5.1 Critical Points

Wednesday, June 12, 2019 7:14 AM

A critical point is an x-value in the domain of $f(x)$ for which $f'(x) = 0$ or $f'(x) = \text{DNE}$.

ex $f(x) = \dfrac{2x^2}{x-2}$

① $f'(x) = \dfrac{(x-2)\cdot(4x) - (2x^2)\cdot(1)}{(x-2)^2} = \dfrac{2x^2-8x}{(x-2)^2}$

② Set $f'(x)$ equal to zero and solve for x (Horizontal Tangent Lines)

$$\frac{2x^2-8x}{(x-2)^2} = 0 \rightarrow 2x(x-4) = 0$$

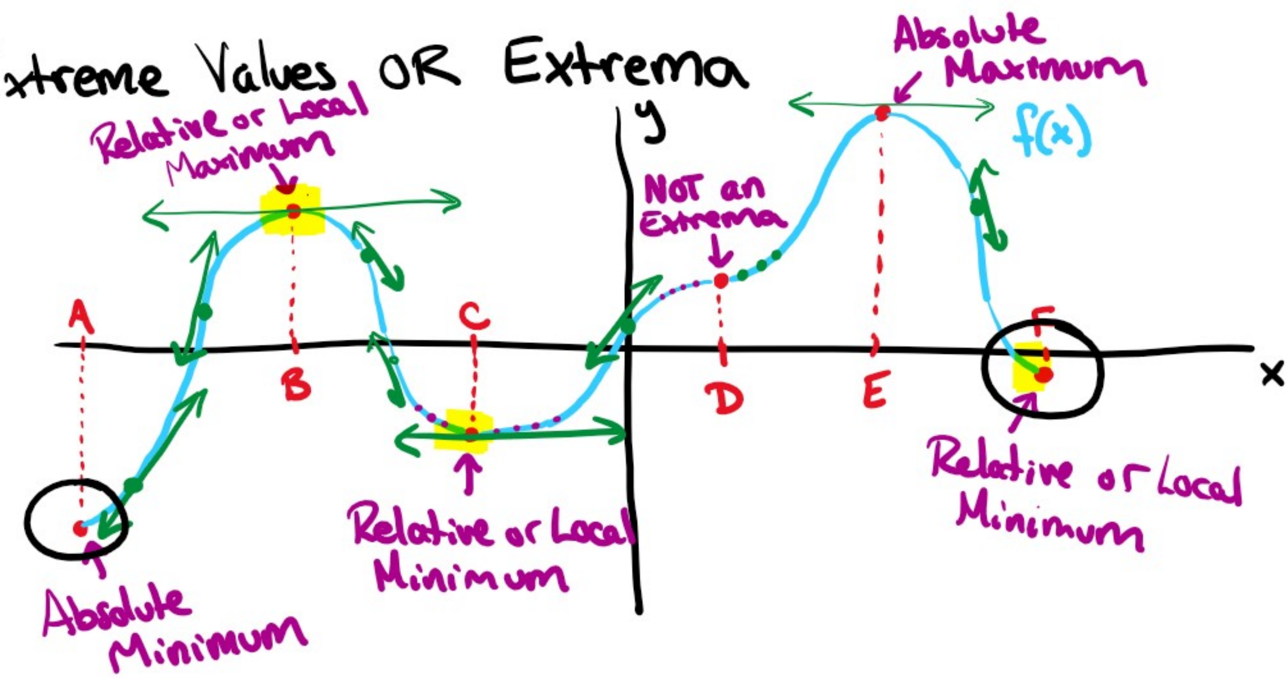
$x=0 \quad x=4$

③ Identify any x-values that make $f'(x)$ DNE

$$\frac{2x^2-8x}{(x-2)^2 = 0} \rightarrow x = 2$$

Critical Points: $x = \underline{0, 2, 4}$

Extreme Values OR Extrema



* Extreme Values only occur at Critical Points *

* Extreme Values only occur at Critical Points and Interval Endpoints *

ex $f(x) = (x^2 - 25)^2$ on interval $[-2, 8]$

① $f'(x) = 2(x^2-25)^1 \cdot (2x)$

② Set $f'(x)$ equal to zero: $4x(x^2-25)=0$

③ Identify where $f'(x)$ DNE $\Big\}$ $4x(x+5)(x-5)=0$

$x=0 \quad x=-5 \quad x=5$

Critical Points: $x = 0, -5, 5$ outside of given interval

④ Plug each critical point AND each interval endpoint into $f(x)$ to find their corresponding y-values

$x=0$	~~$x=-5$~~	$x=5$	$x=-2$	$x=8$
$y=625$		$y=0$	$y=441$	$y=1521$
$(0,625)$		$(5,0)$	$(-2,441)$	$(8,1521)$
Relative Max/Min		Absolute Minimum (least y-value)	Relative Max/Min	Absolute Maximum (greatest y-value)