

1. (10 pts) Evaluate $\lim_{x \rightarrow 0} \frac{\tan^{-1} x - x}{x \cos x - \sin x}$.
2. (10 pts) Write $-1 + \sqrt{3}i$ as $re^{i\theta}$ and find a square root of this quantity.
3. (10 pts) Find the arc length of the curve $y = \log \cos x$ between $x = 0$ and $x = \pi/4$.

4. (10 pts) Evaluate the indefinite integral $\int \frac{(x^3+1) dx}{x^3-x^2}$.
5. (10 pts) Consider the plane region R bounded by the coordinate axes and the curve $y = 1 - x^3$. What is the volume of the solid obtained by rotating R around the y -axis?
6. (10 pts) A spring has a natural length of 10 cm. If a force of 20N is needed to keep it stretched to a length of 12 cm., how much work is required to stretch it from 12 cm. to 14 cm. (Recall that a joule is a newton-meter.)

7. (10 pts) Evaluate the definite integral

$$\int_0^{\pi^2} \sin \sqrt{x} \, dx.$$

8. (10 pts) Does the series $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^2}$ converge or diverge?

9. (10 pts) Does the series $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt[n]{n}}$ converge, and if so, does it converge absolutely?

10. (10 pts) Does the series $\sum_{n=0}^{\infty} \frac{2^n \sin n}{n!}$ converge, and if so, does it converge absolutely?

11. (20 pts) Give the expansion of $\sqrt[3]{1+x}$ as a power series in x , up to and including the x^3 term.

12. (20 pts) Give the radius of convergence and the interval of convergence of

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

13. (20 pts) Give the radius of convergence and the interval of convergence of

$$10x + \frac{10^3 x^3}{3} + \frac{10^5 x^5}{5} + \frac{10^7 x^7}{7} + \dots$$

14. (20 pts) Give the expansion of $\frac{\sin(x^3)}{1-x^5}$ as a power series in x out to and including the x^9 term.
15. (20 pts) Give the Taylor series for $\cos x$ around $a = \pi/2$. You do not need to use \sum notation but should either write down the form of the general term or write down enough terms to make the pattern clear.