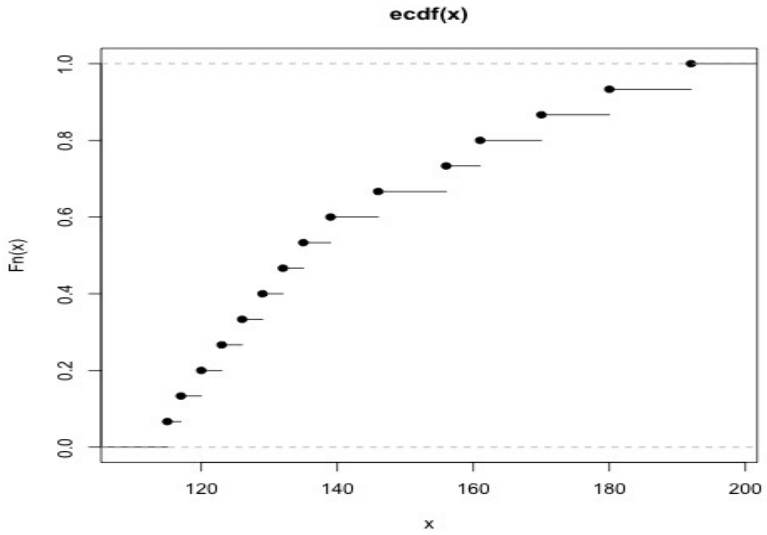
Teste de Kolmogorov-Smirnov

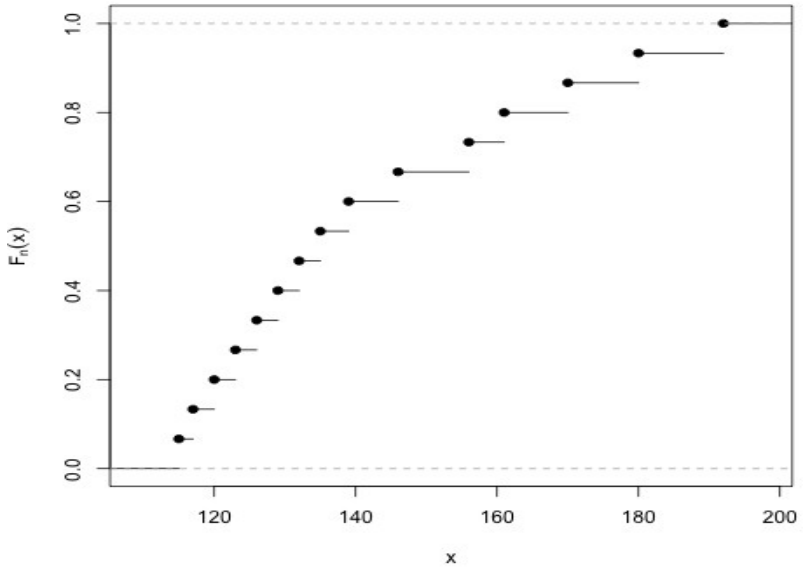
```
### Teste de Kolmogorov-Smirnov (KS)

##  1. Função distribuição empírica
# Dados
x <- c(126, 120, 117, 132, 146, 192, 180, 161, 156, 135, 129, 115, 170,
       139, 123)
cat("n = ", length(x))
```

```
n =  15
```

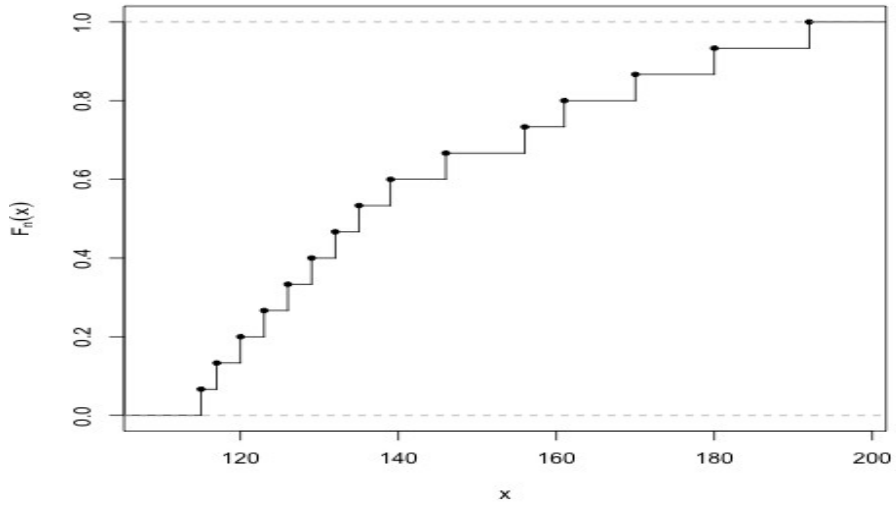
```
# Forma mais simples
plot(ecdf(x))
```



