STAA 567: HW 1

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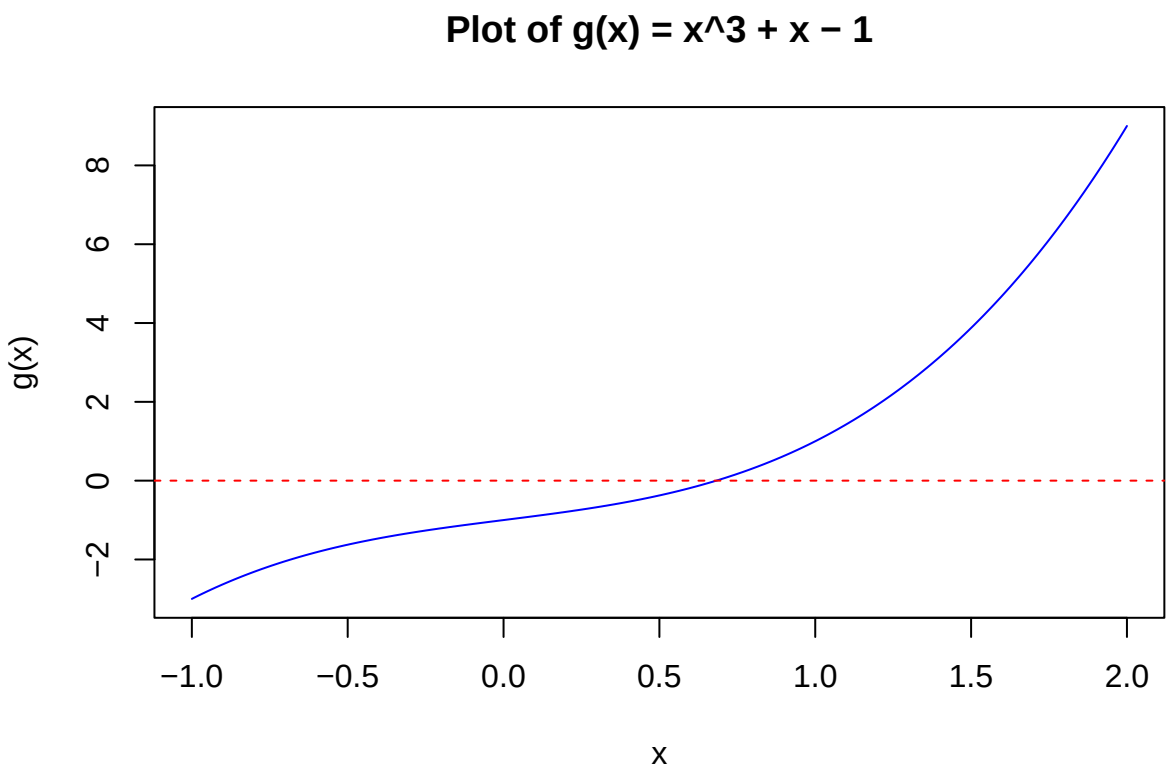
Q1A



Q1B

```
## Estimated root: 0.6822

## Number of iterations: 5
```

Q1C

```
## Estimated root: 0.6821

## Number of iterations: 10
```

Q1D

```
## Derivative of g(x): g'(x) = 3x^2 + 1

## Estimated root: 0.6823

## Number of iterations: 5
```

Appendix

```
#Retain this code chunk!!!
library(knitr)

#tinytex::install_tinytex()


knitr::opts_chunk$set(echo = FALSE)
knitr::opts_chunk$set(message = FALSE)
knitr::opts_chunk$set(warning = FALSE)
#Q1A

g <- function(x) {
  x^3 + x - 1
}

x_values <- seq(-1, 2, length.out = 1000)

y_values <- g(x_values)


plot(x_values, y_values, type = "l", col = "blue",
     main = "Plot of g(x) = x^3 + x - 1",
     xlab = "x", ylab = "g(x)")


abline(h = 0, col = "red", lty = 2)

#Q1B

result <- uniroot(g, interval = c(0, 1), tol = 0.001)

estimated_root <- result$root
iterations <- result$iter


cat("Estimated root:", round(estimated_root, 4), "\n")
cat("Number of iterations:", iterations, "\n")

#Q1C
a <- 0
b <- 1
```

```r
tolerance <- 0.001
iterations <- 0

while ((b - a) >= tolerance) {
  iterations <- iterations + 1
  c <- (a + b) / 2
  if (g(a) * g(c) < 0) {
    b <- c
  } else {
    a <- c
  }
}

estimated_root <- (a + b) / 2

cat("Estimated root:", round(estimated_root, 4), "\n")
cat("Number of iterations:", iterations, "\n")
#Q1D

g_prime <- function(x) {
  3 * x^2 + 1
}

x_old <- 0
tolerance <- 0.001
iterations <- 0

repeat {
  iterations <- iterations + 1
  x_new <- x_old - g(x_old) / g_prime(x_old)
  if (abs(x_new - x_old) < tolerance) {
    break
  }
  x_old <- x_new
}

cat("Derivative of g(x): g'(x) = 3x^2 + 1\n")
cat("Estimated root:", round(x_new, 4), "\n")
cat("Number of iterations:", iterations, "\n")
```