

Calculus Rules

3. Quotient Rule $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{vu' - uv'}{v^2}$

“**SQUARE** the **BOTTOM**, write down the **BOTTOM** and **DIFF** the **TOP**, **MINUS** write down the **TOP** and **DIFF** the **BOTTOM**”

e.g. (i) $y = \frac{x}{1+2x}$

$$\frac{dy}{dx} = \frac{(1+2x)(1) - (x)(2)}{(1+2x)^2}$$

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

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

(ii) $y = \frac{2x}{\sqrt{x^2-4}}$

$$\frac{dy}{dx} = \frac{(x^2-4)^{\frac{1}{2}}(2) - (2x)\left\{\frac{1}{2}(x^2-4)^{-\frac{1}{2}}(2x)\right\}}{(x^2-4)}$$

$$= \frac{2(x^2-4)^{\frac{1}{2}} - 2x^2(x^2-4)^{-\frac{1}{2}}}{(x^2-4)}$$

$$= \frac{2(x^2-4)^{-\frac{1}{2}}\{(x^2-4) - x^2\}}{-8(x^2-4)}$$

$$= \frac{2(x^2-4)^{-\frac{1}{2}}\{-4\}}{-8(x^2-4)}$$
$$= \frac{2(x^2-4)^{-\frac{1}{2}}}{2(x^2-4)}$$
$$= \frac{1}{(x^2-4)^{\frac{1}{2}}}$$

4. Reciprocal Rule $\frac{d}{dx}\left(\frac{k}{v}\right) = \frac{-kv'}{v^2}$

“**MINUS** the DERIVATIVE on the FUNCTION SQUARED”

e.g. (i) $y = \frac{1}{x^2}$

$$\frac{dy}{dx} = \frac{-2x}{x^4}$$
$$= \frac{-2}{x^3}$$

(ii) $y = \frac{6}{4x^2 + 3}$

$$\frac{dy}{dx} = \frac{-6(8x)}{(4x^2 + 3)^2}$$
$$= \frac{-48x}{(4x^2 + 3)^2}$$

Exercise 7G; 1aceg, 2, 4a, 6a, 8a