MA 121 - 001 ①

Tuesday, September 25

today: (2.1: using $f'(x)$)
(2.2: using $f''(x)$)

1.8:

t: time (SEC)

$$s(t) = \underbrace{-16}_{\text{GRAV.}}t^2 + \underbrace{52}_{\text{INIT. VEL.}}t + \underbrace{10}_{\text{INIT. POS}} \quad (\text{FT})$$

DIST; HT; POS (FT.)

(free-falling object)

$s(0) = \underline{10 \text{ FT}}$ $s(1) = \underline{\quad\quad}$

$$s'(t) = v(t) = -16(2t) + 52(1) + 0$$

$$v(t) = -32t + 52 \quad \left(\frac{\text{FT}}{\text{SEC}}\right)$$

$v(0) = \underline{52 \text{ FT/SEC}}$ $v(1) = \underline{\quad\quad}$

$$s''(t) = v'(t) = a(t) = -32(1) + 0$$

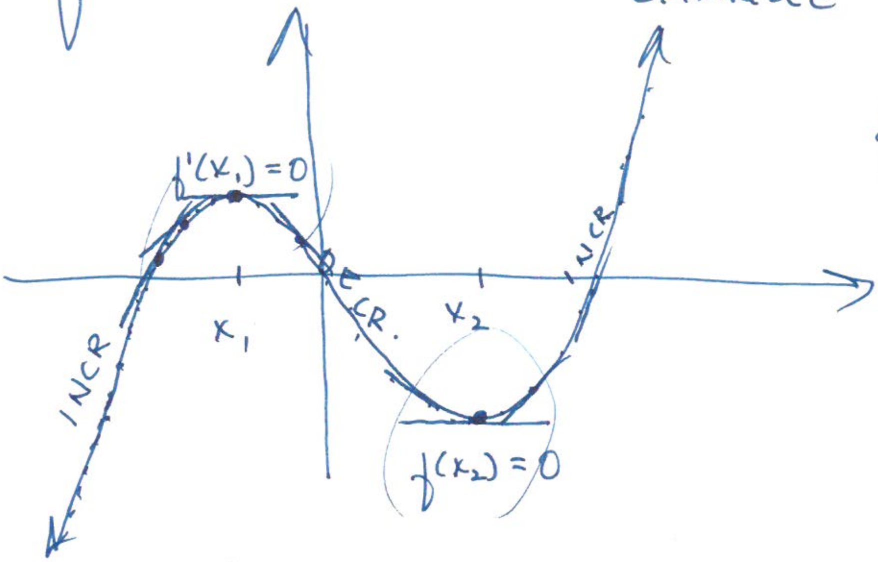
$$\underbrace{a(t) = -32}_{\text{GRAVITY}} \quad \left(\frac{\text{FT/SEC}}{\text{SEC}}\right) \Rightarrow \frac{\text{FT}}{\text{SEC}^2}$$

$$s(t) = -16t^2 + 84t + 0$$

INIT. POS (GROUND)

2.1: USING THE DERIV.

