Rules for Differentiation

Constant Rule $\frac{d}{dx}(c)=0$ Example: $f(x)=19 \quad f'=0$ f(x) = 7 f ′(x) =

Power Rule $\frac{d}{dx}x^n = n\cdot x^{n-1}$ (power as long as x ≠ 0 and/or h ≠ 0)

Example: $f(x)=x^2 \quad f'(x)=2x$ $\quad f(x)=x^4 \quad f'(x)=4x^3$ $\quad f(x)=x^7 \quad f'(x)=$

$f(x)=\sqrt{x} \qquad f'(x)=$

Constant Multiple Rule $\frac{d}{dx}k\cdot u = k\cdot\frac{du}{dx}$

Example: $f(x)=5x^2 \quad f'(x)=10x$ $\quad f(x)=-2x^4 \quad f'(x)=-8x^3$ $\quad f(x)=2x^5 \quad f'(x)=$

Sum/Difference Rule $\frac{d}{dx}(u\pm v)=\frac{du}{dx}\pm\frac{dv}{dx}$

Example: $f(x)=x^3+5x^2-\frac{2}{5}x-4 \qquad f'(x)=3x^2+10x-\frac{2}{5}$

$y=3t^2-4t+2 \quad \frac{dy}{dt}=$

Product Rule $\frac{d}{dx}(u\cdot v)=u\frac{dv}{dx}+v\frac{du}{dx}$ (1st times deriv of 2nd+ 2nd times deriv of 1st)

$p=(x^2+3x)(x-1) \qquad \frac{dp}{dx}=$

Quotient Rule $\frac{d}{dx}\left(\frac{u}{v}\right)=\frac{v\cdot\frac{du}{dx}-u\cdot\frac{dv}{dx}}{v^2}$

(bottom times deriv top – top times deriv bottom all over bottom squared)

$f(x)=\frac{2x}{x-1} \qquad f'(x)=$

$f(x)=\frac{1}{x-1} \qquad f'(x)=$

What if you are only given the value of the functions and their derivatives at certain points?

Let y = u·v $\quad$ u(2) = 3 $\quad$ u′(2) = - 4 $\quad$ v(2)=1 $\quad$ v′(2) = 2
Find y′(2)
By product rule: $\quad$ y′(2) = u(2) v′(2) + v(2) u′(2) $\quad$ y′(2) = 3(2) +1(-4) $\quad$ y′(2) = 2

If $y = \frac{u}{v}$ $\quad$ $Find\ \frac{dy}{dx}(2)$

If we can differentiate a function once, what's to stop us from differentiating again.
f ′ is 1st derivative, f ″ (f double prime) is 2nd derivative $\quad$ f ‴ (f triple prime)

$\frac{dy}{dx}\ \ \frac{d^2y}{dx^2}\ \ \frac{d^3y}{dx^3}$ $\quad$ ”d squared y d x squared” $\quad$ “d cubed y d x cubed”

y ′ 1st derivative $\quad$ y ″ 2nd derivative $\quad$ y ‴ 3rd derivative $\quad$ y^n nth derivative

Example:

$f(x) = 2x^4 - x^3 + 6x$

$f'(x) = 8x^3 - 3x^2 + 6$

$f''(x) = 24x^2 - 6x$

$f'''(x) = 48x - 6$

$f''''(x) = 48$

$f'''''(x) = 0$

Recall position (s), velocity(v), and acceleration (a)
S(t) $\quad$ s= $16t^2$ $\quad$ v(t) $\quad$ s′ =32t $\quad$ a(t) $\quad$ s″=32 ft/sec^2