GSE Accelerated Precalculus

Unit 2 Trig Functions – Review

1. List the domains and ranges:

	Sine	Cosine	Arcsine	Arccosine	Arctangent
Domain	$(-\infty, \infty)$	$(-\infty, \infty)$	$[-1, 1]$	$[-1, 1]$	$(-\infty, \infty)$
Range	$[-1, 1]$	$[-1, 1]$	$[-\pi/2, \pi/2]$	$[0, \pi]$	$(-\pi/2, \pi/2)$

2. Explain how to find the amplitude and vertical shift of a sinusoidal curve when given the max and min.

$$\text{Amp} = \frac{\text{Max} - \text{Min}}{2} \; ; \quad VS = \frac{\text{Max} + \text{Min}}{2}$$

3. Explain how to find the max and min of a sinusoidal curve when given the amplitude and vertical shift.

$$\text{Max} = d + a \; ; \quad \min = d - a$$

4. Explain how you would find the period of a sinusoidal curve when given the x-values of a consecutive max and min.

$$(X_{max} - X_{min}) \times 2 = \text{period}$$

Part 2

The times S of sunset (Greenwich Mean Time) at 40° north latitude on the 15th of each month are given by the following equation: $S(t) = 18.09 + 1.41\sin\left(\frac{\pi}{6}t + 4.60\right)$

The month is represented by t, with $t = 1$ corresponding to January. Minutes have been converted to the decimal part of an hour for this data.

5. What is the period of the model? Is it what you expected? Explain.

$$\left.\frac{\pi}{6} = \frac{2\pi}{P}\right\} \quad P = \frac{2\pi 6}{\pi} \Rightarrow \begin{matrix} 12 \text{ months} \\ P = 12 \text{ months} \end{matrix}$$

Yes, 1 year equal 12 months

6. What is the amplitude of the function? What does it represent in the model? Explain.

$a = 1.41$ Average sunset ≈ 18.09, so max $= 19.58$ min $= 16.68$

7. Rework the problems in your Trig Applications Task and visit this website for more practice writing equations (4 practice problems) for sinusoidal applications:
http://www.algebralab.org/Word/Word.aspx?file=Trigonometry_SineModels2.xml

Part 3. Graphing: Be able to identify all transformations and characteristics given a trig function (such as domain, range, horizontal/vertical shifts, period, amplitude or vertical stretch/compression, reflections).

8. Graph:

(Desmos Graphs)

a.) $f(x) = -\frac{5}{2}\cos\frac{x}{4}$

b.) $f(x) = 4\sin\left(x - \frac{\pi}{2}\right)$

c.) $f(x) = \sec\left(\frac{1}{2}x - \frac{\pi}{2}\right) + 3$

d.) $f(x) = 3\tan 2x - 1$

e.) $f(x) = 2\cot\left(\frac{2\pi}{3}x\right) - 2$

f.) $f(x) = \csc\left(3x - \frac{\pi}{2}\right) + 3$

Unit 2 Trig Functions – Review

$D = \frac{40+(-10)}{2} = 15$

Part 4 . Write a sinusoidal equation with the given characteristics.

9. Sine Curve Max is 20 ft Min is 2 ft Period is 2.5 minutes	10. Starts at a minimum $y=-\cos x$ Sinusoidal axis is y=112 Amplitude is 27 Distance between a consecutive max and min is 10	11. Starts at the center and is falling $y=-\sin x$ Min is -10 Amplitude is 25 Period is 12π

$\boxed{y = 9\sin \frac{4\pi}{5}x + 11}$

$A = \frac{20-2}{2} = 9$

$D = 11 \leftarrow \frac{20+2}{2}$

$P = 2(10) = 20$

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

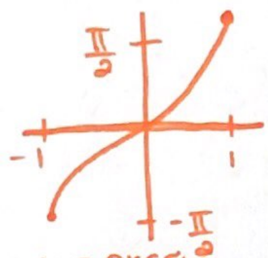
$\boxed{y = -\cos\left(\frac{\pi}{10}x\right) + 112}$

