\pi}{4} = \frac{\sqrt{2}}{2}$

$\cos\frac{-23\pi}{4} = \cos\frac{\pi}{4} = \frac{\sqrt{2}}{2}$

$\tan\frac{-23\pi}{4} = \tan\frac{\pi}{4} = 1$

90. a) $\sec\theta = 2$

Since $\sec\theta = \frac{1}{\cos\theta}$, $\cos\theta = \frac{1}{2}$

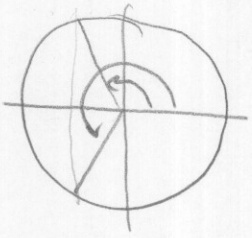


$\theta = \frac{\pi}{3}$ or $\theta = \frac{5\pi}{3}$

$(\theta = 60^\circ$ or $\theta = 300^\circ)$

b) $\sec\theta = -2$

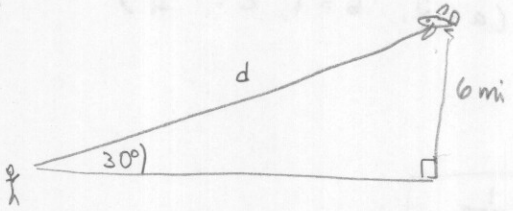
Since $\sec\theta = \frac{1}{\cos\theta}$, $\cos\theta = -\frac{1}{2}$



$\theta = \frac{2\pi}{3}$ or $\theta = \frac{4\pi}{3}$

$(\theta = 120^\circ$ or $\theta = 240^\circ)$

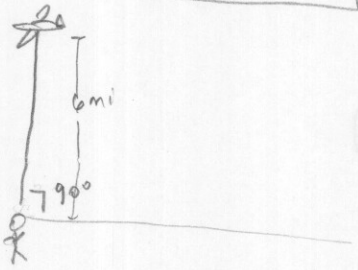
100 a) $\theta = 30^\circ$



$\frac{6}{d} = \sin 30^\circ = \frac{1}{2}$

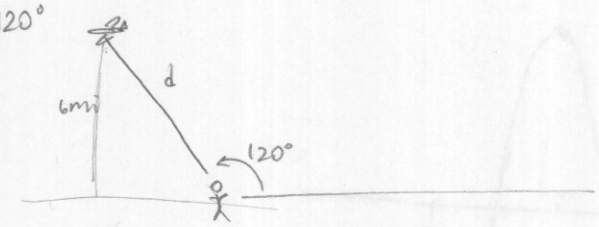
So $\boxed{d = 12 \text{ miles}}$

b) $\theta = 90^\circ$



$\boxed{d = 6 \text{ miles}}$

c) $\theta = 120^\circ$



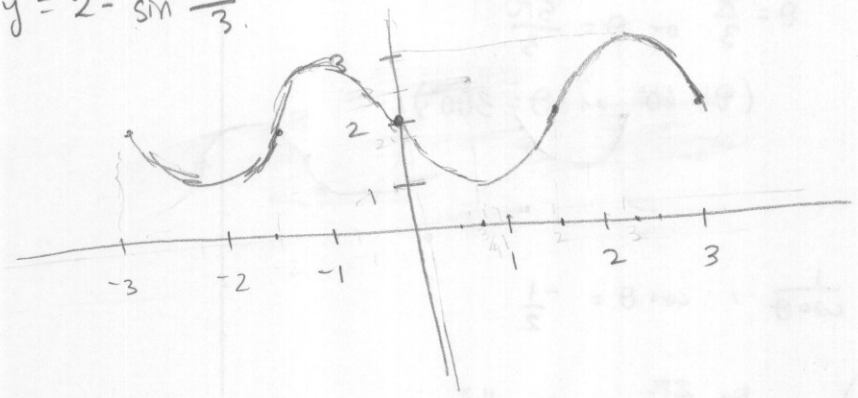
$\frac{6}{d} = \sin 120^\circ = \frac{\sqrt{3}}{2}$

So $d = \frac{12}{\sqrt{3}} = \boxed{4\sqrt{3} \text{ miles}}$

Section 9.5

Odds

53. $y = 2 - \sin\frac{2\pi x}{3}$ Amplitude = 1, Period = $\frac{2\pi}{2\pi/3} = 3$



79. Amplitude is 2

Period is 2π $\longrightarrow$ $b = \frac{2\pi}{2\pi} = 1$

Horizontal shift left by $\pi/4$.

