Name: _____

- This packet is due at **12:00 pm (noon) PDT on Friday, June 4**.
- Neatly fill out this packet either directly or on your own paper. Then upload your answers to Canvas. Please clearly number each problem and keep them in order.
- For each problem in this packet, **organize and show all of your work and justification** for your answer.
- Make sure that it is clear what your final answer is. This may mean boxing/circling it or it may mean doing neither.
- If you are required to draw a graph of a function, each axis must be labeled and given a scale.
- I will not be grading every individual problem, but answers will be available on Canvas after the due date.
- I am happy to help you however I can. Here are some options:
  - Come to my office hours (see syllabus).
  - Email me directly at gknapp4@uoregon.edu

1. Find the Maclaurin series for the hyperbolic sine function: $\sinh(x) = \dfrac{e^x - e^{-x}}{2}$. Fully simplify your answer and be sure to include the interval of convergence.

2. Use the identity $2\sin(x)\cos(x) = \sin(2x)$ to find the power series expansion of $\sin^2(x)$ at $x = 0$.

   Hint: What is $\int 2\sin(x)\cos(x)\,dx$? (use u-substitution)

3. Find a value of n such that the remainder estimate $|R_n| \leqslant \dfrac{M}{(n+1)!}|x-a|^{n+1}$ for the *Maclaurin Series* for $f(x) = \sin(x)$ yields $|R_n| < 10^{-3}$ at $x = 2$. Compute $p_n(2)$ using your favorite computational tool.

4. Find a value of k so that the kth Taylor polynomial for $\ln(1-x)$ centered at $a=0$ approximates $\ln(1-x)$ to within 0.001 for every x in the interval $[-0.5, 0.5]$.

   Recall: The Maclaurin series for $\ln(1-x)$ is $\displaystyle\sum_{n=1}^{\infty} -\frac{x^n}{n}$

5. This problem will not be graded (so you don't have to submit a solution for this problem). But it will give you an idea of a typical final exam problem about differential equations. Suppose that $\sum_{n=0}^{\infty} c_n x^n$ converges to a function which satisfies $\frac{d^2y}{dx^2} - \frac{dy}{dx} + y = 0$ where $y(0) = 1$ and $\frac{dy}{dx}\big|_{x=0} = 0$. Find a formula which relates c_{n+2}, c_{n+1}, and c_n. Compute $c_0, c_1, \ldots c_5$.