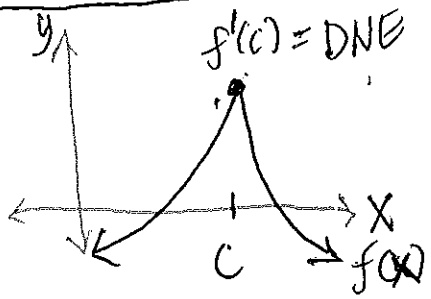
Critical Numbers 11/30

ES: What is a critical number? How do we find it?

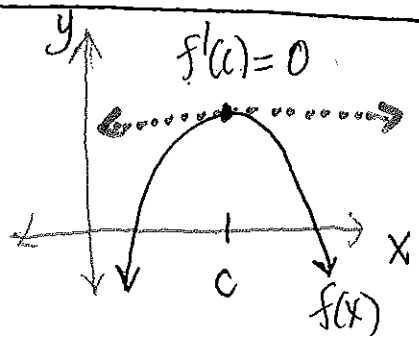
Definition: Let f be defined at c. If $f'(c) = 0$ or if f is not differentiable at c, then c is a critical number of f.

The x-values at these special points (relative min, relative max, where $f'(c) = 0$, $f'(c) = DNE$) are critical numbers.

How does it look like?



c is a critical Number



c is a critical number

Extrema on a closed Interval

How do we find extrema on a closed interval without using a graph?

Process

1. Find the critical numbers of f in (a,b).
2. Evaluate f at each critical number in (a,b).
3. Evaluate f at each end point of $[a,b]$.
4. The smallest of these y-values is the absolute minimum and the greatest y-value is the absolute maximum.

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Name_____

Derivative at a Value

Date_____ Period____

For each problem, find the derivative of the function at the given value.

1) $y = x^2 + 4x$ at $x = -5$

2) $y = -x^3 + 4x^2 - 4$ at $x = 4$

3) $y = \frac{20}{x^2 + 5}$ at $x = 3$

4) $y = \frac{2}{x + 1}$ at $x = 5$

5) $y = (-x + 4)^{\frac{1}{2}}$ at $x = 0$

6) $y = (-3x + 9)^{\frac{1}{2}}$ at $x = -5$

7) $y = e^{-x+2}$ at $x = 4$

8) $y = -\ln(x + 3)$ at $x = 5$

9) $y = 2\sin(2x)$ at $x = -\frac{\pi}{2}$

10) $y = -\tan(2x)$ at $x = -\pi$

ex $f(x) = 3x^4 - 4x^3$ $[-1, 2]$

Find all Absolute Extrema

Step1 Find critical #s

$f'(x) = 12x^3 - 12x^2$

$0 = 12x^3 - 12x^2$

$0 = 12x^2(x-1)$

$12x^2 = 0$ → $x = 0$

$x - 1 = 0$ → $x = 1$

Step2 Plug critical #s in f

$f(0) = 3(0)^4 - 4(0)^3$

$f(0) = 0$

$f(1) = 3(1)^4 - 4(1)^3$

$f(1) = -1$ MIN

Step3 Plug end points into f

$f(-1) = 3(-1)^4 - 4(-1)^3$

$f(-1) = 7$

$f(2) = 3(2)^4 - 4(2)^3$

$f(2) = 16$ MAX

Step4

Left End pt	crit #	crit #	Right End pt
$f(-1) = 7$	$f(0) = 0$	$f(1) = -1$ Abs. MIN	$f(2) = 16$ Abs. MAX

Summary

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