NAME:

NetID:

MATH 285 E1/F1 Exam 1 (A) **September 19, 2014** **Instructor: Pascaleff**

Problem	Possible	Actual
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

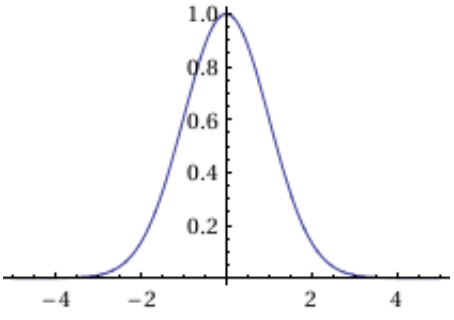
INSTRUCTIONS:

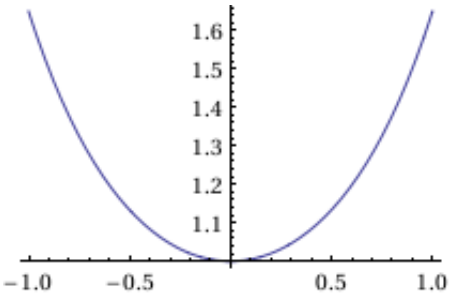
- Do all work on these sheets.
- Show all work.

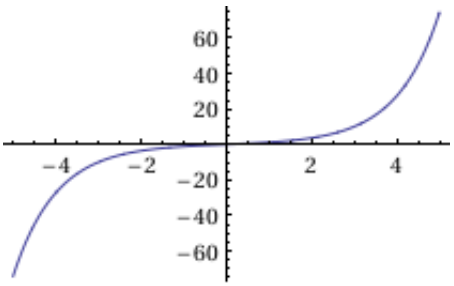
1. (20 points) Consider the differential equation

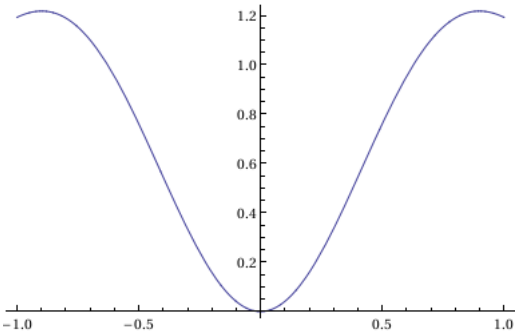
$$\frac{dy}{dx} = xy$$

Which of the following graphs could be a solution curve of this equation? Circle all that apply.









2. (20 points) An object moves along a one-dimensional axis. Its motion is descibed by a function $x(t)$. It is subjected to an acceleration given by

$$a(t) = 1 + \pi \sin(\pi t).$$

Suppose that at $t = 0$, the velocity is zero: $v(0) = 0$. What is the net change in position between $t = 0$ and $t = 1$? That is, what is $x(1) - x(0)$?

3. (20 points) Find the general solution, valid for $x > 0$, of

$$\frac{dy}{dx} = \frac{x^4 + 2y}{x}$$

Hint: Linear equation, integrating factor.

4. (20 points) Consider the equation

$$\frac{dy}{dx} - \frac{2}{x}y = y^2$$

Use the substitution $u = y^{-1}$ to transform this equation into a linear equation for u. Do not solve the resulting equation; the purpose of this problem is merely to transform the original equation for y into one for u.

5. (20 points) A metal ball has been heated to $1000°C$. It is placed into a bath of ice water at $0°C$. After 5 seconds, it has cooled to a temperature of $(1000e^{-10})°C$ (approximately $0.045°C$).

   Suppose now that the metal ball is heated again to $1000°C$, but instead it is placed into boiling water at $100°C$. How long will it take to reach a temperature of $200°C$?

   In both situation, the cooling process is governed by Newton's law of cooling:

$$\frac{dT}{dt} = -k(T - A)$$

   where A is the temperature of the water, and k is a constant.

This page is for work that doesn't fit on the other pages. Please indicate the problem that the work goes with.