



1 A Hyperbolic Function

Let the function f be defined by

$$f(x) = \begin{cases} x \tanh(x) & \text{for } x \geq 0 \\ ax^2 + bx + c & \text{for } x < 0. \end{cases}$$

Find the constants a, b, c so that f is two times differentiable.

2 Water Tank

A water tank shaped like a cone pointing downwards is 10 metres high. 2 metres above the tip the radius is 1 metre. Water is pouring from the tank into a cylindrical barrel with vertical axis and diameter 8 metres. How fast is the height of the water in the barrel changing when the height of the water in the tank is 4 metres, and is decreasing at a rate of 0.2 metres per second?

3 Fuel Consumption

The fuel consumption of a car, D measured in litres per hour, is related to the velocity v by the following formula

$$D(v) = \frac{e^v + e^{-v}}{2} + \frac{1}{v},$$

where v is measured in litres.

- Find an equation describing the velocity v_0 that gives minimal fuel consumption.
- Use Newton's Method to give an approximated solution the the equation found in a).

4 Newtons Method in Maple

- Prove that the polynomial $p(x) = x^5 + 7x^3 - 20$ has exactly one root in the interval $(1, 2)$.
- Write a script in Maple to implement Newtons Method to find an approximated value for this root. For this and problem c) it may be useful to take a look at [Newton's Method](#)
- Use Maples Student[Calculus]-package to approximate this root. How does the value compare to the one found in b)?