Math 1120   **Calculus, section 7**   **Test 2.**

March 5, 2009   Name _____

The problems count as marked.   The total number of points available is 131.
Throughout this test, **show your work.**

1. (12 points) Consider the cubic curve $f(x) = 2x^3 + 3x + 2$.

    (a) What is the slope of the line tangent to the graph of f at the point $(0, 2)$?

    (b) Write an equation of this tangent line in the form $y = mx + b$.

2. (10 points) Suppose f is a function satisfying $f(2) = 3$ and $f'(2) = -1$. What is the y-intercept of the line tangent to the graph of f at the point $(2, 3)$?

3. (15 points) For what values of x is the line tangent to the graph of

$$f(x) = (2x + 1)^2(3x - 4)^2$$

    parallel to the line $y = 7$?

4. (20 points) If a ball is thrown vertically upward from the roof of 256 foot building with a velocity of 64 ft/sec, its height after t seconds is $s(t) = 256 + 64t - 16t^2$.

   (a) What is the height the ball at time $t = 1$?

   (b) What is the velocity of the ball at the time it reaches its maximum height?

   (c) At what time t does the ball reach its maximum height?

   (d) What is the maximum height the ball reaches?

   (e) After how many seconds is the ball exactly 176 feet above the ground?

   (f) The second derivative $s''(t)$ of the position function, also called the acceleration function, is denoted $a(t)$. Compute $a(t)$. Explain why this function is negative for all values of t.

   (g) How fast is the ball going the first time it reaches the height 176? Write the answer with the correct units.

   (h) How fast is the ball going when it hits the ground?

5. (20 points) Let

$$g(x) = (2x^2 - 1)^2(6x).$$

(a) Compute $g'(x)$.

(b) Find the critical points of $g(x)$.

(c) Build the sign chart for $g'(x)$.

(d) Use the sign chart for $g'(x)$ to discuss the nature of each critical point. In other words tell whether each critical point is the location of a local maximum, a local minimum, or neither.

6. (30 points) Consider the table of values given for the functions f, f', g, and g':

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
0	2	1	3	2
1	4	6	2	5
2	6	4	3	4
3	1	2	5	3
4	3	5	2	6
5	5	3	4	1
6	0	3	2	4

(a) Let $V(x) = f(x) \cdot g(x))$. Compute $V'(5)$.

(b) Let $W(x) = \frac{g(x)}{f(x)}$. Compute $W'(3)$.

(c) Let $L(x) = f(x+1) - g(x)^2$. Compute $L'(2)$.

(d) Let $U(x) = (f \circ g)(2x + 1)$. Notice that this is a composition of three functions. Compute $U'(1)$.

(e) Let $K(x) = g(x^3 + 2)$. Compute $K'(1)$

7. (24 points) Compute the following derivatives.

   (a) Let $f(x) = x^2 + x^{-\frac{2}{3}}$. Find $\frac{d}{dx}f(x)$.

   (b) Let $g(x) = \sqrt{x^2 + x + 4}$. What is $g'(x)$?

   (c) Find $\frac{d}{dx}((3x + 1)^2 \cdot (4x^2 - 1))$

   (d) Find $\frac{d}{dt}\frac{2t^2 - 3t}{t^2 - 1}$