

Derivatives of Logs and Exps

Rule for finding **derivative of a^u** (where u is a function of x):

$$\frac{d}{dx} a^u = a^u \ln(a) \frac{du}{dx}$$

Guided Example 1: Given $f(x) = 5^{3x-2}$, find $f'(x)$.

Guided Example 2: Given $f(x) = 3^{\sin(x)} - 2$, find $f'(x)$.

A special case of the rule above is when $a = e$:

$$\frac{d}{dx} e^u = e^u \ln(e) \frac{du}{dx}$$

Because $\ln(e) = 1$, the rule becomes:

$$\frac{d}{dx} e^u = e^u \frac{du}{dx}$$

Guided Example 3: Given $f(x) = e^{5x+2}$, find $f'(x)$.

Rule for finding the derivative of $\log_a u$
(where u is a function of x)

$$\frac{d}{dx} \log_a u = \frac{1}{u \ln a} \cdot \frac{du}{dx}$$

Guided Example 4: Given $f(x) = \log_5(x^2+2)$, find $f'(x)$.

Guided Example 5: Given $f(x) = \log_3(\sin(x))$, find $f'(x)$.

A special case of the rule above is when $a = e$:

Since $\log_e(u) = \ln(u)$ and $\ln(e) = 1$, we have

$$\frac{d}{dx} \ln(u) = \frac{1}{u} \frac{du}{dx}$$

Guided Example 6: Given $f(x) = \ln(x-1)$, find $f'(x)$.

Guided Example 7: Given $f(x) = \ln(\tan(x))$, find $f'(x)$.

Homework: p178 # 1-28 (pick 20)