

1. In finding a root with Newton's method, an initial guess of $x_0 = 4$ with $f(x_0) = 1$ leads to $x_1 = 3$. What is the derivative of f at x_0 ?

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} \rightarrow 3 = 4 - \frac{1}{f'(x_0)}$$

$$\rightarrow \frac{1}{f'(x_0)} = 1$$

$$\rightarrow f'(x_0) = 1.$$

2. Can the bisection method be used to find the roots of the function $f(x) = \sin(x) + 1$? Why or why not? Can Newton's method be used to find the roots? If so, what will be the order of convergence and why?

Bisection cannot be used since $\sin(x) + 1$ does not cross the x -axis.

Newton's method surely can be used. Since $f'(x) = \cos(x)$ at $f'(x) = 0$ at the same locations that $f(x) = 0$, the order of convergence must be ~~quadratic~~ linear.