Continuous Distributions: Normal and Gamma

Contents

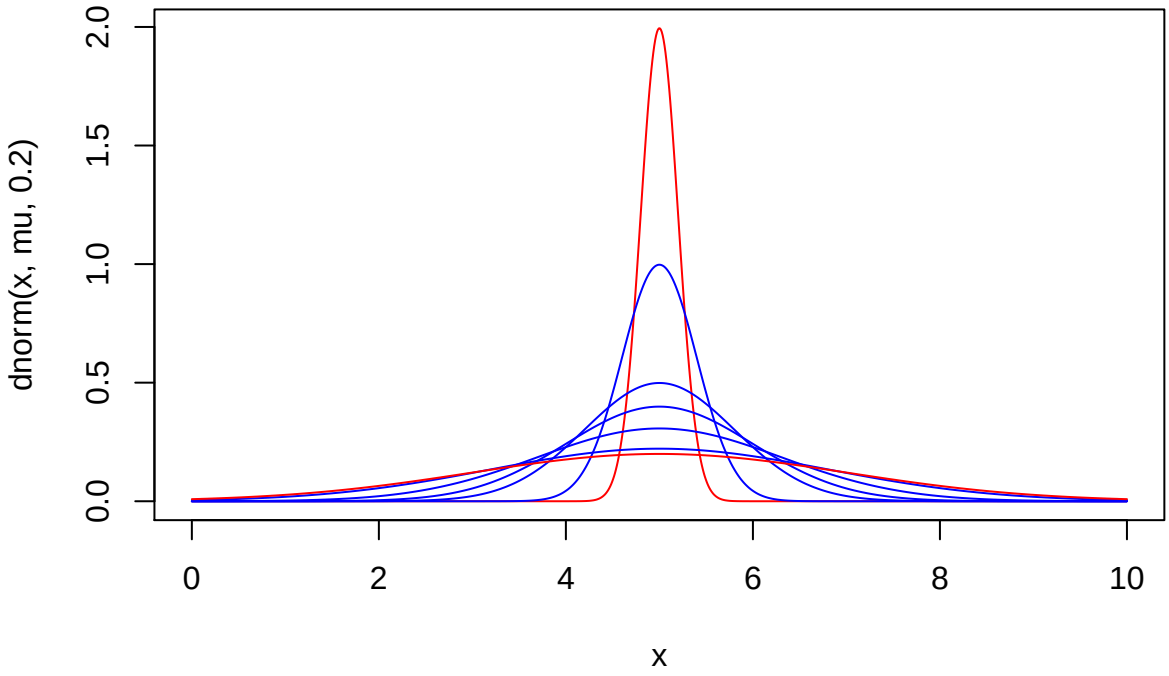
Normal Distibution

In this section we will explore the normal distribution.

Fixed mean, varying standard deviation

Set $\mu = 5$. For values of σ given by $0.2, 0.4, 0.8, 1, 1.3, 1.8, 2$, plot the densities of $N(\mu, \sigma)$ in the same plot. It might help if (1) you have the densities of $N(\mu = 5, \sigma = 0.2)$ and $N(\mu = 5, \sigma = 2)$ to be blue in color and the rest to be red. (2) choose appropriate limits for the x-axis (use x_lim parameter in the plot funtion) and y-axis (use y_lim).

```
mu <- 5
x <- seq(0, 10, length.out=1000)
plot(x, dnorm(x, mu, 0.2), type="l", col="red")
lines(x, dnorm(x, mu, 0.4), col="blue")
lines(x, dnorm(x, mu, 0.8), col="blue")
lines(x, dnorm(x, mu, 1), col="blue")
lines(x, dnorm(x, mu, 1.3), col="blue")
lines(x, dnorm(x, mu, 1.8), col="blue")
lines(x, dnorm(x, mu, 2), col="red")
```

