Name _____ Student ID_____

Section time & instructor _____

Math 1A—Calculus, Spring 2017—Haiman
Midterm Exam 3

Instructions:

• Wait until time to start is announced before looking at the exam questions.

• Write your name, ID number and section time and instructor's name on this page now. Before turning in your exam, write your name and ID number where indicated on the first side of the second page.

• Write your answers on the exam paper in the space provided. Do preliminary work on scratch paper, then write a clear and concise answer giving your solution and enough steps to justify it.

Points may be deducted for incorrect or irrelevant parts of a solution even if a correct answer is included.

If you need more space for your solution to a problem, attach an extra page and write your name and ID number on it. Extra pages should not normally be necessary.

• You may use one sheet (written on both sides) of prepared notes. No other notes, books, calculators, or other electronic devices are allowed.

• There are 6 questions, for a total of 100 points.

1. In this problem, $f(x) = xe^{-x}$.

(a) (8 pts) Find the intervals where f is increasing or decreasing, and all local maxima and minima of f.

(b) (8 pts) Find the intervals where the graph of f is concave upward or downward, and find all inflection points on the graph.

(c) (8 pts) Sketch the graph of f, accurately displaying the information found in parts (a) and (b). Your sketch should also be accurate at $x = 0$ and as $x \to \pm\infty$.

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2. (15 pts) Compute the indefinite integral

$$\int (x - \frac{1}{x})\sqrt{x}\, dx.$$

3. (8 pts each) Find the two limits:

(a)

$$\lim_{x \to \pi/2} \frac{\sin 2x}{\cos x}$$

(b)

$$\lim_{x \to 0} \frac{\sin 2x}{\cos x}$$

4. (15 pts) Compute the definite integral

$$\int_{-1}^{1} \frac{1}{x^2 + 1}\, dx.$$

5. (15 pts) If $g(x)$ is defined by $g(x) = \int_1^{3x} \sin(t^2)\, dt$, find $g'(x)$.

6. (15 pts) Find the rectangle of largest area which has its bottom side on the x-axis and its two top corners on a circle of radius 3 centered at the origin.