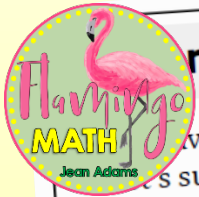


Precalculus Honors

Sinusoidal Curve Fitting & Applications



Unit 10: Sinusoidal Curve-Fitting and Applications

You have discovered several characteristics of trigonometric functions written in standard form. Summarize here, using the sine function. Describe and explain the changes to the graph for each value in the equation below.

EX #1: Given the standard form of a sine function, $y = A \sin(Bx - C) + D$, complete the summary in the table below.

Given:	Variable Expression	Explain the effect of this transformation on the parent function
Amplitude	A	half the height of the wave. A vertical stretch or shrink.
Period	$\frac{2\pi}{B}$	length of one full cycle of the wave
	C	horizontal shift, the first "zero point" of a cycle.

Completely Editable 4.10

Lesson 10: Sinusoidal Curve-Fitting and Applications

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EX #1: Given the standard form of a sine function, $y = A \sin(Bx - C) + D$, complete the summary in the table below.

Given:	Variable Expression	Explain the effect of this transformation on the parent function
Amplitude		
Period		
Phase shift		
Vertical shift		

Which expression in the table would change if the function was tangent or cotangent?

_____. What expression would then be used? _____

Finding an Interval for the First Cycle

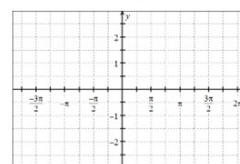
EX #2: We can find the endpoints for the first cycle of a trigonometric function in two ways. Let's explore.

	Method #1	Method #2
Period Begins:		
Period Ends:		

NOTE: *You will use the first and last points of one cycle to divide the interval into four equal segments.*

EX #3: Find the amplitude, period, and phase shift for $y = 2 \cos(2x + 3\pi)$. Graph the function.

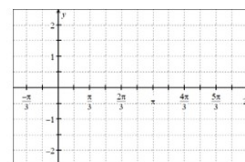
Amplitude:	
Period:	
Phase Shift:	



Graphing Transformations with Key Points

EX #4: Given the equation, $y = -2 \sin(3x - 6\pi)$, describe the transformations that occur from the parent graph $y = \sin x$. Then sketch the graph.

- _____
- _____
- _____
- _____



Summary for Graphing Sinusoidal Functions

To graph sinusoidal functions of the form $y = A \sin(Bx - C) + D$ or $y = A \cos(Bx - C) + D$:

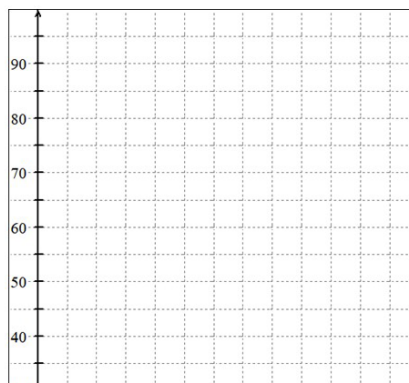
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

Finding Sinusoidal Functions from Data

EX #5: The table below shows the average temperature per month for Atlanta, Georgia. Information was found at the World Climate website (www.worldclimate.com).

Month	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
$^{\circ}\text{F}$	51.6	55.9	63.7	72.7	80.1	86.2	88.3	87.4	82.0	72.7	62.6	54.0

A: Plot the data below, and notice that they approximate sinusoidal behavior:



C. Let's model this graph with a sine function in the form of $y = A \sin(Bx - C) + D$.

Use the data plot to estimate the amplitude, period, vertical and horizontal translations.

Use these values in the sinusoidal equation and test your model by using your calculator to graph it on top of the data.

NOTES

4.10

Sinusoidal Curve-Fitting
And Applications
Homework

Name _____

Date _____ Period _____

Problems 1–4, Write the equation for the given function that has the following characteristics.**1. Sine function**

Amplitude: 4 Period: π

Phase Shift: $-\frac{1}{2}$ Vertical shift: none

2. Cosine function

Amplitude: 3 Period: 4π

Phase Shift: 2 Vertical shift: -1

3. Tangent function

Amplitude: 5 Period: 3π

Phase Shift: $-\frac{1}{3}$ Vertical shift: 2

4. Sine function

Amplitude: 3 Period: $\frac{\pi}{2}$

Phase Shift: -2 Vertical shift: 4

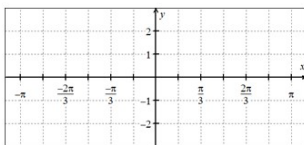
Problems 5–10, Find amplitude, period, and phase shift of each function. Graph the function.

