

# MATH 123 PRACTICE MIDTERM 3

NAME (PRINTED):

DISCUSSION TIME:

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Please *turn off all electronic devices*. You may use both sides of a  $8.5 \times 11$  sheet of paper for notes while you take this exam. No calculators, no course notes, no books, no help from your neighbors. **Show all work**—the grading will be based on your work shown as well as the end result. Remember to put your name at the top of this page. Good luck.

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1. (10 pts) Solve the following D.E.

$$\frac{dy}{dx} = \frac{(x+1)\tan(y)}{(x^2+1)\sec^2(y)}$$

2. (10 pts) Sketch the graph of the polar equation  $r = \sin(\frac{1}{2}\theta)$  from  $\theta = 0$  to  $\theta = 2\pi$  and find the area enclosed by the curve.

3. (10 pts)

A) Find the isoclines for  $y' = y - x^2$  and use them to graph the slope field.

B) Use the slope field to determine for what values of  $b$  does the IVP  $y(0) = b$  and  $y' = y - x^2$  have a solution that is strictly decreasing.

C) Find  $\lim_{x \rightarrow -\infty} f(x)$  for any solution  $f(x)$  to  $y' = y - x^2$ .

4. (10 pts) Find all points with horizontal and vertical tangents on the polar curve  $r = e^\theta$

5. Derive Euler's formula using the Taylor series for  $e^x$ .

6. (10 pts) Show that if  $b \neq 0$ ,  $e^{ax} \cos(bx)$  and  $e^{ax} \sin(bx)$  are linearly independent functions.

7. (10 pts) Solve  $y' - 3y = 0$ .



8. (10 pts) Solve  $y'' + 2y' + y = 0$ .

9. (10 pts) Solve  $y'' + 2y' + 2y = 0$ .

10. (10 pts) Solve  $xy' + \frac{y}{\ln(x)} = x^2$ .