## LECTURE: 3-6 DERIVATIVES OF LOGARITHMIC FUNCTIONS [PART 2]

Note the difference between derivatives of powers of *x* and exponentials (where *x* shows up in the *exponent*).

**Derivative Rules:** Let *n* and *a* be constants. (Note, there is no rule when there is a variable in the base *and* the exponent.)

• 
$$\frac{d}{dx}x^n =$$
 \_\_\_\_\_

•  $\frac{d}{dx}a^x =$  \_\_\_\_\_

When you have a variable in both the base and the exponent you **must** use

\_ to find the derivative of the function.

**Example 1:** Find the derivatives of the following functions using logarithmic differentiation.

(a)  $y = x^{2/x}$ 

(b)  $y = (\ln x)^{\cos x}$ 

**Example 2:** Find an equation of the tangent line to  $f(x) = \ln(x + \ln x)$  at x = 1.

**Example 3:** Let  $f(x) = cx + \ln(\sin x)$ . For what value of c is  $f'(\pi/4) = 6$ ?

## 3-7 RATES OF CHANGE IN THE NATURAL AND SOCIAL SCIENCES [A START]

**Physics example:** A particle moves according to the law of motion  $s = f(t) = t^4 - 4t + 1$ , where *t* is measured in seconds and *s* is measured in meters.

(a) Find the velocity at time *t*. What is the velocity after 2 seconds?

(b) When is the particle at rest?

(c) When is the particle moving forward (in the positive direction)?

(d) Draw a diagram to illustrate the motion of the particle.

(e) Find the total distance traveled in the first 8 seconds.