5. $y = 2 \cos(3x - \pi)$

Amplitude:

Period:

Phase shift:

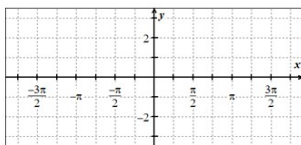


6. $y = -2 \sin\left(2x - \frac{\pi}{2}\right)$

Amplitude:

Period:

Phase shift:

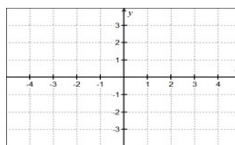


7. $y = 2 \cos(\pi x + 2\pi)$

Amplitude:

Period:

Phase shift:

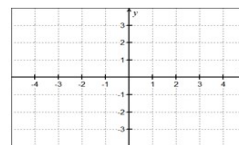


8. $y = -3 \sin(\pi x - 4\pi)$

Amplitude:

Period:

Phase shift:

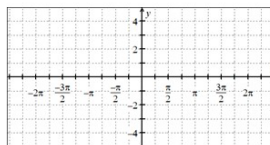


9. $y = -4 \cos\left(\frac{1}{2}x - \pi\right)$

Amplitude:

Period:

Phase shift:

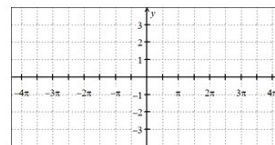


10. $y = 2 \sin\left(\frac{x}{2} + \frac{3\pi}{2}\right)$

Amplitude:

Period:

Phase shift:

**Problems 11–14,** Solve the following application problems.

11. The current, I , in amperes, flowing through an alternating current circuit (AC) at time t , where t is measured in seconds, is given by $I = 120 \sin\left(30\pi t - \frac{\pi}{6}\right)$, $t \geq 0$.

A. What is the maximum current available in amperes?

B. Find the current, I , in amperes, at $t = \frac{1}{2}$ sec.

12. The voltage V , produced in an alternating current generator can be modeled by $V(t) = 220 \sin(120\pi t)$.

A. Find the amplitude and period.

B. If a resistance of $R = 20$ ohms is present, what is the current I ? Use Ohm's Law $V = IR$.C. Find the amplitude and period of the current I .

13. A buoy in the Gulf of Mexico sends a signal beacon to a Coast Guard station. The behavior of the buoy can be modeled by the function $h = a \sin(bt) + 4$, where h is measured in feet above sea level. During a recent tropical storm, the height varies from 1 foot to 8 feet with a 4.5 second interval between one 8-foot height to the next. Find the values of the constants a and b .

14. In Miami, FL, there are 12 hours 45 minutes of sunlight on the summer solstice, but only 10 hours 35 minutes of sunlight on the winter solstice.

A. Write a function that models this data using the format:

Free-Response Questions

The depth of the water at the end of the Cocoa Beach Pier varies with the tide on any given day. Suppose the high tide occurs at 5:15 a.m. and the depth of the water is 15 feet, then low tide occurs at 11:27 a.m. with a depth of 9.5 feet.

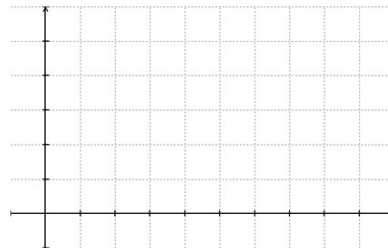


A. Sketch a graph showing how the depth of the water depends on the time since midnight.

B. Write a trigonometric equation as a sine function that models the depth of the water t hours after midnight.

C. What is the depth of the water at noon?

D. If a large party boat needs at least 12 feet of water to navigate past the pier, find the time period, after noon, that the boat can safely pass by the end of the pier.



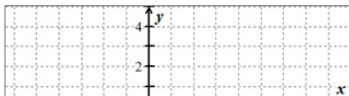
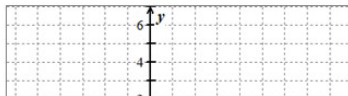
Practice Sets

of the year.

Lesson Warm-Ups

Name _____ Date _____ Period _____	
Lesson 4.10 - Sinusoidal Curve Fitting and Applications Warm-Up # 1	
1. State the amplitude given $y = -2 \cos\left(-2x + \frac{\pi}{2}\right) - 1$	2. State the vertical shift using the equation from #1.
3. Find the period of the graph.	4. Find the phase shift of the graph and specify whether the shift is to the right or to the left.

Name _____ Date _____	
Lesson 4.10 - Sinusoidal Curve Fitting and Applications Warm-Up # 2	
1. State the amplitude given $y = 3 \cos\left(2x + \frac{\pi}{2}\right) + 2$	2. State the vertical shift using the equation from #1.
3. Find the period of the graph.	4. Find the phase shift of the graph and specify whether the shift is to the right or to the left.

4.10 Sinusoidal Curve Fitting Form A	4.10 Sinusoidal Curve Fitting Form B
Name _____	Name _____
Date _____ Period _____	Date _____ Period _____
Given: $y = -3 \cos\left(2x + \frac{\pi}{2}\right) - 2$	Given: $y = 4 \cos\left(-2x + \frac{\pi}{2}\right) + 1$
1. State the amplitude	1. State the amplitude
2. State the vertical shift.	2. State the vertical shift.
3. Find the period.	3. Find the period.
4. Find the phase shift and specify whether the shift is to the right or to the left.	4. Find the phase shift and specify whether the shift is to the right or to the left.
5. Graph the function.	5. Graph the function.
	

Daily Lesson Quiz

Grade: _____	Grade: _____
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