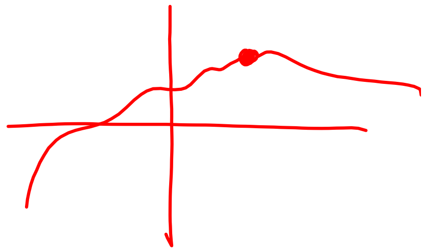
f is continuous @ c

$$\lim_{x\to c} f(x) = f(c)$$



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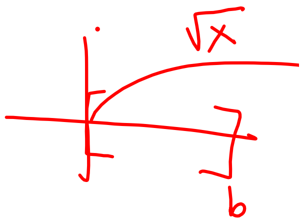
f is continuous on (a, b) if
f is cts @ every point $c \in (a, b)$



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f is continuous on $[a, b]$
if f is cts. on (a, b) and

$\lim_{x\to a^+} f(x) = f(a)$ and $\lim_{x\to b^-} f(x) = f(b)$

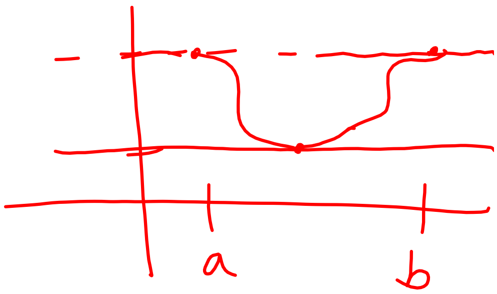
discontinuities:

- V.A.'s & holes when denominator is zero $\frac{x+2}{x-3}$ or $\frac{(x+2)(x-3)}{x-3}$
- pieces of piecewise fn don't line up $\begin{cases} x-2, & x > 2 \\ 5, & x \le 2 \end{cases}$
- $\sqrt{x}$ on $[-3, 7]$

$f(a) = f(b)$

& $\dfrac{f(b) - f(a)}{b-a} = 0$

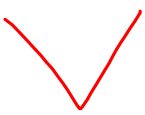
$f'(x) =$

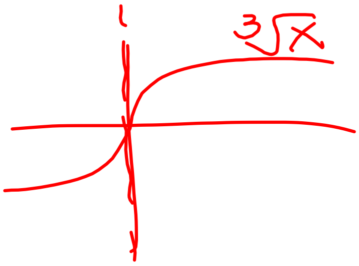


$f'(x) = \lim_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

differentiability implies continuity

$f'(c) = \lim_{x \to c} \dfrac{f(x) - f(c)}{x - c}$

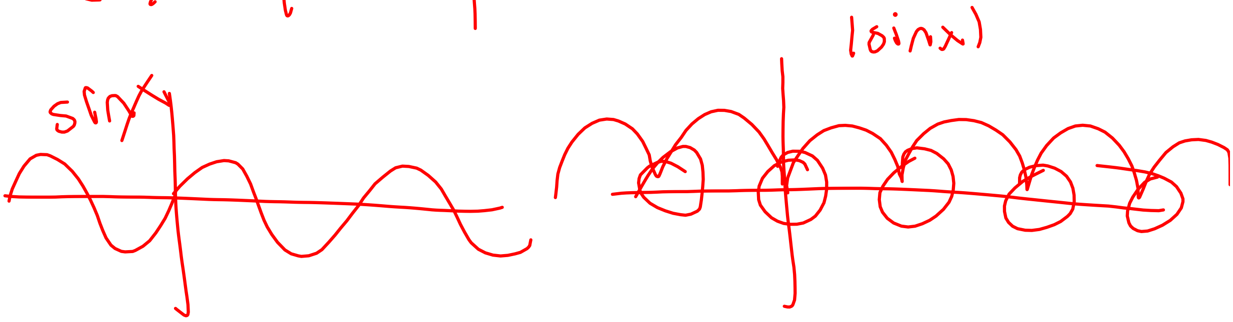




$[-1, 1]$

$[0, 1]$ $(0, 1)$

$f(x) = |\sin x|$



3.3-3.4 Increasing, Decreasing, Concavity, and the 1st and 2nd Derivative Tests

What do f' and f'' tell us about f?

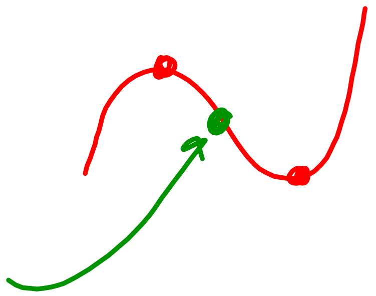
Recall that f' is the rate of change or slope of f,
f'' is the slope or rate of change of f'.

f'	f
+	↗ increasing
−	↘ decreasing

f''	f'	f
+	↗ increasing	concave up
−	↘ decreasing	concave down

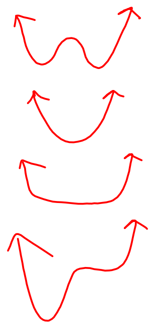
f'(x)=0 when f has a relative maximum or minimum.
These x-values (and those where f'(x) is undefined) are called critical numbers.

f''(x)=0 when f changes concavity.
The points where concavity changes are called inflection points.



3.4

16. $f(x) = x^3(x-4) = x^4 - 4x^3$



$f'(x) = 4x^3 - 12x^2$

$4x^2(x-3) = 0$

critical #'s : 0, 3

$f'(-1), f'(1), f'(4)$

$-\ 0\ -\ 3\ +$

$\searrow\ \ \searrow\ \ \nearrow$

f is decreasing $(-\infty, 3)$
& increasing on $(3, \infty)$

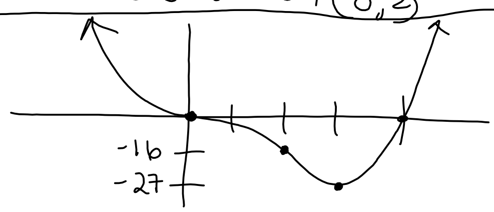
f has a relative (& absolute min) @ $(3, -27)$

$f''(x) = 12x^2 - 24x$ $f''(-1), f''(1), f''(3)$

$12x(x-2) = 0$ $+\ 0\ -\ 2\ +$

$x = 0, 2$

f has inflection points @ $(0,0)$ & $(2,-16)$
f is concave up on $(-\infty, 0) \cup (2, \infty)$
& concave down on $(0, 2)$



HW #9 (due Fri, 23 Jan)
3.1 # 17-31 odd - Absolute Extrema on an Interval
3.2 # 7-19 odd - Rolle's Theorem
3.2 # 31-37 odd - Mean Value Theorem
Quiz #6 - Mon, 26 Jan

HW #10 (due Fri, 30 Jan)
3.3 # 11-31 odd - Increasing, Decreasing, and Relative Extrema
3.4 #11-25 odd - Inflection Points and Concavity
3.5 #15-31 odd - Limits at Infinity
7.7 #11-35 odd - l'Hopital's Rule
Quiz #7 - Fri, 30 Jan

HW #11 (due Wed, 4 Feb)
7.7 #37-53 odd - l'Hopital's Rule with logs
3.7 #3,5,17,23,29 - Optimization
Test 4 - Wed, 4 Feb

Final Exam - Thurs, 12 Feb 1:00-3:00pm