Calculus AB
2-4
Chain Rule

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Chain Rule-

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

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

$y = \sin(x^3)$

$\frac{dy}{dx} = \cos(x^3) \cdot 3x^2$

$= 3x^2 \cos(x^3)$

$$f(x) = a(b(c(x)))$$

$$f'(x) = a'(b(c(x)))\, b'(c(x))\, c'(x)$$

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Find the derivative of the function. (pg 133)

7) $y = (2x - 7)^3$ $\quad f(x) = g(h(x))$

$y = (2x-7)^3$

$h(x) = 2x-7$

$g(x) = x^3$

$\frac{dy}{dx} = 3(2x-7)^2 \cdot 2$

$= 6(2x-7)^2$

$1 \quad 3 \quad 3 \quad 1$

$8x^3 - 3(4x^2)(7) + 3(2x)(7)^2 - 7^3$

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15) $y = \sqrt[3]{9x^2 + 4}$ $\quad f(x) = g(h(x))$

$y = \sqrt[3]{9x^2+4} = (9x^2+4)^{\frac{1}{3}}$

$y' = \frac{1}{3}(9x^2+4)^{-\frac{2}{3}} \cdot 18x$

$y' = \frac{6x}{\sqrt[3]{(9x^2+4)^2}}$

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25) $f(x) = x^2(x-2)^4$

$F(x) = x^2(x-2)^4$

$F'(x) = 2x(x-2)^4 + x^2 \cdot 4(x-2)^3(1)$

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

$= 2x(x-2)^3[(x-2) + 2x]$

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

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*) $f(x) = \sin(2x)\sqrt{x^3+7x-5}$

chain chain product rule

$\sin(2x)$ $(x^3+7x-5)^{\frac{1}{2}}$

$F'(x) = 2\cos(2x)(x^3+7x-5)^{\frac{1}{2}} + \sin 2x \cdot \frac{1}{2}(x^3+7x-5)^{-\frac{1}{2}}(3x^2+7)$

deriv 1st x 2nd + 1st x deriv. 2nd

$\frac{2\sqrt{x^3+7x-5}\,2\cos 2x\sqrt{x^3+7x-5}}{2\sqrt{x^3+7x-5}} + \frac{\sin(2x)(3x^2+7)}{2\sqrt{x^3+7x-5}}$

$= \frac{4\cos 2x(x^3+7x-5) + \sin 2x(3x^2+7)}{2\sqrt{x^3+7x-5}}$

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29) $y = \dfrac{x}{\sqrt{x^2+1}}$ $\quad x\,(x^2+1)^{\frac{1}{2}}$

$$\frac{dy}{dx} = \frac{1\cdot\sqrt{x^2+1} - x\left[\frac{1}{2}(x^2+1)^{-\frac{1}{2}}(2x)\right]}{\left(\sqrt{x^2+1}\right)^2}$$

$$= \frac{\frac{\sqrt{x^2+1}}{\sqrt{x^2+1}} - \frac{2x^2}{2\sqrt{x^2+1}}}{x^2+1} = \frac{x^2+1-x^2}{(x^2+1)\sqrt{x^2+1}}$$

$$\frac{1}{\sqrt{(x^2+1)^3}}$$

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Assignment

Pg. 133
8-34 even

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