

[30] 1. Evaluate each of the following indefinite integrals.

a) $\int \frac{\sqrt{x^2 - 9}}{x} dx$

b) $\int \frac{4x - 3}{x^2 + 3x} dx$

c) $\int \frac{\ln x}{\sqrt{x}} dx$

- [30] 2. Evaluate each of the following integrals or show that the integral diverges. Note: some of these integrals may be improper.

a) $\int_0^{\infty} \frac{dx}{(x+4)^2}$

b) $\int_0^{\pi/2} \sin^3 \theta \cos^8 \theta d\theta$

c) $\int_3^4 \frac{dx}{\sqrt{4-x}}$

[16] 3. Find each of the following limits. Give clear reasons for your answers.

a) $\lim_{x \rightarrow 0} \frac{1 - \cos 2x}{x^2}$

b) $\lim_{x \rightarrow 0^+} (1 + \tan x)^{1/\sin x}$

- [44] 4. Determine whether the series converges absolutely, converges conditionally, or diverges. Give a clear reason for each answer. Give the name of any tests you use.

a)
$$\sum_{n=0}^{\infty} \frac{(-1)^n (n+1)}{n^2 + 4}$$

b)
$$\sum_{n=1}^{\infty} \left(\frac{3n}{1-2n} \right)^n$$

c)
$$\sum_{n=1}^{\infty} \frac{(-e)^n}{(2n)!}$$

$$\text{d) } \sum_{n=0}^{\infty} \frac{2^n}{3^n + 1}.$$

- [12] 5. Find the interval of convergence for the power series. (Be sure to check convergence at the endpoints.)

$$\sum_{n=1}^{\infty} \frac{(x-2)^n}{n^2 3^n}$$

[8] 6. Find the Taylor polynomial of degree 3 for $f(x) = \sin x$ about $a = \pi/4$.

[12] 7. Find the Maclaurin series for each function.

a) $f(x) = \frac{x^3}{2+x}$

b) $f(x) = x \cos(3x)$

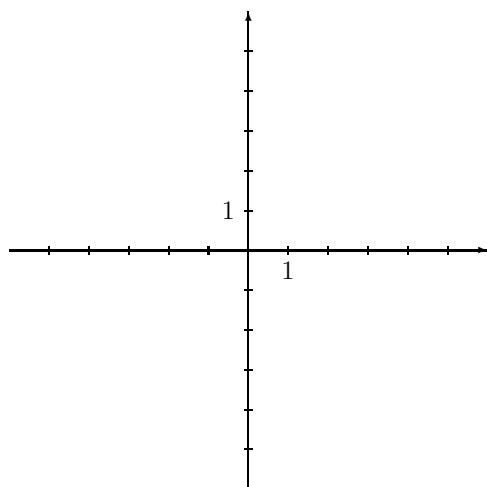
[10] 8. a) Give the Maclaurin series for $\tan^{-1}(x)$.

b) Find the Maclaurin series for $\tan^{-1}(x^2)$.

c) Approximate $\int_0^{0.6} \tan^{-1}(x^2) dx$ with $|\text{error}| < 0.001$.

[8] 9. Find an equation of the line tangent to the curve $x = t \cos t$, $y = 4 + \sin 3t$ at the point where $t = \pi$.

- [8] 10. Eliminate the parameter to find a Cartesian equation for the curve $x = 1 + 3 \cos 2t$, $y = 2 - 3 \sin 2t$. Identify and sketch the curve. Indicate with an arrow the direction in which the curve is traced as t increases.



- [10] 11. Find the length of the curve $x = t^3$, $y = 2t^2$ over the interval $0 \leq t \leq 1$.

[12] 12. Find the area of the region inside the curve $r = 3 + 3 \cos \theta$.

