[Note: Section 2.8 Related Rates will ***not*** be on this Exam.]

1. Find the critical numbers for $g(t) = 4t^3 - 3t^2 + 1$

2. Given $f(x) = 2\sqrt{x} - x$, find the absolute maximum and minimum *values* of $f(x)$ on the interval $[0, 9]$.

3. Let $f(x) = 1 - x^{2/3}$. Show that $f(-1) = f(1)$ but there is no number c in $(-1, 1)$ such that $f'(c) = 0$. Why does this not contradict Rolle's Theorem?

4. Apply the Mean Value Theorem to the function $f(x) = \sqrt{x-2}$ on the interval [2, 6] and find all values of c that satisfy the MVT.

5. Given $f(x) = \dfrac{(x-1)^3}{x^2}$

(a). Find the intervals of increase or decrease.

(b). Find the local maximum and minimum values.

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

6. Given $f(\theta) = \cos^2(\theta)$, on $0 \le \theta \le 2\pi$,

(a). Find the intervals of increase or decrease.

(b). Find the local maximum and minimum values.

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

7. Section 3.3 #27

8. Evaluate the following limits. [Show all work - no shortcuts].

(a). $\lim\limits_{x\to\infty} \dfrac{3 - x^2 + 4x^3}{x^4 + 2x}$

(b). $\lim\limits_{x\to-\infty} \dfrac{2x^2 + 3x + 1}{3x^2 - 3x - 4}$

9. Find $\lim\limits_{x\to\pm\infty} f(x)$ for the following functions and determine any horizontal and slant asymptotes.

(a). $f(x) = \dfrac{2x+1}{\sqrt{4x^2 - x}}$

(b). $g(x) = \dfrac{2x^3 - 3x^2 + 2}{x^2 - 3x}$

10. Given the following function and its derivatives

$$f(x) = \frac{x}{9-x^2} \qquad f'(x) = \frac{x^2+9}{(9-x^2)^2} \qquad f''(x) = \frac{2x(x^2+27)}{(9-x^2)^3}$$

Use the Summary of Curve Sketching to determine the relevant information. Sketch the graph of the function. Label any maximum and minimum points and inflection points.

domain:	slant asymptote:	coordinates of local max/min(s):
x-intercept(s):	critical numbers:	intervals where concave up:
y-intercept:	intervals where increasing:	intervals where concave down:
vertical asymptote(s):		
horizontal asymptote(s):	intervals where decreasing:	inflection point(s):

11. If a box with a square base and open top is to hold 4 ft^3, find the dimensions of the box that will require the least amount of material.

12. Find the maximum possible volume of a right circular cylinder if its total surface area (including top and bottom) is 150π.

13. A Norman window is constructed by adjoining a semicircle to the top of an ordinary rectangular window. Find the dimensions of the Norman window with the largest possible area if the total perimeter is 16 ft.

14. Given $f(x) = 4x^3 - 12x^2 + 12x - 3$, [The graph is given below.]

(a). Explicitly write out Newton's formula for finding the root of this function.

(b). Start with an initial guess of $x_0 = 0.5$ and iterate Newton's Method once. [***Do <u>not</u> simplify your answer!***]

(c). Starting with $x_0 = 0.5$, demonstrate Newton's method by marking $x_0, x_1, x_2, \ldots$ and the associated tangent lines on the graph of $f(x)$. Does it seem like Newton's method will work if you start with this initial guess?

(d). Starting with $x_0 = 1.0$, demonstrate Newton's method by marking $x_0, x_1, x_2, \ldots$ and the associated tangent lines on the graph of $f(x)$. Does it seem like Newton's method will work if you start with this initial guess? Why or why not?