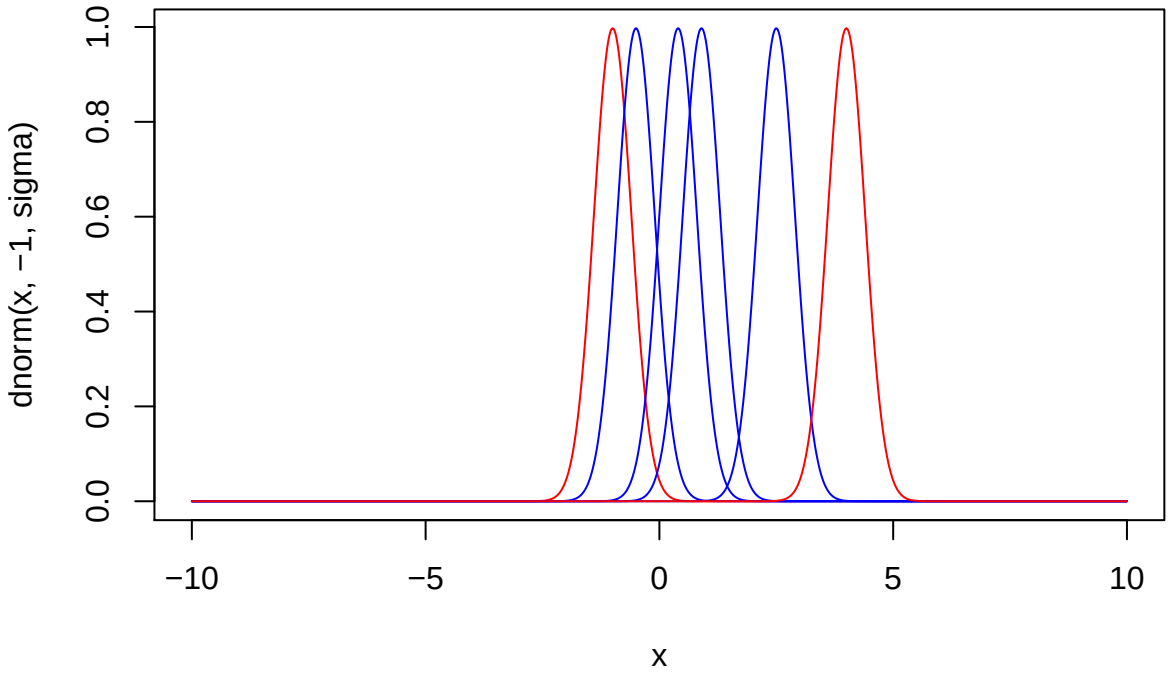


What do you notice about the plot? Comment about how the width changes. Answer: the larger SD is, the wider the plot is. The maximum value of the function also gets higher the smaller SD is.

Varying mean, fixed standard deviation

Set $\sigma = 0.4$. For values of μ given by $-1, -0.5, 0, 0.4, 0.9, 2.5, 4$ plot the densities of $N(\mu, \sigma)$ in the same plot. You might need to choose appropriate limits for the x-axis.

```
sigma <- 0.4
x <- seq(-10, 10, length.out=1000)
plot(x, dnorm(x, -1, sigma), type="l", col="red")
lines(x, dnorm(x, -0.5, sigma), col="blue")
lines(x, dnorm(x, 0.4, sigma), col="blue")
lines(x, dnorm(x, 0.9, sigma), col="blue")
lines(x, dnorm(x, 2.5, sigma), col="blue")
lines(x, dnorm(x, 4, sigma), col="red")
```



