DAY 42 § 3.3 PRODUCT RULE & QUOTIENT RULE

$$y = \boxed{f(x)} \cdot \boxed{g(x)}$$

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

$$y = \frac{\boxed{f(x)}}{\boxed{g(x)}}$$

$$\frac{dy}{dx} = \frac{\boxed{g(x)} \cdot \boxed{f'(x)} - \boxed{f(x)}\boxed{g'(x)}}{[\boxed{g(x)}]^2}$$

Be Careful WITH SUBTRACTION ORDER MATTERS!

p. 139-140 #3-30 (x3) 31-33, 52, 53

(3) $f(x) = (x)(e^x)$

$f'(x) = x \cdot e^x + e^x \cdot 1$

$f'(x) = e^x(x+1)$

(6) $y = (t^2+3)(e^t)$

$\frac{dy}{dt} = (t^2+3)(e^t) + (e^t)(2t)$

$\frac{dy}{dt} = e^t(t^2+2t+3)$

(9) $f(x) = \frac{\boxed{x}}{\boxed{e^x}}$

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

$f'(x) = \frac{\cancel{e^x}(1-x)}{\cancel{e^x} \cdot e^x}$

$f'(x) = \frac{1-x}{e^x}$

(12) $g(x) = \frac{\boxed{x^{3.2}}}{\boxed{5^x}}$

$g'(x) = \frac{5^x \cdot (3.2x^{2.2}) - x^{3.2}(\ln 5)5^x}{5^{2x}}$

$g'(x) = \frac{\cancel{5^x}(3.2x^{2.2} - (\ln 5)x^{3.2})}{\cancel{5^x} \, 5^x}$

$g'(x) = \frac{x^{2.2}(3.2 - (\ln 5)(x))}{5^x}$

(15) $y = \frac{3x+1}{5x+2}$

$\frac{dy}{dx} = \frac{(5x+2)(3) - (3x+1)(5)}{(5x+2)^2}$

$\frac{dy}{dx} = \frac{15x+6-15x-5}{(5x+2)^2}$

$\frac{dy}{dx} = \frac{1}{(5x+2)^2}$

(18) $f(x) = \frac{x^2+3}{x}$

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

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

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

DAY 42 continued 21-30 (x3)

(21) $f(z) = \dfrac{z^2+1}{\sqrt{z}}$

Eliminate complex fraction w/ $\cdot \frac{LCD}{LCD}$

$$f'(z) = \frac{\left(\frac{(\sqrt{z})(2z)}{1} - (z^2+1)\frac{1}{2\sqrt{z}}\right)}{\left(\frac{z}{1}\right)} \cdot \frac{(2\sqrt{z})}{(2\sqrt{z})}$$

$$f'(z) = \frac{4z^2 - (z^2+1)}{2z^{3/2}} = \boxed{\frac{3z^2-1}{2z^{3/2}}} \text{ OR } = \boxed{\frac{3z^{\frac{5}{2}} - z^{\frac{1}{2}}}{2z^2}}$$

OR

(24) $f(z) = \dfrac{3z^2}{5z^2+7z}$

$$f'(z) = \frac{(5z^2+7z)(6z) - (3z^2)(10z+7)}{(5z^2+7z)^2}$$

$$f'(z) = \frac{\cancel{30z^3} + 42z^2 - \cancel{30z^3} - 21z^2}{(5z^2+7z)^2} = \frac{21z^2}{(5z^2+7z)^2}$$

(27) $f(x) = \dfrac{x^2+3x+2}{x+1} = \dfrac{(x+2)\cancel{(x+1)}}{\cancel{(x+1)}} = (x+2),\ x \neq -1$

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

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

$f'(x) = 1,\ x \neq -1$

(30) $f(x) = (2-4x-3x^2)(6x^e - 3\pi)$

$$f'(x) = (2-4x-3x^2)(6ex^{e-1}) + (6x^e - 3\pi)(-4-6x)$$

leave this one... nothing simpler is going to happen from expanding

DAY 42 continued again

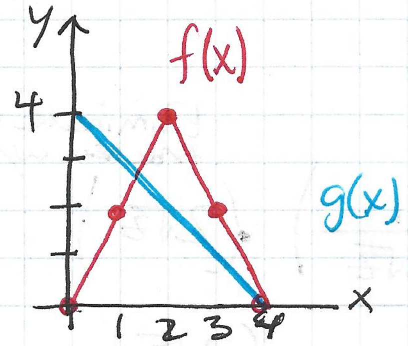
31, 32, ~~33~~, 52, 53

CANCEL #33

31

32

~~33~~




| 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 |

31 $h(x) = f(x) \cdot g(x)$

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

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

$h'(1) = (2)(-1) + (2)(3) = 4$

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

$\therefore h'(2) = \text{dne}$

c) $h'(3) = f(3)\, g'(3) + f'(3)\, g(3)$

$h'(3) = (2)(-1) + (-2)(1) = -4$

32 $k(x) = \dfrac{f(x)}{g(x)}$

$k'(x) = \dfrac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{(g(x))^2}$

32 a) $k'(1) = \dfrac{g(1) \cdot f'(1) - f(1) \cdot g'(1)}{[g(1)]^2}$

$= \dfrac{(3)(2) - (2)(-1)}{3^2} = \dfrac{6+2}{9} = \dfrac{7}{9}$

b) $k'(2) \Rightarrow f'(2)$ dne $\therefore k'(2)$ dne.

c) $k'(3) = \dfrac{g(3) \cdot f'(3) - f(3) \cdot g'(3)}{[g(3)]^2}$

$= \dfrac{(1)(-2) - (2)(-1)}{(1)^2} = \dfrac{0}{1} = 0$

52 a) $h(x) = f(x) + g(x)$

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

$h'(2) = f'(2) + g'(2)$

$h'(2) = 5 + -2$

$h'(2) = 3$

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

$h'(x) = fg' + f'g$

$h'(2) = f(2)g'(2) + f'(2)g(2)$

$h'(2) = (3)(-2) + (5)(4)$

$h'(2) = -6 + 20$

$h'(2) = 14$

c) $h(x) = \dfrac{f(x)}{g(x)}$

$h'(x) = \dfrac{gf' - fg'}{(g)^2}$

$h'(2) = \dfrac{g(2)f'(2) - f(2)g'(2)}{(g(2))^2}$

$h'(2) = \dfrac{(4)(5) - (3)(-2)}{(4)^2}$

$h'(2) = \dfrac{20+6}{16} = \dfrac{26}{16}$

$h'(2) = \dfrac{13}{8}$

GIVEN:

$x = 2$ $\quad f(2) = 3 \quad g(2) = 4$

$\quad f'(2) = 5 \quad g'(2) = -2$