

MATH 2414 Guided Project One

**Problem 1 (10 points)** Name and Section Number

Last digit of Blinn ID:

Note if the end digit of your ID number is odd or even. \*\* Make sure your work is neat. If needed, attach extra paper.

**Problem 2 (40 points)** In class we learned that  $\sum_{n=0}^{\infty} \frac{x^n}{n!} \rightarrow e^x$  for all real numbers  $x$ . In this project we will extend that result. In many of the problems below, your action depends upon the odd / even you noted above.

Evaluate the series for  $ix$  and for  $2ix$ . What pattern do you notice? (HINT: remember the other power series we have discussed in class)

**Problem 3 (40 points)** Now, take the series you found above and use it to evaluate three different values. What patterns do you notice? ODD:  $e^{2i\pi}, e^{i\pi/3}, e^{i\pi/4}$  EVEN:  $e^{i\pi/2}, e^{i\pi/6}, e^{i\pi/4}$

**Problem 4 (40 points)** Based upon what you have done so far, you should be able to show that the following trigonometric function can be written in terms of the series above you evaluated.  $\cos x$  and  $\sin x$

**Problem 5 (40 points)** Now, based upon what you have done above, you should be able to show that  $\sinh x \equiv -i \sin(ix)$  and  $\cosh x \equiv \cos(ix)$

**Problem 6 (50 points)** Now, use everything above to show why Euler's identity is true:

$$e^{i\pi} + 1 = 0$$