NAME _____

STUDENT ID _____

RECITATION INSTRUCTOR _____

RECITATION TIME _____

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|---|---|
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DIRECTIONS

1. Write your name, student ID number, recitation instructor's name and recitation time in the space provided above. Also write your name at the top of pages 2, 3 and 4.
2. The test has four (4) pages, including this one.
3. Write your answers in the boxes provided.
4. You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
5. Credit for each problem is given in parentheses in the left hand margin.
6. No books, notes or calculators may be used on this exam.

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(10) 1. Find the absolute maximum and absolute minimum values of $f(x) = x^3 - 3x^2 + 3x$ on the interval $[-1, 2]$.

| | |
|---|---|
| abs. max. | $f(\ \ ) =$ |
| abs. min. | $f(\ \ ) =$ |

(8) 2. Suppose $f$ is continuous on $[2, 5]$, $f$ is differentiable on $(2, 5)$ and $1 \leq f'(x) \leq 4$ for all $x$ in $(2, 5)$. Show that $3 \leq f(5) - f(2) \leq 12$. (Hint: Use the Mean Value Theorem.)

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(20) 3. Find each of the following limits as a real number, $+\infty$, $-\infty$ or DNE (does not exist).

(a) $\lim_{x\to 0} \dfrac{\sin x - x}{x^3}$

(b) $\lim_{x\to 1^+} x^{\frac{1}{1-x}}$

(c) $\lim_{x\to\infty} x \tan \dfrac{1}{x}$

(d) $\lim_{x\to 0^+} (\ln x - \ln \sin x)$

(10) 4. The number $x = -1$ is a critical number of the function $f(x) = xe^x$. Decide whether it is a local minimum or a local maximum. Give reasons for your answer.

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(20) 5. Let $f(x) = \dfrac{x^2}{x^2 - 4}$. Give all the requested information and sketch the graph of the function on the axes below. Give both coordinates of the intercepts, local extrema and points of inflection, and give an equation of each asymptote. Write NONE where appropriate.

| | |
|---|---|
| domain | |
| intercepts | |
| symmetry | |
| horizontal asymptotes | |
| vertical asymptotes | |
| intervals of increase | |
| intervals of decrease | |
| local maxima | |
| local minima | |
| intervals of concave down | |
| intervals of concave up | |
| points of inflection | |

(12) 6. Find the dimensions of the rectangle of largest area that has its base on the $x$-axis and its other two vertices on the parabola $y = 8 - x^2$.

base = [ ]

height = [ ]

(5) 7. Find the most general antiderivative of $f(x) = 4\sec x \tan x - \dfrac{3}{x}$.

[ ]

(5) 8. If $\displaystyle\int_2^8 f(x)dx = 1.7$ and $\displaystyle\int_5^8 f(x)dx = 2.5$, find $\displaystyle\int_2^5 f(x)dx$.

$\displaystyle\int_2^5 f(x)dx =$ [ ]

(10) 9. Find $f$ if $f''(x) = \sqrt{x}$, $f(1) = 1$, and $f'(1) = 2$.

$f(x) =$ [ ]