

Calculus I

§ Derivative of $a \ln(bx + c)$

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Example

Compute the indicated derivative.

$$\frac{d}{dx} (2 \ln(3x - 1))$$

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$$\frac{d}{dx}(2 \ln(3x - 1)) = 2 \cdot \frac{d}{dx}(\ln(3x - 1))$$

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$$\begin{aligned}\frac{d}{dx} (2 \ln(3x - 1)) &= 2 \cdot \frac{d}{dx} (\ln(\textcolor{red}{3x - 1})) \\ &= 2 \cdot \frac{d}{dx} (\ln \textcolor{red}{u})\end{aligned} \quad \left| \text{Set } \textcolor{red}{3x - 1} = \textcolor{red}{u}\right.$$

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Compute the indicated derivative.

$$\begin{aligned}\frac{d}{dx}(2 \ln(3x - 1)) &= 2 \cdot \frac{d}{dx}(\ln(3x - 1)) \\ &= 2 \cdot \frac{d}{dx}(\ln u) && \left| \text{Set } 3x - 1 = u \right. \\ &= 2 \cdot \frac{d}{du}(\ln u) \cdot \frac{du}{dx}\end{aligned}$$

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 \frac{d}{dx} (2 \ln(3x - 1)) &= 2 \cdot \frac{d}{dx} (\ln(3x - 1)) \\
 &= 2 \cdot \frac{d}{dx} (\ln u) && \left| \text{Set } 3x - 1 = u \right. \\
 &= 2 \cdot \frac{d}{du} (\ln u) \cdot \frac{du}{dx} \\
 &= 2 \cdot \frac{1}{u} \cdot \frac{d}{dx} (3x - 1) \\
 &= 2 \cdot \frac{1}{3x - 1} \cdot ?
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 \frac{d}{dx} (2 \ln(3x - 1)) &= 2 \cdot \frac{d}{dx} (\ln(3x - 1)) \\
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 &= 2 \cdot \frac{1}{u} \cdot \frac{d}{dx} (3x - 1) \\
 &= 2 \cdot \frac{1}{3x - 1} \cdot 3 \\
 &= \frac{6}{3x - 1}
 \end{aligned}$$

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