**Math 151**
**Quiz 5**
**Fall 2008**

Show all work in a neat and organized fashion. Clearly indicate your answers.
20 points possible.

The following formulas may or may not be useful:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**1.** (5 pts.) Find the differential $dy$ of each function. (You do not have to simplify your answers.)

(a) $y = \dfrac{x^2 + 1}{x^3 + x + 1}$

(b) $y = \sin(x^3)$

**2.** (5 pts.) Use differentials to estimate $\sqrt{25.7}$ (your work must clearly show that you know how to use differentials to find this estimate).

**3.** (5 pts.) Find the absolute maximum and absolute minimum values of $f$ on the given interval.

$f(x) = x^3 - 6x^2 + 5x + 8, \qquad [1, 4]$

**4.** (5 pts.) Recall the following theorem.

**Rolle's Theorem.** *Suppose*

(1) $f$ *is continuous on the closed interval* $[a, b]$*;*
(2) $f'(x)$ *exists for all* $x$ *such that* $a < x < b$*; and*
(3) $f(a) = f(b)$*.*

*Then there must exist at least one number* $c$ *with* $a < c < b$ *such that* $f'(c) = 0$*.*

Verify that the following function satisfies the three hypotheses of Rolle's Theorem on the given interval. Then find all numbers $c$ that satisfy the conclusion of Rolle's Theorem.

$f(x) = 9x^2 - x^4, \qquad [-3, 3]$