

Starter

$$f(x) = x^3 + 8x^2 + 5x + 4$$

- a) Find the value of $f'(-2)$
- b) Find the value of $f'(0)$
- c) Find the value(s) of x for which $f'(x) = 0$
- d) State whether your x -value(s) in part c are minimums or maximums by graphing $f(x)$ with a window setting of:
- $x_{\min} = -10$
 - $x_{\max} = 10$
 - $x_{\text{sc}} = 1$
 - $y_{\min} = -20$
 - $y_{\max} = 80$
 - $y_{\text{sc}} = 5$
- e) Verify your answers in part c by using the 'calc' features of your calculator.

New Unit starting today

chapter 3 - Applications of ~~Deriv~~
Differentiation.

5 Quizzes (1 each Friday)

1 Unit test

↳ 12 MC. }
2 FRQ's } equally weighted.

Topics/Content you are responsible for

m' → Critical Points to determine
extrema

m'' → Mean Value theorem

m''' → first Derivative & Second Derivative
Tests (to determine types of extrema)

\curvearrowleft → Curve Matching

Major topics summarization is posted
on www.scubamouse.weebly.com

This week

Today \rightarrow 3.1

Critical points & Extrema

Wednesday \rightarrow 3.2

Mean Value Theorem

Friday \rightarrow Quiz 3.1 & 3.2

then A.P. Q's.

Today

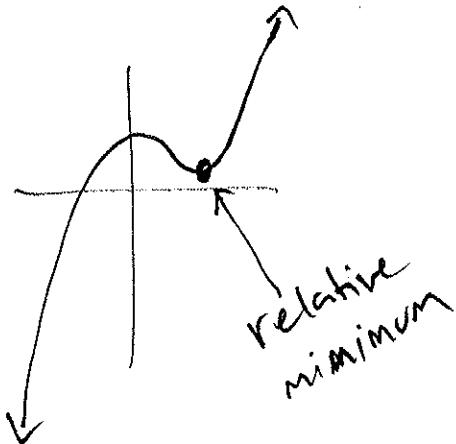
Major Q's to answer/know

- 1) Extrema, what is it?
- 2) Critical points, what are they AND how are they used to find extrema of a function?
- 3) How do I find/determine relative extrema on an open interval?
- 4) How do I find absolute extrema on a closed interval?

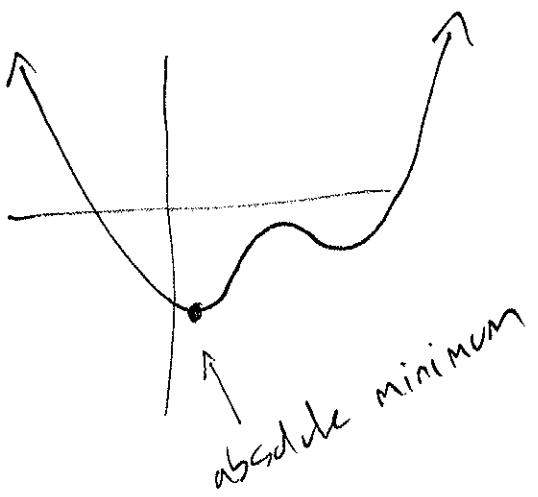
Q11

Extrema \rightarrow (graphical)
the low points and high points of
a function

relative extrema



absolute extrema



example

Find all the relative max and/or min for

$$f(x) = x^3 - 2x^2 - 5x + 6$$

graphically

Max

$$x = -0.786 \text{ or } 2.119$$

Min

$$x = -4.060$$

analytically

$$f'(x) = 3x^2 - 4x - 5$$

$$0 = 3x^2 - 4x - 5$$

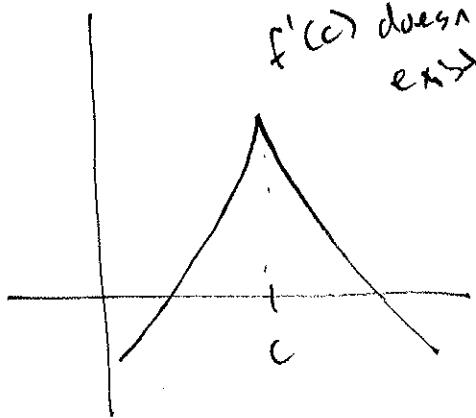
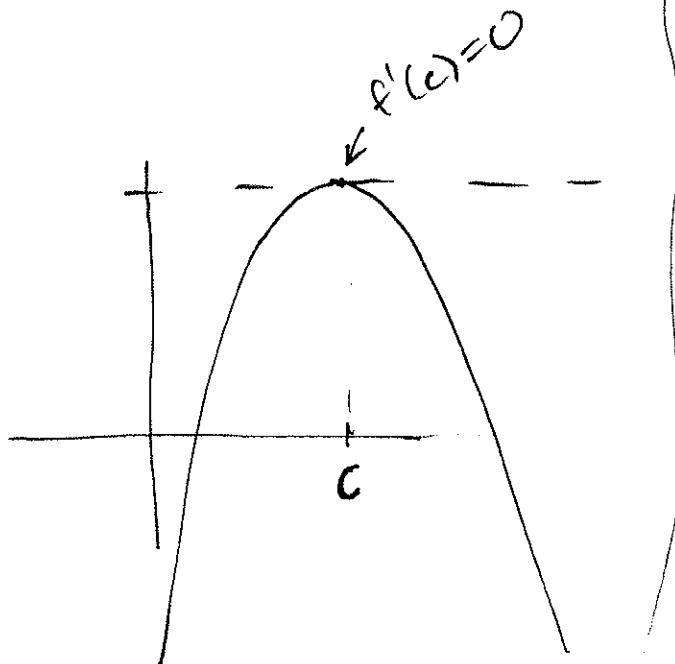
quad
first
b and d's

$$x = \frac{4 \pm \sqrt{16 - -60}}{6}$$

$$x = -0.786 \text{ or } 2.119$$

Q2]