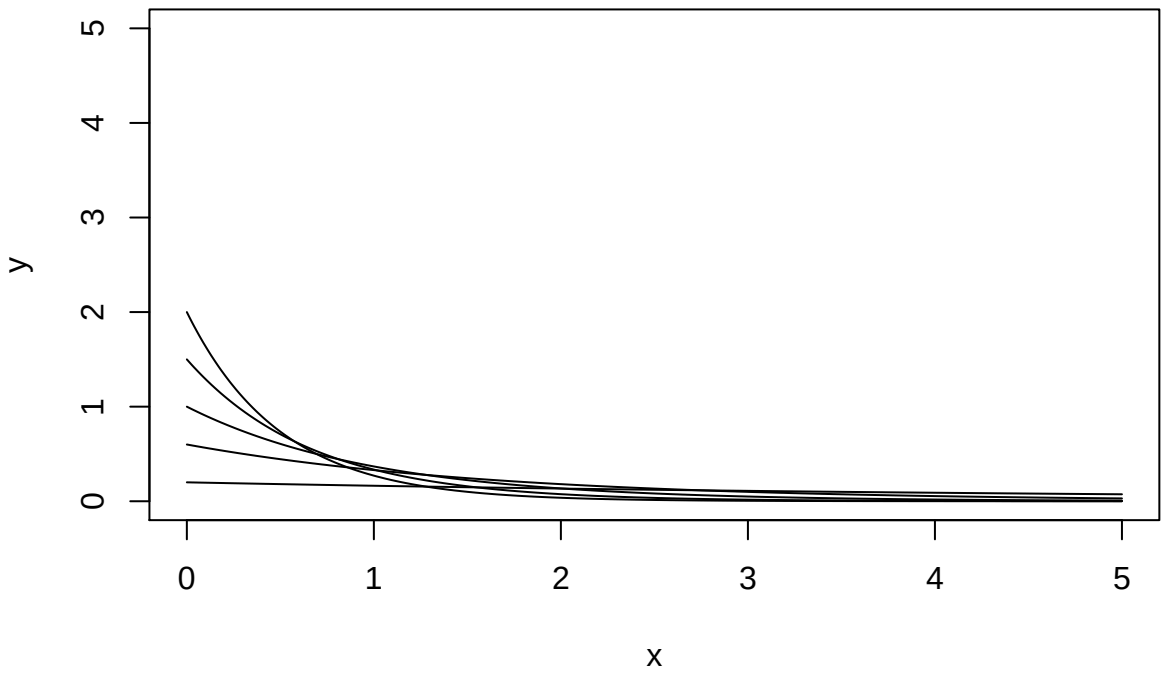
Gamma Distibution

We will plot the Gamma distibution for different shapes and scales. You might need to adjust the limits of x and y axes appropriately.

$\alpha = 1$, varying scales

Set $\alpha = 1$, vary β over $0.2, 0.6, 1, 1.5, 2$. Plot the densities of $Gamma(\alpha, \beta)$ in a single plot.

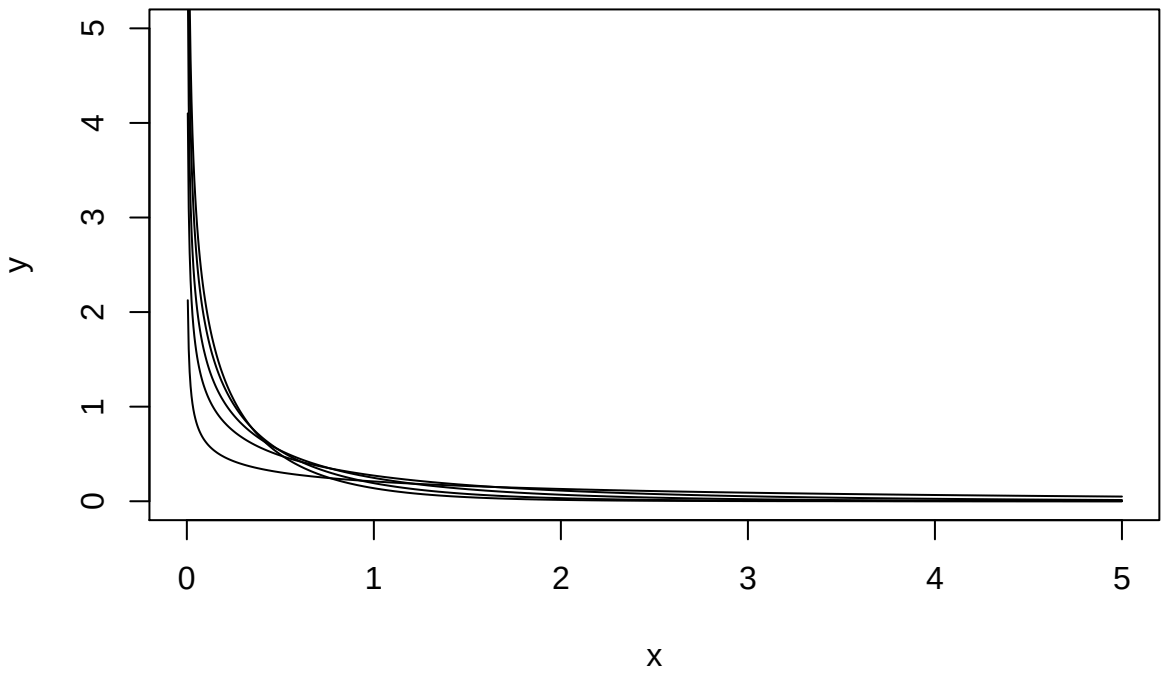
```
alpha <- 1
betas <- c(0.2, 0.6, 1, 1.5, 2)
x <- seq(0, 5, length.out=1000)
plot(1, type="n", xlab="x", ylab="y", xlim=c(0, 5), ylim=c(0, 5))
for (beta in betas) {
  lines(x, dgamma(x, alpha, beta))
}
```



