

► **Print your name legibly as it appears on the class rolls:**

Last _____ First _____

ID Number: 1 0 0 0 _ _ _ _ _

► **Check the appropriate section:**

- 001 – Dr. Krueger
- 004 – Dr. Shan
- 007 – Dr. Jorgensen
- 010 – Dr. Epperson
- 013 – Mr. Clanton

► ► ► ► ► **Fill in your scantron exactly as below** ◀ ◀ ◀ ◀ ◀

NAME	Last, first (EXACTLY AS YOU WROTE ABOVE)		
SUBJECT	1426- YOUR SECTION #	TEST NO.	FXA
DATE		PERIOD	

► **Turn cell phones off and put them out of sight. Turn off all beepers and alarms.**

► **Do not write below this line**

Part I total (48 points)	Your score 3 × _____ = _____
17 (10 points)	
18 (11 points)	
19 (11 points)	
20 (10 points)	
21 (10 points)	
Part II total (52 points)	
Final Exam Total (100 points)	

$$\sum_{k=1}^n k = \frac{n(n+1)}{2}$$

$$\sum_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\sum_{k=1}^n k^3 = \frac{n^2(n+1)^2}{4}$$

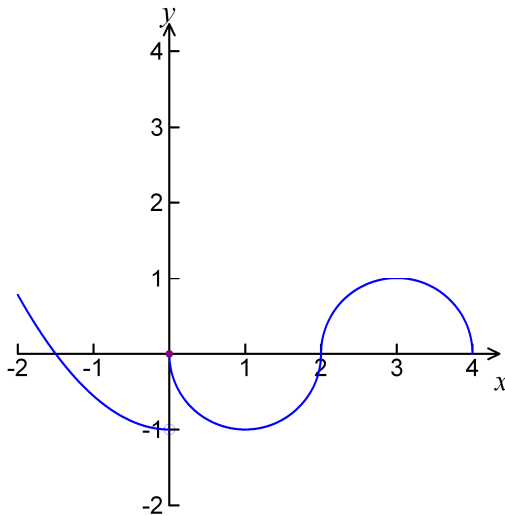
The square brackets following an exam question number refer to a section/problem number in the text. Problem numbers preceded by the symbol ~ are modeled on that problem from the text, but not identical to it. Problem numbers without the symbol are identical to or very close to the problem from the text.

INSTRUCTIONS FOR PART I: Write your answers for these questions on a scantron (form 882-E or 882-ES) and mark only one answer per question. **Your grade will be determined solely by what you mark on your scantron.** Each of the questions in this part counts 3 points, for a total possible score of 48 points. You may use an approved calculator. You may write on this exam or request scratch paper if needed.

1. [2.5/~8] Find the limit $\lim_{x \rightarrow -1^-} \frac{-1}{x^2(x+1)}$.

- (a) 0 (b) $1/2$ (c) $-\frac{1}{2}$ (d) ∞ (e) $-\infty$

2. [2.6 and 3.1] The graph of a function f , shown below, has a vertical tangent at the point $(2, 0)$ and horizontal tangents at the points $(1, -1)$ and $(3, 1)$. For what values of x in the interval $(-2, 4)$ is f NOT differentiable?



- (a) 0 only
 (b) 0 and 2 only
 (c) 1 and 3 only
 (d) 0, 1 and 3 only
 (e) 0, 1, 2, and 3 only

3. [3.6/43] If $\frac{dy}{dx} = -\frac{x^2}{y^2}$, find the value of $\frac{d^2y}{dx^2}$ at the point $(2, 2)$.

- (a) -12 (b) -2 (c) 0 (d) 2 (e) 12

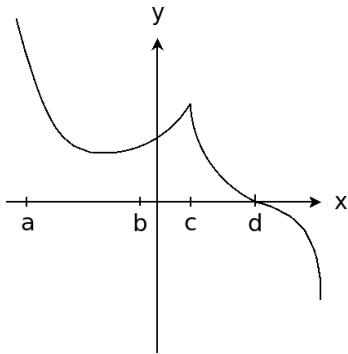
4. [3.7/~65] Given that $x^y = y^x$, compute $\frac{dy}{dx}$ at the point $(2, 2)$.

