Assignment 5.4

To be completed on a separate piece(s) of paper.

1. Solve the following equations algebraically using exact values. $0 \le \theta < 2\pi$

a) $2\cos 3x = \sqrt{3}$

b) $5\tan\left(x - \frac{\pi}{3}\right) - 4 = 1$

c) $0 = 2\cos\left(x - \frac{\pi}{6}\right) + 1$

d) $4\sin 2x = -2$

e) $\sin 3x = \frac{\sqrt{3}}{2}$

f) $\sqrt{2}\cos\frac{1}{2}x = -1$

2. Solve the following equations and state a general solution using exact values in radians.

a) $\sqrt{2}\sin 7x = -1$

b) $2\cos 3\left(x - \frac{\pi}{4}\right) = 1$

3. On a typical day at an ocean port, the water has a maximum depth of $20\ m$ at $8{:}00\ AM$. The minimum depth of $12\ m$ occurs 6.2 hours later. Assume that the relationship between the depth of water and time is a sinusoidal function. Write an equation for the depth of the water at any time, t hours. (Midnight is $0{:}00\ AM$ or $t = 0$)

4. The rotation of a Ferris wheel is modelled by the equation $h = 26\cos 2\pi\frac{t-25}{50} + 27$ where h is the height above the ground in meters and time, t, is in seconds.

a) Draw a graph of 2 cycles and label the maximum, minimum, and middle line. Clearly label your axes.
b) At what time will the rider reach the maximum height?
c) What is the maximum height?
d) How long will it take until the rider can get off the Ferris wheel?
e) How high is the Ferris wheel above the ground?

5. A Ferris wheel has a radius of $25\ m$ and rotates every 80 seconds. A rider enters the seat at the lowest point on the wheel $2\ m$ above the ground.

a) Draw a graph of 2 cycles and label the maximum, minimum, and middle line. Clearly label your axes.
b) Write a function that gives the height, h, after t seconds of motion for the rider.
c) Find the height of a rider after 35 seconds. (nearest hundredth)

6. A wheel of radius $20\ cm$ has its centre $25\ cm$ above the ground. It rotates once every 10 seconds. Determine an equation for the height, h, above the ground of a point on the wheel at time t seconds if this point has a minimum height at $t = 0$ seconds.

7. Tides are a periodic rise and fall of water in the ocean. A low tide of $4.2\ m$ in White Rock, BC occurs at $4{:}30\ AM$, the next high tide of $11.8\ m$ occurs at $11{:}30\ AM$ the same day.

a) Write an equation that describes the tide.
b) What is the tide height at $1{:}15\ PM$, that same day? (nearest tenth)
c) If the first high tide is at $11{:}30\ AM$, at what time does the next high occur?

Answers:

1. a) $\frac{\pi}{18}, \frac{11\pi}{18}, \frac{13\pi}{18}, \frac{23\pi}{18}, \frac{25\pi}{18}, \frac{35\pi}{18}$ b) $\frac{7\pi}{12}, \frac{19\pi}{12}$ c) $\frac{5\pi}{6}, \frac{3\pi}{2}$

d) $\frac{7\pi}{12}, \frac{11\pi}{12}, \frac{19\pi}{12}, \frac{23\pi}{12}$ e) $\frac{\pi}{9}, \frac{2\pi}{9}, \frac{7\pi}{9}, \frac{8\pi}{9}, \frac{13\pi}{9}, \frac{14\pi}{9}$ f) $\frac{3\pi}{2}$

2. a) $\frac{5\pi}{28} + \frac{2\pi}{7}n, n \in I$ $\frac{\pi}{4} + \frac{2\pi}{7}n, n \in I$ b) $\frac{13\pi}{36} + \frac{2\pi}{3}n, n \in I$ $\frac{29\pi}{36} + \frac{2\pi}{7}n, n \in I$

3. Answers may vary. This is are the most common ones.

$y = 4\cos\frac{2\pi}{12.4}(x - 8) + 16$ $y = -4\cos\frac{2\pi}{12.4}(x - 14.2) + 16$ $y = 4\sin\frac{2\pi}{12.4}(x - 4.9) + 16$

4. a) See solution posted on Weebly
b) $25\ seconds$ c) $53\ m$ d) $50\ seconds$ e) $1\ m$

5. a) See solution posted on Weebly
b) Answers may vary. This is are the most common ones.

$y = 25\cos\frac{2\pi}{80}(x - 40) + 27$ $y = -25\cos\frac{2\pi x}{80} + 27$ $y = 25\sin\frac{2\pi}{80}(x - 20) + 27$

c) $50.10\ seconds$

6. Answers may vary. This is are the most common ones.

$y = 20\cos\frac{2\pi}{10}(x - 5) + 25$ $y = -20\cos\frac{2\pi x}{10} + 25$ $y = 20\sin\frac{2\pi}{10}(x - 2.5) + 25$

7. a) Answers may vary. This is are the most common ones.

$y = 3.8\cos\frac{2\pi}{14}(x - 11.5) + 8.0$ $y = -3.8\cos\frac{2\pi}{14}(x - 4.5) + 8.0$ $y = 3.8\sin\frac{2\pi}{14}(x - 8.0) + 8.0$

b) $10.7\ m$
c) $1{:}30\ AM$ the following day