STA5075: Practical 4

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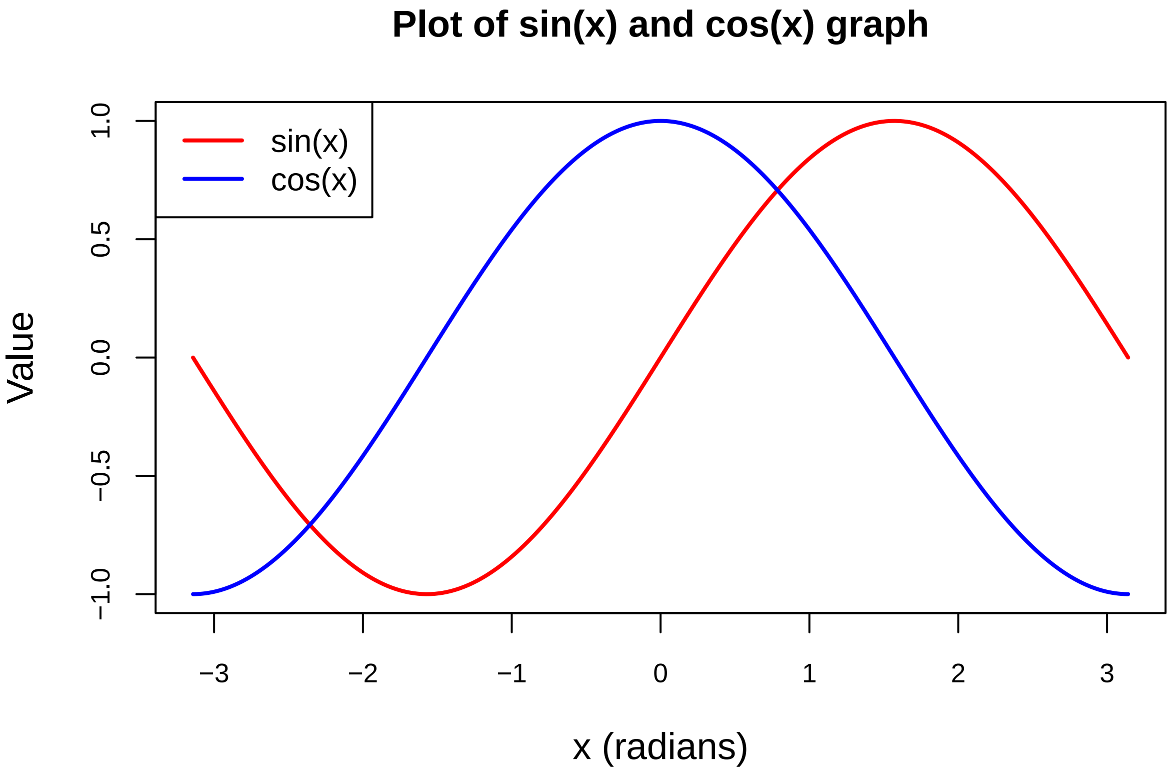
Create a smooth version of the above sin function: increase the number of x-values at which f(x) is evaluated, e.g to 1000. Your final plot should:

- Plot the line directly, without points first. Increase line width, and change colour to red.
- Add the cos(x) line to the same plot, in blue.
- Improve the general look of the figure.

```r
x <- seq(-pi, pi, length = 1000) # vector of 10 values between -pi
y <- sin(x) # sin(x) for each x value
y2 <- cos(x) # cos(x) for each x value

# plot sin(x) graph
plot(y ~ x,
     type = "l", # line plot
     col = "red", # colour of line = red
     main = "Plot of sin(x) and cos(x) graph", # add a title
     xlab =  "x (radians)",
     ylab = "Value",
     cex.axis = 0.8,
     cex.lab = 1.2,
     lwd =2
)
lines(x, y2, col = "blue", lwd =2 ) # add cos(x) points to existing graph
legend("topleft", legend = c("sin(x)", "cos(x)"),
       col = c("red", "blue"), lty = 1, lwd = 2)
```


Plot of sin(x) and cos(x) graph
sin(x)
cos(x)
Value
1.0
0.5
0.0
−0.5
−1.0
−3
−2
−1
0
1
2
3
x (radians)

