MATH 103 Pre-Calculus Mathematics Name_____
Final Exam Fall 2008 (December 10)

Please answer all questions in the given "Blue Book", except for sketches of graphs. Show any relevant work used in arriving at (or verifying) an answer, but be sure to clearly mark that answer. You will be graded on your best fourteen answers from among the nineteen problems.

Section A

1. (a) 40 degrees equals _____ radians.
(b) For what t in the interval $[0, 2\pi)$ does the angle of t radians coincide with the angle of $-\frac{23\pi}{3}$ radians?
(c) In a particular circle, the arc cut by an angle of $\frac{2\pi}{3}$ radians has length 7. What is the circle's radius?

2. Suppose that $P(t) = (\frac{1}{4}, \frac{\sqrt{15}}{4})$. Determine

(a) $P(-t)$
(b) $P(t + \pi)$
(c) $P(t + \frac{\pi}{2})$ *Hint:* $\sin(x + \pi/2) = \cos x$, $\cos(x + \pi/2) = -\sin x$
(d) $P(t - 6\pi)$

3. For each given value of t, find t's reference number/angle r_t:

(a) $t = \pi/7$
(b) $t = 5\pi/4$
(c) $t = -4\pi/3$
(d) $t = 17\pi/2$

4. For each given value of t, find both $\sin t$ and $\cos t$:

(a) $t = -4\pi/3$
(b) $t = 7\pi/6$

5. For each equation, identify all t in $[0, 2\pi)$ that satisfy it.

(a) $\cos t = -\frac{1}{2}$
(b) $\sin t = \frac{1}{2}$
(c) $\sin 2t = 1$

6. Find all t in $[0, 2\pi)$ satisfying $2\sin^2 t - \sin t - 1 = 0$. (*Hint:* Factor it.)

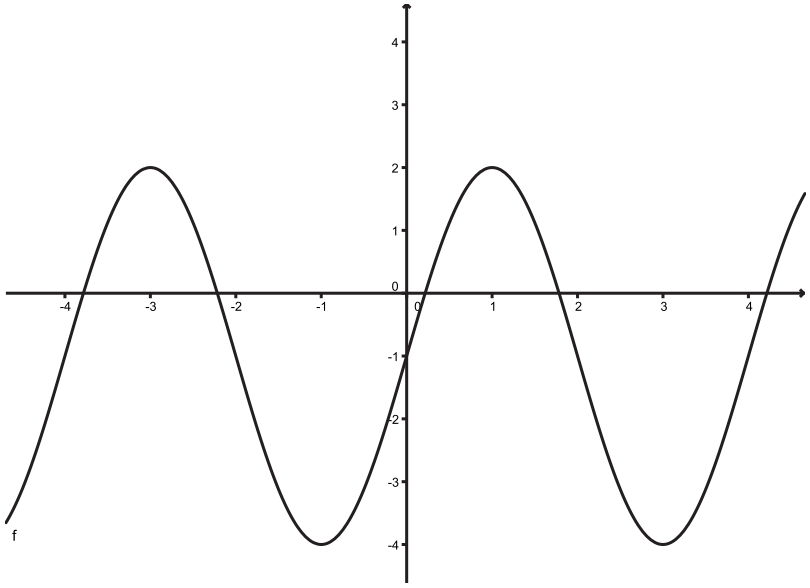
7. Suppose that $\sin t = \frac{2}{3}$. Then what are the possible values of $\cos t$?

8. Use one of the Sum/Difference Formulas to calculate $\cos \frac{\pi}{12}$. (Note that $\frac{1}{12} = \frac{1}{3} - \frac{1}{4}$).

9. Use a Double-Angle Formula in order to calculate $\sin \frac{\pi}{2}$.

10. Chris needs to look up at a 45-degree angle in order to see the top edge of a building that is 65-feet tall. How far from the building is Chris standing? (For a little extra credit, make your calculation account for the fact that Chris's eyes are five feet above the ground.)

11. For some constants A, B, C, and D, the graph below is that of $y = A\cos(Bx + C) + D$. Identify A, B, C, and D.
Hint: Use the difference between the maximum and minimum values to determine A, use the period to determine B, use the values of x at which minima and maxima occur (relative to where they occur in the graph of $y = \cos x$) to determine C/B, and use maximum and minimum values (relative to those of $\cos x$, and taking into account A's influence) to determine D.

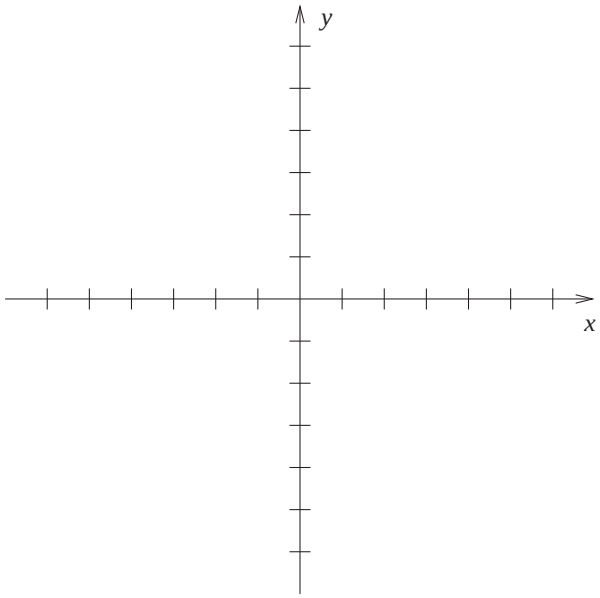


12. If we restrict the domain of the sine function to the interval $[-\pi/2, \pi/2]$, we get a one-to-one function. Call it $\sin_1$. Being one-to-one, $\sin_1$ has an inverse function, which is called arcsin.

(a) What is $\arcsin(\sin \pi/4)$?
(b) What is $\arcsin(1/2)$?

Section B

1. Give the standard form of the equation of the circle described by $x^2 - 2x + y^2 + 4y = 11$, identify its center and radius, and sketch it in the space below.



2. Find an equation (in any of the standard forms) describing the line that passes through $(4, 3)$ and is parallel to the line given by $2x - 4y + 3 = 0$

3. Let $f(x) = \sqrt{2x} - 1$ and $g(x) = x - 5$.
(a) Describe $(f \circ g)(x)$ and identify its domain and range.
(b) Describe $(g \circ f)(x)$ and identify its domain and range.

4. Describe the inverse function of $f(x) = 4x^3 - 2$.

5. Describe a rational function having
(i) $y = -3$ as its horizontal asymptote,
(ii) $x = 5, -8$ as its zeros,
(iii) a "hole" at $x = 6$, and
(iv) $x = -2$ and $x = -4$ as its vertical asymptotes.

6. Factor completely the polynomial $P(x) = x^3 - 3x + 2$ and identify its zeros.

7. Consider the parabola described by the equation $y = -x^2 + 2x + 1$. Determine its Vertex Form equation, sketch its graph in the space below, and identify the domain and range of the function described by this equation.