Writing Equations for sinusoidal data

$$Amp = A = \frac{Max - Min}{2}$$

$$Vertical = (\mathrm{C}) = \frac{\mathrm{Max} + \mathrm{Min}}{2}$$

$$period = p$$

Horizontal Stretch/Shrink

$$\mathrm{B} = \frac{2\pi}{\mathrm{p}}$$

How to choose an appropriate model based on the behavior at some given time, T.

y = A cos B(t – T) + C
if at time T the function attains a maximum value

y = -A cos B(t – T) + C
if at time T the function attains a minimum value

y = A sin B(t – T) + C
if at time T the function halfway between a minimum and a maximum value

y = -A sin B(t – T) + C
if at time T the function halfway between a maximum and a minimum value

Construct a sinusoid with the given amplitude and period that goes through the given point.

$y = A \sin B(x-c) + D$

A) Amp: 6, period 8π, point (0, 0)

$A = 6$

$B = \frac{2\pi}{per} = \frac{2\pi}{8\pi} = \frac{1}{4}$

$y = 6 \sin \frac{1}{4}x$

B) Amp: 5.5, period $\frac{\pi}{6}$, point (4, 0)

$A = 5.5$

$B = \frac{2\pi}{Per} = \frac{2\pi}{\frac{\pi}{6}} = 2\cancel{\pi} \cdot \frac{6}{\cancel{\pi}} = 12$

P.S. 4 Right

$y = 5.5 \sin 12(x-4)$

C) Amp: 8, period 10π, point (0, 0)

$A = 8$

$B = \frac{2\pi}{10\pi} = \frac{1}{5}$

$y = 8 \sin \frac{1}{5}x$

D) Amp: 4.5, period $\frac{\pi}{10}$, point (6, 0)

$A = 4.5$

$B = \frac{2\pi}{\frac{\pi}{10}} = 20$

P.S. 6 Right

$y = 4.5 \sin 20(x-6)$

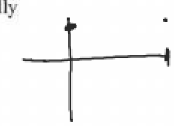
Calculating the Ebb and Flow of Tides for Maui

19.03 hr

February 12th, 2016, high tide occurred at 7:02 pm. At that time the water was 1.5 meters deep. Low tide occurred at 12:36 p.m, at which time the water was only .2 meters deep. Assume that the depth of the water is a sinusoidal function of time with a period of half a lunar day (about 12 hrs 24 min) 12.4

$\frac{2}{60} = .03$

a) Model the depth, D, as a sinusoidal function of time, t, algebraically then graph the function.



$A = \frac{max - min}{2} = \frac{1.5 - .2}{2} = .65$

$D = \frac{max + min}{2} = \frac{1.5 + .2}{2} = .85$

$B = \frac{2\pi}{per} = \frac{2\pi}{12.4} = \frac{\pi}{6.2}$

Shift Right 19.03

$y = .65 \cos \frac{\pi}{6.2}(x - 19.03) + .85$

b) At what time did the first low tide occur?

$(.43)(60)$

12:26 am

00:26 am

c) What was the approximate depth of the water at 6:00 am and at 3:00 pm?

$\hookrightarrow t = 6$

1.4872 m

$\hookrightarrow t = 15$

.5549 m

d) What was the first time on this day when the water was 1 meter deep?

$1 = .65 \cos \frac{\pi}{6.2}(x - 19.0) + .85$

$\frac{.15}{.65} = \frac{.65 \cos \frac{\pi}{6.2}(x - 19.03)}{.65}$

$\frac{\pi}{6.2} = .507$

$.2308 = \cos \frac{\pi}{6.2}(x - 19.03)$

$.2308 = \cos .507(x - 19.03)$

$.2308 = \cos(.507x - 9.648)$

$\cos^{-1}(.2308) = .507x - 9.648$

$1.34 = .507x - 9.648$

$+9.648 \qquad +9.648$

$\frac{10.988}{.507} = \frac{.507x}{.507}$

9:16 am

$x = 21.673$

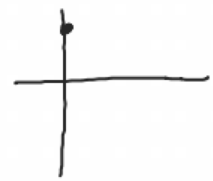
-12.4

9.273

Calculating the Ebb and Flow of Tides for Los Angeles

February 12th, 2016, high tide occurred at 12:30 pm. At that time the water was 5 feet deep. Low tide occurred at 6:00 p.m, at which time the water was only .5 feet deep. Assume that the depth of the water is a sinusoidal function of time with a period of half a lunar day (about 12 hrs 24 min)

a) Model the depth, D, as a sinusoidal function of time, t, algebraically then graph the function.



$A = 2.25$

$D = 2.75$

$B = \frac{\pi}{6.2}$

P.S. 12.5 Right

$$y = 2.25 \cos \frac{\pi}{6.2}(t - 12.5) + 2.75$$

b) At what time did the first low tide occur? 6:18 am

c) What was the approximate depth of the water at 4:00 am and at 9:00 pm?

$\hookrightarrow t = 4$

1.8672 ft

$\hookrightarrow t = 21$

1.8672

d) What was the first time on this day when the water was 2 meter deep?

$$2 = 2.25 \cos .507(x - 12.5) + 2.75$$

$$-.75 = 2.25 \cos .507(x - 12.5)$$

$$-.333 = \cos(.507x - 6.3375)$$

$$\cos^{-1}(-.333) = .507x - 6.3375$$

$$1.91 = .507x - 6.3375$$

3:52 am

$$8.248 = .507x$$

$$x = 16.268$$

$$-12.4$$

$$x = 3.86$$