$B = \frac{2\pi}{12\pi} = \frac{1}{6}$

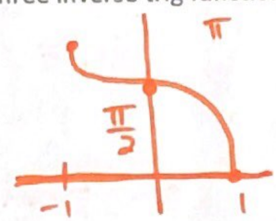
$\boxed{y = -25\sin\left(\frac{1}{6}x\right) + 15}$

Part 5. Inverse Trig Functions

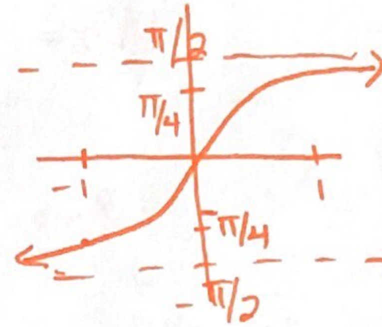
12. Graph the parent graphs for the three inverse trig functions.



y = arcsin



y = arccos



y = arc tan

13. Explain why the domain and range are limited to the values they are.

It must pass the vertical line test to be one-to-one.

So, Arc sin : D: [-1, 1] original range R: [-π/2, π/2]

Arccos : D: [-1, 1] original range R: [0, π)

Arc tan : D: (-∞, ∞) original range R: (-π/2, π/2)

restricted to be one-to one

CCGPS Precalculus Name ______________________________

Unit 2 Study Guide: Graphing Trigonometric Functions

I. **Know how to graph parent graphs and find the characteristics for sine, cosine, tangent, secant, cosecant, cotangent, $\cos^{-1}\theta$, $\sin^{-1}\theta$, and $\tan^{-1}\theta$.**

II. **Identify characteristics and graph two cycles of the transformed graphs.**

1. $y = -\cos(2x) + 5$

(graphed on desmos)

Amplitude: 1

Period: π

Sinusoidal Axis(midline): $y = 5$

Phase shift: none

Frequency: $1/\pi$

Domain: $(-\infty, \infty)$; $\{x \mid x \in \mathbb{R}\}$

Range: max/min: $[4, 6]$

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

Amplitude: 4

Period: $2\pi/3$

Sinusoidal Axis: $y = -3$

Phase shift: left by π

Frequency: $3/2\pi$

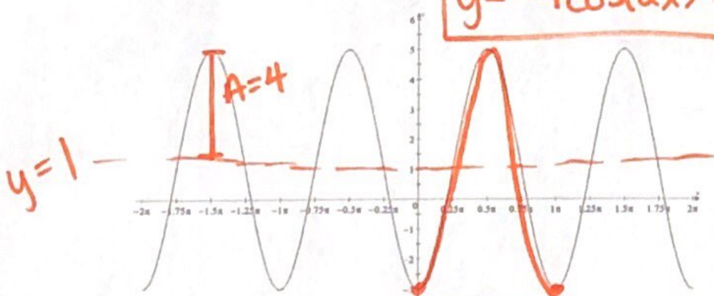
Domain:

Range:

domain $(-\infty, \infty)$; $\{x \mid x \in \mathbb{R}\}$ range max/min: $[-7, 1]$