- (a) $\ln 2$ (b) 2 (c) $\frac{1}{2}$ (d) 0 (e) 1

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5. [3.9/1] The radius of a circle is changing at the rate of $-\frac{2}{\pi}$ m/sec. At what rate is the circle's area changing when $r = 10$ m?
 (a) -40 m²/sec (b) -20π m²/sec (c) -4 m²/sec (d) 10 m²/sec
 (e) 20π m²/sec
6. [3.10/Example 2] Find the linearization of $f(x) = \sqrt{1+x}$ at $x = 3$.
 (a) $L(x) = \frac{1}{2}(x+1)^{-1/2}$ (b) $L(x) = \frac{1}{4}x$ (c) $L(x) = \frac{5}{4} - \frac{x}{4}$
 (d) $L(x) = -\frac{5}{4} + \frac{x}{4}$ (e) $L(x) = \frac{5}{4} + \frac{x}{4}$
7. [4.1/40] Given the function $f(x) = x^3 - 3x$, which of the following are TRUE?
 I. f has no extreme values.
 II. f has an absolute maximum value of 2.
 III. f has a local maximum at $x = -1$.
 IV. f has a local minimum value of -2 .
 (a) I only (b) III only (c) IV only (d) III and IV only (e) II, III, and IV only
8. [3.1, 4.1, 4.2, 5.3 (Theorem 1)] If f is continuous for $a \leq x \leq b$ and differentiable for $a < x < b$, which of the following is FALSE?
 (a) $f'(c) = \frac{f(b) - f(a)}{b - a}$ for some c such that $a < c < b$.
 (b) $\lim_{h \rightarrow 0} \frac{f(c+h) - f(c)}{h} = \infty$ for some c such that $a < c < b$
 (c) f has a minimum value on $a \leq x \leq b$.
 (d) f has a maximum value on $a \leq x \leq b$.
 (e) $\int_a^b f(x)dx$ exists.

9. [4.4] Which of the following is TRUE for the graph below?



- (a) the graph is concave up on the interval (a, c)
 (b) an inflection point occurs at $x = c$
 (c) the graph is concave down on the interval (b, d)
 (d) the graph has no concavity on the interval (a, d)
 (e) the second derivative is negative on the interval (c, d)

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10. [4.6/47] Find the limit $\lim_{x \rightarrow 1^+} x^{1/(1-x)}$.

- (a) $\frac{1}{1-e}$ (b) $\frac{1}{e}$ (c) 0 (d) 1 (e) does not exist

11. [4.8/~93] Solve the initial value problem: $\frac{dy}{dx} = 3x^{-2/3}$, $y(-1) = -6$.

- (a) $y = 3x^3 - 3$ (b) $y = 2\sqrt[3]{x^2} - 8$ (c) $y = -\sqrt[2]{x^3 + 1} - 6$
 (d) $y = -3\sqrt[3]{x^2} - 3$ (e) $y = 9\sqrt[3]{x} + 3$

12. [5.3/10] Suppose that f and g are integrable functions and that

$$\int_1^9 f(x) dx = -1, \quad \int_7^9 f(x) dx = 5, \quad \int_1^7 g(x) dx = 4.$$

Evaluate $\int_1^7 [2f(x) - 3g(x)] dx$.

- (a) -24 (b) -14 (c) -4 (d) -2 (e) not enough information is given

13. [5.4/44] Find $\frac{d}{dx} \int_0^{x^2} \cos \sqrt[3]{t} dt$.

- (a) $\cos \sqrt[3]{x}$ (b) $\cos \sqrt[3]{x^2}$ (c) $2x \cos \sqrt[3]{x^2}$ (d) $\cos 2x$ (e) $\cos x^2 - 1$

14. [5.5/44] Find $\int \frac{\ln \sqrt{x}}{x} dx$

- (a) $\frac{1}{2} (\ln \sqrt{x})^2 + C$ (b) $\ln \frac{1}{\sqrt{x}} + C$ (c) $\ln(\sqrt{x} - x) + C$
 (d) $\frac{1}{4} (\ln x)^2 + C$ (e) $e^{\ln \sqrt{x} - \ln x} + C$

15. [5.6/~66] What is the area of the region between the curves $y = x^2$ and $y = -x$ from $x = 0$ to $x = 2$?

