

Math Weekly Lesson Preparation Guide

Teacher Name: Kimberly West	Grade: 11 th /12 th Precalculus
Week of: January 27 th thru 31 st	Unit: 4 Lesson Numbers: 4.3 Periodic Functions and 4.4 Graphs of Sine and Cosine

Purpose: The Weekly Lesson Preparation Guide is to provide a structure that encourages teachers to think through and internalize the daily/weekly instructional expectations.

Planning Questions	Monday	Tuesday	Wednesday	Thursday	Assessment
	Assessment	Lesson 4.3	Lesson 4.4	Lesson 4.4	OR
	QUIZ				Remediation
1. Which specific	P.F.TF.A.2 Convert from	P.F.TF.A.4 Use the unit	P.F.GT.A.3 Graph the	P.F.GT.A.3 Graph the	P.F.TF.A.4 Use the
Tennessee	radians to degrees and	circle to explain	six trigonometric	six trigonometric	unit circle to
standard(s) are	from degrees to radians	symmetry (odd and even)	functions and identify	functions and identify	explain symmetry
being addressed in	P.F.TF.A.1 Understand	and periodicity of	characteristics such	characteristics such as	(odd and even) and
this lesson? What	radian measure of an	trigonometric functions	as period, amplitude,	period, amplitude,	periodicity of
is the focus of this	angle as the length of the		phase shift, and	phase shift, and	trigonometric
lesson? What will	arc on the unit circle	Objective: I can use	asymptotes	asymptotes	functions
the lesson	subtended by the angle.	periodicity to evaluate	P.F.GT.A.1 Interpret		P.F.GT.A.1 Interpret
objective be for	P.G.AT.A.1 Use the	trig functions	transformations of	Objective : I can find	transformations of
each day?	definitions of the six		trigonometric	the amplitude, period,	trigonometric
	trigonometric ratios as		functions	and/or frequency of a	functions
	ratios of the sides in a			transformed sine or	P.F.GT.A.3 Graph
	right tringle to solve		Objective: I can	cosine function	the six
	problems about lengths		graph sinusoids.		trigonometric
	of sides and measures of				functions and
	angles.				identify
	P.F.TF.A.3 Use special				characteristics
	triangles to determine				such as period,
	geometrically the values				amplitude, phase

	of sine, cosine, tangent				shift, and
	for $\pi/3$, $\pi/4$, and $\pi/6$, and				asymptotes
	explain how to use the				
	unit circle to express the				
	values of sine, cosine,				
	and tangent for π -x, π +x,				
	and 2π-x in terms of their				
	values for x, where x is				
	any real number				
	P.G.AT.A.1 Use the				
	definitions of the six				
	trigonometric ratios as				
	ratios of the sides in a				
	right tringle to solve				
	problems about lengths				
	of sides and measures of				
	angles.				
	P.F.TF.A.4 Use the unit				
	circle to explain				
	symmetry (odd and				
	even) and periodicity of				
	trigonometric functions				
Modeling:					
2. Complete all			Chantar 4	Chapter 4	
tasks included in		Chapter 4 Trigonometric Precalculus	Trigonometric Functions Trigonometric Functions	Trigonometric Functions Precalculus	
the lesson and		Functions Graphical, Numerical, Algebraic tre Editor	The first	TO THE ROLL	
review the		Section 4.3	Section 4.4 Graphs of Sine	Section 4.4 Graphs of Sine	
sample/anticipated		Trigonometry Extended: The	and Cosine: Sinusoids	and Cosine: Sinusoids	
student responses.		Circular Functions	POLYMAN MENOREMANNS Copyright 2379, 2013, 2011 Prantocal Salandra, Inc. 1	PROCESSE ANNOTALISMANC Copyrigin C 2017, 2011, 2011 Process Side arising Sec. 1	
For each task		P / VOC-9911 ALENDA EARNING. Coppings C 2019, 2015, 2011 Passens Education, Inc. 1			
consider:			What you'll learn about	What you'll learn about	
 What are the 			The Basic Waves Revisited Sinusoids and Transformations	The Basic Waves Revisited Sinusoids and Transformations	
multiple			Modeling Periodic Behavior with Sinusoids	Modeling Periodic Behavior with Sinusoids	
solution paths			and why Sine and cosine gain added significance when used to model waves and periodic behavior.	and why Sine and cosine gain added significance when used to model waves and periodic behavior.	
students might				1	
			POSTORII ARMENIARANS Coppright C 2019, 2015, 2011 Province Sides afrom Sec. 2	PROCESIII ARMANIAMAN Coppingle C 2019, 2013, 2011 Process Education, Inc. 2	



- What is the purpose of this task? Specifically, which aspect(s) of rigor are being addressed (conceptual understanding, procedural fluency, and/or application)? How does this differ based on the solution path
- Given this purpose, what key concepts and vocabulary might students need to understand to access the task?

Unit Circle

The unit circle is a circle of radius 1 centered at the origin.



Trigonometric Functions of Real Numbers

Let t be any real number, and let P(x,y) be the point corresponding to t when the number line is wrapped onto the unit circle as described above. Then

$$\sin t = y \qquad \csc t = \frac{1}{y} \quad (y \neq 0)$$

$$\cos t = x \qquad \sec t = \frac{1}{x} \quad (x \neq 0)$$

$$\tan t = \frac{y}{x} \quad (x \neq 0) \quad \cot t = \frac{x}{x} \quad (y \neq 0)$$

Periodic Function

A function y = f(t) is **periodic** if there is a positive number c such that f(t+c) = f(t) for all values of t in the domain of f. The smallest such number c is called the **period** of the function.



