The Chain Rule

$(f \circ g)'(x) = f'(g(x)) \cdot g'(x)$

or $\frac{dy}{dx} f(g(x)) = f'(g(x)) \cdot g'(x)$

Steps:

1. Take the derivative of the outer fcn. (leave the inner alone)
2. Take the derivative of the inner fcn.
3. Mult. together

ex.1 Find the derivative of $f(x) = (\underbrace{x^3+1}_{\text{inner}})^2$ ← outer
w.r.t. x.

$f'(x) = 2(x^3+1)^1(3x^2)$
$= 6x^2(x^3+1)$

Alternate Method

$u = x^3+1$ $\qquad f(x) = u^2$

$\frac{du}{dx} = 3x^2$ $\qquad f'(x) = 2u \frac{du}{dx}$

$f'(x) = 2(x^3+1)(3x^2)$
$= 6x^2(x^3+1)$

ex.2 Find $f'(x)$ if $f(x) = \sqrt{3x+4}$

$f(x) = (3x+4)^{\frac{1}{2}}$
$f'(x) = \frac{1}{2}(3x+4)^{-\frac{1}{2}}(3)$
$= \frac{3}{2}(3x+4)^{-\frac{1}{2}}$

ex.3 Find the derivative of $f(x) = \overset{u}{(3x^2+1)^4}\overset{v}{(2x^2+5)}$

$f'(x) = \overset{u'}{4(3x^2+1)^3(6x)}\overset{v}{(2x^2+5)} + \overset{v'}{(4x)}\overset{u}{(3x^2+1)^4}$
$= 24x(3x^2+1)^3(2x^2+5) + 4x(3x^2+1)^4$

GCF $\quad = \underline{4x(3x^2+1)^3}\left(6(2x^2+5) + 3x^2+1\right)$
$= 4x(3x^2+1)^3(15x^2+31)$

* 1, 2, 3, 4, 7, 9, 11,
13, 14, 21
27, 29