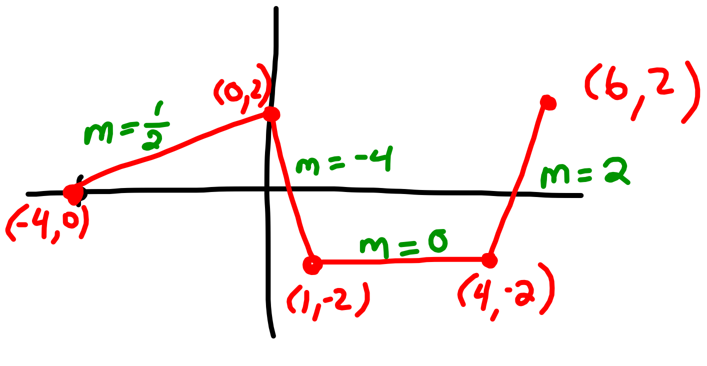
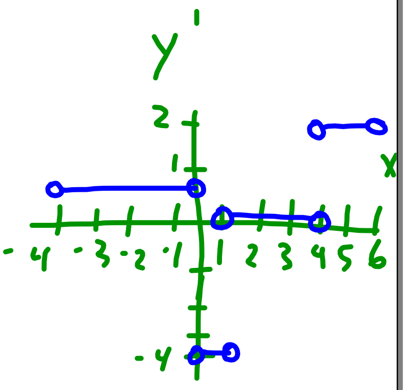
① $f(x) = \frac{1}{x}$, $a = 2$

(26)



a



b. $x = 0$
$x = 1$
$x = 4$

Use the definition of a derivative to find the derivative of f(x)= $5x^2 - 8x$

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h \to 0} \frac{5(x+h)^2 - 8(x+h) - (5x^2 - 8x)}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{5x^2} + 10xh + 5h^2 - \cancel{8x} - 8h - \cancel{5x^2} + \cancel{8x}}{h}$$

$$= \lim_{h \to 0} 10x + 5h - 8 = 10x - 8$$

Sep 18-3:22 PM

Use the definition of a derivative to find the derivative of f(x) = $\frac{-6}{x^2}$

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$\lim_{h \to 0} \frac{\frac{-6}{(x+h)^2} - \frac{-6}{x^2}}{h} = \lim_{h \to 0} \frac{\frac{-6}{(x+h)^2} \cdot \frac{x^2}{x^2} + \frac{6}{x^2} \frac{(x+h)^2}{(x+h)^2}}{h}$$

$$= \lim_{h \to 0} \frac{\frac{-6x^2 + 6x^2 + 12xh + 6h^2}{x^2(x+h)^2}}{h} \cdot \frac{1}{h} = \lim_{h \to 0} \frac{12xh + 6h^2}{h \cdot x^2 (x+h)^2}$$

$$= \lim_{h \to 0} \frac{12x + 6h}{x^2 (x+h)^2} = \frac{12x}{x^2 \cdot x^2} = \frac{12x}{x^4} = \frac{12}{x^3}$$

Oct 4-8:22 AM

3-2 Differenability

Learning Objecves:

I understand different ways that a funcon might be non-differenable.

I understand how to find/graph derivaves on a graphing calculator at a given x.

I understand that differenability implies local linearity and connuity.

I can understand the Intermediate Value Theorem for derivaves.

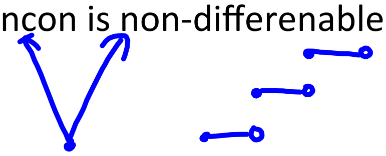
Sep 18-3:22 PM

One Sided Derivaves

A funcon y = f(x) is differenable (the derivave exists) at a point x = c if and only if

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

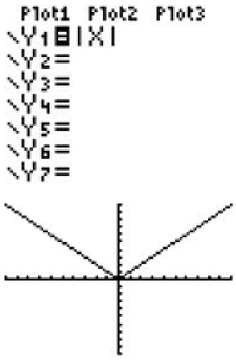
In other words, the slope must be approaching the same thing on the le side as it is on the right side. If there is an abrupt change in the slope at some point x = c, that means that the funcon is non-differenable at that point.

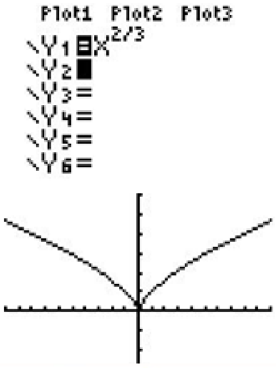


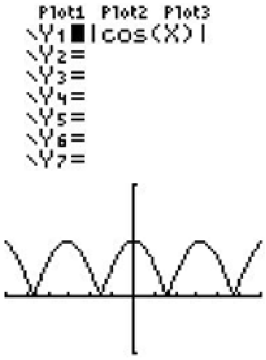
How could a funcon be Non-Differenable?

