Name _____ Rec. Instr._____
Signature _____ Rec. Time_____

Math 220
Exam 3
April 9, 2015

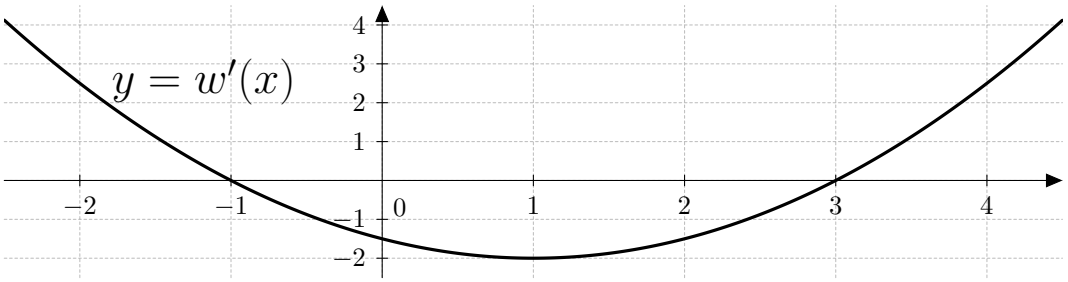
No books, calculators, or notes are allowed. Please make sure that your cell phone is turned off. You will have 75 minutes to complete the exam. Unless instructed otherwise, **show your work** on each problem.

| Problem | Points | Points Possible | Problem | Points | Points Possible |
|---|---|---|---|---|---|
| 1 | | 12 | 7 | | 7 |
| 2 | | 8 | 8 | | 6 |
| 3 | | 12 | 9 | | 10 |
| 4 | | 5 | 10 | | 12 |
| 5 | | 6 | 11 | | 15 |
| 6 | | 7 | Total Score | | 100 |

**1.** (12 points) Find the absolute maximum and absolute minimum of $k(x) = x^2 - 2x + 5$ on $[-1, 2]$.

**2. A.** (5 points) Find the linearization of $v(x) = \sin(x)$ at $x = 0$.

**B.** (3 points) Use your answer from Part **A** to estimate $\sin(-.01)$.




**3.** (3 points each) $y = w'(x)$ is plotted above. Find:

**A.** Interval(s) where $w(x)$ is increasing: _____ decreasing: _____

**B.** $x$-coordinate(s) where $w(x)$ has a local max: _____ local min: _____

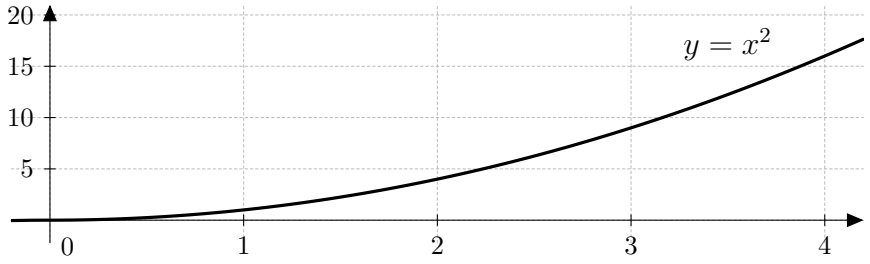
**C.** Interval(s) where $w(x)$ is concave up: _____ concave down: _____

**D.** $x$-coordinate(s) where $w(x)$ has an inflection point: _____

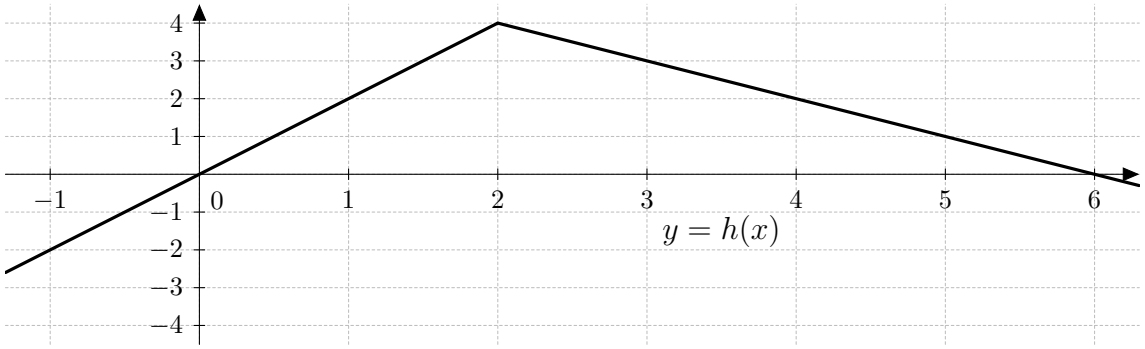
**4.** (5 points) Find the differential $dy$ if $y = e^{3x}$.

**5.** (6 points) Find the most general antiderivative of $\sec^2(x) + 3x^4 + 2$. (I hope that you 'C' what I mean.)

**6.** (7 points) Find the function $g(x)$ satisfying $g'(x) = \sin(x) + 1$ and $g(0) = 3$.




**7.** (7 points) Estimate the area between $y = x^2$ and the $x$-axis over the interval [0,4]. Use $n = 2$ rectangles, taking the sampling points to be midpoints. In the language of our textbook, this is $M_2$. Also, illustrate the rectangles on the graph above.




**8.** (3 points each) $y = h(x)$ is plotted above. Evaluate the following definite integrals. (No work needs to be shown.)

**A.** $\displaystyle\int_{-1}^{0} h(x)\,dx =$

**B.** $\displaystyle\int_{2}^{6} h(x)\,dx =$

**9.** (10 points) If a bakery charges $x$ dollars per cake, it makes a total profit of $P(x) = -x^2 + 100x - 30$. If the bakery wants to maximize profit, what should it charge per cake? (Justify why your answer is an absolute maximum.)

**10.** (12 points) Find the dimensions of the box with square base that has volume 8 and minimal surface area. (Justify why your answer is an absolute minimum.)

**11.** The function $f(x)$ and its first and second derivatives are:

$$f(x) = x^2(x-3) \qquad f'(x) = 3x(x-2) \qquad f''(x) = 6(x-1).$$

Find the information below about $f(x)$, and use it to sketch the graph of $f(x)$. When appropriate, write NONE. No work needs to be shown on this problem.

**A.** (1 point) Domain of $f(x)$: _____

**B.** (1 point) $y$-intercept: _____

**C.** (1 point) $x$-intercept(s): _____

**D.** (1 point) Interval(s) $f(x)$ is increasing: _____

**E.** (1 point) Interval(s) $f(x)$ is decreasing: _____

**F.** (1 point) Local maximum(s) $(x, y)$: _____

**G.** (1 point) Local minimum(s) $(x, y)$: _____

**H.** (1 point) Interval(s) $f(x)$ is concave up: _____

**I.** (1 point) Interval(s) $f(x)$ is concave down: _____

**J.** (1 point) Inflection point(s) $(x, y)$: _____

**K.** (5 points) Sketch $y = f(x)$ on the graph below.