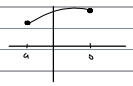
4.2 (Day 1) Extreme Values

Objective: 1. Know how to find critical points.
2. Find extrema, local and absolute.

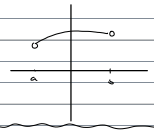
CLOSED INTERVAL



$[a, b]$

$a \le x \le b$

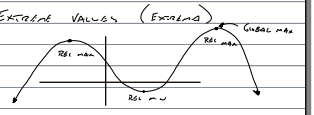
OPEN INTERVAL



(a, b)

$a < x < b$

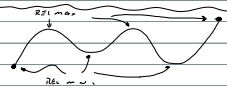
EXTREME VALUES (EXTREMA)

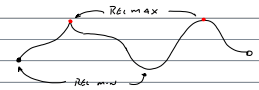


LET $f(x)$ BE DEFINED AT $x = c$
IF $f'(x) = 0$
OR $f'(x)$ IS UNDEFINED AT c

THEN c IS A CRITICAL NUMBER

IF $f(x)$ HAS A RELATIVE MAX OR MIN AT $x = c$, THEN c IS A CRITICAL NUMBER OF $f(x)$ OR c IS AN ENDPOINT OF AN INTERVAL





FINDING EXTREMA ON A CLOSED INTERVAL.

1. FIND THE CRITICAL NUMBERS IN (a, b)
2. EVALUATE THE CRITICAL NUMBERS
   (FIND THE Y-VALUES)
3. EVALUATE THE ENDPOINTS OF $[a, b]$
   (FIND THE Y-VALUES)
4. LOWEST POINT MIN (GLOBAL)
5. HIGHEST POINT MAX (GLOBAL)

FIND THE CRITICAL NUMBERS (X-VALUES)

1. $y = x^2 - 8x + 10$
   $y' = 2x - 8$
   $0 = 2x - 8$
   $\boxed{4 = x}$

2. $y = 2x^3 - x^2 + 1$
   $y' = 6x^2 - 2x$
   $0 = 2x(3x - 1)$
   $\boxed{x = 0 \quad x = \frac{1}{3}}$

3. IS 1 A CRITICAL # OF
   $y = x^4 - 3x^3 + 3$
   $y' = 4x^3 - 9x^2$
   $y'(1) = 4 - 9 = -5$ NO!!

4. $y = \sqrt{x^2 - x}$
   $y' = \frac{1}{2}(x^2 - x)^{-\frac{1}{2}}(2x - 1)$
   $y' = \frac{2x - 1}{2\sqrt{x^2 - x}}$
   $y' = \frac{2x - 1}{2\sqrt{x(x - 1)}}$
   $0 = 2x - 1$ ALSO. $x = 0$ $x = 1$
   $\boxed{\frac{1}{2} = x}$

PG 222 # 1, 5, 21, 34, 62-65

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