

13 Extreme Values of a Function

1-10

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date per

1. $y = 2x^2 - 8x + 9$

$y' = 4x - 8$

$0 = 4x - 8$

$4x = 8$

$x = 2$

$y(2) = 2(2)^2 - 8(2) + 9$

$= 8 - 16 + 9$

$y = 1$

 $(2, 1)$ is a global min

2. $y = \sqrt{x+1}$

$x \geq -1$

$y(-1) = \sqrt{(-1)+1} = 0$

$y' = \frac{1}{2}(x+1)^{-1/2} = \frac{1}{2\sqrt{x+1}}$

$0 = \frac{1}{2\sqrt{x+1}} \quad 2\sqrt{x+1} = 0$

no soln

 $x = -1$
will make y' undef $(-1, 0)$ is a global minimum

3. $y = \frac{1}{\sqrt[3]{x-1}} = (x-1)^{-1/3}$

$y' = -\frac{1}{3}(x-1)^{-4/3} = -\frac{1}{3\sqrt[3]{(x-1)^4}}$

$0 = y' \quad y' \text{ undef}$

$\text{no soln} \quad 3\sqrt[3]{(x-1)^4} = 0$

$x = 1$

$y(1) = \frac{1}{\sqrt[3]{1-1}} = \text{undef}$

no max or min



4. $y = \frac{x}{x^2+1}$

$y' = \frac{(x^2+1) \cdot 1 - x(2x)}{(x^2+1)^2}$

$0 = \frac{-x^2+1}{(x^2+1)^2}$

$0 = -x^2+1 \quad (x^2+1)^2 = 0$

$x = \pm 1$

no soln

$y(1) = \frac{1}{1^2+1} = \frac{1}{2}$

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

abs. max at $(1, 1/2)$
abs. min at $(-1, -1/2)$

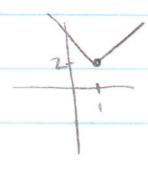
dim
 $y(2) = 2$

5. $y = \begin{cases} 4-2x & x \leq 1 \\ x+1 & x > 1 \end{cases}$

$y(1) = 4 - 2(1) = 2$

$y' = \begin{cases} -2 & x < 1 \\ 1 & x > 1 \end{cases}$

y' DNE when $x=1$



abs min at (1, 2)

6. $y = \begin{cases} 3-x & x < 0 \\ 3+2x-x^2 & x \geq 0 \end{cases}$



$y(0) = 3 + 2(0) - (0)^2 = 3$

$y(1) = 3 + 2(1) - (1)^2 = 4$

$y' = \begin{cases} -1 & x < 0 \\ -2x+2 & x > 0 \end{cases}$

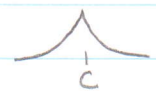
local min @ (0, 3)

local max @ (1, 4)

$y' = 0$
 $-2x+2=0$
 $x=1$

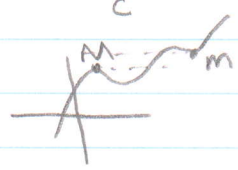
y' DNE
 $x=0$

7. False



$f(c)$ is a max, but $f'(c)$ DNE

8. False



$m > M$

9. f cts, $f' \leq 0$ on $[0, 10]$ $f'(4) = 0$ or DNE

- A) True f only gets lower as $x \rightarrow 10$
- B) True f' does not change from > 0 to < 0 or vice versa
- C) maybe Cp means $f'(4) = 0$ or DNE
- D) maybe " "
- \rightarrow E) False " "

10. A) \checkmark \leftarrow only one

\rightarrow B) $f'(x) = 3x^2 - 6 \rightarrow 3x^2 = 6 \rightarrow x^2 = 2 \rightarrow x = \pm\sqrt{2} \leftarrow 2$ solns

C) $f'(x) = 3x^2 + 6 \rightarrow 3x^2 = -6 \rightarrow x^2 = -2 \rightarrow$ no real solns

D) $f(x)$ has NO extrema

E) $f'(x) = 1 + \frac{1}{x} \neq 0$ has no extrema