library(latex2exp)  
### 1  
### a  
exponential\_distribution <- function(x, theta) {  
 ifelse(x >= 0,  
 theta \* exp(-theta \* x),  
 0)  
}  
  
xs <- seq(-1, 5, length.out = 1e4)  
ys <- exponential\_distribution(x = xs, theta = 1)  
  
thetas <- seq(0.5, 1.5, length.out = 3)  
y\_vec <- sapply(X = thetas, FUN = function(x)  
 exponential\_distribution(x = xs, theta = x))  
  
plot(xs, y\_vec[,3], type = 'l',  
 main = TeX('$p(x|\\theta)\\;vs.\\;x,\\;\\theta =0.5,1,1.5\\;x=\\[-1,\\;5\\]$'),  
 xlab = TeX('$x$'), ylab = TeX('$p(x|\\theta)$'))  
lines(xs, y\_vec[,2], col = 'red'); lines(xs, y\_vec[,1], col = 'blue')  
points(0, 0, pch=1)  
points(0, 0.5, pch=19)  
points(0, 1, pch=19)  
points(0, 1.5, pch=19)  
legend("topright",  
 legend = c(TeX('$\\theta =1.5$'), TeX('$\\theta =1$'), TeX('$\\theta =0.5$')),  
 col = c("black", "red", "blue"), lty = rep(1,3))  
### b  
thetas <- seq(0, 5, length.out = 1e4)  
exp\_dist\_vec <- Vectorize(exponential\_distribution, vectorize.args = "theta")  
  
y\_vec <- sapply(X = seq(1,3,length.out = 3), FUN = function(x)  
 exp\_dist\_vec(x = x, theta = thetas))  
  
plot(thetas, y\_vec[,1], type = 'l',  
 main = TeX('$p(x|\\theta)\\;vs.\\;\\theta,\\;\\theta = (0,\\;5\\],\\;x=1, 2, 3$'),  
 xlab = TeX('$\\theta$'), ylab = TeX('$p(x|\\theta)$'))  
lines(thetas, y\_vec[,2], col = 'red')  
lines(thetas, y\_vec[,3], col = 'blue')  
points(0, 0, pch=1)  
legend("topright", legend = c(TeX('$x=1$'), TeX('$x=2$'), TeX('$x=3$')),  
 col = c('black', 'red', 'blue'), lty = rep(1,3))  
  
### 2  
### a  
uniform\_distribution <- function(x, theta) {  
 ifelse((0<=x) & (x<=theta),  
 1 / theta,  
 0)  
}  
  
# xs <- seq(-1, 6, length.out = 1e4)  
# ys <- uniform\_distribution(x = xs, theta = 5)  
# plot(xs, ys, type = 'l')  
# points(0, 0, pch=1); points(0, 0.2, pch=16)  
# points(5, 0, pch=1); points(5, 0.2, pch=16)  
  
thetas <- seq(2, 10, length.out = 1e4)  
ys1 <- uniform\_distribution(x = 3, theta = thetas)  
ys2 <- uniform\_distribution(x = 5, theta = thetas)  
ys3 <- uniform\_distribution(x = 7, theta = thetas)  
  
y\_vec <- sapply(X = seq(1,3,length.out = 3), FUN = function(x)  
 uniform\_distribution(x = x, theta = thetas))  
  
plot(thetas, ys1, type = 'l',  
 main = TeX('$p(x|\\theta)\\;vs.\\;\\theta,\\;\\theta = \\[2,\\;10\\],\\;x=3,5,7$'),  
 xlab = TeX('$\\theta$'), ylab = TeX('$p(x|\\theta)$'))  
lines(thetas, ys2, col = 'red')  
lines(thetas, ys3, col = 'blue')  
points(3, 0, pch=1); points(3, max(ys1), pch=19)  
points(5, 0, pch=1); points(5, max(ys2), pch=19)  
points(7, 0, pch=1); points(7, max(ys3), pch=19)  
legend("topright", legend = c(TeX('$x=3$'), TeX('$x=5$'), TeX('$x=7$')),  
 col = c('black', 'red', 'blue'), lty = rep(1,3))