## Math 2080: Differential Equations Worksheet 1.1: What is a differential equation?

NAME:	
1	. Consider an investment that grows at a constant interest rate of 5%, compounded continuously. Suppose that initially, the investment is worth \$1000. If $P(t)$ is the value of the investment, write out an initial value problem (IVP) – a differential equation with an initial condition – that $P(t)$ satisfies and sketch the solutions.
2	. Consider an investment that grows at a constant interest rate of 5%, compounded continuously. Suppose that initially, the investment is growing at a $rate$ of \$100/year. If $P(t)$ is the value of the investment, write out an IVP that $P(t)$ satisfies and sketch the solutions.
3	. The mass $m(t)$ of a radioactive substance decays at a rate proportional to the amount remaining. Suppose there are 100 grams initially. Write out an IVP that $m(t)$ satisfies and sketch the solutions.

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- 4. The temperature T(t) of a cup of coffee cools at a rate proportional to the difference in its temperature with the ambient room temperature (say,  $70^{\circ}$ ). Suppose that the coffee is initially  $190^{\circ}$ .
  - (a) Write out an initial value problem that T(t) satisfies and sketch the solutions.

(b) Let y(t) = T(t) - 70, which represents the number of degrees that the coffee is above or below the room temperature. Substituting T = y + 70 back into your IVP from the previous part to get a much simplier IVP in terms of the function y(t) and sketch the solutions.

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