Problem Set 1   **Calculus 1**   **Due 6/17/04**

You are encouraged to work in groups of two to four on this assignment and make a single group submission. Each problem is worth 5 points. For full credit indicate clearly how you reached your answer. All work must be legible and submitted on clean paper without ragged edges.

1. Consider a circle, centered at the origin, with a radius of 5.
    a)   Show that the point (3,-4) is on the circle.
    b)   Find the slope of the line connecting the center of the circle to the point (3,-4).
    c)   Find an equation for the line tangent to the circle at the point (3,-4).

2. At 9am Jon injects 52.8mg of caffeine into his bloodstream. With each hour that passes, 30% of the caffeine in his bloodstream is removed.
    a)   Write a function giving the amount of caffeine in Jon's bloodstream after t hours.
    b)   How much caffeine (to the nearest tenth of a mg) remains in Jon's bloodstream at 11:30am?
    c)   At what time (to the nearest minute) does Jon have 40mg of caffeine in his bloodstream?

3. Friday's forecast is for a high of 78° and a low of 60°. Suppose that the low occurs at 3am and the high occurs at 3pm, with the temperature varying sinusoidally.
    a)   Write a function giving the temperature on Friday t hours after midnight.
    b)   What is the temperature at noon Friday?
    c)   What is the average rate of change of the temperature for the hour following noon Friday?
    d)   What is the average rate of change of the temperature for the half hour following noon Friday?

4. Jon is planning to go to a movie and wants to pick the best seat. By "best seat" he means the seat where the angle formed by his eye and lines extending to the bottom and top edges of the screen is as large as possible. If the bottom edge of the screen is 12 feet above the floor, the top edge of the screen is 32 feet above the floor, Jon's eye (when seated) is 4 feet above the floor, and the floor is horizontal:
    a)   What angle (to the nearest degree) will Jon's eye make with the bottom and top edges of the screen if he sits in the front row, 8 feet from the screen?
    b)   What angle (to the nearest degree) will Jon's eye make with the bottom and top edges of the screen if he sits in the middle of the theater, 40 feet from the screen?
    c)   What angle (to the nearest degree) will Jon's eye make with the bottom and top edges of the screen if he sits in the back of the theater, 70 feet from the screen?