MATH 141: Some Practice Final Problems

Here are problems that cover the last two weeks of our class.

Remember the final is cumulative; you should look at Practice Midterm 1+2 and Midterm 1+2 as well.

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1. A plane flying horizontally at an altitude of 1 mi and a speed of 500 mph passes directly over a radar station. Find the rate at which the distance from the plane to the station is increasing when it is 2 miles away from the station.

2. Short answer questions:

   (a) What are the two methods for finding local minimums and maximums called? State the weaknesses of one of the methods.

   (b) What is the method for finding absolute minimums and maximums called?

   (c) What is the strength of **Part 2** of the Fundamental Theorem of Calculus?

   (d) Find three particular antiderivatives of the function $f(x) = \sin(x)$.

3. Suppose $f(x) = \dfrac{x}{x^2+1}$.

   (a) Find all intervals on which $f(x)$ is increasing and decreasing.

   (b) Find all local minimums and maximums.

4. Evaluate the following expressions. If applicable, you are allowed to use Fundamental Theorem of Calculus.

   (a) $\sum_{i=1}^{5} \frac{f(i)}{i}$ given that $f(x) = x^2$

   (b) $\int_1^5 x\,dx$

   (c) $\lim_{x\to\infty} \frac{x+1}{\sqrt{x^4-2}}$

   (d) $\lim_{x\to\infty} (x^5 - x^3)$

(e) $\int_{-1}^{1} (3x^2 + 4x + 4)\, dx$

(f) $\int_{\pi/2}^{\pi} \cos(x)\, dx$

(g) $\lim_{x \to \infty} \frac{x^2}{x^3 + 1}$

(h) $\int_{1}^{4} \frac{1}{\sqrt{x}}\, dx$

5. Suppose $f(x) = x^2$. Approximate the area underneath the curve on the interval $[1, 2]$ using four rectangles and right endpoints.

   Only set up the sum; do not compute it.

6. Consider the functions

$$g(x) = \int_0^x t^2\, dt \qquad\qquad h(x) = \int_0^x \sin(t^3)\, dt$$

(a) What is the geometric meaning of the number $g(5)$?

(b) What is the geometric meaning of the number $h(3)$?

(c) Find the derivative with respect to x of $g(x)$.

(d) Evaluate the following expression:

$$\frac{d}{dx}[g(x) + h(x)]$$

7. Determine the intervals of concavity of

$$f(x) = 2x^3 - 9x^2 + 12x - 3$$