

# Final Exam

Time: 180min

1. (5 pts) Find  $dy/dx$  if  $y = \cosh x^{\sinh x}$ .

2. (35 pts) Find

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

b)  $\int \cos^4 x dx$

c)  $\int_{-2}^3 \frac{1}{x^7} dx$

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

e)  $\int \tan^{-1}(x) dx$

3. (10 pts) Find

a)  $\lim_{x \rightarrow 0} (x^2 \ln x)$

b)  $\lim_{x \rightarrow \infty} x^{\frac{1}{x}}$

4. (5 pts) Write 1.29999999... as the ratio of two integers.

5. (25 pts) Determine whether or not the following series converge.

a)  $\frac{1}{2^2} + \frac{3}{2^3} + \frac{5}{2^4} + \frac{7}{2^5} + \dots$

b)  $\sum_{n=1}^{\infty} \frac{\ln n}{n}$

c)  $\sum_{n=2}^{\infty} \frac{n}{\ln n}$

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

e)  $\sum_{n=1}^{\infty} (-1)^n \frac{n+7}{n^2 \sqrt{n}}$

6. (10 pts) (a) Find the Maclaurin series for  $e^x$  and compute its radius of convergence. (b) Find the convergence set of the power series

$$1 - x + \frac{x^2}{2} - \frac{x^3}{3} + \frac{x^4}{4} + \dots$$

7. (10 pts) Find a series which converges to  $\pi$ .