$$f'(x) = m_{TAN} = \text{INSTANTANEOUS RATE OF CHANGE}$$



$f(x) = x^3 + \cdots\cdots$

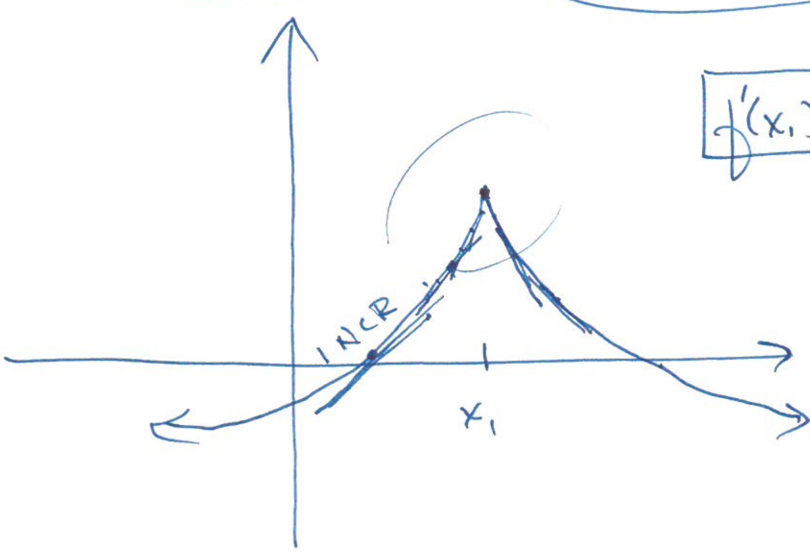
HORIZONTAL TANGENT LINE

– set $\boxed{f'(x) = 0}$ ("FLAT" PLACES)

– possible transition from INCR/DECR or DECR/INCR.

$*$ $f'(x) = \text{POS} \longrightarrow f(x)$ INCR.

$f'(x) = \text{NEG} \longrightarrow f(x)$ DECR.



$\boxed{f'(x_1) = \text{D.N.E.}}$ (undef.)

("STEEP" PLACES) VERTICAL TANGENT LINE THERE

1. find $f'(x)$

2. (a) $f'(x) = 0$ (flat ...)

   (b) $f'(x)$ DNE (steep ...)
   (fails to exist)

   } CRITICAL VALUES → USED TO FIND CRIT PTS

3. determine INCR / DECR based on the SIGN of $f'(x)$

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ex: $f(x) = 12 + 9x - 3x^2 - x^3$ polynom ∴ CONTIN.

$f'(x) = 9 - 6x - 3x^2$ ✓

(a) $f'(x) = 0$ ✓

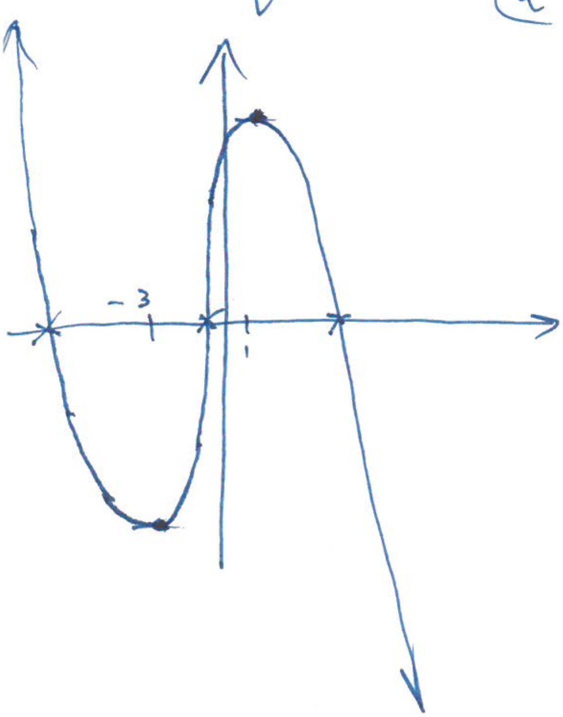
$0 = 9 - 6x - 3x^2$

$0 = -(3x^2 + 6x - 9)$

$0 = -1(3x - 3)(x + 3)$

$-3x$ $+9x$

(b) ~~$f'(x)$ D.N.E.~~ ~~???~~



$3x - 3 = 0$

$3x = 3$

$x = 1$

$(1, f(1)) = (1, 17)$

$f(1) = 12 + 9(1) - 3(1)^2 - (1)^3$

$f(1) = 12 + 9 - 3 - 1 = 17$

$x + 3 = 0$

$x = -3$

$(-3, f(-3)) = (-3, -15)$

$f(-3) = 12 + 9(-3) - 3(-3)^2 - (-3)^3$

$f(-3) = 12 - 27 \cancel{-27} \cancel{+27}$

$f(-3) = -15$

(4)

$f'(x) = -(3x-3)(x+3)$

$f'(x)$:

$f'(-4) = -$ | $f'(0) = +$ | $f'(2) = -$

$f(x)$ DECR. $x=-3$ $f(x)$ INCR. $x=1$ $f(x)$ DECR

$$\begin{cases} f'(-4) = -(-)(-) = \text{NEG} \\ f'(0) = -(-)(+) = \text{POS} \\ f'(2) = -(+)(+) = \text{NEG} \end{cases}$$

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non-polynom.

