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 2021** on the first page of your test. 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.** You must start uploading your test to Gradescope by 9:01pm. Write the **honor code statement** given in the box below on the **first page** of your test and **sign** and **date it**.

On my honor, as a University of Colorado Boulder student, I have neither given nor received unauthorized assistance on this work. Signature:_____ Date:_____

1. (24pts) Start this problem on a **new** page. The following parts of this problem are not related.

   (a)(12pts) Find and classify the *critical points* of $f(x) = x^3 - 2x^2 + 4$ as being either a *local maximum*, *local minimum*, or *neither* using the **First Derivative Test**. You do not have to find the local extreme y-values. Show all work.

   (b)(12pts) Suppose we want to approximate the x-intercept of $f(x) = 3x^2 - 2$ 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. **Simplify your answer.**)

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2. (28pts) Start this problem on a **new** page. The following parts of this problem are not related.

   (a)(12pts) Find the most general antiderivative of $f(x) = \dfrac{5}{\sqrt{x}} + \sec^2(x)$. Justify your answer.

   (b)(12pts) Approximate the area under the curve $x^2 + 2x + 4$ from $x = 0$ to $x = 6$ with a *Riemann sum* using $n = 3$ subintervals of equal width and left endpoints (that is, find the approximation L_3).

   (c)(4pts) *(Multiple Choice)* Using right endpoints (R_n) and subintervals of equal width, which limit below is equal to $\displaystyle\int_1^3 \frac{x}{x^2+4}\,dx$? (**No justification necessary** - *Choose only one answer, copy down the entire answer.*)

   (A) $\displaystyle\lim_{n\to\infty}\sum_{i=1}^{n}\frac{2i/n}{(2i/n)^2+4}\cdot\frac{2}{n}$ (B) $\displaystyle\lim_{n\to\infty}\sum_{i=1}^{n}\frac{1+2i/n}{(1+2i/n)^2+4}\cdot\frac{2}{n}$ (C) $\displaystyle\lim_{n\to\infty}\sum_{i=1}^{n}\frac{1+2(i-1)/n}{(1+2(i-1)/n)^2+4}\cdot\frac{2i}{n}$ (D) $\displaystyle\lim_{n\to\infty}\sum_{i=1}^{n}\frac{2i/n}{(2i/n)^2+4}$

PROBLEMS #3 & #4 ON THE NEXT PAGE

3. (24pts) Start this problem on a **new** page. The following parts of this problem are not related.

(a) (12pts) Evaluate the integral $\int_0^1 |x^2 - 2x|\, dx$. Simplify your answer.

(b) (12pts) Find numbers x and y satisfying the equation $3x + y = 12$ such that the product of x and y is as large as possible. Justify your answer by classifying your critical point(s) using the *Second Derivative Test*. **Be sure to answer the question being asked.**

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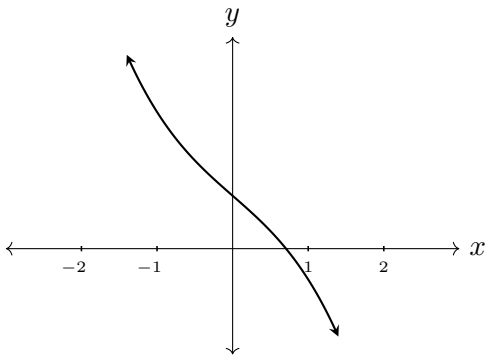
4. (24pts) Start this problem on a **new** page. The following parts of this problem are not related.

(a)(10pts) Evaluate the definite integral $\int_1^4 \frac{1 + x^{5/2}}{x^{1/2}}\, dx$. Simplify your answer.

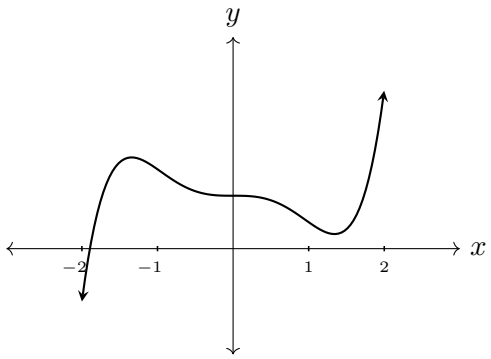
(b)(10pts) If $g(t)$ is *integrable* and $\int_0^1 g(t)\, dt = 5\sqrt{5} - 8$, find $\int_1^0 \Big[g(t) - 10\Big]\, dt$. Show all work.

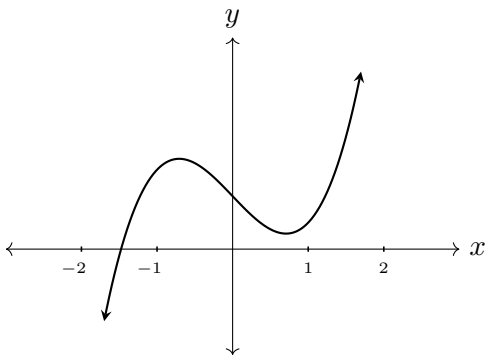
(c)(4pts) Which graph below best matches the graph of the function $f(x)$ given that $f'(0) = -3$ and $f''(x) = 6x$? **Choose only <u>one</u> answer.** *No justification necessary, clearly indicate your answer otherwise points will be deducted.*

Graph (A)

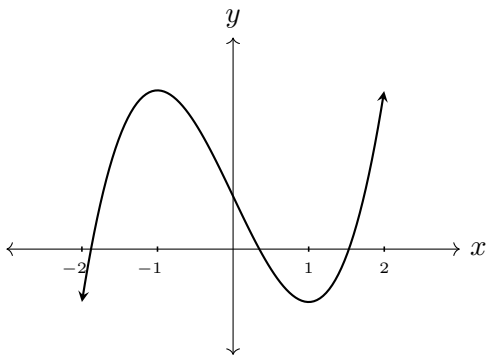


Graph (B)





Graph (C)



Graph (D)

— **END** —
(Stay Safe.)