**Exam 3  Calc 1  7/21/2005**

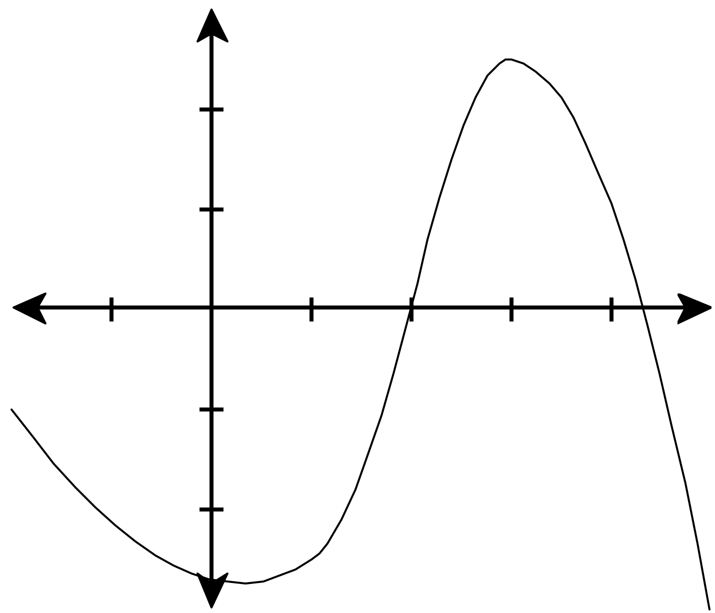
Each problem is worth 10 points. For full credit provide complete justification for your answers.

1. Find an antiderivative for the function $f(x) = 12x^2 - 3$ for which $F(1) = 2$.

2. Find the interval(s) of increase of the function $g(x) = 2x^3 - 5x^2 + 4$.

3. Use the graph of the function shown below to answer the following questions, assuming that beyond the region shown the graph continues to follow the trends of the portion shown. Assume that the tick marks along the axes are at unit intervals, and approximate values as necessary.

a) State the interval(s) on which the function is concave down.



b) State the approximate coordinates of any inflection point(s) of the function.

4. Use calculus to find the absolute minimum and absolute maximum values of

$$f(x) = 2x^3 - 3x^2 - 12x + 1$$

on the interval [-3,3].

5. Use Newton's Method with the initial approximation $x_1 = 1$ to find $x_3$, the third approximation to the root of the equation $x^3 + 2x - 5 = 0$.

6. Evaluate $\lim_{x \to 0^+} \sqrt{x} \ln x$.

7. Find the point on the line $5x + 3y = 15$ that lies closest to the point $(1,0)$.

8. Bunny is a calculus student at Enormous State University, and she's wondering about something. Bunny says "So we just learned about these antiderivative thingies, and I was wondering about them. Like, if you had something like $x$ times $e$ to the $x$, and you wanted its antiderivative, would you use the Product Rule on it just like you would with derivatives? I mean, like, do the antiderivative of the first times the second, plus the first times the antiderivative of the second? Or is that only for derivatives?"

Help Bunny out by **explaining** how she could tell, and whether it works the way she describes.

9. Show that functions of the form g($x$) = $\dfrac{x^n}{e^x}$ have local extremums where $x = n$. [Hint: You might warm up by working it with $n = 2$.]

10. Find a function of the form $f(x) = x^3 - b\,x^2 + c\,x - 2$ which has a local minimum where $x = 2$ and a point of inflection where $x = 1$.

Extra Credit (5 points possible):

Show that $\left|\sin x - \cos x\right| \le \sqrt{2}$ for all values of $x$.