February 13, 2004   **Name** _____

The first 12 problems count 7 points each and the final one counts 40 points. The total number of points available is 124. Throughout this test, **show your work.**

1. What is the degree of the polynomial $p(x) = (x^2 - 1)^3(x^3 + 7)$?

2. Let P denote the midpoint of the line segment joining $(2, 3)$ and $(8, 11)$. What is the distance from P to the point $(-2, 3)$?

3. Find the (implied) domain of

$$f(x) = \frac{\sqrt{x - 4}}{x - 7},$$

and write your answer in interval notation.

4. Find all the x-intercepts of the function

$$t(x) = (2x - 1)^3(x + 1)^2 - (2x - 1)^2(x + 1)^3.$$

5. The line tangent to the graph of $y = e^{2x}$ at the point $(0, 1)$ has slope 2. What is the x-intercept of the line?

6. Consider the rational function $k(x) = \frac{(2x+1)^2(x+5)}{3x^3 - 5x^2}$. Estimate the value $k(1000)$. Does k have a horizontal asymptote? Discuss.

7. Find an equation for a line perpendicular to the line $3x - 4y = 7$ and which goes through the point $(-2, -3)$.

8. Let $k(x) = x^2 - x$. Evaluate and simplify $\frac{k(x+h) - k(x)}{h}$. Then find the limit of the expression as h approaches 0.

9. Suppose the functions f and g are given completely by the table of values shown.

x	$f(x)$	x	$g(x)$
0	2	0	5
1	7	1	7
2	5	2	4
3	1	3	2
4	3	4	6
5	6	5	3
6	0	6	1
7	4	7	0

10. What is $f \circ g \circ f(2)$?

11. Solve $(f \circ g)(x) = 7$?

12. (10 points) The supply and demand curves are given below for digital cameras at XYZ Distributors, where x represents the number of units and p the price. Find the equilibrium quantity and price. Demand: $p = -x^2 - 2x + 100$ and Supply: $p = 10x + 55$.

13. (40 points) Compute each of the following limits.

(a) Let $f(x) = \begin{cases} x + 2 & \text{if } x \neq 1 \\ 1 & \text{if } x = 1 \end{cases}$

$$\lim_{x \to 1} f(x)$$

(b) $\displaystyle\lim_{x \to 0} \frac{x^2 - 2x}{x}$

(c) $\displaystyle\lim_{x \to 3} \frac{x^2 - 3x}{x^2 + x - 12}$

(d) $\displaystyle\lim_{x \to 2} |x^2 - \sqrt{16x - 7}|$

(e) $\displaystyle\lim_{x \to 1} \frac{x^2 - 1}{x^3 - 1}$

(f) $\displaystyle\lim_{x \to 9} \frac{x - 9}{\sqrt{x} - 3}$

(g) $\displaystyle\lim_{x \to 1} \frac{\frac{1}{3x} - \frac{1}{3}}{x - 1}$

(h) $\displaystyle\lim_{x \to \infty} \frac{2x^2}{(1 - x)^2}$