

Math 31B Practice Problems I

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1. Differentiate the function.

(a) $f(x) = e^{x \cos 2x}$

(c) $f(x) = \log_3(2 - 5x)$

(b) $f(x) = (x^3 - 2x)4^x$

(d) $f(x) = \ln(x^4 \sin^2 x)$

2. Use logarithmic differentiation to find the derivative of

$$f(x) = \frac{x^4(2x^2 + 1)^{1/3}}{\cos x}$$

3. Evaluate the integral.

(a) $\int_0^6 e^{-2x} dx$

(b) $\int \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$

(c) $\int \frac{2x^3}{x^4 + 1} dx$

(d) $\int \tan x dx$

4. Evaluate the following limits.

(a) $\lim_{x \rightarrow \infty} \frac{e^x - e^{-x}}{e^x + e^{-x}}$

(d) $\lim_{x \rightarrow \infty} (\ln(1 + x) - \ln(3 + x))$

(b) $\lim_{x \rightarrow 0} \ln(\cos x)$

(e) $\lim_{x \rightarrow 0} \frac{6^x - 3^x}{x}$

(c) $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$

(f) $\lim_{x \rightarrow 1} \left(\frac{x}{x-1} - \frac{1}{\ln x}\right)$

5. Determine whether the sequence converges or diverges. If it converges, find the limit.

(a) $a_n = e^{1/n}$

(c) $a_n = 1 - (0.2)^n$

(e) $a_n = \frac{(-1)^{n-1}n}{n^2 + 1}$

(g) $a_n = \frac{n^n}{n!}$

(b) $a_n = n \sin\left(\frac{1}{n}\right)$

(d) $a_n = n^2 e^{-n}$

(f) $a_n = \frac{\cos^2 n}{2^n}$

(h) $a_n = \frac{e^n}{n!}$

*6. Determine whether the series is convergent or divergent. State what test(s) you used to come to your conclusion.

(a) $\sum_{n=1}^{\infty} \frac{1 + 3^n}{2^n}$

(c) $\sum_{n=1}^{\infty} \frac{2}{n^{0.85}}$

(e) $\sum_{n=1}^{\infty} \frac{n+1}{n\sqrt{n}}$

(g) $\sum_{n=3}^{\infty} \left(\frac{1}{n+1} - \frac{1}{n-1}\right)$

(b) $\sum_{n=1}^{\infty} \frac{e^n}{n^2}$

(d) $\sum_{n=1}^{\infty} \frac{1 + \sin n}{10^n}$

(f) $\sum_{n=1}^{\infty} \cos\left(\frac{\pi}{n}\right)$