§3.2 - Quotient Rule

$$\left[\frac{x^4-x}{x^2}\right]' = \left[x^2-x^{-1}\right]' = 2x-(-x^{-2}) = 2x+\frac{1}{x^2} = \cdots$$

$$\left[\frac{x^2}{x^4-x}\right]' \Rightarrow \text{Quotient Rule: } \left[\frac{f(x)}{g(x)}\right]' = \frac{f'(x)g(x)-g'(x)f(x)}{[g(x)]^2}$$

$$\left[\frac{x^4-x}{x^2}\right]' = \frac{[x^4-x]'x^2-[x^2]'(x^4-x)}{(x^2)^2} = \frac{(4x^3-1)x^2-(2x)(x^4-x)}{x^4}$$

$$= \frac{4x^5-x^2-2x^5+2x^2}{x^4} = \frac{2x^5+x^2}{x^4} = \boxed{2x+\frac{1}{x^2}}$$

$$\left[\frac{x^2}{x^4-x}\right]' = \frac{[x^2]'(x^4-x)-[x^4-x]x^2}{(x^4-x)^2} =$$

$$= \frac{2x(x^4-x)-(4x^3-1)x^2}{(x^4-x)^2} = \frac{2x^5-2x^2-[4x^5-x^2]}{(x^4-x)^2}$$

$$= \frac{2x^5-2x^2-4x^5+x^2}{(x^4-x)^2} = \frac{-2x^5-x^2}{(x^4-x)^2}$$

$$\left[\frac{x^2e^x}{2x+1}\right]' = \frac{[x^2e^x]'(2x+1) - [2x+1]'(x^2e^x)}{(2x+1)^2} =$$

$$= \frac{\left([x^2]'e^x + x^2[e^x]'\right)(2x+1) - 2x^2e^x}{(2x+1)^2}$$

$$= \frac{(2xe^x + x^2e^x)(2x+1) - 2x^2e^x}{(2x+1)^2}$$

$$= \frac{4x^2e^x + 2xe^x + 2x^3e^x + x^2e^x - 2x^2e^x}{(2x+1)^2}$$

$$\frac{3x^2e^x + 2xe^x + 2x^3e^x}{(2x+1)^2}$$

$$= \frac{xe^x(2x^2+3x+2)}{(2x+1)^2}$$