

Name _____ Rec. Instr. _____
 Signature _____ Rec. Time _____

Math 220
 Final Exam
 May 13, 2015

No books, calculators, or notes are allowed. Please make sure that your cell phone is turned off. You will have 110 minutes to complete the exam. Unless instructed otherwise, **show your work.**

Problem	Points	Points Possible	Problem	Points	Points Possible
1		16	8		5
2		8	9		2
3		6	10		6
4		18	11		6
5		12	12		6
6		6	13		4
7		5	Total Score		100

1. (4 points each) Evaluate the following:

A. $\lim_{x \rightarrow -2} \frac{x+2}{x^2-4} =$

B. $\lim_{x \rightarrow \infty} \frac{2x^4 - 3x^3 + x + 9}{7x^4 + 2x^2 - 3} =$

C. $\frac{d}{dx} \int_0^x \cos(e^t) dt =$

D. $\frac{d}{dx} \left(\frac{2^x \cdot \tan(x)}{5x+2} \right) =$

2. (8 points) If a factory spends L thousand dollars on labor and M thousand dollars on materials, it will produce LM^2 thousand watches. In order for the factory to produce four thousand watches, how much should the company spend on labor and materials in order to minimize the total cost $L + M$? (Justify why your answer corresponds to an absolute minimum.)
3. (6 points) A 5-foot ladder rests against the wall. The bottom of the ladder slides away from the wall at a rate of 2 feet/second. How fast is the top of the ladder sliding down the wall when the bottom of the ladder is 3 feet from the wall?

4. (6 points each) Evaluate the following:

A. $\int_0^1 \sqrt{x} \, dx =$

B. $\int e^x \sin(e^x) \, dx =$

C. $\int_1^e \frac{(\ln(x))^3}{x} \, dx =$

5. (6 points each) Find $\frac{dy}{dx}$ for:

A. $x^3 + xy + y^3 = 10$

B. $y = \frac{x^x}{(3x + 1)^5}$

6. (6 points) Let $f(x) = x^2 + 1$. Using the **limit definition of the derivative**, find $f'(3)$.

7. A. (3 points) Find the linearization of $h(x) = \ln(x)$ at $x = 1$.

B. (2 points) Use the linearization from Part A to estimate $\ln(1.1)$.

8. For $0 \leq t \leq 20$, let $w(t) = 20 - t$ be the rate that water flows out of a storage tank in gallons per minute at time t minutes after the tank ruptures.

A. (3 points) Calculate $\int_0^{10} w(t) dt$.

B. (2 points) What does $\int_0^{10} w(t) dt$ represent?

9. (1 point each) Let $p(x) = x^2 - 1$. Over what intervals are $p(x)$:

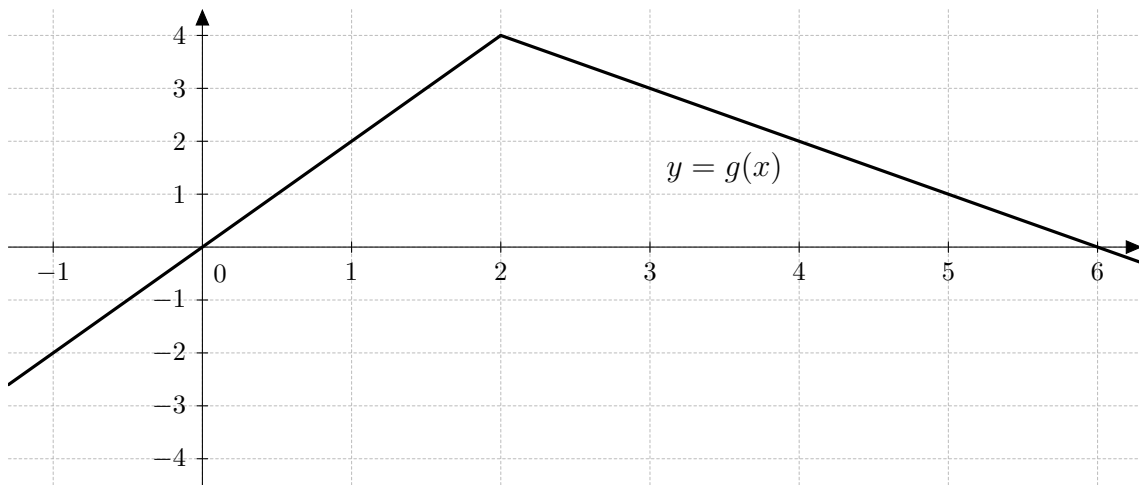
A. Concave up: _____

B. Concave down: _____

10. (6 points) Find the area bounded between $y = x^2$ and $y = 1$.

11. (6 points) Find the volume of the solid obtained by rotating the region bounded by $y = \sqrt{\sin(x)}$ from 0 to π around the x -axis.

12. (6 points) Find the absolute maximum and absolute minimum of $v(x) = x + \sin(x)$ on the interval $[0, 2\pi]$.



13. (2 points each) $y = g(x)$ is plotted above. Evaluate the following definite integrals.

A. $\int_{-1}^2 g(x) \, dx =$

B. $\int_2^6 (g(x) + 4) \, dx =$