

Quotient Rule for Differentiation:

$$\left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2}$$

$$\frac{d}{dy} \left( \frac{y^3 + 2y^5}{3y^2 - 7} \right)$$

$$\frac{d}{dx} \left( \frac{x^2 + 2}{\ln(3x)} \right)$$

$$\frac{d}{dt} \left( \frac{e^{2t}}{3t^2 + \ln(t)} \right)$$

Quotient Rule for Differentiation:  $\left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2}$

$$\frac{d}{dy} \left( \frac{y^3 + 2y^5}{3y^2 - 7} \right) = \frac{d}{dy} \left( \frac{u}{v} \right) = \frac{u'v - uv'}{v^2}$$

$$= \frac{(3y^2 + 10y^4)(3y^2 - 7) - (y^3 + 2y^5)(6y)}{(3y^2 - 7)^2}$$

$$= \frac{(9y^4 - 21y^2 + 30y^6 - 70y^4) - (6y^4 + 12y^6)}{9y^4 - 42y^2 + 49}$$

$$u = y^3 + 2y^5, \quad u' = 3y^2 + 10y^4$$

$$v = 3y^2 - 7, \quad v' = 6y$$

$$= \frac{18y^6 - 67y^4 - 21y^2}{9y^4 - 42y^2 + 49}$$

$$= \frac{y^2(18y^4 - 67y^2 - 21)}{(3y^2 - 7)^2}$$

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$$\begin{aligned}\frac{d}{dx} \left( \frac{x^2+2}{\ln(3x)} \right) &= \frac{2x \ln(3x) - (x^2+2) \frac{1}{x}}{(\ln(3x))^2} = \frac{2x \ln(3x) - x - 2/x}{(\ln(3x))^2} \\ &= \frac{2x^2 \ln(3x) - x^2 - 2}{x (\ln(3x))^2}\end{aligned}$$

$$\begin{aligned}\frac{d}{dt} \left( \frac{e^{2t}}{3t^2 + \ln(t)} \right) &= \frac{2e^{2t} (3t^2 + \ln(t)) - e^{2t} (6t + 1/t)}{(3t^2 + \ln(t))^2} \\ &= \frac{6t^2 e^{2t} + 2e^{2t} \ln(t) - 6te^{2t} - \frac{1}{t} e^{2t}}{(3t^2 + \ln(t))^2} \\ &= \frac{(6t^3 + 2t \ln(t) - 6t^2 - 1) e^{2t}}{t (3t^2 + \ln(t))^2}\end{aligned}$$