Calc AB | Lesson 63 | 11/5/15

Agenda: 11/3/15

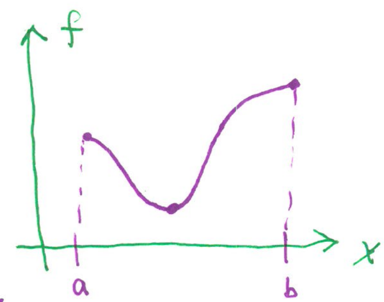
Lesson 63

Critical Number Theorem

Extreme Value Theorem (Max-Min Value Theorem)

- If f is continuous on the closed interval $I = [a, b]$, then f attains a maximum value M and a minimum value on I.

★ Obvious statement but the proof is quite involved and beyond this class.



★ Existance Theorem but doesn't say how to find them.

Critical Number Theorem (Closed Interval Theorem)

- If f is a continuous function on a closed interval I and if f attains a max or min at $x = c$ where $c \in I$, then either
  1. c is an endpoint of I
  2. $f'(c)$ does not exist
  3. $f'(c) = 0$

Ex. Find the maximum and minimum values of $f(x) = -2x^3 + 3x^2 + 12x - 1$ on the interval $[-4, 3]$.

$$f'(x) = -6x^2 + 6x + 12 = -6(x^2 - x - 2) = -6(x-2)(x+1)$$

Critical Numbers: $(x = -4, 3 \quad x = 2, -1)$

$$\left.\begin{aligned} f(-4) &= 127 \\ f(-1) &= -8 \\ f(2) &= 19 \\ f(3) &= 8 \end{aligned}\right\}$$

f attains a max value of 127 at $x = -4$ and a min value of -8 at $x = -1$.

Ex 63.4 f is continuous on $[-2, 4]$. Also $f(-2) = 2$, $f(-1) = -1$ and $f(4) = 5$. Find the values of x where f attains absolute max/min.

x	$-2 < x < -1$	$x = -1$	$-1 < x < 2$	$x = 2$	$2 < x < 4$
$f'(x)$	(−)	undefined	(+)	0	(+)
$f''(x)$	(−)	undefined	(−)	0	(+)

Absolute max at $x = 4$

Absolute min at $x = -1$