## 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.)

- $\frac{d}{d x} x^{n}=$ $\qquad$ - $\frac{d}{d x} a^{x}=$
$\qquad$
When you have a variable in both the base and the exponent you must use
$\qquad$ 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 $f(x)=c x+\ln (\sin x)$. For what value of $c$ is $f^{\prime}(\pi / 4)=6$ ?

## 3-7 Rates of Change in the Natural and Social Sciences [A Start]

Physics example: A particle moves according to the law of motion $s=f(t)=t^{4}-4 t+1$, 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.