$y = 2\sin(x + \pi/4)$ $\quad (a = 2,\ b = 1,\ c = -\frac{\pi}{4})$

95. $y = 0.001\sin(880\pi t)$

a) period = $\frac{2\pi}{b} = \frac{2\pi}{880\pi} = \boxed{\frac{1}{440}}$

b) frequency = $\frac{1}{p} = \frac{1}{1/440} = 440$

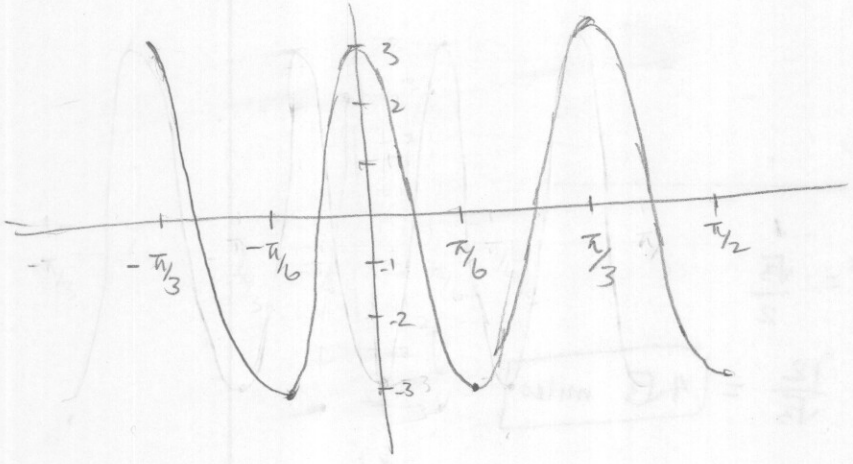
Evens

60. $y = -3\cos(\omega x + \pi) = -3\cos(6(x + \frac{\pi}{6}))$

Amplitude = 3

period = $\frac{2\pi}{b} = \frac{2\pi}{6} = \frac{\pi}{3}$

Horizontal shift left by $\pi/6$.



80. Amplitude: 2

period: 4 $\longrightarrow$ $b = \frac{2\pi}{4} = \frac{\pi}{2}$.

Horizontal shift left by 1

$$y = 2\sin\left(\frac{\pi}{2}(x-1)\right) = 2\sin\left(\frac{\pi x}{2} - \frac{\pi}{2}\right)$$

92. $v = 1.75 \sin \frac{\pi t}{2}$, t time in seconds.

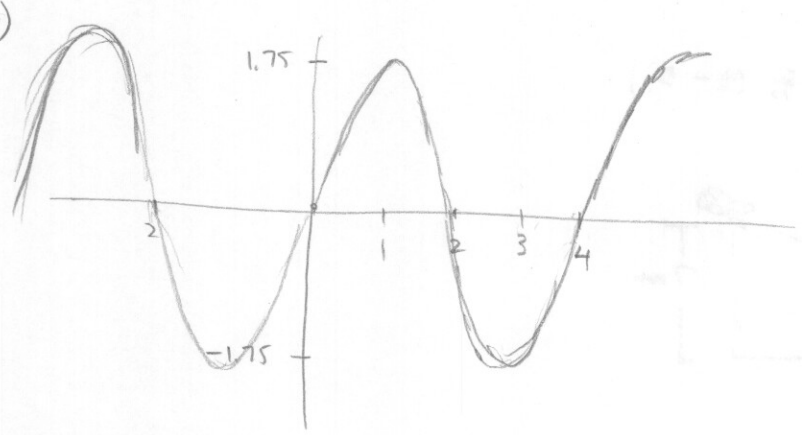
a) One full respiratory cycle = one period.

$$\text{period} = \frac{2\pi}{b} = \frac{2\pi}{\pi/2} = \boxed{4 \text{ seconds}}$$

b) Number of cycles per minute:

$$\frac{60 \text{ seconds}}{\text{minute}} \times \frac{1 \text{ cycle}}{4 \text{ seconds}} = \boxed{15 \text{ cycles/min}}$$

c)



94. $P = 100 - 20\cos\frac{5\pi t}{3}$

a) period: $\frac{2\pi}{b} = \frac{2\pi}{5\pi/3} = \boxed{\frac{6}{5} \text{ seconds}}$

b) One period has one heartbeat

So there are $\frac{60}{6/5} = \boxed{50 \text{ heartbeats per minute}}$

98. $h(t) = 53 + 50 \sin\left(\frac{\pi}{10} t - \frac{\pi}{2}\right)$

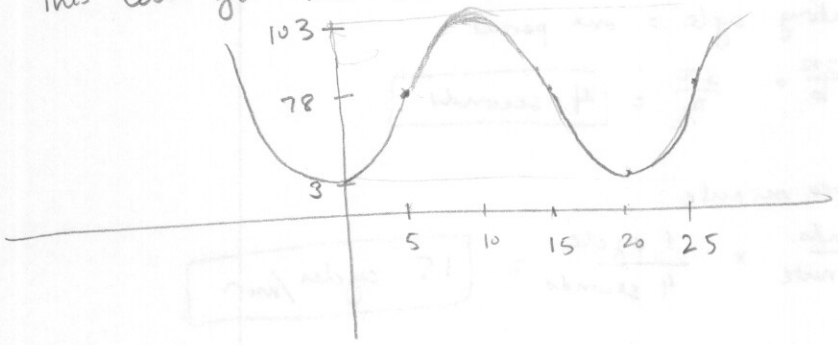
a) period $= \frac{2\pi}{b} = \frac{2\pi}{\pi/10} = 20$ seconds.

