

MTH 252Z Lab

The Fundamental Theorem of Calculus Part 1

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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 first part of the Fundamental Theorem of Calculus tells us.
2. Let $f(x) = \cos x + \sin x$. Let $g(x) = \int_0^x f(t) dt$.
 - (a) Graph f in Desmos. Copy this graph onto your paper three times.
 - (b) On your first graph, draw a representation of $g\left(\frac{\pi}{6}\right)$.
 - (c) On your second graph, draw a representation of $g\left(\frac{\pi}{4}\right)$.
 - (d) On your third graph, draw a representation of $g\left(\frac{\pi}{3}\right)$.
 - (e) Find $\frac{d}{dx} \left(\int_0^x f(t) dt \right)$.
 - (f) Find $g'\left(\frac{\pi}{3}\right)$.
 - (g) What does $g\left(\frac{\pi}{3}\right)$ represent? What does $g'\left(\frac{\pi}{3}\right)$ represent?
3. Evaluate the following derivatives.
 - (a) $\frac{d}{dx} \left(\int_1^x \tan t dt \right)$
 - (b) $\frac{d}{dx} \left(\int_{\pi}^{x^2} \tan t dt \right)$
 - (c) $\frac{d}{dx} \left(\int_0^{\tan x} e^{t^2} dt \right)$
 - (d) $\frac{d}{dx} \left(\int_{10}^{\cos x} \frac{-1}{t} dt \right)$
4. If $f(x) = \ln \sqrt{1+x^2}$ and $g(x) = \int_x^{e^x} f(t) dt$ with $x > 0$, then find a formula for $g'(x)$.
5. Find $\frac{d}{dx} \left(\int_{x^2}^{e^x} |t+2| dt \right)$.
6. A young Damien is learning to drive. Suppose $f(t) = t^3 - t^2$ represents the velocity of the car in m/s that Damien is driving for $0 \leq t \leq 3$ seconds.
 - (a) If $g(x) = \int_0^x f(t) dt$, what are the units of g ?
 - (b) What does $g(1)$ represent?
 - (c) What does $g'(1)$ represent?
 - (d) Describe what is happening for Damien in these three seconds.