DAY 45 §3.4 CHAIN RULE

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

$h(x) = \text{outer}(\text{inner})$ $h'(x) = \text{outer}'(\text{inner}) \cdot (\text{inner}')$

pp 146–147: # 3–11 (odd) 21, 28, 33, 36, 41, 45, 57–58, 71

(3) $g(x) = (4x^2+1)^7$

$g'(x) = 7(4x^2+1)^6 \cdot (8x)$

(5) $y = \sqrt{e^x+1} = (e^x+1)^{\frac{1}{2}}$

$\frac{dy}{dx} = \frac{1}{2}(e^x+1)^{-\frac{1}{2}}(e^x)$

$\frac{dy}{dx} = \frac{e^x}{2\sqrt{e^x+1}}$

(7) $h(w) = (w^4-2w)^5$

$h'(w) = 5(w^4-2w)^4(4w^3-2)$

(9) $w(r) = \sqrt{r^4+1} = (r^4+1)^{\frac{1}{2}}$

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

$\frac{4r^3}{2\sqrt{r^4+1}} = w'(r)$

(11) $f(x) = e^{2x}(x^2+5^x)$

$f'(x) = (e^{2x})(2x+(\ln 5)5^x) + (x^2+5^x)(2e^{2x})$

$f'(x) = e^{2x}\left[2x + (\ln 5)(5^x) + 2x^2 + 2 \cdot 5^x\right]$

$f'(x) = e^{2x}\left[2x^2 + 2x + (\ln 5)5^x + 2 \cdot 5^x\right]$

$f'(x) = e^{2x}\left[2x(x+1) + 5^x(\ln 5 + 2)\right]$

(21) $v(t) = t^2 e^{-ct}$

$v'(t) = (t^2)(-ce^{-ct}) + (2t)e^{-ct}$

$v'(t) = (te^{-ct})(-ct+2)$

$v'(t) = (te^{-ct})(2-ct)$

(28) $z(x) = \sqrt[3]{2^x+5} = (2^x+5)^{\frac{1}{3}}$

$z'(x) = \frac{1}{3}(2^x+5)^{-\frac{2}{3}} \cdot ((\ln 2)(2^x))$

$z'(x) = \frac{(\ln 2)\, 2^x}{3(2^x+5)^{2/3}}$

(33) $y = \frac{\sqrt{z}}{2^z}$

$\frac{dy}{dx} = \frac{\frac{2^z \cdot 1}{2\sqrt{z}} - \sqrt{z}(\ln 2)\, 2^z}{(2^z)^2}$

$\frac{dy}{dx} = \frac{\frac{1}{2\sqrt{z}} - (\ln 2)\sqrt{z}}{2^z} \cdot \frac{(2\sqrt{z})}{(2\sqrt{z})}$ LCD

LCD

$\frac{dy}{dx} = \frac{1 - 2\ln 2 \cdot \sqrt{2z}}{(2\sqrt{z})2^z} = \frac{1 - \ln 4 \cdot \sqrt{2z}}{(\sqrt{z})(2^{z+1})}$

DAY 45 continued #41, 45, 57, 58, 71

(41) $w(t) = (t^2+3t)(1-e^{-2t})$

$w'(t) = (t^2+3t)(2e^{-2t}) + (1-e^{-2t})(2t+3)$

NOTHING TO FACTOR SO LEAVE IT.

(45) $f(w) = (5w^2+3)(e^{w^2})$

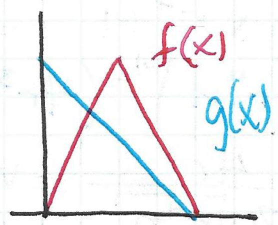
$f'(w) = (10w)(e^{w^2}) + (2we^{w^2})(5w^2+3)$

$f'(w) = (2we^{w^2})(5 + 5w^2+3)$

$f'(w) = (2we^{w^2})(5w^2+8)$

FACTOR & SIMPLIFY

(57)
(58)



x	f(x)	f'(x)	g(x)	g'(x)
0	0	2	4	-1
1	2	2	3	-1
2	4	dne	2	-1
3	2	-2	1	-1
4	0	-2	0	-1

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

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

a) $h'(1) = f'(g(1)) \cdot g'(1)$

$h'(1) = f'(3) \cdot g'(1)$

$h'(1) = (-2)(-1) = 2$

b) $h'(2) = f'(g(2)) \cdot g'(2)$

$= \underbrace{f'(2)}_{\text{dne}} \cdot g'(2)$ $\therefore$ $h'(2)$ dne.

c) $h'(3) = f'(g(3)) \cdot g'(3)$

$h'(3) = f'(1) \cdot g'(3)$

$h'(3) = (2)(-1) = -2$

(58) $u(x) = g(f(x))$

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

a) $u'(1) = g'(f(1)) \cdot f'(1)$

$= g'(2) \cdot f'(1)$

$= (-1) \cdot (2) = -2$

b) $u'(2) = g'(f(2)) \cdot \underbrace{f'(2)}_{\text{dne}}$

c) $u'(3) = g'(f(3))\, f'(3)$

$= g'(2) \cdot f'(3)$

$= (-1)(-2)$

$= 2$

(71) Fish population $P(t) = 10e^{0.6t}$
t in months.

$P(12) = 10e^{0.6(12)} \approx 13{,}394.307$

In the 12th month there are 13,394 fish in the population.

$P'(t) = 10 \cdot (0.6)\, e^{0.6t} = 6e^{.6t}$

$P'(12) = 8036.584$ fish/mo.

In the 12th month the population of fish is increasing at a rate of 8036 fish per month.

when/what/behavior/rate value/units!