This tells you that it takes 20 seconds for the Ferris wheel to make one revolution.

b) amplitude $= 50$.

This tells you that the Ferris wheel has radius 50 feet.

c)

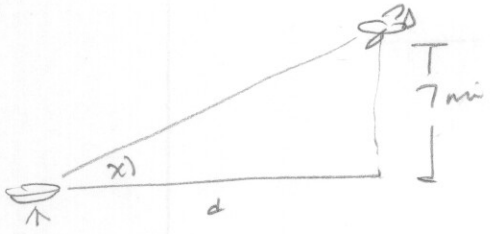


$h(t) = 53 + 50 \sin\left(\frac{\pi}{10}(t - 5)\right)$

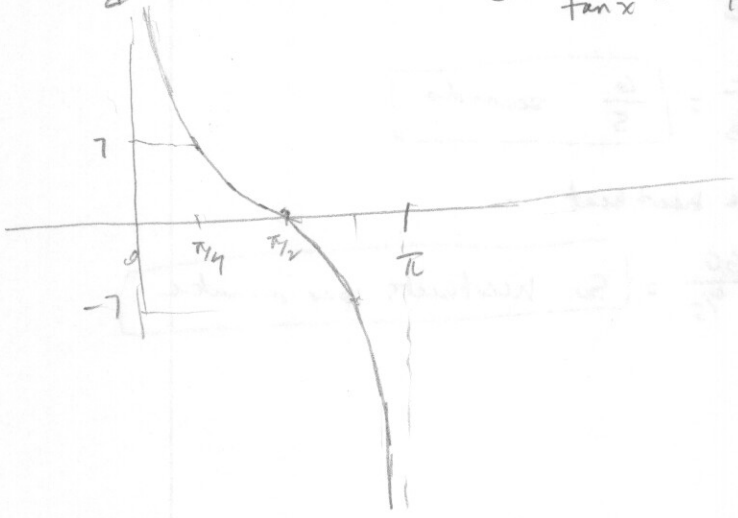
Section 9.6

Odds

91.

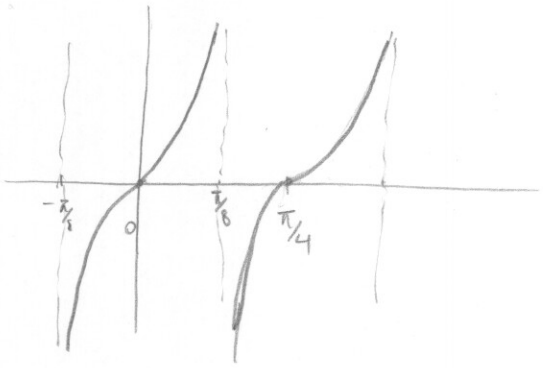


$\frac{7}{d} = \tan x$, so $d = \frac{7}{\tan x} = 7 \cot x$

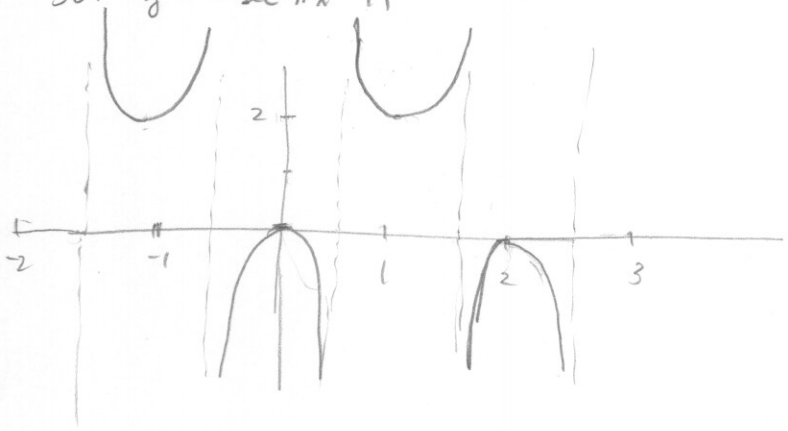


Evens

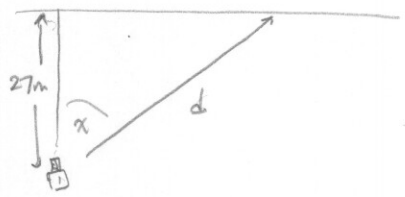
16. $y = \tan 4x$



36. $y = -\sec \pi x + 1$



92.



$\frac{27}{d} = \cos x$, so $d = \frac{27}{\cos x} = 27 \sec x$.