Signal Processing and Analysis
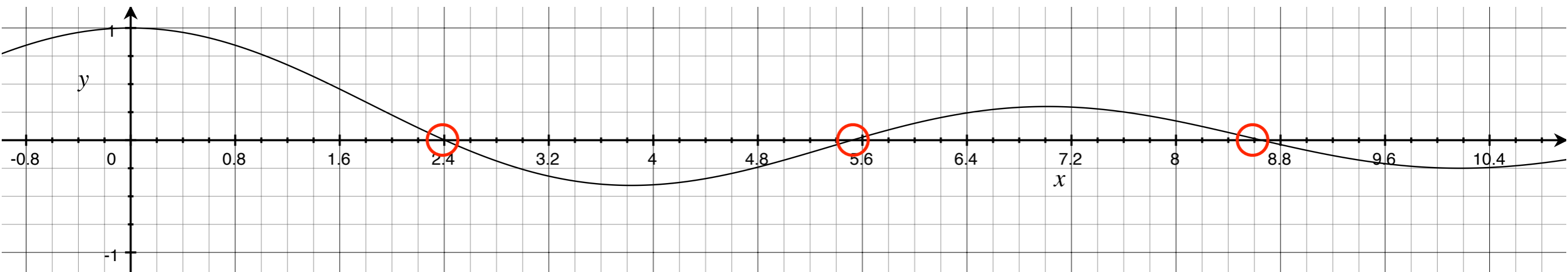
Homework 1

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October 18, 2016

Solution of equations by iteration

Solve $J_0(x) = 0$ by fixed-point iteration, Newton's method, secant method, and bisection method within $0 \le x \le 10$ and compare the results.

$$J_n(x) = x^n \sum_{m=0}^{\infty} \frac{(-1)^m x^{2m}}{2^{2m+n} m!(n+m)!}$$

Bisection method

This simple but slowly convergent method for finding a solution of $f(x) = 0$ with continuous f is based on the **intermediate value theorem**, which states that if a continuous function f has opposite signs at some $x = a$ and $x = b(> a)$, that is, either $f(a) < 0, f(b) > 0$ or $f(a) > 0, f(b) < 0$, then f must be 0 somewhere on $[a, b]$. The solution is found by repeated bisection of the interval and in each iteration picking that half which also satisfies that sign condition.