

**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 2019** 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.**

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1. (24pts) The following problems are not related.

(a)(12pts) Find the value of the number  $a$  so that the function  $f(x) = \frac{ax + 5}{x^2 - 1}$  has a critical point at  $x = 2$ . Show all work.

(b)(12pts) Suppose  $g'(x) = 4x^3(x - 1)^3 + 3x^4(x - 1)^2$ . Find the local maximum and local minimum of the function  $g(x)$  and justify your answer with either the 1st or 2nd Derivative Test. Clearly label your answers.

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2. (28pts) The following problems are not related.

(a)(12pts) Set-up, **but do not evaluate**, a Riemann sum to estimate the area under the curve  $f(x) = x \sin(x)$  from  $x = 0$  to  $x = \pi$  using five rectangles of equal width and left endpoints. (*NOTE: Do not leave your answer in terms of  $f(x)$ , you should set up your equation to the point that the only thing left to do is evaluate the equation but then **do not evaluate it.***)

(b)(12pts) Water flows from the bottom of a storage tank at a rate of  $r(t) = 200 - 4t$  liters per minute, where  $0 \leq t \leq 50$ . Find the amount of water that flows from the tank during the first 10 minutes. Simplify your answer. Show all work.

(c)(4pts) Which limit below is equal to  $\int_0^\pi x \sin(x) dx$ ? **Choose only one answer.** *No justification necessary, copy down the entire answer. If you do not copy down the entire answer, points will be deducted.*

$$(A) \lim_{n \rightarrow \infty} \sum_{i=1}^n \frac{\pi i}{n} \sin\left(\frac{\pi i}{n}\right) \quad (B) \lim_{i \rightarrow \infty} \sum_{i=1}^n \frac{\pi i}{n} \sin\left(\frac{\pi i}{n}\right) \frac{\pi}{n} \quad (C) \lim_{n \rightarrow \infty} \sum_{i=1}^n \sin\left(\frac{\pi i}{n}\right) \frac{\pi}{n} \quad (D) \lim_{n \rightarrow \infty} \sum_{i=1}^n \sin\left(\frac{\pi i}{n}\right) \frac{\pi^2 i}{n^2}$$


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3. (20pts) The following problems are not related.

(a)(10pts) Suppose we want to approximate the value of  $\sqrt[3]{2}$  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)(10pts) Find the most general antiderivative of the function  $f(x) = \sqrt[3]{x} + \sec^2(x) + \pi^2$ . Show all work.

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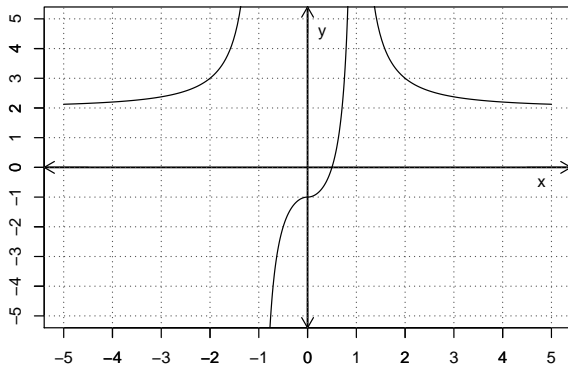
PROBLEM #4 ON THE OTHER SIDE

4. (28pts) The following problems are not related.

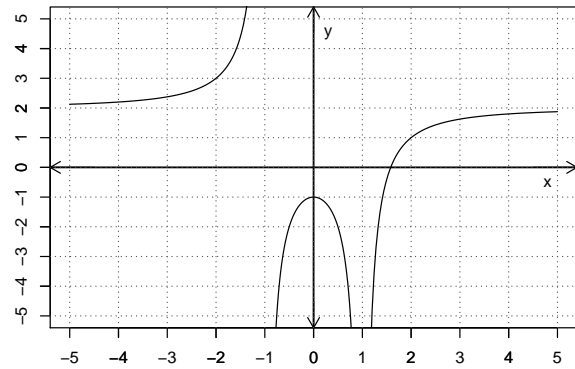
(a)(12pts) If  $\int_0^1 x\sqrt{x^2+4} dx = 5\sqrt{5} - 8$ , find  $\int_1^0 [t\sqrt{t^2+4} - 10] dt$ . Show all work.

(b)(12pts) Evaluate the definite integral  $\int_0^3 |x-2| dx$ . Show all work. Simplify your answer.

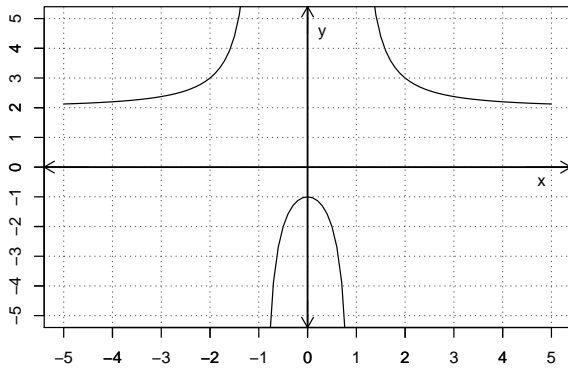
(c)(4pts) Suppose, for the function  $f(x)$ , we have  $f'(x) = \int \frac{6(3x^2+1)}{(x^2-1)^3} dx$ . Which graph below best matches the graph of the function  $f(x)$ ? (*Hint: Do not try to solve the integral, you already have all the information needed to solve this problem.*) **Choose only one answer.** *No justification necessary, clearly indicate your answer otherwise points will be deducted.*



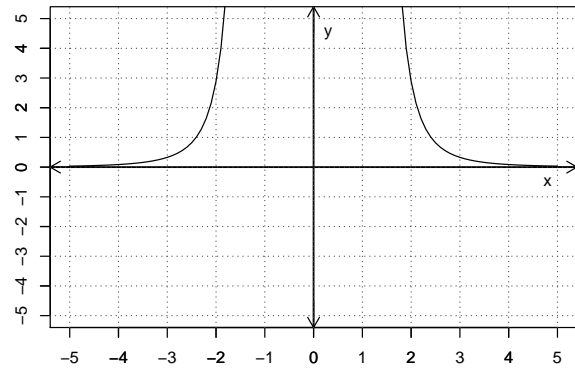
**Graph A**



**Graph B**



**Graph C**



**Graph D**

THE LIST OF APPM 1350 LECTURE NUMBERS/INSTRUCTOR NAMES FOR THE FRONT OF YOUR BLUE BOOK:

Lecture #	Instructor	Class Time	Class Location
120	Susan HALLOWELL	MWF 9-9:50	FLMG 104
130	Sujeet BHAT	MWF 10-10:50	ECCR 200
150	Sujeet BHAT	MWF 12-12:50	ECCR 1B51
170	Sandra WILLIAMS	MWF 2-2:50	ECCR 108