- **CE 603: Numerical Methods**
  HW-6: Due Date: 19th September

1. Find the value of $\sqrt[3]{75}$ to four significant figure accuracy using a four function calculator ($+,\ -,\ \times,\ \div$) with: (i) fixed-point iteration, and (ii) Newton-Raphson method.

2. Write a computer program that finds the first three positive roots of

$$\sin x - \frac{b}{x}\cos x = 0$$

Newton's method. Try it on

$$\tan x - \frac{b}{x} = 0.$$

Explain any differences in behavior. You may use the Matlab code used in the class.

3. The natural frequencies of a uniform caltilever beam are related to the roots β_i of the frequency equation $f(\beta) = \cosh\beta\cos\beta + 1 = 0$, where

$$\beta_i^4 = (2\pi f_i)^2 \frac{m L^3}{E I}$$

$f_i = i$ th natural freqency (cycles/second)
m = mass of the beam
L = length of the beam
E = modulus of elasticity
I = moment of inertia of the cross − section

Determine the lowest two frequencies of a steel beam 0.9 m long, with a rectangular cross-section 25 mm wide and 2.5 mm high. The mass density of steel is 7850 kg/m^3 and $E = 200$ GPa. Note that that moment of inertial of the rectangular beam is $\frac{(\text{width} \times \text{height}^3)}{12}$. Use Ridder's method.

4. The three angles shown in the figure of the four-bar linkage are related by

$$150\cos\theta_1 + 180\cos\theta_2 - 200\cos\theta_3 = 200$$
$$150\sin\theta_1 + 180\sin\theta_2 - 200\sin\theta_3 = 0$$

Determine θ_1 and θ_2 when $\theta_3 = 75^o$. Note that there are two solutions. You may use the `newtonRapson2` Matlab code discussed in the class.