Differentiation

short function list

$\frac{d}{dx}(c) = 0$ constant function rule

$\frac{d}{dx}(x) = 1$ identity rule

$\frac{d}{dx} x^p = p x^{p-1}$ power rule

$\frac{d}{dx} e^x = e^x$ exp rule

$\frac{d}{dx} \ln x = \frac{1}{x}$ ln rule

$\frac{d}{dx} \sin x = \cos x$ trig rules

$\frac{d}{dx} \cos x = -\sin x$

...

$\frac{d}{dx} \arcsin x = \ldots$ arctrig rules

...

notation

$\frac{d}{dx}$ (expression in x)

"take the derivative wrt x of the expression to the immediate right"

$\frac{d}{dx}(ax^2+b) = a(2x) + 0$

rules { const coeff, power, sum, constant function

$\frac{dy}{dx}$ = derivative of y wrt x = rate of change of y wrt x

operation rule list

$\frac{d}{dx} f(x) = \frac{d}{dx}(\text{algebra rewrite}(f(x)))$ rewrite rule (think first before differentiating!)

$\frac{d}{dx}(c f(x)) = c \frac{d}{dx} f(x)$ constant multiplier rule.

$\frac{d}{dx}\left(\frac{f(x)}{c}\right) = \frac{1}{c}\frac{d}{dx} f(x)$ not quotient rule!

$\frac{d}{dx}(f(x) \pm g(x)) = \frac{d}{dx} f(x) \pm \frac{d}{dx} g(x)$ sum/difference rule

$\frac{d}{dx}(f(x)g(x)) = \left(\frac{d}{dx} f(x)\right) g(x) + f(x) \frac{d}{dx} g(x)$ product rule

$\frac{d}{dx}\left(\frac{top(x)}{bot(x)}\right) = \frac{bot(x)\frac{d}{dx}top(x) - top(x)\frac{d}{dx}bot(x)}{bot(x)^2}$ quotient rule

$\frac{d}{dx}\left(\frac{c}{f(x)}\right) = c\frac{d}{dx}(f(x))^{-1}$ not quotient rule, use chain rule + rewrite rule, + const mult rule

$\frac{d}{dx} f(g(x)) = f'(g(x))\frac{d}{dx} g(x)$ chain rule

$\frac{d}{dx} f(u) = f'(u)\frac{du}{dx}$ $\left[\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx}\right]$

MAPLE

```
> diff(f(x),x);
> simplify(%);
```

or

```
> with(Student[Calculus1]);
> DiffTutor(f(x));
```

or (MAPLE FUNCTION)

```
> f:=x->x^2;
> D(f)(x);
> simplify(%);
```