Worksheet #1: Review of Calculus
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Instructor: Norman Sheu
Section Leader: CJ Dowd

Problem 1. What is the definition of a derivative? If $f, g : \mathbb{R} \to \mathbb{R}$ are differentiable functions, why is it true that

$$(f+g)'(x) = f'(x) + g'(x)?$$

Problem 2. Compute the derivatives with respect to x of the following functions:

(a) $\sin(x)\cos(x)$

(b) 2^{x^2}

(c) $\frac{x}{\sqrt{x^2+1}}$

Problem 3. What is the definition of the definite (Riemann) integral $\int_a^b f(x)dx$? What is the definition of the indefinite integral $\int f(x)dx$?

Problem 4. State both parts of the Fundamental Theorem of Calculus and conceptually/pictorially explain why they are true.

Problem 5. Compute the following indefinite integrals:

(a) $\int \frac{dx}{x\ln(x)}$

(b) $\int ye^y dy$

(c) $\int \frac{1}{1+u^2} du$

(d) $\int \frac{\sqrt{z^2-1}}{z} dz$ (Hint: Trig substitution)