

Name _____

Class block _____

January 17, 2003

Honors Pre-Calculus Test

Chapter 4

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Part A (50%) _____

Part B (50%) _____

overall _____

Write complete, fully explained solutions. If you use your graphing calculator for a significant step, tell what you did on the calculator.

Use radian measures for all angles, except where stated in Part B #5.

Part A. Trigonometric functions and their inverses

1. Without using a calculator, find the value of $\sec(-\frac{5}{4}\pi)$. Explain how you find the value. Include a diagram showing $-\frac{5}{4}\pi$ as an angle.

2. Suppose $\tan^{-1}(w) = \frac{\pi}{5}$. Identify **two angles**, in the interval from 0 to 2π , whose tangents equal w .

3. Consider a circle of radius 3 centered at the origin. Find the coordinates of the point on this circle located at an angle of θ , where $0 \leq \theta \leq \pi$ and $\tan(\theta) = 2$.

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4. These questions concern forming an inverse for the secant function.

- a. Which of the following restricted domains for $\sec(x)$ would be appropriate for forming an inverse?

Choice I: $0 < x < \pi, x \neq \pi/2$

Choice II: $-\pi/2 < x < \pi/2, x \neq 0$

Explain why your choice is appropriate, and explain why the other choice is not.

- b. Based on the restricted domain chosen in part **a**, graph the function $\sec^{-1}(x)$. Label your graph to identify any asymptotes, intercepts, and/or endpoints.

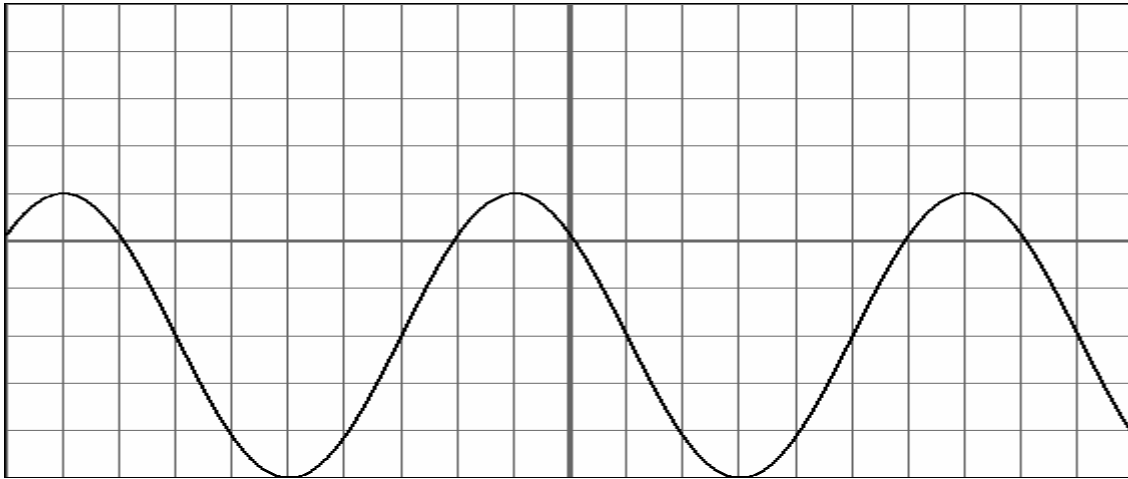
5. Assuming that $0 \leq x \leq 1$, prove that $\sin^{-1}(x) + \cos^{-1}(x) = \pi/2$.

Part B. Modeling and applications

1. Answer the following questions about the function $f(x) = M \sin(\pi x) + N$.
Explanations are not required.

- a. What is the domain? _____
- b. What is the range? _____
- c. What is the period? _____

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



Show or explain how you get your answer.

3. A bicycle's front wheel has a diameter of 70 cm. Suppose that someone rides this bicycle at a speed of 30 km/hour. Calculate the wheel's angular speed, expressed in radians per minute.

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4. The table at the right shows the normal average temperature in Boston for each month of the year. Consider this data as a function of m , the number of the month of the year ($m = 1$ for January, $m = 2$ for February, etc.).

Write a trigonometric function **involving cosine** that approximately fits this temperature data. Show or explain how you get your answer.

month	avg. temperature
Jan.	30°
Feb.	31°
Mar.	38°
Apr.	49°
May	59°
June	68°
July	74°
Aug.	72°
Sept.	65°
Oct.	55°
Nov.	45°
Dec.	34°

5. A wheelchair ramp rises 1 inch for every horizontal distance of 12 inches. (This is the maximum slope permitted under the Americans with Disabilities Act.) Find the ramp's angle of inclination, expressed in degrees.

6. Find a sinusoidal function $f(x)$ that has the following properties:

- The point $(0, 6)$ is a local minimum point of $f(x)$.
- The period of $f(x)$ is half the period of the function $g(x) = \cos(4x)$.

Sketch a graph and write a formula for your function $f(x)$.