

General Rules  $k$  is a constant,  $u, v$  and  $f, g$  are functions of  $x$ .

- (1) If  $k$  is a constant, then  $\frac{d}{dx}k = 0$ .
- (2) If  $n$  is a real number, then  $\frac{dx^n}{dx} = nx^{n-1}$ .
- (3)  $\frac{d(ku)}{dx} = k\frac{du}{dx}$ .
- (4)  $\frac{d(u+v)}{dx} = \frac{du}{dx} + \frac{dv}{dx}$ .
- (5) (Product rule)  $\frac{d(u \cdot v)}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$ .
- (6) (Quotient rule)  $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ .
- (7) (Chain rule)  $\frac{d}{dx}f(g(x)) = f'(g(x)) \cdot g'(x)$ .

### Exponential and Log Functions

- For  $a$  a constant,  $\frac{da^x}{dx} = \ln a \cdot a^{x*}$ . In particular  $\frac{de^x}{dx} = e^{x*}$ .
- For  $a$  a constant,  $\frac{d}{dx}\log_a x = \frac{1}{x \ln a}$ . In particular,  $\frac{d}{dx}\ln x = \frac{1}{x}^*$ .

The three starred rules are on the gateway, but the other one is not.

### Trig Functions

- $\frac{d}{dx}\sin x = \cos x,^*$   $\frac{d}{dx}\sec x = \sec x \tan x$ ,  $\frac{d}{dx}\tan x = \sec^2 x.^*$
- $\frac{d}{dx}\cos x = -\sin x,^*$   $\frac{d}{dx}\csc x = -\csc x \cot x$ ,  $\frac{d}{dx}\cot x = -\csc^2 x$ .
- $\frac{d}{dx}\arcsin x = \frac{1}{\sqrt{1-x^2}},^*$   $\frac{d}{dx}\operatorname{arcsec} x = \frac{1}{|x|\sqrt{x^2-1}}$ ,  $\frac{d}{dx}\arctan x = \frac{1}{1+x^2}.^*$
- $\frac{d}{dx}\arccos x = \frac{-1}{\sqrt{1-x^2}}$ ,  $\frac{d}{dx}\operatorname{arccsc} x = \frac{-1}{|x|\sqrt{x^2-1}}$ ,  $\frac{d}{dx}\operatorname{arccot} x = \frac{-1}{1+x^2}$ .

The five starred rules are on the gateway and the rest are not.