

1. Calculate the following:

a. $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^2 \tan x}$ b. $\lim_{x \rightarrow 0} \frac{x^{10/3}}{\sin x - x}$

c. $\lim_{x \rightarrow \pi/2} \frac{\cos x}{x - \pi/2}$ d. $\lim_{x \rightarrow 0} \frac{\int_0^x (1 - \cos t) dt}{x^3}$

e. $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{i=1}^n \sin \frac{i}{n}$

2. Find the general solutions to the following differential equations.

a. $\frac{dy}{dx} = \sqrt[3]{\frac{x}{y}}$ b. $\frac{d^2x}{dt^2} = -\omega^2 x$

c. $\frac{d^2x}{dt^2} = -g$

3. section 5.2, #22,35,36

4. For each function below, determine whether or not it is Riemann integrable on the interval $(0,1]$, and **fully** explain your result: (a) $f(x) = \sin(1/x)$, (b) $f(x) = 1/\sqrt{x^2} \sin x$, (c) $f(x) = x$ for x rational and $= -x$ for x irrational.

5. Calculate $\int_1^2 (3x^2 - 2) dx$ from the definition of the integral, that is, using Riemann sums.

6. Calculate the following integrals:

(a) $\int_0^4 \sqrt{x} dx$ (b) $\int_0^{\pi/2} \sin x dx$ (c) $\int_1^3 \frac{1 - 3x^3}{x^2} dx$

(d) $\int_0^\pi \sin^2 x dx$ (e) $\int_0^\pi x \cos(x^2 + \pi) dx$ (f) $\int_{-3}^3 x^3 dx$

7. Find $\frac{d}{dx} \int_0^{x^2} \tan \theta d\theta$.