Name: _____

Write all of your responses on these exam pages, use the back if necessary. Show all your work, answers without supporting justification will not receive credit.

1. (*15 Points*): Find dy given $y = \sqrt{3 + x^2}$, at $x = 1$ and $dx = -0.1$.

2. (*20 Points*): Find the absolute maximum and absolute minimum of the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 1$ on the interval $[-2, 3]$.

3. (*20 Points*): Verify that the function $f(x) = 2x^2 - 3x + 1$ satisfies the hypotheses of the Mean Value Theorem on the interval $[0, 2]$. Then find all numbers c that satisfy the conclusion of the Mean Value Theorem.

4. (*15 Points*): Find the following limit,

$$\lim_{x \to 3} \frac{\ln(x/3)}{x - 3}$$

5. (*40 Points*): Given the function $f(x) = 3x^4 - 4x^3 + 2$,

   (a) Find $f'(x)$.

   (b) Find all the critical numbers to the function, keep your answers in exact form.

   (c) Find the intervals of increasing and decreasing of the function.

   (d) Find all local maximums and minimums of the function.

   (e) Find $f''(x)$.

   (f) Find all the places where the function could change concavity, keep your answers in exact form.

   (g) Find the intervals of concave up and concave down of the function.

   (h) Find all of the points of inflection.