# Root Finding: Bisection Method

Determine the positive real root of:

$$\ln(x^2) = 0.7$$

a) Graphically.

Now we turn to finding the root via the Bisection Method with initial guesses $x_l = 0.5$ and $x_u = 2$.

b) Verify that $x_l = 0.5$ and $x_u = 2$ constitute valid initial guesses.
c) Provide an upper bound on the number of iterations required until the absolute error falls below $|E_t| = 0.05$.
d) Perform 3 iterations of the Bisection Method with initial guesses $x_l = 0.5$ and $x_u = 2$. Fill out the following table:

| **Iteration** | $\boldsymbol{x_l}$ | $\boldsymbol{x_u}$ | $\boldsymbol{x_r}$ | $\boldsymbol{f(x_l)}$ | $\boldsymbol{f(x_u)}$ | $\boldsymbol{f(x_r)}$ | $\boldsymbol{\lvert e_a \rvert}$ (%) | $\boldsymbol{\lvert E_t \rvert}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.5 | 2 | | | | | - | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |

Recall that $\boldsymbol{|e_a| = 100\% * \left|\frac{present - previous}{present}\right|}$ and $\boldsymbol{|E_t| = |true\ - approx|}$. For this problem, $x_{true} = 1.41907$.