2.4 The Chain Rule

-- allows you to take the derivative of a function inside another function

If both f & g are differentiable functions, then:

$$\frac{d}{dx}[f(g(x))] = f'(g(x))\,g'(x)$$

-- take the derivative of the outside first, then multiply by the derivative of the inside

ex1) $h(x) = (2x - 5)^4$

$h' = 4(2x-5)^3 \cdot (2)$

$= 8(2x-5)^3$

2) $f(x) = (3x^2+7x-2)^3$

$f' = 3(3x^2+7x-2)^2 \cdot (6x+7)$

3) $g(x) = \sqrt{8x^2+4} = (8x^2+4)^{1/2}$

$g' = \frac{1}{2}(8x^2+4)^{-1/2} \cdot (16x)$

$g' = \dfrac{8x}{\sqrt{8x^2+4}}$

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General Power Rule

-- a special case of the chain rule

If u is a differentiable function of x and n is any rational number, then:

$$\frac{d}{dx}[u^n] = n \cdot u^{n-1} \cdot u'$$

ex) $f(x) = \sqrt[3]{(x^2-1)^2} = (x^2-1)^{2/3}$

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

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

1) $f(x) = -3\sqrt[4]{2-9x}$

find f'

$f = -3(2-9x)^{1/4}$

$f' = \frac{-3}{4}(2-9x)^{-3/4} \cdot (-9)$

$f' = \dfrac{27}{4(2-9x)^{3/4}} = \dfrac{27}{4\sqrt[4]{(2-9x)^3}}$

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2) $g(t) = \dfrac{-4}{(t+2)^2} = -4(t+2)^{-2}$

find g'(t)

$g' = 8(t+2)^{-3} \cdot (1)$

$g' = \dfrac{8}{(t+2)^3}$

3) Find the equation of the tangent line to the function at the given point:

$y = \dfrac{1}{(x^2-3x)^2}$ at x = 4

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hw: p130 # 9,13,15,19,21,25,~~57,61,69,70,73~~

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