Algebra 2 · Unit 7 Worksheet

Trigonometric Functions

Name: _____ Date: _____

This unit develops cosine, sine, and tangent as FUNCTIONS, building from right-triangle ratios and the unit circle. You will graph trigonometric functions, identify amplitude, midline, and period, and use trig to model periodic phenomena.

Part A · The Unit Circle

1. Use the unit circle to find each EXACT value.

a. $\cos(0)$ = _____ $\sin(0)$ = _____

b. $\cos(\pi/2)$ = _____ $\sin(\pi/2)$ = _____

c. $\cos(\pi)$ = _____ $\sin(\pi)$ = _____

d. $\cos(\pi/4)$ = _____ $\sin(\pi/4)$ = _____

e. $\cos(\pi/3)$ = _____ $\sin(\pi/3)$ = _____

f. $\cos(\pi/6)$ = _____ $\sin(\pi/6)$ = _____

Part B · Pythagorean Identity

2. If $\sin(\theta) = 3/5$ and θ is in Quadrant II, find $\cos(\theta)$ and $\tan(\theta)$.

a. Use $\sin^2(\theta) + \cos^2(\theta) = 1$ to find $\cos(\theta)$.

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b. Why is $\cos(\theta)$ negative in Quadrant II?

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c. Then $\tan(\theta) = \sin(\theta)/\cos(\theta)$ = _____

Part C · Negative and Beyond 2π Angles

3. Find each value by relating to a reference angle in the unit circle.

a. $\cos(-\pi/3)$ = _____ (How is this related to $\cos(\pi/3)$?)

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b. sin(7π/6) = _____ (Reference angle?)

c. cos(13π/4) = _____ (Hint: subtract a multiple of 2π first.)

d. Why are sine and cosine PERIODIC with period 2π?

Part D · Graphs and Features

4. Sketch y = sin(x) and y = cos(x) on the same axes for x from 0 to 2π.

a. What is the AMPLITUDE? _____ The PERIOD? _____ The MIDLINE? y = _____

b. What is the phase shift between sin and cos? cos(x) = sin(x + _____)

Sketch sin(x) and cos(x), labeling each with key points (0, π/2, π, 3π/2, 2π).

Part E · Transformations of Trig Functions

5. For y = 3·sin(2(x − π/4)) + 1:

a. Amplitude = _____

b. Period = _____ (Hint: period = 2π / |b|)

c. Midline: y = _____

d. Phase shift = _____

e. Maximum value = _____ Minimum value = _____

Part F · Modeling Periodic Motion

6. A Ferris wheel has radius 20 ft, its center is 25 ft above the ground, and it makes one full rotation every 30 seconds.

a. Write a function h(t) for the rider's HEIGHT above the ground (starting at the bottom).

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b. Identify the amplitude, midline, and period in your model.

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c. How high is the rider after 10 seconds?

Part G · Tangent and Its Asymptotes

7. Consider tan(x) = sin(x)/cos(x).

a. Where is tan(x) undefined? List the first few values.

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b. Why does the graph of tan(x) have VERTICAL ASYMPTOTES there?

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c. What is the period of tan(x)? Is it the same as sin/cos? Why or why not?

Part H · Error Analysis

8. Diego computed $\sin(\pi/6) = 0.5$ and wrote $\sin(30) = 0.5$ with his calculator, but his calculator gave -0.988.

What went wrong?

What does this tell you about RADIANS vs. DEGREES?

9. Lin claims $\sin(2x) = 2 \cdot \sin(x)$. Test with $x = \pi/6$: $\sin(\pi/3) = ?$ and $2 \cdot \sin(\pi/6) = ?$

Compute both. Are they equal?

What is the CORRECT formula for $\sin(2x)$?

Part I · Open Reflection

10. Why do trigonometric functions show up in so many natural phenomena (sound waves, tides, planetary motion, alternating current)? What property of these phenomena makes sine/cosine the right tool?