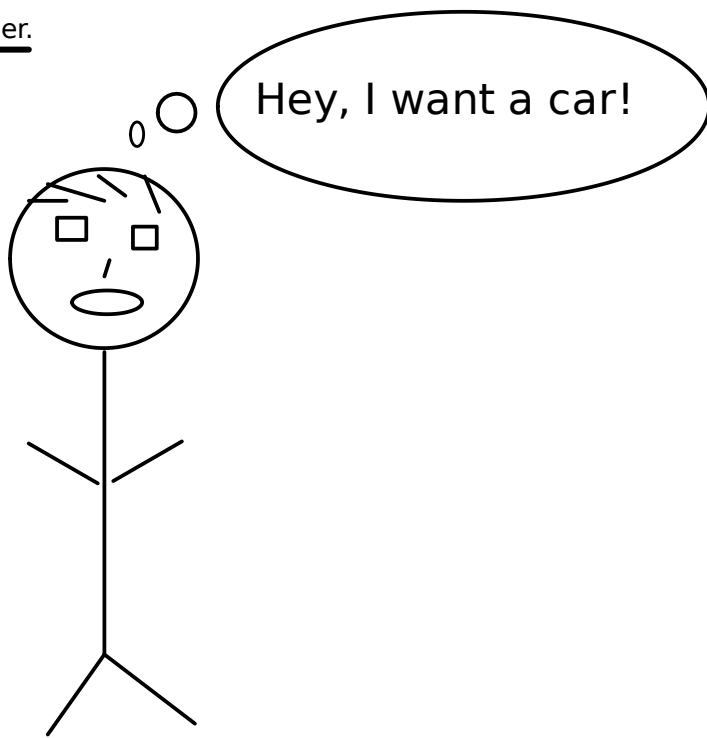


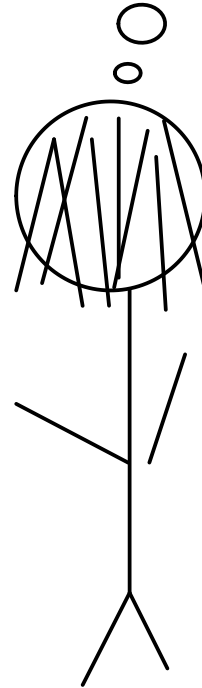
# Chapter 3

## Applications of Derivatives

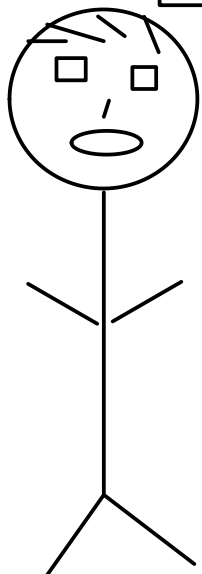
3.8 Newton's Method



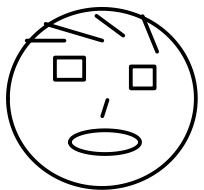
Okay! Here's my offer:  
- \$18,000 new car or;  
- \$375/month for five years



Hmm... If I want to negotiate, I need to find the interest rate he is charging. In this way, I can compare it with the other car dealer that I met yesterday.



Let's do the math.



Annuary:

Equation to solve:

## Roots of polynomials.

- for quadratic polynomial  $f(x) = ax^2 + bx + c$ , the roots are given by:

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{a}$$

- There are formulas for cubics and quartics (horribly long...).
- For polynomials of degree greater than 4, there is no general formula!



Niels Henrik Abel

- 1802-1829
- Died from Tuberculosis

Evariste Galois

- 1811-1832

- Died in a duel for the mysterious mistress...

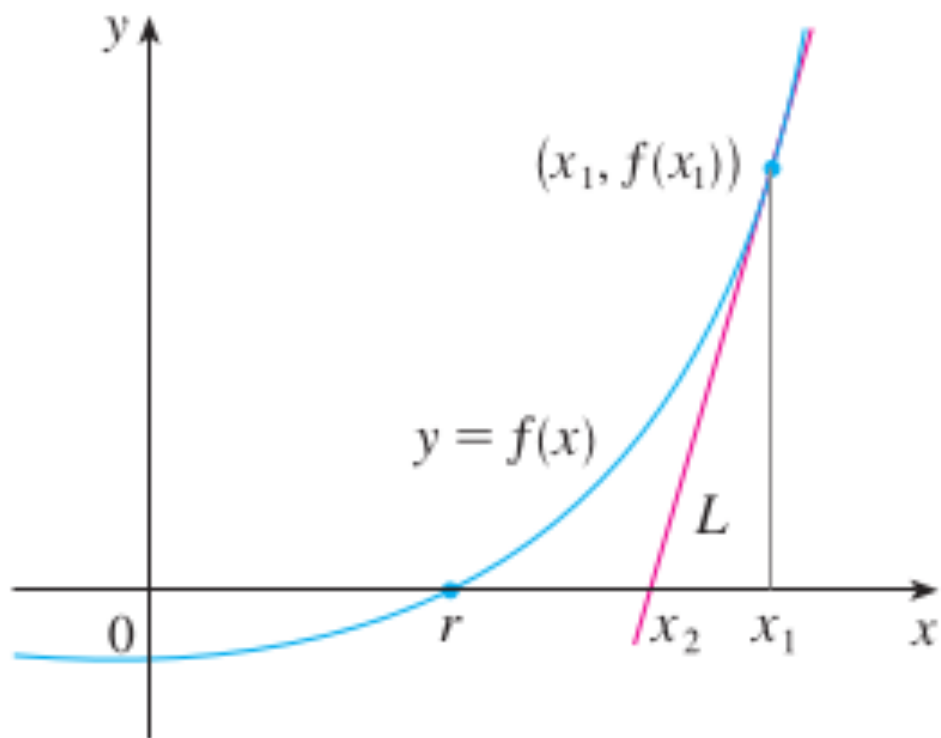


## The urgent need of Newton's method!

### KEY IDEAS:

- The tangent line approximate well the function.
- Replace the function with its tangent line.
- Intersect the tangent line with the x-axis.

Data:



$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

**EXAMPLE 1** Starting with  $x_1 = 2$ , find the third approximation  $x_3$  to the root of the equation  $x^3 - 2x - 5 = 0$ .

# *MANY<sup>MANY</sup> APPLICATIONS!!!*

- Finding solutions to general equations such as

$$\cos(x) = x$$

- At the core of many numerical methods in engineering.