Closed book, closed notes, no calculators/PDAs; no reference materials of any kind. Turn off all handheld devices, including cell phones.

Show work; a correct answer, by itself, may be insufficient for credit. Arithmetic need not be simplified, unless the problem requests it.

I understand the above, and I understand that cheating has severe consequences, from a failing grade to expulsion.

SIGN YOUR NAME:
I. Multiple choice

A. (5 pts) (no partial credit) Compute \( \lim_{x \to 0} \left[ \frac{3x^4 + 2x^3}{7x \sin^2 x} \right] \). Circle one of the following answers:

(a) 0  
(b) \( \infty \)  
(c) \( \frac{5}{7} \)  
(d) \( \frac{2}{7} \)  
(e) NONE OF THE ABOVE

B. (5 pts) (no partial credit) Compute \( \lim_{x \to -\infty} \left[ \frac{\sqrt{16x^6 - x}}{16x^3 + x} \right] \). Circle one of the following answers:

(a) \( \frac{1}{4} \)  
(b) \( -\frac{1}{4} \)  
(c) \( \frac{1}{2} \)  
(d) \( -\frac{1}{2} \)  
(e) NONE OF THE ABOVE

C. (5 pts) (no partial credit) Which is the intuitive definition of \( \lim_{x \to 3} (g(x)) = 8 \)? Circle one of the following answers:

(a) If \( g(x) \) is close to 3, then \( x \) is close to 8.  
(b) If \( x \) is close to 3, but not equal to 3, then \( g(x) \) is close to 8, but not equal to 8.  
(c) If \( g(x) \) is close to 8, but not equal to 8, then \( x \) is close to 3.  
(d) If \( x \) is close to 3, but not equal to 3, then \( g(x) \) is close to 8.  
(e) NONE OF THE ABOVE
D. (5 pts) (no partial credit) Compute \( \lim_{t \to 3} \left[ \frac{t^2 + t - 12}{t - 3} \right] \). Circle one of the following answers:

(a) 3
(b) 4
(c) 5
(d) 6
(e) NONE OF THE ABOVE

E. (5 pts) (no partial credit) Compute \( \lim_{x \to 0} \left[ \frac{x^3 + 2x^2 - 4x}{\sin(8x)} \right] \). Circle one of the following answers:

(a) 2/3
(b) -1/2
(c) 1/2
(d) -2/3
(e) NONE OF THE ABOVE

F. (5 pts) (no partial credit) Compute \( \lim_{h \to 0} \left[ \frac{\sqrt{9 + h} - \sqrt{9 + 4h}}{3h} \right] \). Circle one of the following answers:

(a) 1/6
(b) -1/6
(c) 1/9
(d) This limit does not exist.
(e) NONE OF THE ABOVE
II. True or false (no partial credit):

a. (5 pts) For every $x < 0$, $\sqrt{x^4} = -x^2$.

b. (5 pts) Let $f(x) = x^3$. Then $f$ is a one-to-one function.

c. (5 pts) Let $f(x) = |x|$. Then $f$ is continuous at every real number.

d. (5 pts) If a function $f$ is continuous at a number $a$, then $f$ is differentiable at $a$.

e. (5 pts) Let $f(x) = |x|$. Then the domains of $f$ and of $f'$ are equal.
III. Computations. Show work. Unless otherwise specified, answers must be exactly correct, but can be left in any form easily calculated on a standard calculator.

1. (10 pts) Find all horizontal asymptotes to

\[ y = \frac{\sqrt{9x^4 + 2x + 5}}{2x^2 - 3}. \]

(NOTE: A horizontal asymptote is a line; your answers should be equations of lines, NOT numbers.)
2. (15 pts) Draw a single graph showing a function \( f : [3, 5] \to \mathbb{R} \) with all of the following properties:

- Its domain is the interval \([3, 5]\).
- It is continuous on \([3, 5]\).
- It is differentiable on \((3, 4)\) and on \((4, 5)\).
- For all \(x \in (3, 4)\), we have: \( f'(x) = -1 \).
- For all \(x \in (4, 5)\), we have: \( f'(x) = 1 \).
- It is not differentiable at 4.
- \( f(4) = 0 \).
3. (10 pts) Compute \( \lim_{x \to \infty} \left[ \frac{x^2 + \sin^2 x}{2x^2 + 1} \right]. \)
4. (10 pts) Let $f(x) = (x + 1)^3(x - 2)^4(x - 5)$. Find all of the maximum intervals of positivity and negativity for $f$. 