Name:

# 3.2 Derivatives of Exponential Functions

**Derivative of Exponential Functions:** For any constant $a$,

$$\frac{d}{dx}\left(a^x\right) =$$

In particular,

$$\frac{d}{dx}\left(e^x\right) =$$

1. Compute the following derivatives, or state that it is not possible with the tools we currently have.

   (a) $\frac{d}{dx}\left(e^x\right) =$

   (b) $\frac{d}{dx}\left(4^x\right) =$

   (c) $\frac{d}{dx}\left(x^e\right) =$

   (d) $\frac{d}{dx}\left(e^3\right) =$

   (e) $\frac{d}{dx}\left(5e^x\right) =$

   (f) $\frac{d}{dx}\left(xe^x\right) =$

   (g) $\frac{d}{dx}\left(e^{x+2}\right) =$

2. Find the equation of the line that is tangent to the graph of the function $g(x) = 2e^x$ at $x = 1$.

3. An animal population is given by $P(t) = 300(1.044)^t$ where t is the number of years since the study of the population began.

   (a) Find $P(5)$ and interpret your result.

   (b) Find $P'(5)$ and interpret your result.

   (c) Find a tangent line to $P(t)$ at $t = 5$. Check your equation using Desmos.