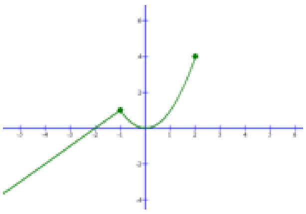
What would it look like?

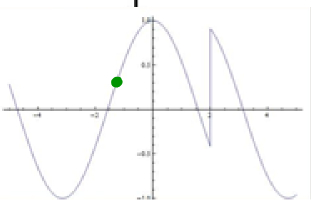
Corners and Cusps

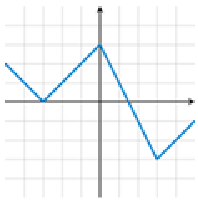






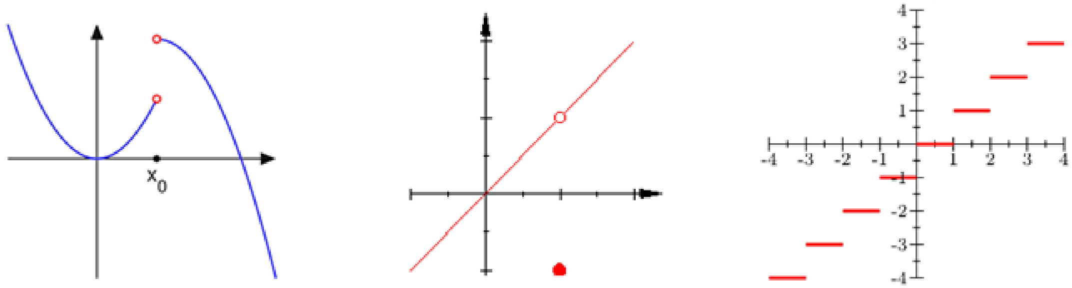






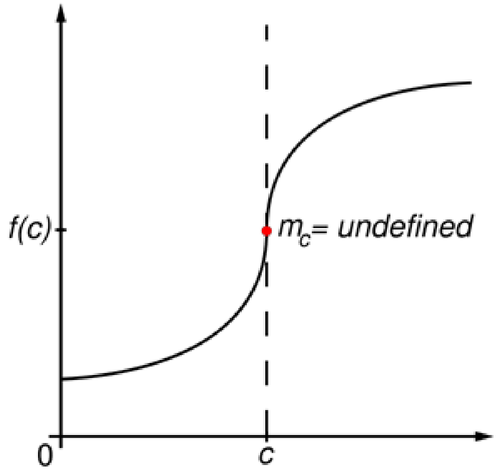
Remember, the derivave is really the slope. The slope is not approaching the same thing on both sides.

Disconnuies



Remember, a derivave is really the slope of a tangent line. If there is no tangent line, there is no slope, there is no derivave.

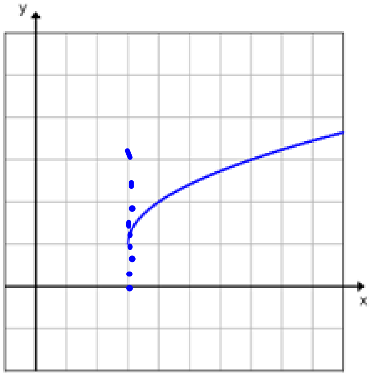
Vercal Tangent Lines

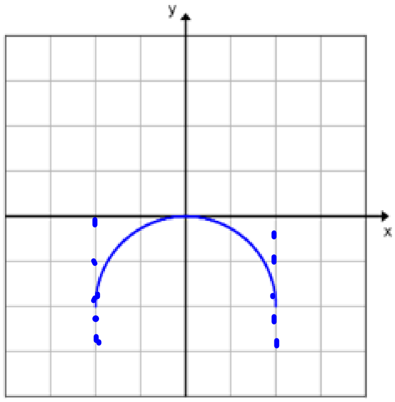


Remember, a derivave is really a slope. A vercal tangent line has an undefined slope hence the derivave is undefined too. This case is different than the others in that there actually is a tangent line at the point in queson – its just that the slope of that tangent line isn't defined.

Sep 18-3:22 PM

Endpoints

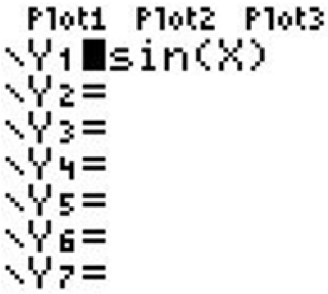


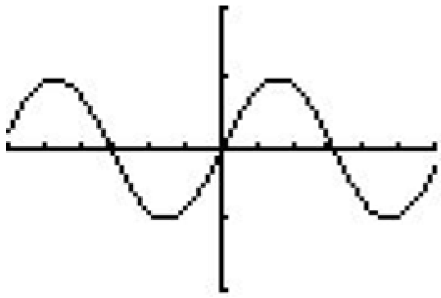


Remember, a derivave is really the slope of a tangent line. If there is no tangent line, there is no slope, there is no derivave. The slope exists on one side but not the other.

