3.4 ~~extension~~ Chain Rule

$y \to u \to x$

$f(x) = f(g(x))$

$F'(x) = f'(g(x))\,g'(x)$

$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

$(u^n)' = nu^{n-1} \cdot u'$

$(\sin u)' = \cos u \cdot u'$

$(\cos u)' = -\sin u \cdot u'$

$(\tan u)' = \sec^2 u \cdot u'$

$(\cot u)' = -\csc^2 u \cdot u'$

$(\sec u)' = \sec u \tan u \cdot u'$

$(\csc)' = -\csc u \cot u \cdot u'$

Chain Rule Extension
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If $f(x) = f(g(x))$ where $f(-2) = 8$, $f'(-2) = 4$, $f'(5) = 3$, $g(5) = -2$ and $g'(5) = 6$ find $F'(5)$

$f(x) = f(g(x))$

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

$F'(5) = f'(g(5)) \cdot g'(5)$

$= f'(-2) \cdot (6)$

$= f'(-2) \cdot 6$

$= (4)(6) = 24$

52 if $h(x) = \sqrt{4 + 3f(x)}$ where $f(1) = 7$ and $f'(1) = 4$ find $h'(1)$

$(u^n)' = nu^{n-1} \cdot u'$

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

$h'(x) = \frac{1}{2}(4 + 3f(x))^{-1/2}(0 + 3f'(x))$

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