

DATE: \_\_\_\_\_

## Exponential Growth & Decay

1. If  $\frac{dy}{dx} = \frac{e^x}{y^2}$  and  $y(0) = 1$ , find an equation for  $y$  in terms of  $x$ .

2. If  $\frac{dy}{dx} = \frac{\sin x}{\cos y}$  and  $y(0) = \frac{3\pi}{2}$ , find an equation for  $y$  in terms of  $x$ .

3. A radioactive element decays exponentially proportionally to its mass. One-half of its original amount remains after 5,750 years. If 10,000 grams of the element are present initially, how much will be left after 1,000 years?

### AP CALCULUS AB – Practice Problem

**A graphing calculator is required for some problems or parts of problems.**

The number of gallons,  $P(t)$ , of a pollutant in a lake changes at the rate  $P'(t) = 1 - 3e^{-0.2\sqrt{t}}$  gallons per day, where  $t$  is measured in days. There are 50 gallons of the pollutant in the lake at time  $t = 0$ . The lake is considered safe when it contains 40 gallons or less of pollutant.

- a) Is the amount of pollutant increasing at time  $t = 9$ ? Why or why not?
- b) For what value of  $t$  will the number of gallons of pollutant be at its minimum? Justify your answer.
- c) Is the lake safe when the number of gallons of pollutant is at its minimum? Justify your answer.
- d) An investigator uses the tangent line approximation to  $P(t)$  at  $t = 0$  as a model for the amount of pollutant in the lake. At what time  $t$  does this model predict that the lake becomes safe?