MATH 142 (Sections 502)
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Calculus I Review Problems

1. Find the indicated limit or explain why it does not exist.

   (a) $\lim_{u \to 1} \dfrac{u^2 - 1}{u + 1}$

   (b) $\lim_{u \to -1} \dfrac{u^2 - 1}{u + 1}$

   (c) $\lim_{x \to 0} \dfrac{\tan x}{\sin(2x)}$

   (d) $\lim_{x \to 0} \dfrac{\sin(x)}{x}$

   (e) $\lim_{x \to \infty} \dfrac{\sin(x)}{x}$

   (f) $\lim_{x \to \infty} \dfrac{3x^2 - 2x + 7}{2x^2 + 5x + 9}$

2. State the definition of f', the derivative of a function f. Describe the derivative of a function in geometric terms.

3. Compute the derivative of each of the following functions.

   (a) $f(x) = x^3 - 3x^2 + x^{-2}$

   (b) $y = \sin(t^2) - \sin^2(t)$

   (c) $g(u) = \dfrac{3u - 5}{(u^2 - 1)^2}$

   (d) $L(x) = \displaystyle\int_1^x \frac{1}{t}\, dt$

   HINT: Use the Fundamental Theorem of Calculus.

4. A page of a book is to contain 27 square inches of print. If the margins at the top, bottom, and one side are 2 inches and the margin at the other side is 1 inch, what size page would use the least paper?

5. Compute each definite or indefinite integral.

   (a) $\displaystyle\int_0^1 x^3 - 3x^2 + 3\sqrt{x}\, dx$

   (b) $\displaystyle\int \frac{y^2 - 1}{(y^3 - 3y)^2}\, dy$

   (c) $\displaystyle\int_0^{\pi/2} \cos^4 x \sin x\, dx$

6. Find the area of the region bounded by $y = x - x^2$ and the x-axis.

7. Find the length of the arc of the curve $y = \frac{x^3}{3} + \frac{1}{4x}$ from $x = 1$ to $x = 3$.