- (a) $\frac{2}{3}$ (b) $\frac{8}{3}$ (c) 4 (d) $\frac{14}{3}$ (e) $\frac{16}{3}$

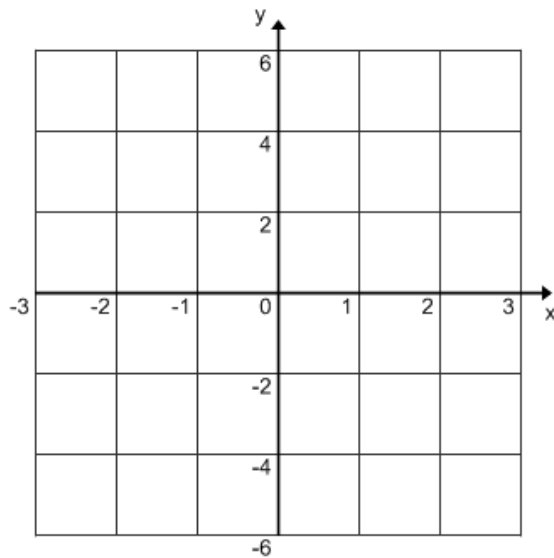
16. [5.6/16] The integral $\int_1^4 \frac{dy}{2\sqrt{y}(1+\sqrt{y})^2}$ is equivalent to which of the following?

- (a) $\int_1^4 \frac{dx}{x^2}$ (b) $\int_2^3 \frac{dx}{x^2}$ (c) $\int_1^4 \frac{dx}{(1+x)^2}$ (d) $\int_1^2 \frac{dx}{1+x^2}$ (e) $\int_4^9 \frac{dx}{\sqrt{x}}$

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INSTRUCTIONS FOR PART II: For these questions, you must write down **all** steps in your solutions. Write legibly and carefully label any graphs or pictures. **Draw a box around your final answer.** Partial credit will be given for those parts of your solution that are correct. The total value of the questions in this section is 52 points.

17. **10 points** [4.4/~19] Sketch the graph of $f(x) = 3x^5 - 5x^3 + 2$. You should
- Identify the domain _____.
 - Label all local extrema.
 - Label all inflection points.



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18. **11 points** [4.5/32] Bob is 3 miles offshore (that is, 3 miles from the shore or edge of the water) in a rowboat and wishes to reach a treasure chest 10 miles down a straight shoreline from the point nearest the rowboat. He can row 2 mi/hr and walk 5 mi/hr. How far down shore toward the treasure chest should he land his rowboat to reach the treasure in the least amount of time?

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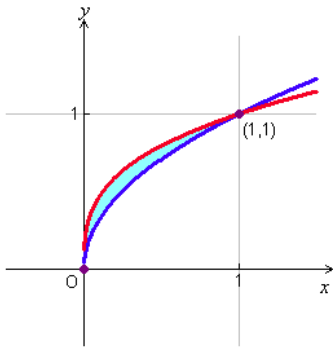
19. **11 points** [5.2/35, 5.4] Evaluate the integral $\int_0^1 (1-x^2) dx$ by

- (a) writing a formula for the lower sum obtained by dividing the interval into n equal subintervals and
- (b) taking the limit of the sum in (a) as $n \rightarrow \infty$.

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20. **10 points** (a) [5.3/58] Find the average value of the function $f(x) = 3x^2 - 3$ on the interval $[0, 2]$.

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- (b) [5.6/54] Write but DO NOT EVALUATE the integral that represents the area of the shaded region (shown below) in the first quadrant bounded by $x = y^3$ and $x = y^2$.



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21. **10 points** [3.8 & 5.6] Evaluate $\int_0^1 \frac{\arcsin x}{\sqrt{1-x^2}} dx$.

END OF EXAM

If your scratch paper contains any work to be graded, INDICATE THAT ON THE EXAM BESIDE THE APPROPRIATE PROBLEM and ask proctor to attach scratch paper to the exam.