Math 101(04) **Practice Exam III** **5 November 2001**

1. Find the linear function $L(n)$ that best approximates $\tan((45+n)^\circ)$ when n is close to 0.

2. A circular table top is measured to be 6 ft in diameter, using an old measuring tape whose markings could be off by as much as $\frac{1}{2}$ inch. Suppose this measurement is used to calculate the area of the table. Use differentials to estimate the largest possible error in the determination of the area.

3. A water balloon is dropped from a hovering United Nations helicopter. The balloon's velocity v (measured in feet per second, in the downward direction) obeys the equation

$$v'(t) \quad = \quad 32 - 0.2v(t).$$

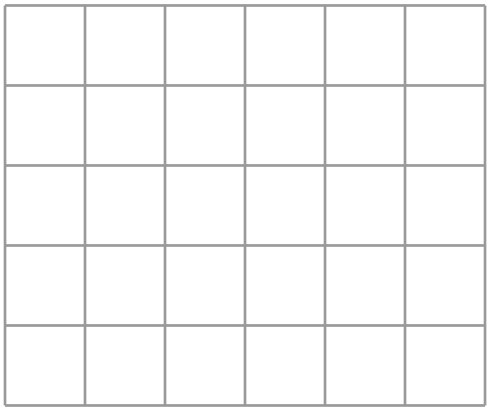
At $t = 4$ seconds, the balloon's velocity is 88 feet per second. Use differentials or a linear approximation to approximate the balloon's velocity at $t = 4.5$ seconds.

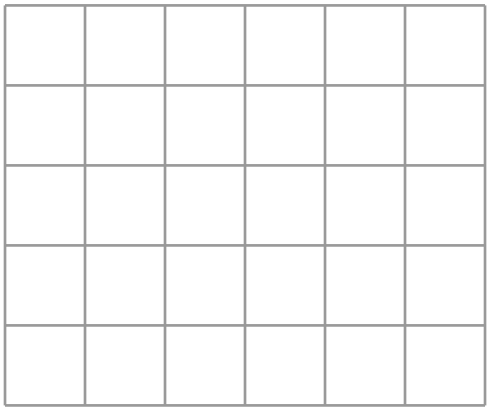
4. Let $f(x) = x^3 - 6x^2 + 9x - 4$. Find the absolute maximum and minimum values of f on the interval $[0, 5]$.

5. Sketch the graph of a function f satisfying the following:

   - f is continuous on $[0, 4]$
   - f has a local maximum at 1
   - f is not differentiable at 1, but is differentiable at all other points in $(0, 4)$
   - f has an absolute maximum at 3
   - the absolute minimum value of f is 1.

   (Two grids are provided; one is for practice. Be sure to indicate which grid contains your final answer.)





6. Let $f(x) = \cos x - 3x$.

   (a) Prove that f has at least 1 root.

(b) Prove that f has at most one root.