Objectives:

- Take derivatives of exponential functions.

Derivative of $f(x) = e^x$:

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

Example: Find $f'(x)$ for $f(x) = 5e^x$.

Example: Find $\dfrac{d}{dx}\big(f(x)\big)$ for $f(x) = 4x^7 + 2e^x$.

Derivative of an exponential function with arbitrary base b:

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

Example: Find $f'(x)$ for $f(x) = 2^x$.

Example: Find $\dfrac{d}{dx}\big(g(x)\big)$ for $g(x) = 4 \cdot 10^x + x^3 + e^x$.

Example: Find the derivative of $s(t) = \pi^x - 3e^x + x^\pi + \pi^2$.

Question: What about $f(x) = e^{x^2}$?

Answer:

Explanation of why if $f(x) = e^x$, then $f'(x) = e^x$:

Example: During the 2000's, the population of Hungary was modeled by

$$P(t) = 10.186(0.997)^t$$

($P(t)$ in millions of people, t in years since 2000). Assuming this model remains accurate:

1. What does the model say the population of Hungary was in the year 2000?

2. What does the model predict for the population of Hungary in the year 2020?

3. How fast does the model predict the population will increase/decrease in 2020? (Include units)

Example: Find the equation of the tangent line to $f(x) = 3e^x$ at $x = 1$.