Differentiation Review : part II

Tuesday, March 3, 2015 9:34 AM

Product Rule

$u = f(x) \qquad v = g(x)$

$$(f(x)\,g(x))' = f'(x)\,g(x) + f(x)\,g'(x)$$

$$= u'v + uv' = \left(\frac{d}{dx}u\right)v + u\frac{dv}{dx}$$

When differentiating a product of functions use this rule. Don't make up your own rule!

$$(uv)' \neq u'v'$$

Example $f(x) = xe^x \qquad f'(x) = ?$

$u = x \qquad v = e^x$

$u' = 1 \qquad v' = e^x$

$$f'(x) = xe^x + 1 \cdot e^x$$

$$= xe^x + e^x$$

Note $f'(x) \neq 1 \cdot e^x$

Quotient rule

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{f'(x)g(x) - g'(x)f(x)}{(g(x))^2}$$

$u = f(x)$

$v = g(x)$

$$= \frac{u'v - v'u}{v^2}$$

Note $\frac{d}{dx}\left(\frac{u}{v}\right) \neq \frac{u'}{v'}$ ← made up rule which is incorrect.

Ex $\frac{d}{dx}\left(\frac{e^x}{x}\right) = \frac{xe^x - e^x}{x^2}$

$u = e^x$ ← top $\qquad u' = e^x$

$v = x$ ← bottom $\qquad v' = 1$