Calculus I
Distributing before differentiating, part 2

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2019

Example (Difference Rule, Negative Fractional Exponents)

Differentiate $\quad v = \dfrac{3\sqrt{x} - \sqrt[3]{x}}{x}$.

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$$v = 3\textbf{?} \quad - \textbf{?}$$

Example (Difference Rule, Negative Fractional Exponents)

Differentiate $\quad v = \dfrac{3\sqrt{x} - \sqrt[3]{x}}{x}$.

$$v = 3\frac{\sqrt{x}}{x} - \frac{\sqrt[3]{x}}{x}$$

$$v = 3x^{-\frac{1}{2}} - \text{?}$$

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Difference Rule: $\quad \dfrac{\mathrm{d}v}{\mathrm{d}x} = \dfrac{\mathrm{d}}{\mathrm{d}x}\left(3x^{-\frac{1}{2}}\right) - \dfrac{\mathrm{d}}{\mathrm{d}x}\left(x^{-\frac{2}{3}}\right)$

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Constant Multiple Rule: $\quad = {\color{red}3}\dfrac{\mathrm{d}}{\mathrm{d}x}\left(x^{-\frac{1}{2}}\right) - \dfrac{\mathrm{d}}{\mathrm{d}x}\left(x^{-\frac{2}{3}}\right)$

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Constant Multiple Rule: $\quad = 3\dfrac{\mathrm{d}}{\mathrm{d}x}\left(x^{-\frac{1}{2}}\right) - \dfrac{\mathrm{d}}{\mathrm{d}x}\left(x^{-\frac{2}{3}}\right)$

Power Rule: $\quad = 3\left(\textbf{?}\qquad\right) - \left(\textbf{?}\qquad\right)$

Example (Difference Rule, Negative Fractional Exponents)

$$\text{Differentiate} \quad v = \frac{3\sqrt{x} - \sqrt[3]{x}}{x}.$$

$$v = 3\frac{\sqrt{x}}{x} - \frac{\sqrt[3]{x}}{x}$$

$$v = 3x^{-\frac{1}{2}} - x^{-\frac{2}{3}}.$$

$$\text{Difference Rule:} \quad \frac{\mathrm{d}v}{\mathrm{d}x} = \frac{\mathrm{d}}{\mathrm{d}x}\left(3x^{-\frac{1}{2}}\right) - \frac{\mathrm{d}}{\mathrm{d}x}\left(x^{-\frac{2}{3}}\right)$$

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$$\text{Power Rule:} \quad = 3\left(-\frac{1}{2}x^{-\frac{3}{2}}\right) - \left(\textbf{?}\qquad\right)$$

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Difference Rule: $\quad \dfrac{dv}{dx} = \dfrac{d}{dx}\left(3x^{-\frac{1}{2}}\right) - \dfrac{d}{dx}\left(x^{-\frac{2}{3}}\right)$

Constant Multiple Rule: $\quad = 3\dfrac{d}{dx}\left(x^{-\frac{1}{2}}\right) - \dfrac{d}{dx}\left(x^{-\frac{2}{3}}\right)$

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Constant Multiple Rule: $\quad = 3\dfrac{\mathrm{d}}{\mathrm{d}x}\left(x^{-\frac{1}{2}}\right) - \dfrac{\mathrm{d}}{\mathrm{d}x}\left(x^{-\frac{2}{3}}\right)$

Power Rule: $\quad = 3\left(-\dfrac{1}{2}x^{-\frac{3}{2}}\right) - \left(-\dfrac{2}{3}x^{-\frac{5}{3}}\right)$

$$= \frac{2}{3}x^{-\frac{5}{3}} - \frac{3}{2}x^{-\frac{3}{2}}.$$