INSTRUCTIONS: Books, notes, and electronic devices are **not** permitted. Write (1) **your name**, (2) **1350/Exam 3**, (3) **lecture number/instructor name** and (4) **SPRING 2016** on the front of your bluebook. Also make a **grading table** with room for 4 problems and a total score. **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.**

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1. The following problems are not related.

   (a)(8 pts) Approximate the area of the region bounded by the function $f(x) = \begin{cases} \sqrt{4-x^2}, & \text{if } 0 \le x < 2 \\ \frac{1}{2}x - 1, & \text{if } x \ge 2 \end{cases}$ and the x-axis from $x = 0$ to $x = 4$ using a Riemann Sum with 4 subintervals of equal length and *left* endpoints.

   (b)(8 pts) Suppose an object has velocity $v(t) = t^2 - 4$, find the *total distance* travelled by the object for $0 \le t \le 4$.

   (c)(8 pts) If $\int_0^4 g(x)\,dx = 3.4$, find the *net area* of the region bounded by the curve $h(x) = 1 - 2g(x)$ for $0 \le x \le 4$.

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2. Evaluate the following integrals, remember to show all work and simplify your answer:

   (a)(9 pts) $\displaystyle\int \frac{d\theta}{\cos^2(\theta)\sqrt[3]{1+\tan(\theta)}}$ (b)(9 pts) $\displaystyle\int_1^5 \frac{x}{\sqrt{2x-1}}\,dx$ (c)(9 pts) $\displaystyle\int_{-a}^{a} \left[\pi a - \pi|x| + \sqrt{a^2-x^2}\right] dx$, for $a > 0$.

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3. The following problems are not related, justify your answers and cite any theorems that you use.

   (a)(8 pts) Find dy/dx if $y = \left(\int_0^{3x} \sin(t^4)\,dt\right)^3$ (Justify your answer and cite any theorems that you use.)

   (b)(8 pts) The height H (in feet) of a palm tree after growing for t years is given by $H(t) = \sqrt{t+1} + 5t^{1/3}$, find the tree's average height for $0 \le t \le 8$.

   (c)(8 pts) Suppose $F(x)$ is an antiderivative of $f(x) = (\sin x)/x$, $x > 0$. Express $\displaystyle\int_1^3 \frac{\sin(2x)}{x}\,dx$ in terms of F. (Justify your answer and cite any theorems that you use.)

ALMOST DONE! PROBLEM #4 ON THE OTHER SIDE

4. The following problems are not related, remember to justify your answers.

(a)(10 pts) Ralphie has asked you to design an open-top stainless steel box. It is to have square base and a volume of 32 ft^3, to be welded from thin stainless steel and to weigh no more than necessary. Find the dimensions (length, width, and height) of such a box.

(b)(10 pts) Suppose $f(x) = x^4/4 + x^2 - 3x$, **set up** (but do not evaluate) Newton's method to approximate a *critical point* of the function $f(x)$. (In other words, give a formula for calculating the $(n+1)$-st approximation, x_{n+1}, in terms of the n-th approximation, x_n.) Simpify your answer.

(c)(5 pts) Which of the five choices given below is the limit $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{\pi}{n} \sin\left(2\pi + \frac{2\pi i}{n}\right)$ equivalent to? Clearly write down your answer(s) in your blue book, **no justification necessary** - *be sure to copy down the entire answer, don't just write down the roman numeral of your choice(s).*

$(i) \int_{\pi}^{3\pi} \frac{\sin(2x)}{2}\,dx \quad (ii) \int_{\pi}^{2\pi} \sin(2x)\,dx \quad (iii) \int_{0}^{\pi} \sin(2x+\pi)\,dx \quad (iv) \int_{0}^{\pi} \frac{\pi}{x}\sin(2\pi+x)\,dx \quad (v) \int_{-\pi}^{\pi} \sin(2x+\pi)\,dx$

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

Lecture #	Instructor	Class Time	Location
120	Murray Cox	MWF 9-9:50	EDUC 220
130	Brendan Fry	MWF 10-10:50	ECCR 200
150	Brendan Fry	MWF 12-12:50	FLMG 102
170	Sujeet Bhat	MWF 2-2:50	ECCR 245
180	Sujeet Bhat	MWF 3-3:50	ECCR 116
340R	Ann DeFranco	MWF 8:30-9:20	WVN 181A
801	Sandra Williams	MWF 2-2:50	LRVN N101

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