

AP CALCULUS AB –
DERIVATIVES INVOLVING LOGARITHMIC AND EXPONENTIAL FUNCTIONS

- 1) For all x (except 0), calculate

$$\frac{d}{dx}[x \ln|x| - x] = 1 \cdot \ln|x| + x \cdot \frac{1}{|x|} \cdot \frac{x}{|x|} - 1 = \ln|x| + \frac{x^2}{x^2} - 1 = \ln|x|$$

- 2) For $x > 0$, calculate

$$\frac{d}{dx}[x \ln x - x] = 1 \cdot \ln x + x \cdot \frac{1}{x} - 1 = \ln x + 1 - 1 = \ln x$$

- 3) For all x (except 0), calculate

$$\begin{aligned} \frac{d}{dx}\left[x \log_b|x| - \frac{x}{\ln b}\right] &= 1 \cdot \log_b|x| + x \cdot \frac{1}{(\ln b)|x|} \cdot \frac{x}{|x|} - \frac{1}{\ln b} = \log_b|x| + \frac{x^2}{(\ln b)x^2} - \frac{1}{\ln b} \\ &= \log_b|x| \end{aligned}$$

- 4) For $x > 0$, calculate

$$\frac{d}{dx}\left[x \log_b x - \frac{x}{\ln b}\right] = 1 \cdot \log_b x + x \cdot \frac{1}{(\ln b)x} - \frac{1}{\ln b} = \log_b x$$

- 5) For all x , calculate

$$\frac{d}{dx}\left[\frac{b^x}{\ln b}\right] = \frac{1}{\ln b} \cdot (\ln b)b^x = b^x$$