- What would happen if the x's were a random uniform sample between -pi and pi? Try

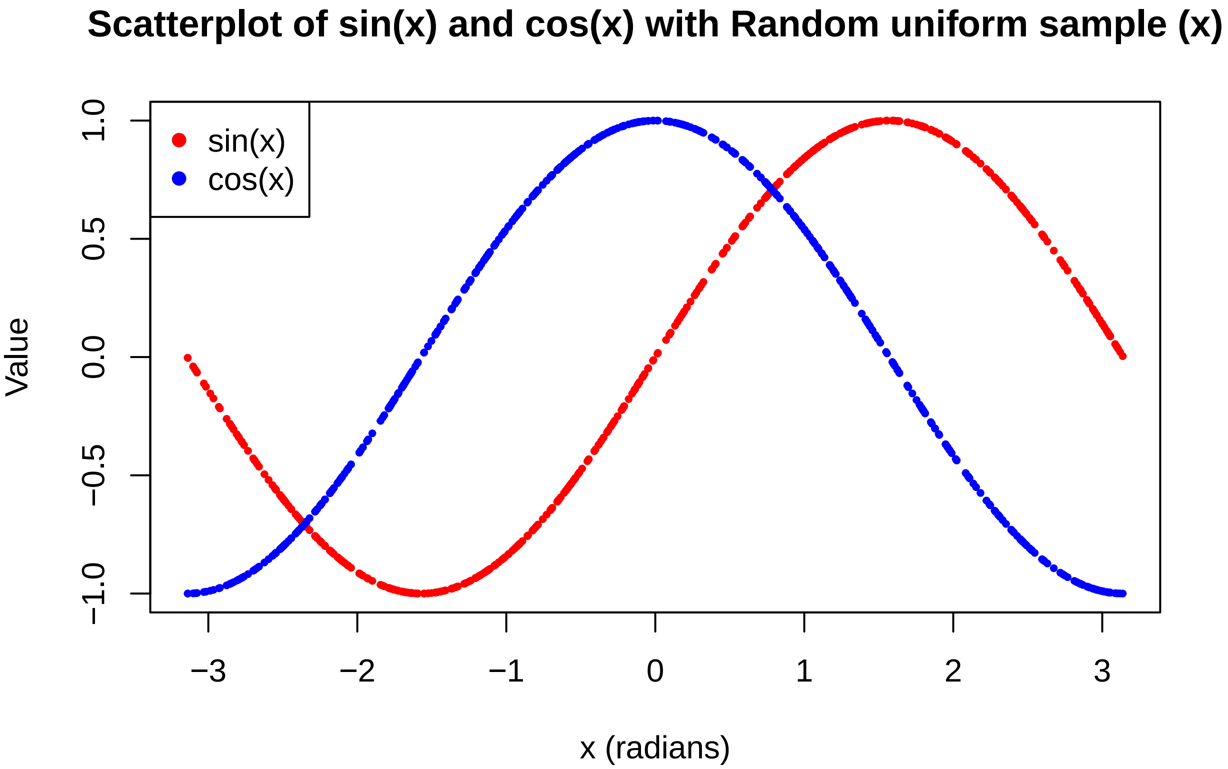
```r
set.seed(123)

x_random <- runif(500, min = -pi, max = pi)
y_random <- sin(x_random)
y2_random <- cos(x_random)

# Plot sin(x)
plot(x_random, y_random,
     col = "red",
     cex = 0.6,
     pch = 20,
     main = "Scatterplot of sin(x) and cos(x) with Random uniform sample (x)",
     xlab = "x (radians)",
     ylab = "Value")

# add cos(x) points
points(x_random, y2_random, col = "blue", pch = 20, cex = 0.6)

# Add legend
legend("topleft",
       legend = c("sin(x)", "cos(x)"),
       col = c("red", "blue"),
       pch = 16)
```



We notice that the distribution is the same, and if we were to increase the number of randomly sampled values in the `runif` function then we would get a more continuous, smooth line (since we have more data points) and it will begin to resemble that of the first cos(x) and sin(x) graphs produced.