Critical points are the points on a graph where the tangent line has a slope of 0 OR the tangent line can't be computed i.e. the derivative doesn't exist.



Minimums and maximums will only exist at critical points.

examples] State all relative maximums and minimums

a) $g(x) = x^4 - 8x^2$
 $g'(x) = 4x^3 - 16x$
 $g'(x) = 4x(x^2 - 4)$
 $g'(x) = 4x(x-2)(x+2)$

b) $f(x) = \frac{4x}{x^2 + 1}$

critical pts $\left\{ \begin{array}{l} x=0 \text{ max} \\ x=2 \text{ min} \\ x=-2 \text{ min} \end{array} \right.$

~~(extrema)~~
~~Maximums & minimums will only exist or be~~
~~found at critical points.~~

Same examples \Rightarrow More space / easier to follow
Find the critical values

a) $g(x) = x^4 - 8x^2$ b) $f(x) = \frac{4x}{x^2 + 1}$

$$g'(x) = 4x^3 - 16x$$

$$g'(x) = 4x(x^2 - 4)$$

$$= 4x(x-2)(x+2)$$

$$\begin{array}{l} x=0 \\ x=2 \\ x=-2 \end{array} \left. \begin{array}{l} \text{critical} \\ \text{pts} \end{array} \right\}$$

$$f'(x) = \frac{(4)(x^2+1) - 4x(2x)}{(x^2+1)^2}$$

$$= \frac{4x^2 + 4 - 8x^2}{(x^2+1)^2}$$

$$= \frac{-4x^2 + 4}{(x^2+1)^2}$$

$$= \frac{-4(x^2 - 1)}{(x^2+1)^2}$$

$$= \frac{-4(x+1)(x-1)}{(x^2+1)^2}$$

$$\begin{array}{l} x=-1 \\ x=1 \end{array} \left. \begin{array}{l} \text{critical} \\ \text{pts} \end{array} \right\}$$

using calc

min at $x=2$

max at $x=0$

min at $x=-2$

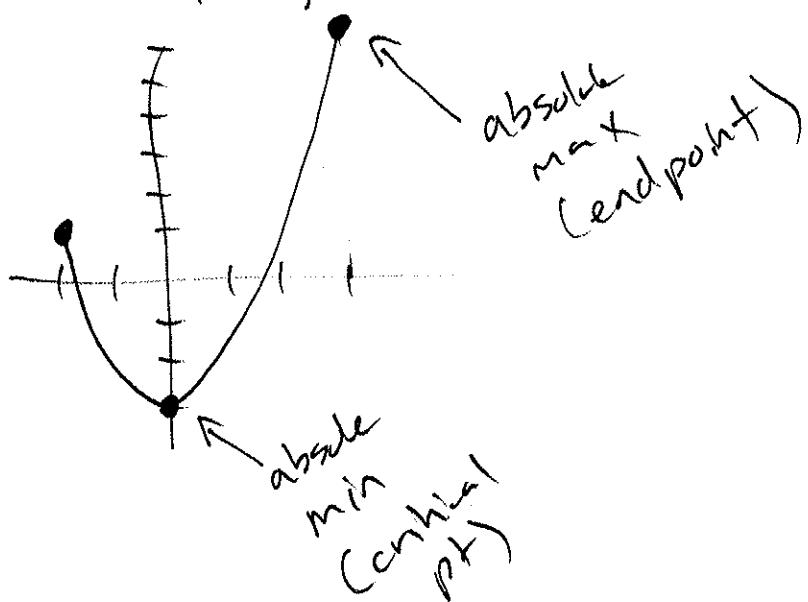
using
calc

$x=-1$ is min
 $x=1$ is max

Q4] Find absolute extrema on a closed interval.

ex] Find the absolute min and max for

$$f(x) = x^2 - 3 \text{ on } [-2, 3]$$



On a closed interval, to determine the absolute extrema.

- 1) Find the critical points
- 2) Compute their \vec{y} -coordinates
- 3) Compute the y -coordinates of the endpoints.
- 4) Compare them.

pg 167
#11-15 odd
#19-29 odd

Closed interval example

#22 on page 167

find absolute mins and max on the interval

$$f(x) = 2x^3 - 6x, \text{ on } [0, 3]$$

crit pts

$$f'(x) = 6x^2 - 6$$

$$0 = \frac{6x^2 - 6}{6}$$

$$0 = x^2 - 1$$

$$0 = (x+1)(x-1)$$

crit pts

$$\cancel{x= -1}$$

$$x = 1$$

