MIDTERM #2

This exam is 5 pages long (counting this one); check that you have all the pages. Show your work. Correct answers with no justification may receive little or no credit. No calculators, notes, or books are allowed. No unnecessary simplification is required. Use the backs of pages if you run out of space, and make sure that I can find your answers.

THINK JOYFULLY

PROBLEM	POINTS	SCORE
1	10	
2	15	
3	10	
4	20	
5	20	
6	25	
EXTRA CREDIT	2	
TOTAL	100	

1. (10 pts) Find $\lim\limits_{x \to 0} \dfrac{\sin x^2}{x}$.

2. (15 pts) Find the maximum and minimum values of the function $f(x) = x^3 - 3x$ on the interval $[-3, 2]$.

3. (10 pts) Let $p(t)$ be the number of squirrels living on campus t months after January 1st. Give a formula for the average number of squirrels on campus during the first six months of the year.

4. (20 pts) The area A of a square is increasing at the rate of 8 in.^{2} /sec. At what rate is the edge length x increasing when each edge is 4 in.? (Give units.)

5. (20 pts)

    (a) Find the tangent line to the graph of the function $f(x) = \sqrt{x}$ at the point $(4, 2)$.

    (b) Use your answer to (a) to estimate $\sqrt{3}$. (If you didn't get an answer to (a), use the line $y = 3x + 5$.)

6. (25 pts) A rectangular box has a square base with edges at least 1 in. long. It has no top, and the total area of its five sides is 300 in.² What is the maximum possible volume of such a box?

EXTRA CREDIT What is the maximum possible volume of a sphere?