

## Week 6 - Review session

Feb. 10, 2016

### Reminder

Midterm today at 6pm in CHEM B150.  
Be there 10-15 minutes earlier.

### What we have learned so far:

- implicit differentiation
- related rates
- critical points
- MVT
- first derivative test

### Example 1.

Assuming that Fig. 1 shows a graph of the derivative of a function  $f$ , which statement is true?

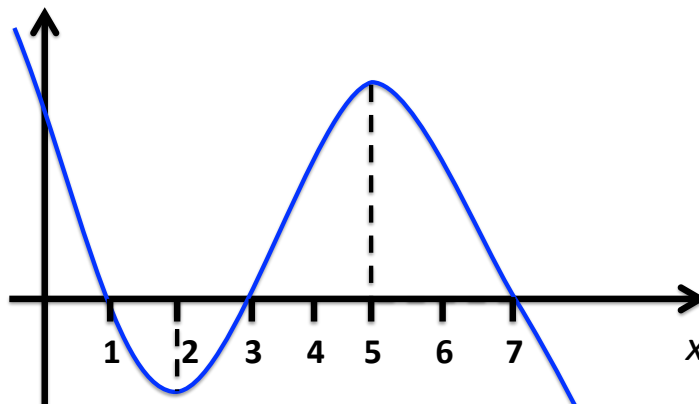


Figure 1

- $f$  has a local min at  $x = 3$  and two local max at  $x = 1$  and  $x = 7$ .
- $f$  has a local min at  $x = 2$  and a local max at  $x = 5$ .
- $f$  has two local min at  $x = 1$  and  $x = 7$  and a local max at  $x = 3$ .
- One can't find the local extrema of  $f$  using Fig. 1 as a graph of  $f'$ .
- None of the above!

**Example 2.**

Given the equation  $x^3y^2 + y^3 \sin(xy) = 0$  find  $\frac{dy}{dx}$ .

**Example 3.**

Find all the critical numbers of  $f(x) = x^{1/3}e^{-3x}$ . Find the local minimum and maximum values of  $f(x)$  if they exist. Identify the intervals where the function is increasing.

**Example 4.**

Assuming that  $f$  and  $f'$  are differentiable for all  $-\infty < x < \infty$  and that  $f'(2) = 3$ ,  $f'(5) = 0$  show that  $f''(c) = -1$  has at least one real solution.

**Example 5.**

Suppose you fill a 5m-long trough with water at a rate of  $2m^3/minute$ . If the cross-section of the trough is in the shape of an isosceles triangle that is 4m wide at the top and 3m high, how fast is the height of the water in the trough increasing when the water is 1m deep?

**Example 6.**

Find all the critical points of the function

$$f(x) = \begin{cases} 2x^3 - 3x^2 - 12x & x \leq 0 \\ e^{-11x}(1-x) - 1 & 0 < x \end{cases}$$