Quotient Rule

Let $h(x) = \dfrac{f(x)}{g(x)}$, where f & g are difb$^{\underline{le}}$.

Then $h'(x) = \dfrac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$.

Proof:

$$\frac{1}{h}\left[\frac{f(x+h)}{g(x+h)} - \frac{f(x)}{g(x)}\right]$$

$$= \frac{1}{h}\left[\frac{f(x+h)g(x) - f(x)g(x+h)}{g(x)g(x+h)}\right]$$

$$= \frac{1}{h}\left[\frac{f(x+h)g(x) - f(x)g(x) + f(x)g(x) - f(x)g(x+h)}{g(x)g(x+h)}\right]$$

$$= \frac{1}{h}\left[\frac{[f(x+h) - f(x)]g(x) + f(x)[g(x) - g(x+h)]}{g(x)g(x+h)}\right]$$

$$= \left[\frac{f(x+h) - f(x)}{h}g(x) - f(x)\frac{[g(x+h) - g(x)]}{h}\right]\left[\frac{1}{g(x)g(x+h)}\right]$$

$$\xrightarrow{h \to 0} \left[f'(x)g(x) - f(x)g'(x)\right]\left[\frac{1}{g(x)^2}\right]$$

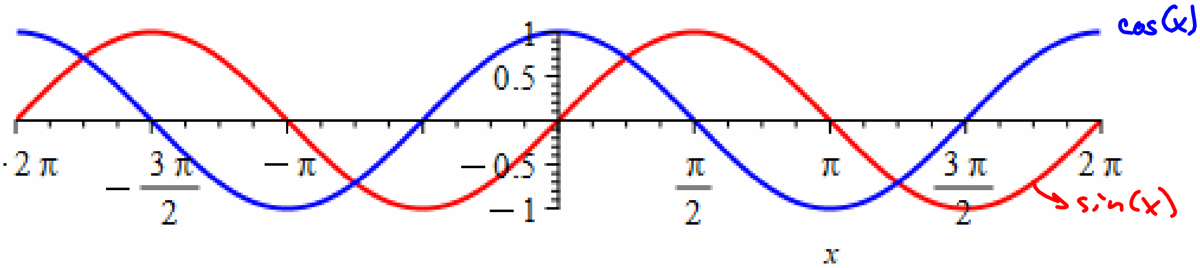
$$= \frac{f'g - fg'}{g^2} \quad \blacksquare$$

See 2.4 videos & notes for proofs.

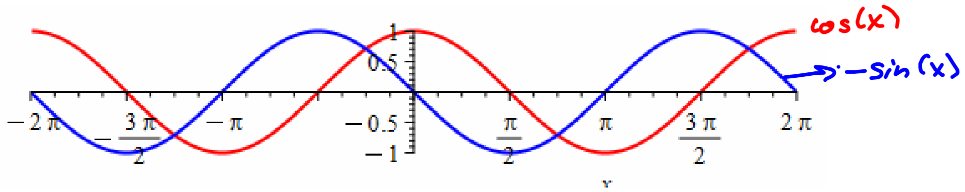
$\frac{d}{dx}[\sin(x)] = \cos(x)$
$\frac{d}{dx}[\cos(x)] = -\sin(x)$
From Scratch (Limit Definition of $f'(x)$)

$\frac{d}{dx}[\tan(x)] = \sec^2(x)$
$\frac{d}{dx}[\cot(x)] = -\csc^2(x)$
$\frac{d}{dx}[\csc(x)] = -\csc(x)\cot(x)$
$\frac{d}{dx}[\sec(x)] = \sec(x)\tan(x)$
Proved by using derivatives of sine & cosine & quotient rule.

The derivative of sin(*x*) is cos(*x*).



The derivative of cos(*x*) is - sin(*x*).



$$\frac{e^{ix} - e^{-ix}}{2i} = \sin(x)$$

$$\frac{e^{ix} + e^{-ix}}{2} = \cos(x)$$

$$\frac{d}{dx}\left[e^{bx}\right] = b \cdot e^{bx}$$