MA 121-002

Thursday, February 7

- finish chain rule (1.7)
- 1.8 (higher order derivatives)
- 2.1 (using $f'(x)$; INCR/DECR; MAX/MIN)
- return TEST #1

1.7: chain rule:

① extended power rule:

$$y = [f(x)]^n \qquad y' = n \cdot [f(x)]^{n-1} \cdot f'(x)$$

ex: $y = (5x+8)^{11}$ ✓

$y' = 11(5x+8)^{10} \cdot (5) = 55(5x+8)^{10}$

② composition of functions:

$y = (f \circ g)(x) = f(g(x))$ $\qquad y' = ??$

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

ex:

$y = f(g(x))$

$y = f(5x+8)$

$y = (5x+8)^{11}$

$f(x) = x^{11}$

$g(x) = 5x+8$

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

$y' = 11(5x+8)^{10} \cdot 5$

$= 11(5x+8)^{10} \cdot 5 = 55(5x+8)^{10}$

(3) chain rule:

y in terms of u ✓

.... u in terms of x ✓

$y = 3u^2 + 5u + 11 \qquad \frac{dy}{du} = 6u + 5$

$u = 2x - 1 \qquad \frac{du}{dx} = 2$

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

↑ deriv of y with respect to x

$\frac{dy}{dx} = (6u + 5) \cdot (2)$

$= (6(2x-1) + 5) \cdot (2)$

$= (12x - 6 + 5) \cdot (2)$

$= (12x - 1)(2) = 24x - 2$

$y = 3u^2 + 5u + 11$

$u = \boxed{2x-1}$

$y = \boxed{3(2x-1)^2} + 5(2x-1) + 11$

$y' = 3 \cdot \boxed{2(2x-1)^1 \cdot 2} + 10 = 3[8x - 4] + 10$

$y' = 24x - 12 + 10 = 24x - 2$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dr} \cdot \frac{dr}{dt} \cdot \frac{dt}{dx}$$ chain

1.8: HIGHER ORDER DERIVATIVES

$y' \quad y'' \quad y''' \quad y^{(4)} \quad y^{(5)} \ldots$

$f'(x) \quad f''(x) \ldots$

$\frac{dy}{dx} \quad \frac{d^2y}{dx^2} \quad \frac{d^3y}{dx^3}$

ex: $f(x) = 11x^3 + 5x^2 - 2x + 3$

$f'(x) = 33x^2 + 10x - 2$

$f''(x) = 66x + 10$

$f'''(x) = 66$

$f^{(4)}(x) = 0 \ldots$

ex: $y = (3x+2)^7$

$y' = 7(3x+2)^6 \cdot 3 = 21\boxed{(3x+2)^6}$

$y'' = 21\left[6 \cdot (3x+2)^5 \cdot 3\right] = (21 \cdot 6 \cdot 3) \cdot (3x+2)^5$

$f(x) = (2x^2 - 3x + 5)^{10}$

$f'(x) = 10\boxed{(2x^2-3x+5)^9(4x-3)}$

$f''(x) = 10\left[(2x^2-3x+5)^9 \cdot (4) + (4x-3)\cdot 9(2x^2-3x+5)^8 \cdot (4x-3)\right]$

$f''(x) = \ldots$

$s(t) = -16t^2 + 64t + 100$ (free falling object)

$s(t)$: ft
t: sec

↑ dist; ht; pos

① $s(t)$:

initial pos. ↙

$t = 0 \quad s(0) = -16t^2 + 64t + 100$

$s(0) = -16(0)^2 + 64(0) + 100 = 100$ ft.

$t = 1 \quad s(1) = -16(1)^2 + 64(1) + 100$

$= -16 + 164 = 148$ ft.

$t = 2 \quad s(2) = -16(2)^2 + 64(2) + 100 =$ _____

② $s'(t) = \boxed{-32t + 64 = v(t)}$ *

$t = 0 \quad v(0) = -32(0) + 64 = 64 \frac{ft}{sec}$ (initial rel.)

$t = 1 \quad v(1) = -32(1) + 64 = 32$ ft/sec

$t = 2 \quad v(2) = -32(2) + 64 = 0$ ft/sec (peak)

$t = 3$

③ $s'(t) = v'(t) = a(t) = \boxed{-32 \frac{ft/sec}{sec}} = -32 \frac{ft}{sec^2}$

GRAV.

MA121-002 Test #1

A's: 81 (41.8 % of the class)
B's: 42 (21.6 % of the class) } 63.4%
C's: 28 (14.4 % of the class)
D's: 22 (11.3 % of the class)
F's: 21 (10.8 % of the class) } 22.1%

Class average: 81.3