INSTRUCTIONS: Books, notes, and electronic devices are not permitted. Write (1) your full name, (2) 1350/Exam 3, (3) lecture number/instructor name and (4) SPRING 2018 on the front of your bluebook. Make a grading table for 4 problems and a total. Do all problems. Start each problem on a new page. Box your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit. Justify your answers, show all work.

1. The following problems are not related.
   
   (a) (11pts) Suppose the acceleration of an object at any time \( t \) is given by \( a(t) = 3t^2 - 4t \) m/s\(^2\), \( t \geq 0 \). Find the velocity, \( v(t) \), at any time \( t \) if \( v(1) = 1 \) m/s. Show all work.

   (b) (11pts) Each of the regions \( A \), \( B \) and \( C \) bounded by the graph of \( f(x) \) and the \( x \)-axis has an area of 5, see below. Find the value of \( \int_{2}^{0} [\pi^2 f(x) - 4] \, dx \).

   ![Graph of f(x) with regions A, B, C]

   Problem 1: Each of the regions \( A \), \( B \) and \( C \) pictured above has an area of 5.

   (c) (4pts) Using right endpoints and subintervals of equal width, which of the limits below is equal to \( \int_{2}^{\pi} \sin(x) \, dx \)?

   (No justification necessary - Choose only one answer, copy down the entire answer.)

   \[
   \begin{align*}
   (A) \quad & \lim_{n \to \infty} \sum_{i=1}^{n} \sin \left( \frac{i\pi}{n} \right) \\
   (B) \quad & \lim_{n \to \infty} \sum_{i=1}^{n} \sin \left( \pi + \frac{i\pi}{n} \right) \\
   (C) \quad & \lim_{n \to \infty} \sum_{i=1}^{n} \frac{\pi \sin \left( \frac{i\pi}{n} \right)}{n} \\
   (D) \quad & \lim_{n \to \infty} \sum_{i=1}^{n} \frac{\pi \sin \left( \frac{i\pi}{n} \right)}{n}
   \end{align*}
   \]

2. The following problems are not related.

   (a) (11pts) Suppose we want to approximate a solution to the equation \( 3\sin(x) = x \) using Newton’s Method. What would the formula for \( x_{n+1} \) be? (To get full points for this question you must provide the explicit formula for \( x_{n+1} \) in terms of \( x_n \), the generic formula for Newton’s Method is not sufficient. You do not need to approximate the solution.)

   (b) (11pts) Write the expression \( \int_{2}^{5} f(x) \, dx + \int_{2}^{f(t)} dt - \int_{-2}^{-1} f(x) \, dx \) as a single integral in the form \( \int_{a}^{b} f(x) \, dx \).

   (c) (4pts) Using differentiation, which one of the choices below can be verified to be equivalent to \( \int x \cos(x) \, dx \)? (No justification necessary - Choose only one answer, copy down the entire answer.)

   \[
   \begin{align*}
   (A) \quad & \frac{x^2}{2} \sin(x) + C \\
   (B) \quad & \cos(x) + x \sin(x) + C \\
   (C) \quad & x \sin(x) + C \\
   (D) \quad & \frac{\cos^2(x)}{2} + C \\
   (E) \quad & \sin(x) + C
   \end{align*}
   \]

PROBLEMS #3 & #4 ON THE OTHER SIDE
3. The following problems are not related. Show all work.

(a)(12pts) Use the Fundamental Theorem of Calculus to evaluate the definite integral \( \int_{-\pi}^{\pi} |3\sin(x)| \, dx \).

(b)(12pts) If \( f(x) = \int_{4}^{x^2} \frac{t - 1}{t^2 + 1} \, dt \), use the Fundamental Theorem of Calculus to find \( f'(2) \). Simplify your answer.

4. The following problems are not related. Show all work.

(a)(12pts) Use \( u \)-substitution to evaluate the definite integral \( \int_{0}^{4} \frac{\sqrt{1 + \sqrt{x}}}{\sqrt{x}} \, dx \). Show all work.

(b)(12pts) Find the **average value** of \( f(x) = \frac{\sin(x)}{\sec(x)} \) on the interval \([0, \pi/4]\). Justify your answer.

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The list of Appm 1350 **Lecture Numbers/Instructor Names** for the front of your blue book:

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<thead>
<tr>
<th>Lecture #</th>
<th>Instructor</th>
<th>Class Time</th>
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<tr>
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<td>MWF 9-9:50</td>
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<td>801</td>
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