Math 140
Exam #3 **Name:**
Summer II '10

1. [10 pts.] Find the linearization $L(x)$ of the function $f(x) = 1/\sqrt{2+x}$ at 0.

2. [10 pts.] Use an appropriate linearization to estimate the value of $\sin 1°$.

3. [10 pts. each] Find the critical numbers of the function.

   (a) $s(t) = 3t^4 + 4t^3 - 6t^2$

   (b) $f(x) = x^{4/5}(x-4)^2$

4. [10 pts. each] Find the absolute maximum and absolute minimum values of f on the given interval.

   (a) $f(x) = x^4 - 2x^2 + 3, \quad [-2, 3]$

   (b) $f(x) = \sin x + \cos x, \quad [0, \pi/3]$

5. [10 pts.] Verify that the function $f(x) = \dfrac{x}{x+2}$ satisfies the hypotheses of the Mean Value Theorem on the interval $[1, 4]$. Then find all numbers c that satisfy the conclusion of the Mean Value Theorem.

6. [10 pts. each] Let $h(x) = 3x^5 - 5x^3 + 3$.

   (a) Find the intervals of increase and decrease.

   (b) Find the local maximum and minimum values.

   (c) Find the intervals of concavity and the inflection points.

7. [10 pts. each] Find the limit.

   (a) $\displaystyle\lim_{y\to\infty} \frac{2-3y^2}{5y^2+4y}$

   (b) $\displaystyle\lim_{x\to-\infty} \frac{\sqrt{9x^6 - x}}{x^3+1}$

   (c) $\displaystyle\lim_{x\to\infty} \left(\sqrt{x^4+6x^2} - x^2\right)$

8. [15 pts.] Find the point on the line $y = 2x - 9$ that is closest to the point $(5, -2)$.

9. [15 pts.] A cylindrical can without a top is made to contain V cm^3 of liquid. Find the dimensions that will that minimize the cost of the metal to make the can.

10. [10 pts.] Find the most general antiderivative of the function $f(x) = 6\sqrt{x} - \sqrt[6]{x}$.

11. [10 pts.] Find f, given $f''(x) = 20x^3 + 12x^2 + 4$, $f(0) = 8, \quad f(1) = 5$.

12. [15 pts.] Show, using appropriate theorems (*not* a graph), that the equation $1+2x+x^3+4x^5 = 0$ has exactly one real root.