Name: **Date:**

6 – 5.2 Derivative of the General Exponential Function, $y = b^x$

Lesson Goals:

- Be able to determine the derivative of an exponential function with any constant base

1) General Exponential Functions, $y = b^x$

- In our previous lesson, the derivative of $y = e^x$ is $\frac{dy}{dx} = e^x$.
- Many applications of exponential functions involve bases other than base e.

Example 1: A bacteria culture starts with 50 000 bacteria. If the bacteria population doubles in 40 minutes, write a function to model the population $P(x)$ after x minutes.

2) Derivative of $y = b^x$

- In the bacteria example, scientists may be interested in the rate of change in the bacteria at time x.
- To determine the rate of change or $\frac{dy}{dx}$, we need to differentiate $y = b^x$.
- General Exponential Function: for $f(x) = b^x$, $f'(x) = (\ln b)b^x$
- Composite Exponential Function: for $f(x) = b^{g(x)}$, $f'(x) = (\ln b)b^{g(x)}g'(x)$

Example 2: Differentiate.

a) $y = 3^x$

b) $y = 5^{x^2-4x}$

Example 3: A bacteria culture starts with 50 000 bacteria. If the bacteria population doubles in 40 minutes, determine the rate of change in the bacteria growth after 60 minutes. Round your answer to the nearest unit.

Example 4: Determine the equation of the tangent to $y = x^5(5^x)$ and $x = -5$.

Homework: Page 240 #1-8 (pick and choose)