INSTRUCTIONS: Books, notes, and electronic devices are **not** permitted. Write (1) **your name**, (2) **1350/EXAM 3**, and (3) **SUMMER 2014** on the front of your bluebook. Also make a grading table with room for 4 problems and a total score. **Work all problems. Start each problem on a new page.** $\boxed{\text{Box}}$ **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. **SHOW ALL WORK**

1. (21 pts) Evaluate the following integrals. You do not need to use the limit definition of an integral for the definite integral.

   (a) $\displaystyle\int \frac{x^4+x+3}{\sqrt[3]{x}}\,dx$ (b) $\displaystyle\int_{-\pi/3}^{\pi/2} (\sin x - 2\cos x)\,dx$ (c) $\displaystyle\int_0^2 \left|x^2-1\right|\,dx$

   (*Hint: Sketch the graph*)

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2. (24 points)

   (a) State the two parts of the Fundamental Theorem of Calculus, including any hypotheses.

   (b) Suppose $h(x) = \displaystyle\int_0^{2x+2} \sin(t-2)\,dt$ and $f(s) = \displaystyle\int_{\pi/2}^{3s} h(x)\,dx$.

      i. Show that $f''(s) = 9h'(3s)$.

      ii. Find $f''(\pi/12)$.

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3. (30 pts) Consider $\displaystyle\int_0^3 \left(x^2-6x+10\right)\,dx$.

   (a) Write down a Riemann sum approximation to this integral by dividing $[0,3]$ into four equal subintervals and using the **left endpoint** of each subinterval for evaluation. You do not need to evaluate the sum.

   (b) Is your sum an overestimate or an underestimate? Briefly explain your answer.

   (c) Write down a Riemann sum to approximate the integral by dividing $[0,3]$ into n equal subintervals and using the **right endpoint** of each subinterval for evaluation.

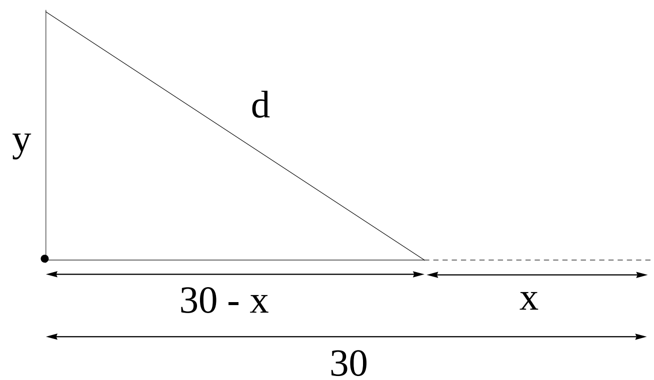
   (d) Evaluate the limit as $n\to\infty$ of the sum in (c). You must explicitly show your work. Check your answer by evaluating the integral.

   Note: The following formulas may be relevant:

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}, \qquad \sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$$

—TURN OVER! One more problem on the other side—

4. (25 points) A car leaves an intersection at noon and drives due north at 40 miles per hour. Another car is 30 miles due east of the intersection at noon. It heads due west at 30 miles per hour and arrives at the intersection at 1 pm. When are the cars closest? In the diagram below, $y(t)$ is the distance the first car has driven north since noon, and $x(t)$ is the distance the second car has driven west since noon.



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