Sinusoid

A function is a **sinusoid** if it can be written in the form $f(x) = a \sin(bx + c) + d$ where a, b, c, and d are constants and neither a nor b is 0.

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Amplitude of a Sinusoid

The **amplitude** of the sinusoid $f(x) = a\sin(bx+c) + d$ is |a|. Similarly, the amplitude of $f(x) = a\cos(bx+c) + d$ is |a|. Graphically, the amplitude is half the height of the wave.

Period of a Sinusoid

The **period** of the sinusoid $f(x) = a \sin(bx + c) + d$ is $2\pi/|b|$. Similarly, the period of $f(x) = a \cos(bx + c) + d$ is $2\pi/|b|$. Graphically, the period is the length of one full cycle of the wave.

Example: Horizontal Stretch or Shrink and Period

Find the period of $y=\sin\left(\frac{x}{2}\right)$ and use the language of transformations to describe how the graph relates to $y=\sin x$. The period is $\frac{2\pi}{1}=4\pi$. The graph of $y=\sin\left(\frac{x}{2}\right)$

is a horizontal stretch of $y = \sin x$ by a factor of 2.

Frequency of a Sinusoid

The **frequency** of the sinusoid $f(x) = a\sin(bx+c) + d$ is $|b|/2\pi$.

Similarly, the frequency of $f(x) = a\cos(bx+c) + d$ is $|b|/2\pi$.

Graphically, the frequency is the number of complete cycles the wave completes in a unit interval.

Example: Combining a Phase Shift with a

Construct a sinusoid with period $\pi/3$ and amplitude 4 that goes through (2,0). To find the coefficient of x, set $2\pi/|b| = \pi/3$ and

To find the coefficient of x, set $2\pi/|b| = \pi/3$ and solve for b.

Find $b = \pm 6$. Arbitrarily choose b = 6.

For the amplitude set |a|=4. Arbitrarily choose a=4. The graph contains (2,0) so shift the function 2 units to the right.

 $y = 4\sin(6(x-2)) = 4\sin(6x-12)$.

Example: Combining a Phase Shift with a Period Change

Find the frequency of the function $f(x) = -\frac{1}{3}\cos 5x$ and interpret its meaning graphically. Sketch the graph in the window $\left[-\frac{2\pi}{5},\frac{2\pi}{5}\right]$ by $\left[-\frac{1}{3},\frac{1}{3}\right]$.

Solution

The frequency is $5 + 2\pi = \frac{5}{2\pi}$. This is the reciprocal of the period, which is $2\pi/5$.

The graph completes one cycle per interval of length $2\pi/5$.



Graphs of Sinusoids (1 of 2)

The graphs of $y = a\sin(b(x-h)) + k$ and $y = a\cos(b(x-h)) + k$ (where $a \neq 0$ and $b \neq 0$) have the following characteristics amplitude = |a|

 $period = \frac{2\pi}{|b|}$

frequency = $\frac{|b|}{2\pi}$

	Vocabulary Initial Side Vertex Terminal Side Measure of an Angle Positive Angle Negative Angle Standard Position Coterminal Angles Reference Triangle Reference Angle Quadrantal Angles Unit Circle Wrapping Function Circular Functions Periodic Period	Vocabulary Sinusoid Amplitude Frequency Phase Shift	When compared to the graphs of $y = a \sin hx$ and $y = a \cos hx$, respectively, they also have the following characteristics: a phase shift of h , a vertical translation of k . **Constructing a Sinusoidal Model Using Time (1 of 2) 1. Determine the maximum value M and minimum value m . The amplitude A of the sunusoid will be $A = \frac{M-m}{2}$, and the vertical shift will be $C = \frac{M+m}{2}$. 2. Determine the period p , the time interval of a single cycle of the periodic function. The horizontal shrink (or stretch) will be $B = \frac{2\pi}{p}$. **The Note of the period of the sunusoid based on behavior at some given time T : For example, at time T : $f(t) = A\cos(B(t-T)) + C$ attains a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is halfway between a maximum value; $f(t) = A\sin(B(t-T)) + C$ is an	
			Vocabulary Sinusoid Amplitude Frequency Phase Shift	

3. What specific tasks/problems will you use to reveal understanding of the grade-level standard(s)? (refer to the Instructional Focus Document Evidence of Learning Statements)	*Selective Pra from pages 340-341 *Look and list steps and voc to explain eac problem solv	cabulary used proper steps and vocabulary	*Selective Practice Problems from pages 350-341 *Look and listen for proper steps and vocabulary used to explain each step in the problem solving process	
Additional				
If your lesson contains homework, how will you utilize the work? Will you need to send scaffolding notes home? Is there a strategy you can use to maximize homework?	Align with Lean Objectives: En homework dire the concepts to allowing studen their learning. Variety of Task different types (e.g., practice, extension) to co levels of unders reinforce the co multiple angles Scaffolded Pro with easier prof gradually increa This helps build and understand tackling more of Extension Chall a few challengi	Align with Learning Objectives: Ensure thomework directly re to the concepts tauge class, allowing stude apply their learning. Variety of Tasks: Inc different types of pro (e.g., practice, applie extension) to cater to various levels of understanding and to oncept from s. oblems: Start blems and ase difficulty. d confidence ding before complex tasks. llenges: Include ing problems e critical thinking in beyond the	by: Align with Learning Objectives: Ensure that homework directly relates to the concepts taught in class, allowing students to apply their learning. Variety of Tasks: Include different types of problems (e.g., practice, application, extension) to cater to various levels of understanding and to reinforce the concept from multiple angles. Scaffolded Problems: Start with easier problems and gradually increase difficulty. This helps build confidence and understanding before tackling more complex tasks. Extension Challenges: Include a few challenging problems that encourage critical thinking and exploration beyond the	