$\alpha = 0.6$, varying scales

Set $\alpha = 0.6$, vary β over $0.2, 0.6, 1, 1.5, 2$. Plot the densities of $Gamma(\alpha, \beta)$ in a single plot.

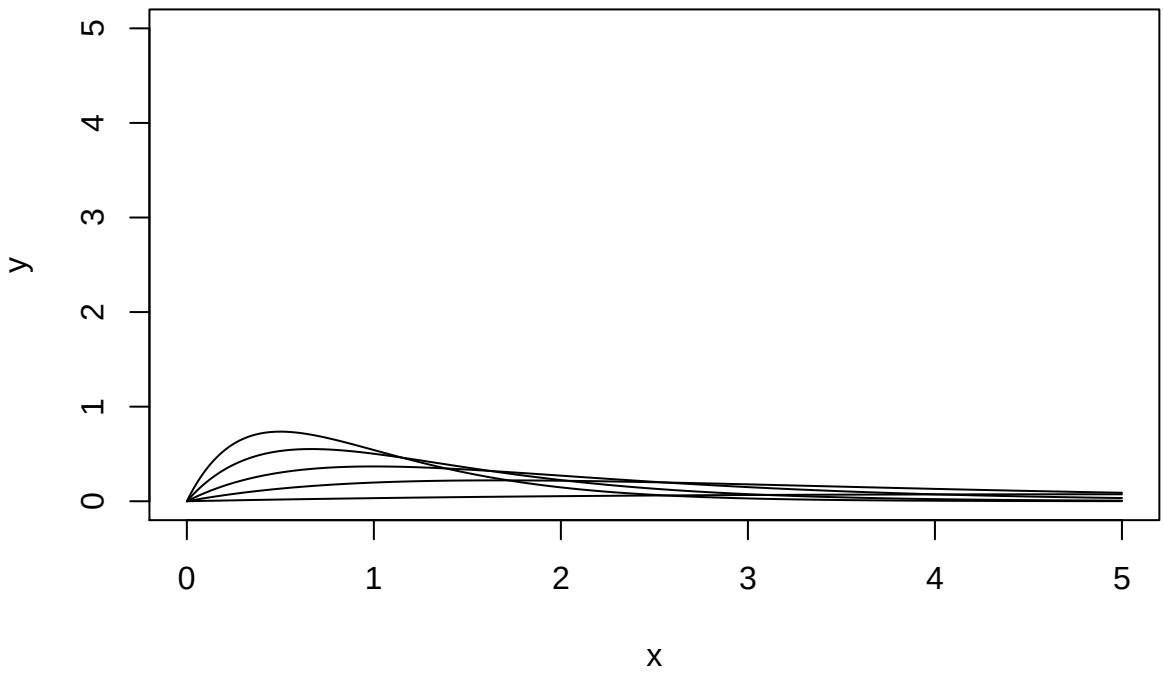
```
alpha <- 0.6
betas <- c(0.2, 0.6, 1, 1.5, 2)
x <- seq(0, 5, length.out=1000)
plot(1, type="n", xlab="x", ylab="y", xlim=c(0, 5), ylim=c(0, 5))
for (beta in betas) {
  lines(x, dgamma(x, alpha, beta))
}
```



$\alpha = 2$, varying scales

Set $\alpha = 2$, vary β over $0.2, 0.6, 1, 1.5, 2$. Plot the densities of $Gamma(\alpha, \beta)$ in a single plot.

