SECTION 3.6 PART 2: MORE LOGARITHMIC DIFFERENTIATION
SECTION 3.7 PART 1: RATES OF CHANGE IN THE NATURAL AND SOCIAL SCIENCES

1. We can use laws of logarithms and implicit differentiation to differentiate functions that are overly complicated/impossible to differentiate with the rules we already have.

   (a) Find the derivative of $y = (3x - x^5)^{2/3}(x - \tan(x))^5$.

      i. First, take the natural log of both sides, use laws of logarithms to change the product into a sum and pull down the exponents.

      ii. Next, implicitly differentiate everything with respect to x.

      iii. Solve for $\frac{dy}{dx}$ and substitute what y equals (from the original function definition) in for y to find the derivative!

   (b) Find the derivative of $y = (\sin(x))^x$.

      i. First, take the natural log of both sides, and use laws of logarithms to pull the x down from the exponent.

      ii. Next, implicitly differentiate everything with respect to x.

      iii. Solve for $\frac{dy}{dx}$ and substitute what y equals (from the original function definition) in for y to find the derivative!

2. A stone is thrown in a pond and a circular ripple travels outward at a speed of 60 cm/s. Determine the rate of change of area inside the ripple at time $t = 1$ second and at time $t = 2$ seconds. (Hint: draw a picture!)

3. A population of caribou is growing, and its population is

$$P(t) = 4000\frac{3e^{t/5}}{1 + 2e^{t/5}}.$$

   (a) What is the population at time $t = 0$?

   (b) Determine the rate of change of the population at any time t.

   (c) Determine the rate of change of the population at time $t = 0$ years.

   (d) Determine the long term population.