Drawbacks of bisection method

a) The convergence of the bisection method is slow as it is simply based on halving the interval.
b) If one of the initial guesses is closer to the root, it will take larger number of iterations to reach the root.
c) If a function $f(x)$ is such that it just touches the x-axis (Figure 6) such as

$$f(x) = x^2 = 0$$

it will be unable to find the lower guess, x_ℓ, and upper guess, x_u, such that

$$f(x_\ell)f(x_u) < 0$$

d) For functions $f(x)$ where there is a singularity[1] and it reverses sign at the singularity, the bisection method may converge on the singularity (Figure 7). An example includes

$$f(x) = \frac{1}{x}$$

where $x_\ell = -2$, $x_u = 3$ are valid initial guesses which satisfy

$$f(x_\ell)f(x_u) < 0$$

However, the function is not continuous and the theorem that a root exists is also not applicable.

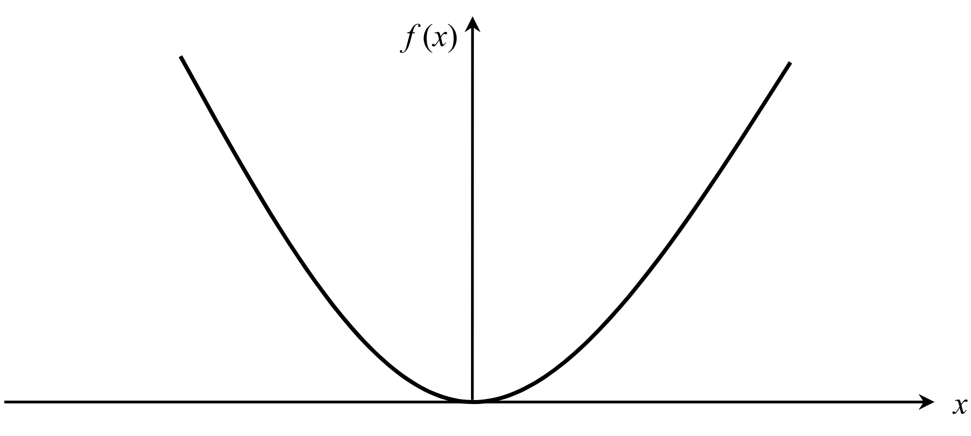

Figure 6 The equation $f(x) = x^2 = 0$ has a single root at $x = 0$ that cannot be bracketed.

[1] A singularity in a function is defined as a point where the function becomes infinite. For example, for a function such as $1/x$, the point of singularity is $x = 0$ as it becomes infinite.

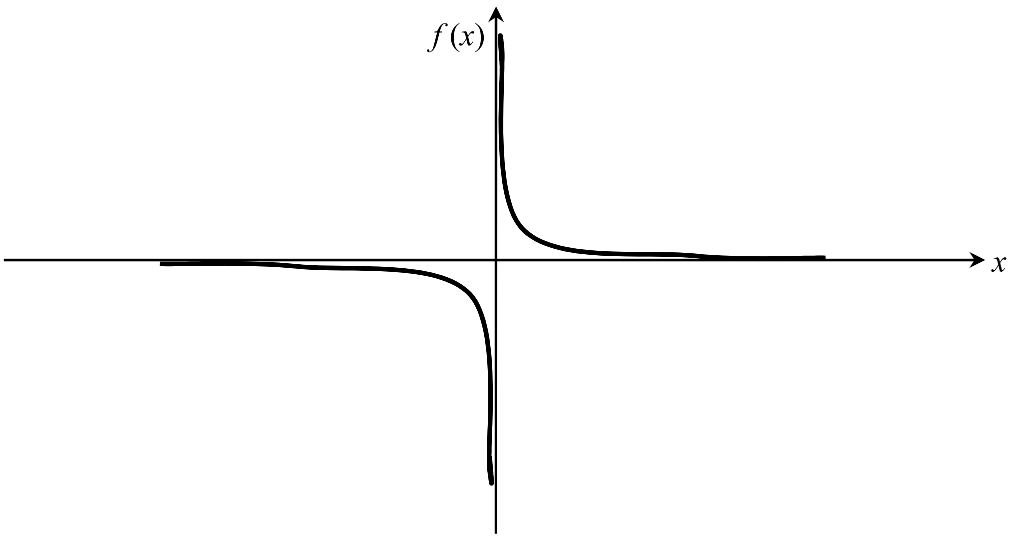

Figure 7 The equation $f(x)=\frac{1}{x}=0$ has no root but changes sign.