Review:

Important exam topics:

Inverses.
Logarithmic differentiation.
Partial fraction decomposition.
Trigonometric inverses.
Hyperbolic functions.
Integration by parts.
Error bounds.

Limits of sequences.
Telescopic series.
Strengths of functions.
Radius and interval of convergence.
Taylor series / polynomials.
Absolute and conditional convergence.

1. True / False:

- Let $\sum a_n$ be a positive series. Then its sequence of partial sums $\{S_N\}$ can oscilate.
- Let $\sum a_n$ be a converging series, Then $\lim_{n\to\infty} a_n = 0$.
- The Limit Comparison Test can always be used to determine whether $\sum a_n$ converges if we know that $\sum b_n$ converges.
- The Leibniz Test states that alternating series converge.
- A power series always has a radius of convergence.

2.: Find terms through degree four of Maclaurin series of $\dfrac{\arctan(x)}{1-x}$.

3: Find the interval of convergence of $\displaystyle\sum_{n=1}^{\infty} \frac{x^{2n}}{(-\sqrt{2})^n}$.

Root test: $L = \frac{x^2}{\sqrt{2}} < 1$ when $x^2 < \sqrt{2}$ so $-\sqrt[4]{2} < x < \sqrt[4]{2}$.

$x = -\sqrt[4]{2}$ diverges, $x = \sqrt[4]{2}$ diverges.

4: Determine the sum of: $\displaystyle\sum_{n=1}^{\infty} \cos\left(\frac{1}{n}\right)\cdot n^2$ or explain why it diverges.

Divergence Test: $\lim_{n\to\infty} \cos\left(\frac{1}{n}\right)\cdot n^2 = \infty$.

5: Integrate: $\displaystyle\int \sin(\ln(x))\,dx \underset{\substack{u=\ln(x)\\ du=\frac{1}{x}dx}}{=} \int e^u \cdot \sin(u)\,du = \frac{1}{2}\, x\cdot\left(\sin(\ln(x)) - \cos(\ln(x))\right)$