4.4.1/4.4.2

Sine and cosine functions

Amplitude

O Notated by a

O Dictates the maxima and minima

O Graphically, it is one-half the height of the wave.

O Algebraically, it is represented as $\frac{M-m}{2}$

Sine Function

O $f(x) = a\sin(b(x - h)) + k$

   O $|a|$ = amplitude

   O b = horizontal stretch/shrink

   O h = phase shift (horizontal translation)

   O k = vertical translation

Sine Function

O Period $= \dfrac{2\pi}{|b|}$

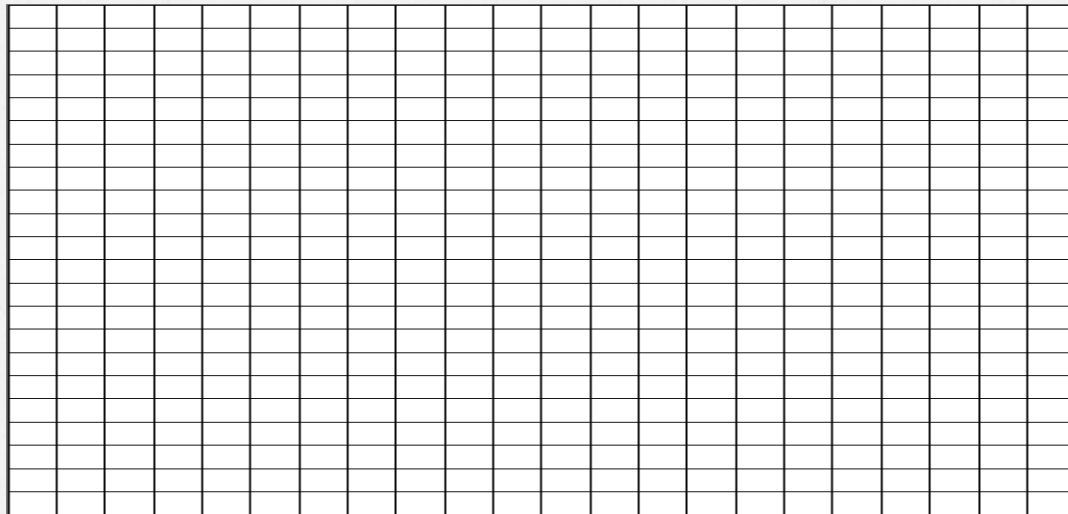O Frequency $= \dfrac{|b|}{2\pi}$

What is true about the period and frequency of a sine function?

Example

O Find the amplitude, period, and frequency of the function $f(x) = \dfrac{-3}{2}\sin 2x$

Example

O Graph one period of the function using only the information obtained from $g(x) = 2 \sin x$

Example

O State the amplitude, period, phase shift, and the vertical translation of
$$h(x) = -3.5 \ sin\left(2x - \frac{\pi}{2}\right) - 1$$

Cosine Function

O $f(x) = a\cos(b(x-h)) + k$

  O |a| = amplitude

  O b = horizontal stretch/shrink

  O h = phase shift (horizontal translation)

  O k = vertical translation

Cosine Function

O Period $= \dfrac{2\pi}{|b|}$

O Frequency $= \dfrac{|b|}{2\pi}$

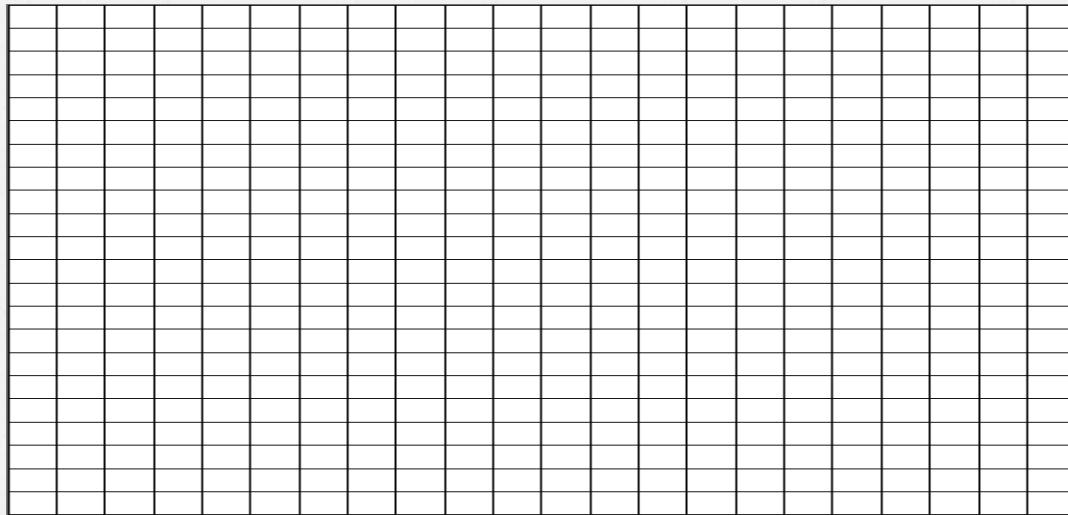What is true about the period and frequency of a cosine function?

Example

O Identify the maxima and minima of $g(x) = -\cos 2x + 3$ by using your knowledge of transformations.

Example

O Graph three periods of the function
$$j(\theta) = 3\cos\frac{\theta}{2}$$

How to create a sinusoidal function from data

O Determine the maximum value (call it M)

O Determine the minimum value (call it m)

O Find the amplitude (see slide #2)

O Determine the period. Call it p. The horizontal shrink will be $b = \frac{2\pi}{p}$

How to create a sinusoidal function from data

O Choose an appropriate sinusoid based on behavior at some given point. For example,

  O $f(t) = a \cos\big(b(t - h)\big) + k$ attains a maximum value

  O $f(t) = -a \cos\big(b(t - h)\big) + k$ attains a minimum value

  O $f(t) = a \sin\big(b(t - h)\big) + k$ is halfway between a min and a max value

  O $f(t) = -a \sin\big(b(t - h)\big) + k$ is halfway between a min and a max value

Example: Ebb & Flow

O A high tide occurred at 9:36 am. At that time the water was 2.7 m deep. Low tide occurred at 3:48 p.m. at which time the water was 2.1 m deep. Assume that the depth of the water is a sinusoidal function of time with a period of half a lunar day (about 12 hours, 24 minutes).

Example: Ebb & Flow

O What function models this phenomenon?

Example: Ebb & Flow

O At what time did the first low tide of the day occur?

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

O When was the first time that the water was 2.4 m deep?

Temperature Model

O The normal monthly temperature in Helena, MT are shown below. Model the temperature T as a sinusoidal function of time, using 20 as the minimum value and 68 as the maximum value. Support your answer by superimposing your model over the scatterplot.

M	1	2	3	4	5	6	7	8	9	10	11	12
T	20	26	35	44	53	61	68	67	56	45	31	21