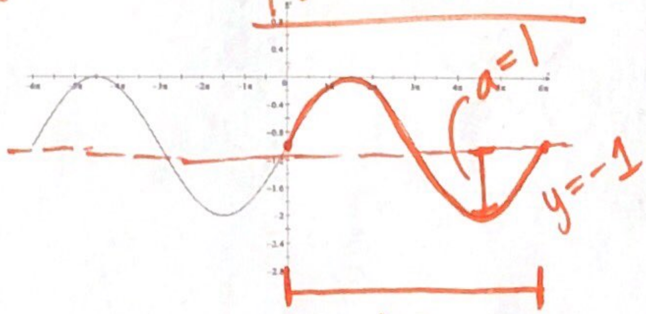
III. **Write Equations from a graph.**

$\boxed{y = -4\cos(2x) + 1}$



$b = \frac{2\pi}{1\pi} = 2$

$\boxed{y = \sin\left(\frac{1}{3}x\right) - 1}$



6π

$b = \frac{2\pi}{6\pi} = \frac{1}{3}$

IV. **Creating graphs given information**

1. Write an equation of cosine that fits the following characteristics.

Amp:2 period: $\frac{2\pi}{3}$ phase shift: $-\pi$ midline: $y = -\frac{7}{8}$

$y = 2\cos 3(x + \pi) - \frac{7}{8}$

Solved on paper attached.

V. **Applications of Trig Functions.**

There is a surfer floating on the ocean. She sees a wave that she will crest 5 seconds from now (t=0). The crest of the wave is 20 feet above the ocean floor. 12 seconds after she crests the wave, she will reach the trough at 4 feet above the ocean floor.

a) Write an equation to represent the surfer's periodic motion.
b) How far above the ocean floor is she now?
c) How far above the ocean floor will she be 2 minutes from now?
d) When will the surfer be at 15 feet above the ocean floor?
e) For how long at one stretch can the surfer stay below 10 feet above the ocean floor

VI.

Write a sinusoidal equation with the given characteristics.

1. Sine Curve Max is 20 ft Min is 2 ft Period is 2.5 minutes	2. Starts at a minimum Sinusoidal axis is y=112 Amplitude is 27 Distance between a consecutive max and min is 10	3. Starts at the center and is falling Min is -10 Amplitude is 25 Period is 12π

Done

VII. Inverse Trig Functions

1. Graph the parent graphs for the three inverse trig functions.

Done

2. Explain why the domain and range are limited to the values they are.

Done

graphed on Desmos

3. Graph y = $\sin^{-1} 2\theta + \pi$

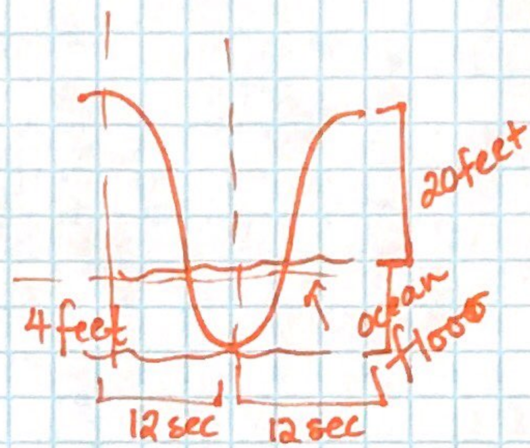
4. Graph y = $2\tan^{-1}(\theta + 1)$

$$A = \frac{20-4}{2} = 8$$

$$B = \frac{2\pi}{24} = \frac{\pi}{12}$$

$t = 0$ @ 5 sec. $\Rightarrow C$

$$D = \frac{20+4}{2} = 12$$



Starting @ max

ⓐ $y = 8\cos\left[\frac{\pi}{12}(t-5)\right] + 12$

ⓑ $y = 8\cos\left[\frac{\pi}{12}(12-5)\right) + 12$

≈ 9.93 ft 0.07 from 10ft

So $9+5 = 14 \rightarrow 14.07$ft

ⓒ $y = 8\cos\left[\frac{\pi}{12}(100-5)\right] + 12$

≈ 14.07ft

ⓓ $15 = 8\cos\left[\frac{\pi}{12}(t-5)\right] + 12$

$t \approx 9.53$ secs. or 0.47 secs

$1 - 0.53$

ⓔ $10 = 8\cos\left[\frac{\pi}{12}(t-5)\right] + 12$

$t \approx 11.97$ sec 0.03 from 10 sec $t = 22.03 - 11.97$

So $11(2) = 22 + 0.03 = \underset{t_2}{22.03}$ $= 10.06$ sec.