
Circle your section:

300 – 450 *MW*

1401 – 001

Boerckel

900 – 1050 *TR*

1401 – 002

Kurtz

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- No notes or calculator allowed, only pencil, eraser, and scrap paper
 - There is a 3 hour time limit on this exam. If the exam is not returned to the proctor in 3 hours the student will receive a zero
 - All scrap work must be collected with the exam or properly disposed of (it may not remain in the students possession)
 - Show all work and box all answers; no work shown or messy work = no credit
 - Reduce and simplify all answers to factored form with positive exponents
 - All domains, ranges, intervals, and inequalities must be answered using interval notation
 - Intercepts must be written as ordered pairs
 - Asymptotes must be written as equations of a line
 - Label at least 3 points and the function on all graphs which you sketch

Point Totals

page 1 _____ /10

page 2 _____ /15

page 3 _____ /10

page 4 _____ /13

page 5 _____ /10

page 6 _____ /10

page 7 _____ /21

page 8 _____ /10

page 9 _____ /5

page 10 _____ /66

page 8 _____ /30

Total: _____ /200

Show All Work

In this section of the test you must show all work. Partial credit is possible in this section. **Make sure all of your answers are in the correct reduced form**

1. (5 pts) Using the definition of derivative (limits) find the derivative of the following function:

$$f(x) = -2x^2 + 1$$

ans: _____

2. (5 pts) Find the equation of the line tangent to the parametric curve of $\begin{cases} x = t^2 - 2 \\ y = t^3 - t \end{cases}$ at $t = -1$.

ans: _____

Show All Work

3. (5 pts) Given the rational function $R(x)$ below, find the intervals for which $R(x)$ is increasing and decreasing:

$$R(x) = \frac{x^2 - 49}{2x^2 - 50}$$

Increasing: _____

Decreasing: _____

4. (5 pts) Find the local extrema of the following function:

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

Local Maxima: _____

Local Minima: _____

5. (5 pts) Given the function $f(x)$ below, state the intervals for which $f(x)$ is concave up and concave down

$$f(x) = \frac{x^4}{12} + \frac{x^3}{3} - \frac{15x^2}{2} + x - 2$$

Concave Up: _____

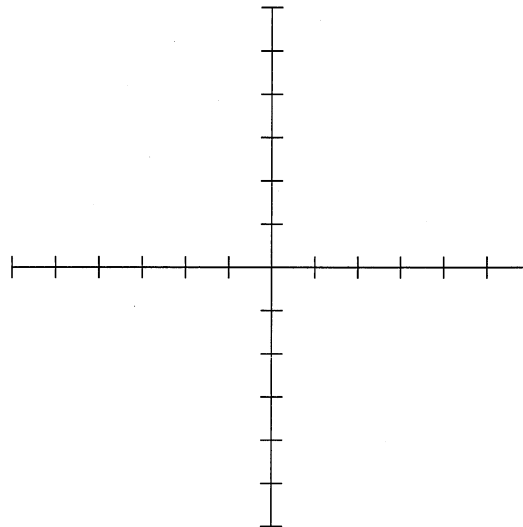
Concave Down: _____

Show All Work

6. (5 pts) Given the following information about the rational function $R(x)$, $R'(x)$, and $R''(x)$, sketch a graph of $R(x)$:

$R(x)$ has a vertical asymptote at $x=-3$, $x=3$
 $R(x)$ has a horizontal asymptote at $y=2$
 $R(x)$ has x-intercepts at $(-1,0)$, $(1,0)$ and $(4,0)$
 $R(x)$ has a y-intercept at $(0,-1)$

Interval	$R'(x)$	$R''(x)$
$(-\infty, -3)$	+	+
$x=-3$	und.	und.
$(-3, 0)$	-	+
$x=0$	0	+
$(0, 3)$	+	+
$x=3$	und.	und.
$(3, \infty)$	+	-



7. (5 pts) Find the absolute maximum and minimum for the given function of the indicated interval.

$$f(x) = 2x^3 - 3x^2 - 12x - 1$$

$[-2, 3]$

Absolute Max: occurs at _____

Absolute Min: occurs at _____

Show All Work

8. (8 pts) Use implicit differentiation to find y' for the following equation. Do not simplify your answer.

(a) $e^{xy} + \ln(y) = 2x + y$

(b) $\tan(y) + \csc(y) = \pi(x) + \sqrt{2}$

Ans: _____

Ans: _____

9. (5 pts) Given $f(x) = -x^2 + 3$ on the interval $[-3, 3]$ calculate S_3 , with $c_i = \frac{x_{i-1} + x_i}{2}$, partitioning the interval into equal lengths:

Ans: _____

Show All Work

10. (5 pts) Show that the Mean Value Theorem holds true for $f(x) = -x^2 + 2$ on $[0,3]$.

