Math 1312 Fall 2008

Calculus II

Second Midterm Exam

Wednesday, October 22, 7:30 pm - 9:00 pm

Your name (please print):

Instructions: This is a closed book, closed notes exam. **Use of calculators is not permitted.** You must justify all of your answers to receive credit. Notation is important, and points will be deducted for incorrect use. Please do all of your work on the paper provided.

The Honor Code requires that you neither give nor receive any aid on this exam.

Please indicate that you have read and understood these guidelines by signing your name in the space provided:

Pledged: _____

Do not write below this line

Problem	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Points	10	10	15	20	15	15	15
Score							

Total: _____

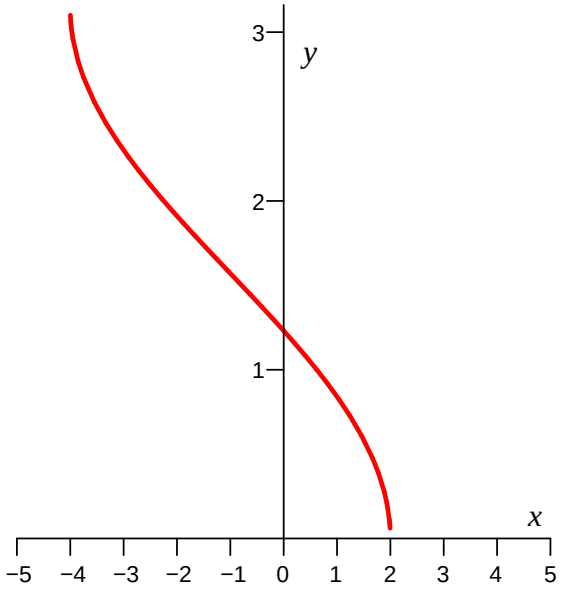
1. Solve the initial value problem $x\dfrac{dy}{dx} + 2y = e^x, \quad y(1) = 3.$

2. Solve the initial value problem $z' + e^{z-t} = 0, \quad z(0) = -1.$

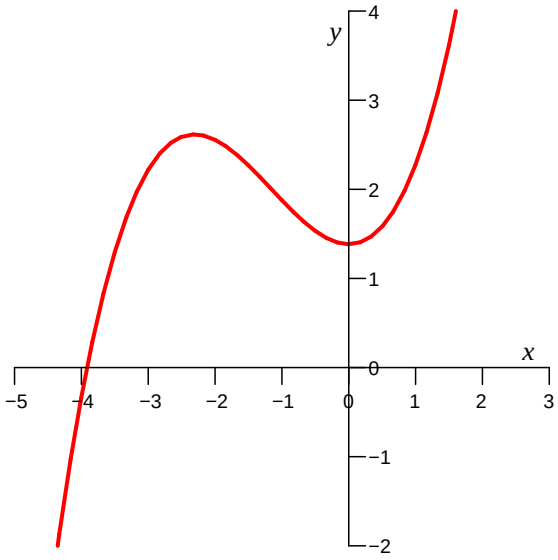
3. Find the general solution to the differential equation $y'' - 4y' + 5y = x - 3$.

4. Briefly explain (one or two sentences should suffice) why the graph shown *cannot* represent a solution to the given differential equation.

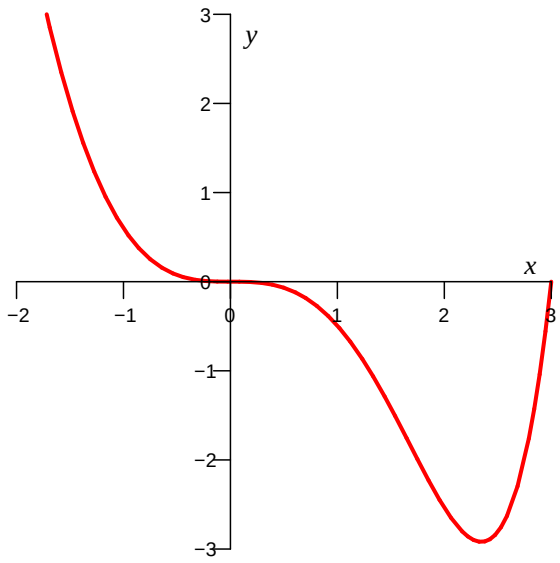
a. $\dfrac{dy}{dx} = x \ln y$ Explanation:



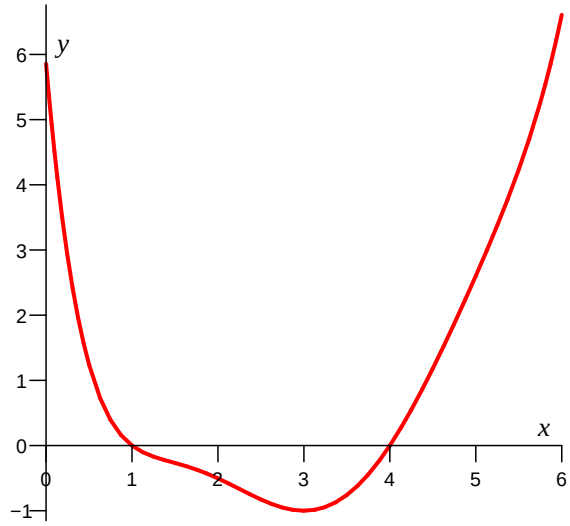
b. $\dfrac{dy}{dx} = x^2 - y^2$ Explanation:



c. $\dfrac{dy}{dx} = -x^2 + \sin y$ Explanation:



d. $\dfrac{dy}{dx} = x - y^2 - 2$ Explanation:



5. The time rate of change of a rabbit population P is proportional to the square root of P. At time $t = 0$ (months) the population numbers 100 rabbits and is increasing at a rate of 20 rabbits per month. How many rabbits will there be one year later?

6. It takes a force of 0.3 N to compress a certain spring 10 cm. A 3 kg mass is attached to one end of the spring.

a. Determine the spring constant k.

b. What value of the damping constant c will result in a critically damped spring-mass system?

c. The spring is stretched 50 cm beyond equilibrium and released. Determine the position of the mass after t seconds.

d. Is there ever a time when the mass passes through its equilibrium position? If so, find it. Otherwise, explain why not.

7.

a. Verify that $y_1 = x^2$ and $y_2 = x^3$ are both solutions of the differential equation $x^2y'' - 4xy' + 6y = 0$.

b. Use part (a) to solve the initial value problem $x^2y'' - 4xy' + 6y = 0$, $y(1) = 1$, $y'(1) = 0$.