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

(1) $f'(x) = 0 - \frac{2}{3} x^{-1/3} = \frac{-2}{3x^{1/3}} = \frac{-2}{3\sqrt[3]{x}}$

(2) (a) $f'(x) = 0$

$0 \neq \frac{-2}{3 \cdot \sqrt[3]{x}}$ no "flat" places

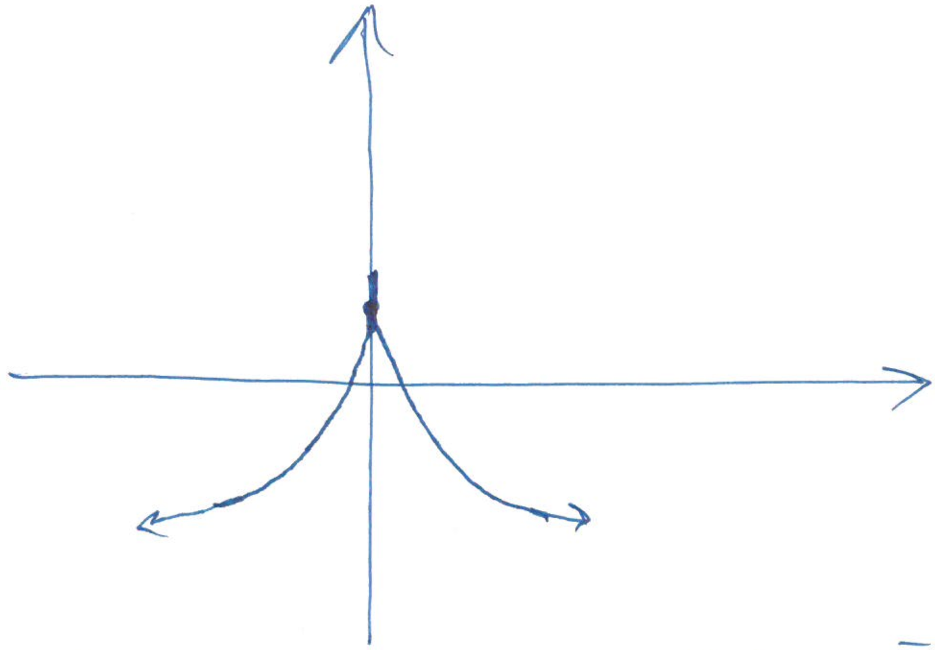
(b) $f'(x)$ DNE (undef.)

$\frac{-2}{3 \cdot \sqrt[3]{x}}$ undef .... when $3 \cdot \sqrt[3]{x} = 0$

when $x = 0$

$f(0) = 1 - 0^{2/3} = 1$ $(0, f(0))$

$(0, 1)$ steep



3) $f'(x)$:

$$f'(x) = \frac{-2}{3 \cdot \sqrt[3]{x}}$$

$f'(-1) = +$ $\qquad$ $f'(1) = -$

$f(x)$ INCR. $\qquad$ $x=0$ $\qquad$ $f(x)$ DECR.

$$f'(-1) = \frac{-2}{3 \cdot \sqrt[3]{-1}} = \frac{-2}{3 \cdot (-1)} = +$$

$$f'(1) = \frac{-2}{3 \cdot \sqrt[3]{1}} = \frac{-2}{3 \cdot 1} = -$$

121-001:

TEST #1

A's: 36

B's: 32

C's: 52

D's: 30

F's: 63

AVE: 67.645