Applications of Derivatives

Math 10A Discussion 7

13 September 2018

I Graphing Functions

1. Suppose $f(3) = 2$, $f'(3) = 1/2$, and $f'(x) > 0$ and $f''(x) < 0$ for all x.
   a) Sketch a possible graph for f.
   b) How many solutions does the equation $f(x) = 0$ have? Why?
   c) Is it possible that $f'(2) = 1/3$? Why?
2. Sketch the graph of the function

$$f(x) = x^{2/3}(6 - x)^{1/3}$$

Hint: Think about domain of f, zeros of f, Critical points of f and f', increasing/decreasing intervals, concavity, inflection points, local max/min, vertical tangents, vertical/horizontal asymptotes.

II Optimization

1. If 1200 cm^2 of material is available to make a box with a square base and an open top, find the largest possible volume of the box.

III L'Hospitals Rule

1. Find the limit using l'Hospital's Rule where appropriate. If LH doesn't apply, explain why.
   a)
$$\lim_{t \to 0} \frac{5^t - 3^t}{t}$$
   b)
$$\lim_{x \to \infty} x^3 e^{-x^2}$$

c)

$$\lim_{x \to \infty} \frac{x}{\sqrt{x^2 + 1}}$$

d)

$$\lim_{x \to \infty} (x - \ln x)$$

2. Use l'Hospital's Rule to help find the asymptotes of f. Then use them, together with information from f' and f'', to sketch the graph of f.

$$f(x) = xe^{-x}$$