



Handout 9

MATH 140 Lab: Section 1

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Note: This handout covers some of the most important problems about differentiation theorems.

Problem 1: Sketch (Graph) for: $y = x^4 - 4x^3 + 10$

① y-intercept ($x=0$)

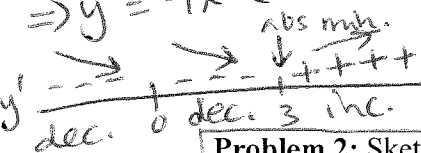
$\Rightarrow y = 10$

x-intercept ($y=0$)

$\Rightarrow 0 = x^4 - 4x^3 + 10 \Rightarrow 0 = x^3(x-4) + 10$
 $\Rightarrow -10 = x^3(x-4) \Rightarrow x = \sqrt[3]{-10}$ or $x - 4 = -10 \Rightarrow x = -6$

② $y' = 4x^3 - 12x^2$

$\Rightarrow y' = 4x^2(x-3) \Rightarrow x = 0$ or $x = 3$



Problem 2: Sketch (Graph) for: $y = x^{4/3} - 4x^{1/3}$

① y-intercept ($x=0$)

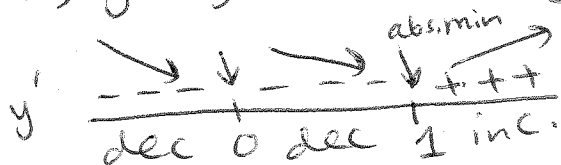
$\Rightarrow y = 0$

x-intercept ($y=0$)

$\Rightarrow 0 = x^{4/3} - 4x^{1/3} \Rightarrow 0 = x^{1/3}(x-4)$
 $x = 0$ or $x = 4$

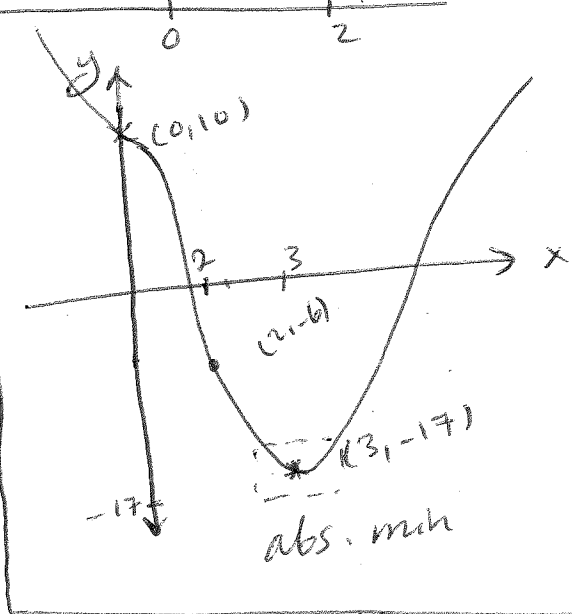
② $y' = \frac{4}{3}x^{1/3} - \frac{4}{3}x^{-2/3}$

$\Rightarrow y' = \frac{4}{3}x^{1/3} - \frac{4}{3x^{2/3}} = \frac{4x-4}{3x^{2/3}}$

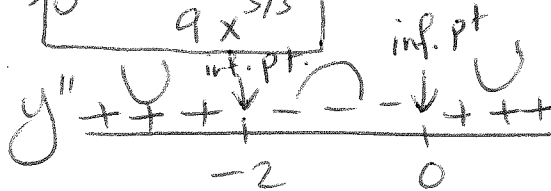


③ $y'' = 12x^2 - 24x$

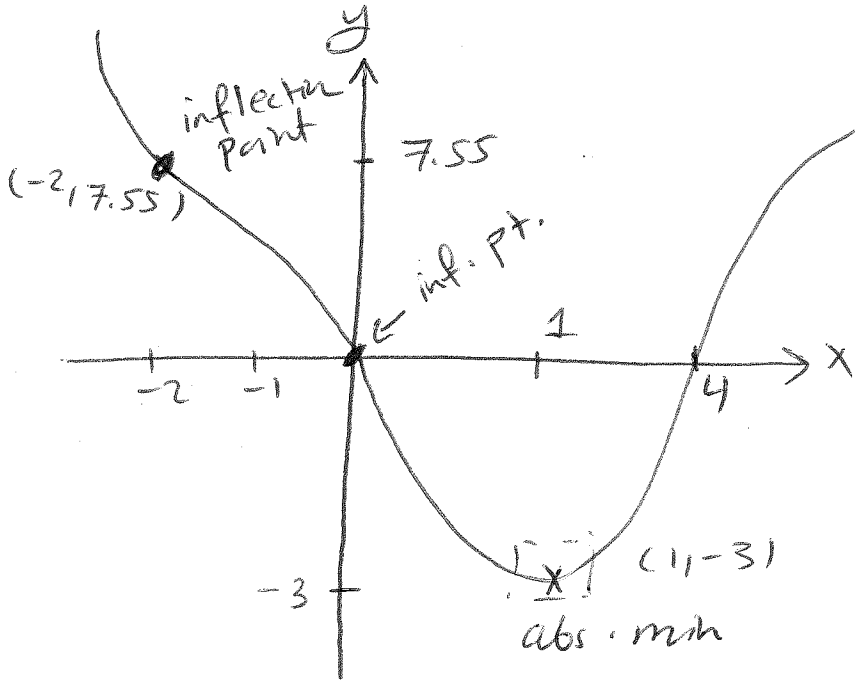
$\Rightarrow y'' = 12x(x-2) \Rightarrow x = 0$ or $x = 2$



③ $y'' = \frac{4}{9}x^{-2/3} + \frac{8}{9}x^{-5/3} = \frac{4}{9x^{2/3}} + \frac{8}{9x^{5/3}}$
 $\Rightarrow y'' = \frac{4x+8}{9x^{5/3}}$



Problem # 2 :



no abs. max