

Texas State University
MATH 3323: Differential Equations, Spring 2020
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Problem Set 1

This first problem set is a review of integral and differential calculus, with an emphasis on the types of integrals and derivatives you will be calculating over and over in our dealings with differential equations.

(1) Compute each indefinite integral

(a) $\int \frac{1}{1-x^2} dx$

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

(b) $\int e^x \sin(x) dx$

(d) $\int \sin(2x) dx$

(2) Compute each definite integral below

(a) $\int_0^2 \cos(\pi x) dx$

(c) $\int_{-1}^1 e^{2x} x dx$

(b) $\int_1^\infty e^{-4x} x^2 dx$

(d) $\int_0^1 \frac{1}{x^2-4} dx$

(3) Use the product rule and chain rules to compute the derivative $\frac{df}{dx}$ of each of the following functions

(a) $f(x) = x^3 + x^2 + x + 1$

(b) $f(x) = \cos(3x) + \cos(2x) + \cos(x) + 1$

(c) $f(x) = \frac{\sin(x^2)}{2 + \cos(x)} - (\sin(x))^2$

(4) (BONUS) Determine which of the following improper integrals converge and which diverge.

(a) $\int_0^1 x^{-1/2} dx$

(c) $\int_1^\infty \frac{1}{x} dx$

(b) $\int_1^\infty \frac{1}{x^2} dx$

(d) $\int_0^\infty e^{-x} x dx$.