

Name _____
December 21, 2004 Block _____

Honors Advanced Mathematics Test
Sections 4.1–4.5; some of 4.8 page 1

Part A (25%) _____
Part B (25%) _____
Part C (25%) _____
Part D (25%) _____
overall _____

General instructions: Write complete, fully explained solutions, except where directions say otherwise. If you use your calculator for a significant step, be sure to tell what you did on the calculator. Use radians for all angle measures throughout the test.

Part A. Trigonometric function definitions and values

1. Suppose that $\cos(\theta) = -\frac{3}{7}$ and $\pi \leq \theta \leq \frac{3\pi}{2}$.

a. Without using your calculator, fill in these values. Explanations are not required.

$$\sin(\theta) = \underline{\hspace{2cm}} \quad \tan(\theta) = \underline{\hspace{2cm}} \quad \sec(\theta) = \underline{\hspace{2cm}}$$

b. Using your calculator, find the angle measure θ (rounded to the nearest 0.01). Briefly explain what you did on the calculator.

2. Using a geometric method and not using your calculator, find the values of $\sin(\frac{5\pi}{3})$, $\cos(\frac{5\pi}{3})$, and $\tan(\frac{5\pi}{3})$. Show your work, including a diagram that shows an angle whose measure is $\frac{5\pi}{3}$.

$$\sin(\frac{5\pi}{3}) = \underline{\hspace{2cm}} \quad \cos(\frac{5\pi}{3}) = \underline{\hspace{2cm}} \quad \tan(\frac{5\pi}{3}) = \underline{\hspace{2cm}}$$

3. For any x , how are $\cos(x)$ and $\cos(x + \pi)$ related? Justify your answer using a circle diagram.

Part C. Sinusoidal modeling

1. Find each of the following, for the function $f(x) = 5 - 3 \cos(2\pi x + \pi)$.

a. amplitude =

c. vertical translation =

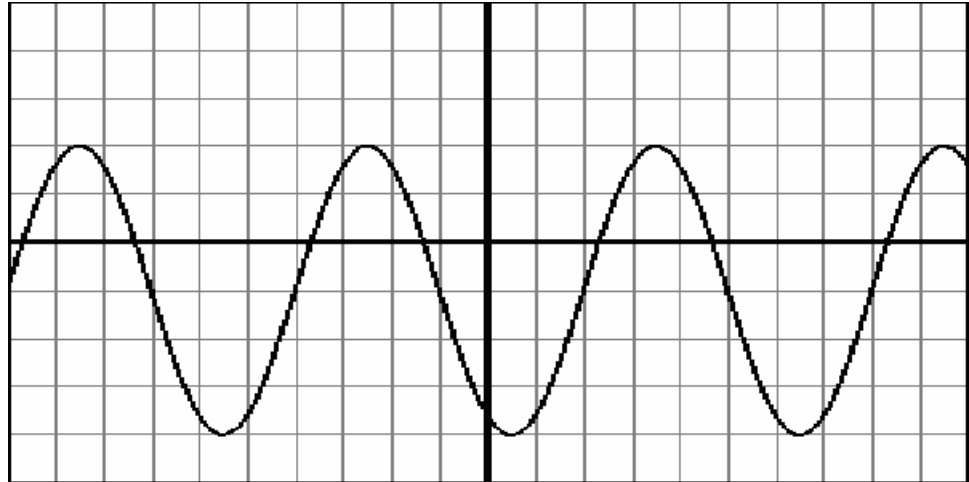
b. period =

d. phase shift =

For problems 2–3: Correct answers with or without explanation will receive full credit.

However, showing your work may improve your chances of partial credit if you make an error.

2. Find a formula **involving cosine** for the function whose graph is shown. (The graphing window is $[-10, 10]$ by $[-5, 5]$. All maxima and minima have whole number y -coordinates.)



Answer to 2: _____

3. The Millennium ferris wheel in London has a diameter of 66 meters. The wheel moves rather slowly: it takes 30 minutes to travel around the wheel. At its highest point, riders are 135 meters off the ground. Write a function model **involving sine** for a rider's elevation above the ground, as a function of the number of minutes since starting at the lowest point of the wheel.

Answer to 3: _____

Part D. The other four trigonometric functions

1. a. Explain how $\tan(\theta)$ can be interpreted as a slope. Include a diagram in your explanation.

b. Based on part a, explain why the tangent function has a period of π .

2. a. Find the value of $\cot(2/3)$.

b. The equation $\cot(x) = 2/3$ has many solutions. Find two of these solutions.

3. Using the same set of axes, sketch the graphs of $\cos(x)$ and $\sec(x)$ for $0 \leq x \leq 2\pi$.
If there are any x -values at which either function is undefined, identify these x -values and briefly explain why.