Ans: _____

11. (5 pts) Find the linear approximation of $f(x) = \sqrt{5x - 1}$ at $x_0 = 1$.

Ans: _____

Show All Work

12. (5 pts) A square sheet of cardboard 12 inch on a side is made into an open box (i.e. there is no top) by cutting squares of equal size out of each corner and folding up the sides. Find the dimensions of the box with the maximum volume.

Dimensions: _____

13. (5 pts) Suppose a 5-ft tall person is 10 ft away from a 20 ft tall lamppost. If the shadow is increasing at a rate of 2 ft/sec, at what rate is the person walking?

Ans: _____

Show All Work

14. (5 pts) Evaluate the integral by computing the limit of Riemann sums.

$$\int_1^3 (-x^2 + 2) dx$$

Ans: _____

15. (16 pts) Evaluate the following integrals.

(a) $\int \left(\frac{x}{\sqrt{x-1}} \right) dx$

(b) $\int (\sin(\cos(x)) \sin(x)) dx$

= _____

= _____

(c) $\int_{-1}^1 (3xe^{x^2+1}) dx$

(d) $\int_0^{\frac{\pi}{4}} \cos(2x) dx$

= _____

= _____

Show All Work

16. (5 pts) What is $\lim_{x \rightarrow c} f(x)$ (what does it mean?, what is the definition?). How would you evaluate it graphically? How would you evaluate it algebraically?

17. (5 pts) Write the definition of a derivative at a point $x=c$. What is the derivative? Give at least 3 different interpretations of the derivative.

Show All Work

18. (5 pts) Write the definition of an integral using the Riemann sum. What is an integral? Give at least 3 different conceptual ways of evaluating an integral.

Fill In The Blank

For this portion of the test you are not required to show any work. Put your answers in the corresponding blanks. **Make sure your answers are in the correct reduced form.** No partial credit will be given on this section.

19.) (2pts each)

(a) _____ (b) _____

(c) _____ (d) _____

(e) _____ (f) _____

(g) _____ (h) _____

20.) (3pts each)

(a) _____ (b) _____ (c) _____

(d) _____ (e) _____ (f) _____

21.)(2pts each)

(a) _____ (b) _____

22.)(2pts each)

(a) _____ (b) _____

23.)(3pts each)

(a) _____ (b) _____

(c) _____ (d) _____

(e) _____ (f) _____

(g) _____ (h) _____

Fill In The Blank

24.)(3pts each)

(a) _____

(b) _____

25.)(3pts each)

(a) _____

(b) _____

(c) _____

(d) _____

26.)(3pts each)

(a) _____

(b) _____

(c) _____

(d) _____

Fill in the blank:

23. (24 pts) **Fill in the blank:** Evaluate the following derivatives and simplify your answers. Place your answers in the appropriate blank space on the answer sheet of the exam.

$$(a) \frac{d}{dx} \frac{\sqrt{2}}{\pi^2} =$$

$$(b) \frac{d}{dx} \frac{-3}{\sqrt[4]{x^3}} =$$

$$(c) \frac{d}{dx} (3x^2 - 4x + \sqrt{x})^{20} =$$

$$(d) \frac{d}{dx} 2 \ln(5x + 3) =$$

$$(e) \frac{d}{dx} \left(\frac{x^2 + 3x - 2}{5x + 1} \right) =$$

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

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

$$(h) \frac{d}{dx} \tan^{-1}(x) =$$

24. (6 pts) **Fill in the blank:** Evaluate the second derivatives of the following functions. Place your answers in the appropriate blank space on the answer sheet of the exam.

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

$$(b) e^{2x} + 2 \ln(3x) - \sin(2x)$$

25. (12 pts) **Fill in the blank:** Evaluate and simplify the following indefinite integrals. Place your answers in the appropriate blank space on the answer sheet of the exam.

$$(a) \int (e^{2x}) dx$$

$$(b) \int \left(\frac{2}{x} - e^{3x} \right) dx$$

$$(c) \int (\tan(x) \sec^2(x)) dx$$

$$(d) \int \left(\frac{1}{\sqrt{1-x^2}} \right) dx$$

26. (12 pts) **Fill in the blank:** Evaluate and simplify the following definite integrals. Place your answers in the appropriate blank space on the answer sheet of the exam.

$$(a) \int_1^e \frac{-2}{x} dx$$

$$(b) \int_3^3 \frac{5x+1}{x} dx$$

$$(c) \int_0^1 (x(x+1)) dx$$

$$(d) \int_0^{\frac{\pi}{2}} -\cos(2x) dx$$