Review for test #4

- Test 4 will be given **during our last class meeting**, Monday, 12/2.
- Test 4 will cover sections 4.5, 4.6, and topics from chapter 5 (see below).
- You will be allowed to use a handwritten 3.5" by 5" note card for this test.
- Topics covered on the exam:
  - Sections 4.5 and 4.6
    - Optimization procedures and problems
  - Chapter 5 topics covered:
    - Antiderivatives $\int f(x)dx$ (also known as *indefinite integrals*)
    - Finding antiderivatives using the rules learned in class.
    - Definite integrals $\int_a^b f(x)dx$
      - Interpretation as *signed* area.
      - Computing definite integrals using antiderivatives (the Fundamental Theorem of Calculus)

Sample problems:

1. Find the absolute maximum and absolute minimum of $f(x) = 100 - x^2$ on the indicated intervals.
   (a) $[-10, 10]$
   (b) $[0, 10]$
   (c) $[10, 11]$
2. Find the Absolute minimum value of $f(x) = x^3 - 6x^2$ on $[0, \infty)$.
3. Find the Absolute maximum value of $f(x) = 5x - 2x \ln x$ on $(0, \infty)$.
4. Find the absolute maximum and minimum, if either exists, for $f(x) = x^3 - 6x^2 + 9x - 6$ on the indicated intervals.
   (a) $[-1, 5]$
   (b) $[-1, 3]$
   (c) $[2, 5]$
5. Find the dimensions of a rectangle with an area of 200 square feet that has the minimum perimeter.
6. A company manufactures and sells x smartphones per week. The weekly price-demand and cost equations are, respectively,
$$p = 500 - 0.4x \text{ and } C(x) = 20,000 + 20x$$

(a) What price should the company charge for the phones, and how many phones should be produced to maximize the weekly revenue? What is the maximum weekly revenue?

(b) What is the maximum weekly profit? How much should the company charge for the phones, and how many phones should be produced to realize the maximum weekly profit?

7. A car rental agency rents 200 cars per day at a rate of \$30 per day. For each \$1 increase in rate, 5 fewer cars are rented. At what rate should the cars be rented to produce the maximum income? What is the maximum income?

8. The function $F(x) = x^3 - 2x + 5$ is an antiderivative of what function?

9. Find each indefinite integral

(a) $\int 10dx$

(b) $\int 10xdx$

(c) $\int 10x^2dx$

(d) $\int \frac{10}{x^2}dx$

(e) $\int \frac{10}{x}dx$

(f) $\int \frac{1+x}{x^3}dx$

(g) $\int x^3(1+x)dx$

(h) $\int \frac{1}{\sqrt{x}}dx$

(i) $\int \frac{e^t - t}{2}dx$

10. Find the particular antiderivative of $C'(x) = 9x^2 - 20x$ that satisfies the condition $C(10) = 2,500$.

11. Find the equation of the curve that passes through $(2, 3)$ if its slope is given by

$$\frac{dy}{dx} = 4x - 3$$

for each x.

12. Find each indefinite integral

(a) $\int (x^2 - 1)^5(2x)dx$

(b) $\int \frac{2}{2x-1}dx$

(c) $\int \frac{1}{2x-1}dx$

(d) $\int 2xe^{x^2}dx$

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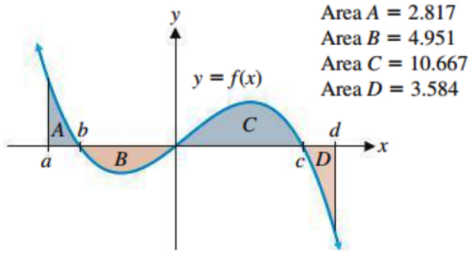
13. Calculate the definite integral by referring to the figure with the indicated areas.



(a) $\int_0^c f(x)dx$

(b) $\int_b^0 f(x)dx$

(c) $\int_a^d f(x)dx$

14. Evaluate the definite integrals

(a) $\int_0^4 2xdx$

(b) $\int_2^5 x^2dx$

(c) $\int_5^7 (2x+3)dx$

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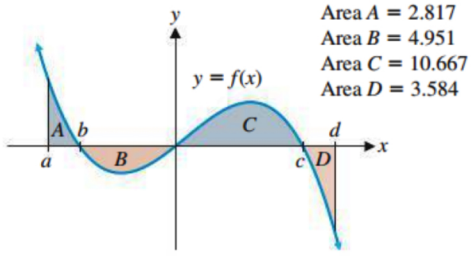

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