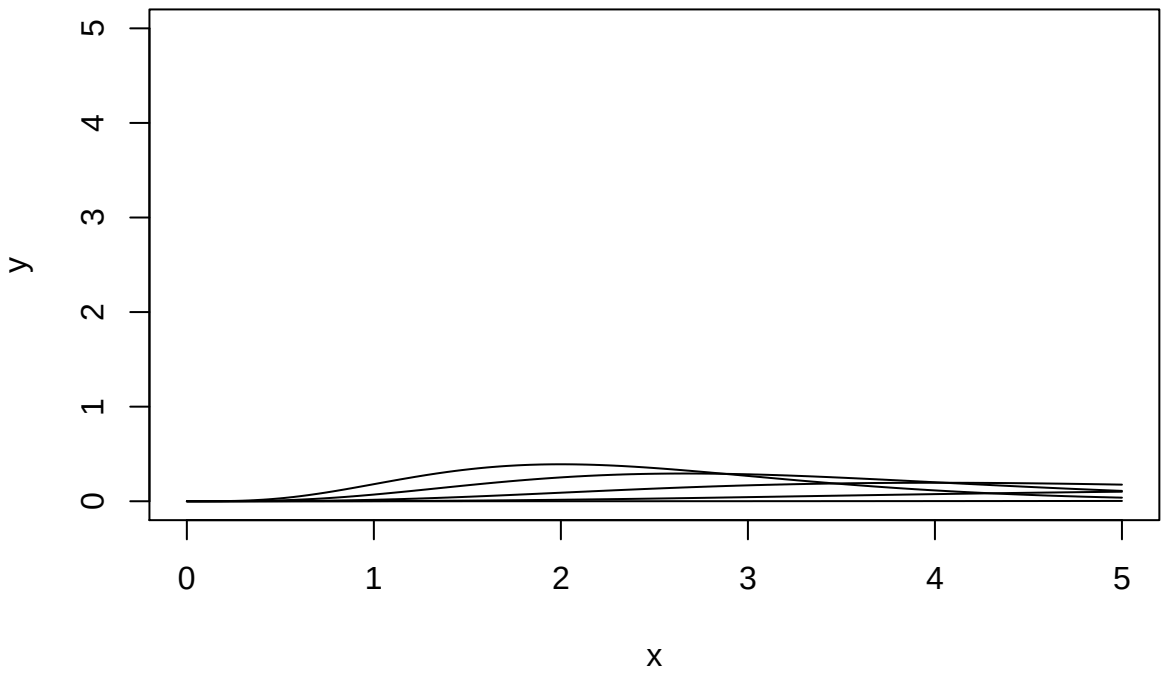
```
alpha <- 2
betas <- c(0.2, 0.6, 1, 1.5, 2)
x <- seq(0, 5, length.out=1000)
plot(1, type="n", xlab="x", ylab="y", xlim=c(0, 5), ylim=c(0, 5))
for (beta in betas) {
  lines(x, dgamma(x, alpha, beta))
}
```



$\alpha = 5$, varying scales

Set $\alpha = 5$, vary β over $0.2, 0.6, 1, 1.5, 2$. Plot the densities of $Gamma(\alpha, \beta)$ in a single plot.

```
alpha <- 5
betas <- c(0.2, 0.6, 1, 1.5, 2)
x <- seq(0, 5, length.out=1000)
plot(1, type="n", xlab="x", ylab="y", xlim=c(0, 5), ylim=c(0, 5))
for (beta in betas) {
  lines(x, dgamma(x, alpha, beta))
}
```


y
0
1
2
3
4
5
0
1
2
3
4
5
x