MATH 75

Test 2

June 16, 2005

Name:_____________________________________

- No books, notes, or calculators are allowed.
- Please show all your work.
- Please simplify your answers.
Multiple choice questions: circle the correct answer

1. Find the derivative of \( f(x) = \sin(4x^2) \).
   - A. \( \cos(4x^2) \)
   - B. \( \cos(8x^2) \)
   - C. \( 8x \cos(4x^2) \)
   - D. \( -4x^2 \cos(8x) \)
   - E. \( -\cos(x)(4x^2) \)

2. Find the vertical asymptotes of \( f(x) = \frac{1 - x^2}{x^2 - 4x} \).
   - A. \( x = 0 \)
   - B. \( x = 4 \)
   - C. \( x = 0 \) and \( x = 4 \)
   - D. \( y = -1 \)
   - E. \( y = -4 \)

3. Evaluate the limit: \( \lim_{x \to \infty} \frac{x^2 + 10}{x^3 - 3} \).
   - A. 0
   - B. 1
   - C. \( -\frac{10}{3} \)
   - D. \( \infty \)
   - E. \( -\infty \)

4. If \( f(t) = \frac{1}{x^2} \), find \( f''(-1) \).
   - A. \(-6\)
   - B. \(-2\)
   - C. 0
   - D. 2
   - E. 6

5. How many inflection points does the function \( y = x + \frac{1}{x} \) have?
   - A. 0
   - B. 1
   - C. 2
   - D. 3
   - E. infinitely many

6. Find the local minimum of \( y = x + \frac{1}{x} \).
   - A. \( x = -2 \)
   - B. \( x = -1 \)
   - C. \( x = 0 \)
   - D. \( x = 1 \)
   - E. \( x = 2 \)
Regular problems: show all your work

7. Show that the equation $x^7 + x^3 + x + 2 = 0$ has exactly one real root.
8. Find the linear approximation of the function $f(x) = \cos(x)$ at $a = \frac{\pi}{2}$. 
9. Find the intervals of increase and decrease of the function \( f(x) = x^4 - 4x^3 + 5. \)
10. Find the slope of the tangent line to the curve $x \cos y + xy^2 - 3y = 0$ at the point $(0,0)$. 
11. At noon, ship A is 120 km east of ship B. Ship A is sailing west at 20 km/h and ship B is sailing south at 30 km/h. How fast is the distance between the ships changing at 2:00 PM?
12. Find the absolute maximum and minimum values of \( f(x) = x^4 - 4x^3 + 5 \) on the interval \([-1, 5]\).
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This page may be used as scratch paper