MTH 252Z Lab
The Fundamental Theorem of Calculus Part 2

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Prompts

1. The Fundamental Theorem of Calculus is the most important theorem of this course. This theorem has two parts, one of which we studied today. Explain in a few sentences what the second part of the Fundamental Theorem of Calculus tells us.
2. The FTC2 has one requirement for f to be able to evaluate $\int_a^b f(x)\ dx$. What is that requirement?
3. Below is a screenshot from ChatGPT when asked to evaluate $\int_0^\pi \sec^2 x\ dx$.

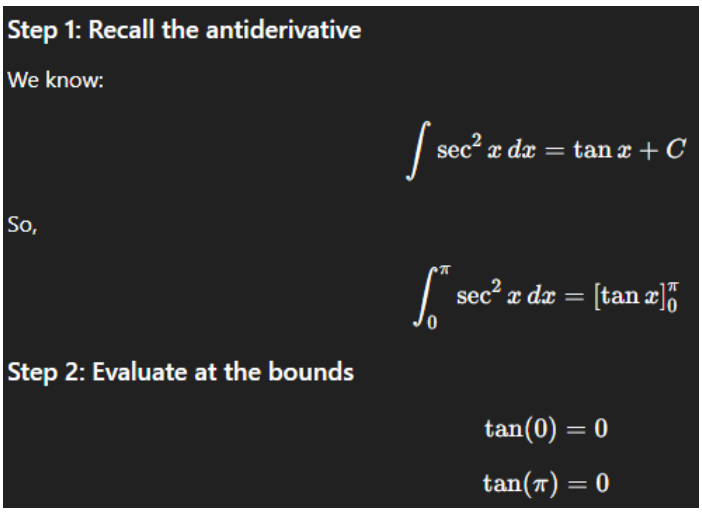

Figure 1: ChatGPT's attempt at computing $\int_0^\pi \sec^2 x\ dx$.

Explain in as much detail as possible what ChatGPT's error is.

4. Evaluate the following definite integrals.
   (a) $\int_1^2 (x + 2x^2 + 3x^3 + 4x^4)\ dx$
   (b) $\int_{-1}^1 \left(x^2 + \frac{1}{1+x^2}\right)\ dx$
   (c) $\int_3^3 \tan t\ dt$

5. Evaluate the following integrals.

   (a) $\displaystyle\int \sqrt[5]{x}\, dx$

   (b) $\displaystyle\int_0^1 \sqrt[5]{x}\, dx$

   (c) $\displaystyle\int_0^{32} \sqrt[5]{x}\, dx$

   (d) $\displaystyle\int_1^{32} \sqrt[5]{x}\, dx$

6. A soccer player runs on a field for 6 seconds with velocity (in feet per second) given by the function $v(t) = 2t^3 - 18t^2 + 36t$.

   (a) Find a formula for the acceleration of the soccer player for these 6 seconds.

   (b) Find a formula for the position of the soccer player for these 6 seconds.

   (c) Find the total displacement of the player in these 6 seconds.

   (d) Find the total distance traveled by the player in these 6 seconds.