Sep 18-3:22 PM

Differenability Implies Local Linearity



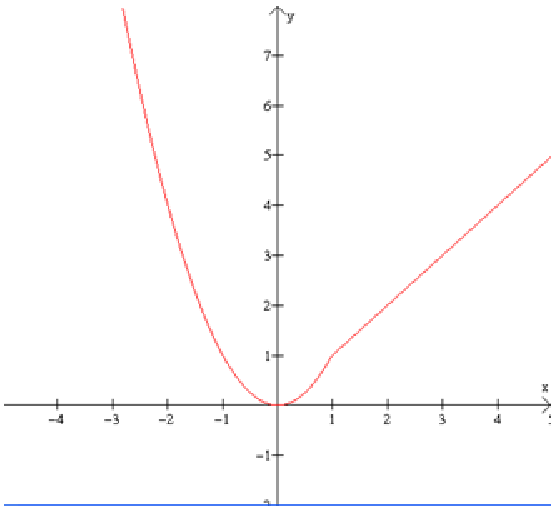


Sep 18-3:22 PM

$$f(x)=\begin{cases} x^2 & if \quad x \le 1 \\ x & if \quad x > 1 \end{cases}$$

$y = x$

$m = 1$



Ex1

a.) Do you think that this funcon is differenable at x = 1? Why or why not?

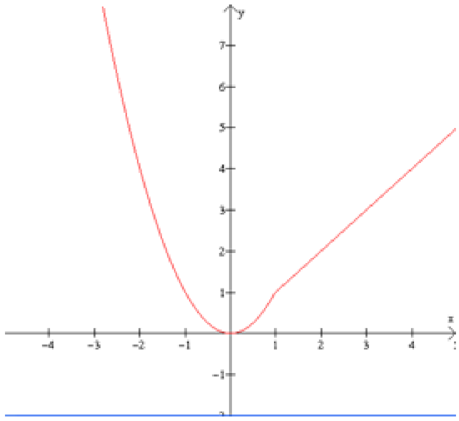
b.) Find the right hand and le hand derivaves at x=1.

$f'(x) = 2x$ at $x=1$

$m = 2$

Since, the slopes are approaching different values on the le and right side of x = 1, the funcon is not differenable at x = 1.

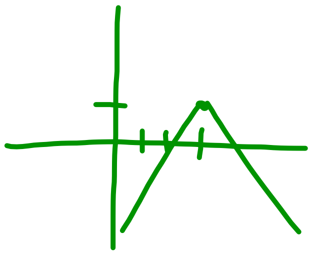
$$f(x) = \begin{cases} x^2 & if \quad x \le 1 \\ x & if \quad x > 1 \end{cases}$$



c.) Make it so that this funcon is differenable at x = 1. You may only change 1 thing in the funcon.

Ex2. Find all points in the domain of f(x) for which f(x) is NOT differenable. Idenfy why the funcon is not differenable at each of these points.

1.) $y = -2|x-3|+1$



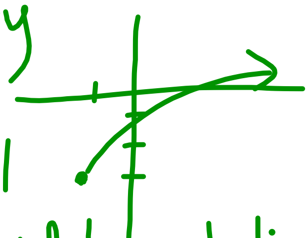
$x = 3$

corner

2.) $f(x) = [\![x]\!]$

not diff. at every integer

jump discontinuity



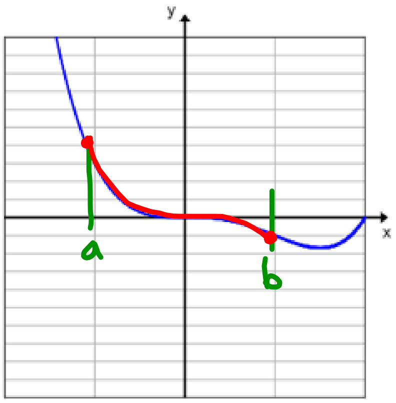
$x = -1$

vertical tangent line

3.) $g(x) = 2\sqrt{x+1} - 3$

Intermediate Value Theorem for Derivaves

If ***a*** and ***b*** are any two points in an interval on which f is differenable, then f’ takes on every value between f’(a) and f’(b) somewhere on the interval .



Sep 18-3:22 PM

Ex3. Graph the derivave of each funcon the graphing calculator

1. $y = x^2$

2.) $y = \sin(x)$

Homework

pg 114 # 1-16, 27-32, 34

Sep 18-3:22 PM