April 11, 2003 **Name** ______________________________

The first 6 problems count 5 points each. Problems 6 through 9 count as marked. In the multiple choice section, circle the correct choice (or choices). The total number of points available is 120.

Each of the next few items are true-false. To get full credit you must give a valid reason for your answer. Circle either True or False, and give your reason in the space provided. Generally, 2 points for the right t/f value and 3 points for the right reason.

1. True or false. If $f''(x) < 0$ on the interval (a, c) and $f''(x) > 0$ on the interval (c, b), then the point $(c, f(c))$ is a point of inflection of f.

2. True or false. If $f'(c) = 0$, then f has a relative maximum or a relative minimum at $x = c$.

3. True or false. If f has a relative maximum at $x = c$, then $f'(c) = 0$.

4. True or false. If $f'(c) = 0$ and $f''(c) < 0$, then f has a relative maximum at $x = c$.

5. True or false. If $h(x) = \sqrt{x^2 - 4}$, then $h'(x) = \frac{1}{2}(x^2 - 4)^{-1/2}$.

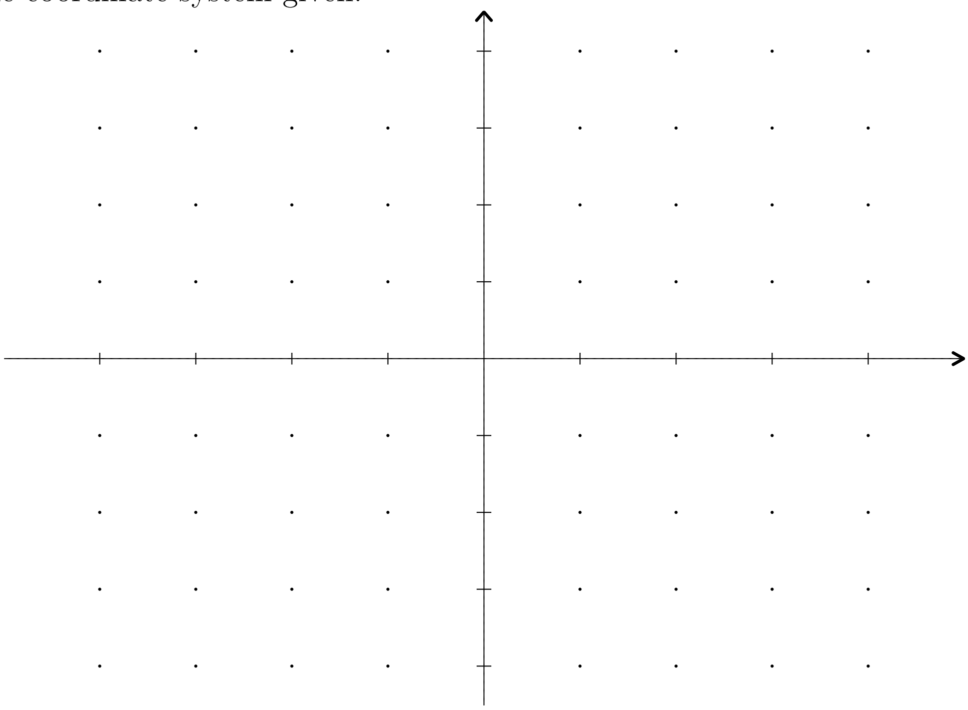
6. True or false. The function $g(x) = (x - 1)^{2/3}$ has a singular point at $x = 1$.

On all the following questions, **show your work.**

7. (20 points) Sketch the graph of a function $g(x)$ satisfying the properties shown in the table below.

x	$g(x)$	$g'(x)$
-2	1	0
0	0	-1
2	0	1

Use the coordinate system given.



8. (20 points) Let $g(x) = (2x - 4)^2(x + 3)^2$.

   (a) Use the test interval technique (not a graphing calculator) to find the intervals over which g is increasing.

   (b) Find and classify each critical point as a location of a. a relative maximum, b. a relative minimum, or c. neither a relative max nor a relative min.

9. (15 points) Consider the rational function

$$f(x) = \frac{(x^2 - 4)(2x + 1)}{(3x^2 - 3)(x - 2)}.$$

   (a) Find the horizontal asymptote(s).

   (b) Find the vertical asymptotes.

   (c) Compute $\lim_{x \to \infty} f(x)$.

10. (15 points) Four congruent $x \times x$ squares from the corners of a cardboard rectangle that measures 16×12. The sides are then folded upward to form a topless box.

   (a) Find the volume V as a function of x. What is the logical domain?

   (b) Compute $V(0), V(1), V(2)$, and $V(3)$.

   (c) Find $V'(x)$.

   (d) Use the results from the question above to determine the critical points of V.

   (e) Find the absolute maximum value of V and the value of x where it occurs.

11. (20 points) Compute each of the following derivatives.

(a) $\frac{d}{dx}\sqrt{x^3+1}$

(b) $\frac{d}{dx}(2x^2+1)^{10}$

(c) $\dfrac{d}{dx}\left(\dfrac{2x+1}{x^2+1}\right)$

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