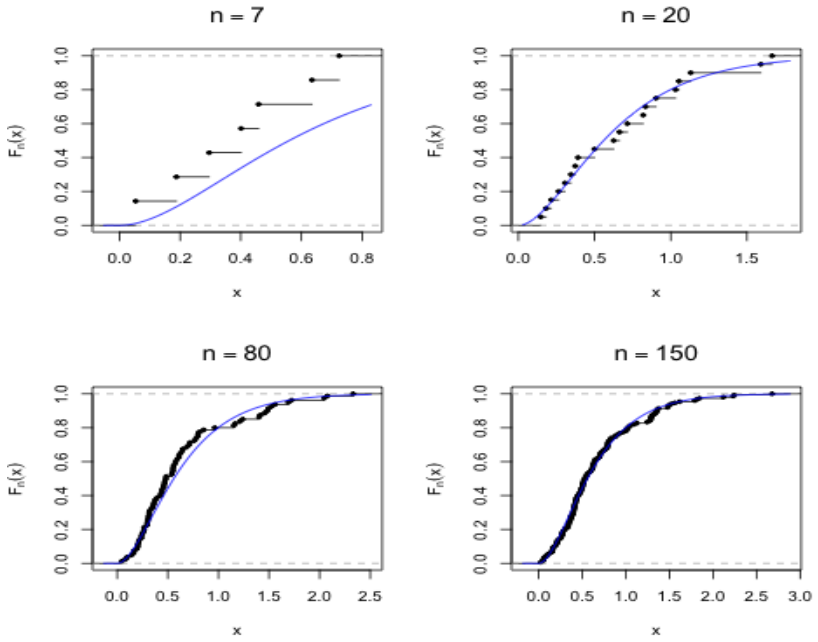

```
# Mudando alguns argumentos
plot(ecdf(x) , main = "", ylab = expression(F[n](x)))
```



```
plot(ecdf(x) , main = "", ylab = expression(F[n](x)), pch = 20,
     verticals = TRUE)
```




```
# Exemplo com diferentes tamanhos de amostra
n <- c(7, 20, 80, 150)
par(mfrow = c(2, 2))
for (tamanho in n) {
   dados <- rgamma(tamanho, shape = 2, rate = 3)
   plot(ecdf(dados) , main = bquote(n == .(tamanho)),
        ylab = expression(F[n](x)), pch = 20, cex.main = 1.5)
   curve(pgamma(x, shape = 2, rate = 3), add = TRUE, col = "blue")
}
```



2. Teste KS

```
# Dados
# X ~ gama(forma = f0, taxa = t0)
f0 <- 2
t0 <- 1.5
n <- 45
dados <- rgamma(n, shape = f0, rate = t0)
```

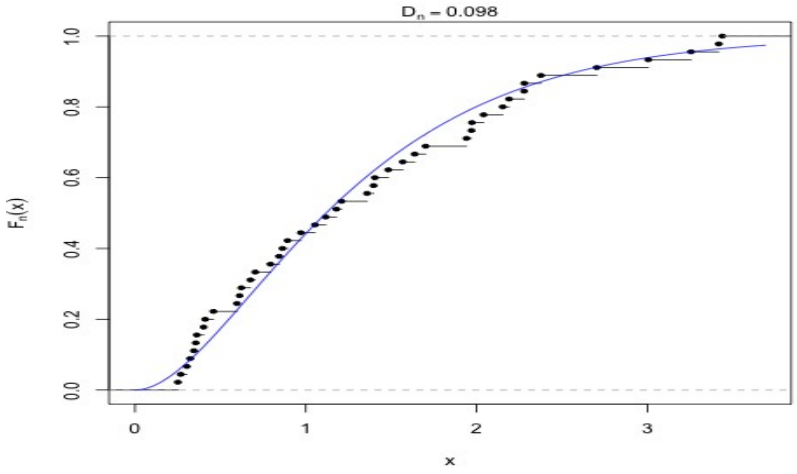
```
# H0: X ~ gama(forma = f0, taxa = t0)
# Default: H1 bilateral e valor-p exato
(tks <- ks.test(dados, "pgamma", shape = f0, rate = t0))
```

```
        One-sample Kolmogorov-Smirnov test
data:  dados
D = 0.098178, p-value = 0.7417
alternative hypothesis: two-sided
```

```
# valor-p aproximado
ks.test(dados, "pgamma", shape = f0, rate = t0, exact = FALSE)
```

```
D = 0.098178, p-value = 0.7786
alternative hypothesis: two-sided
```

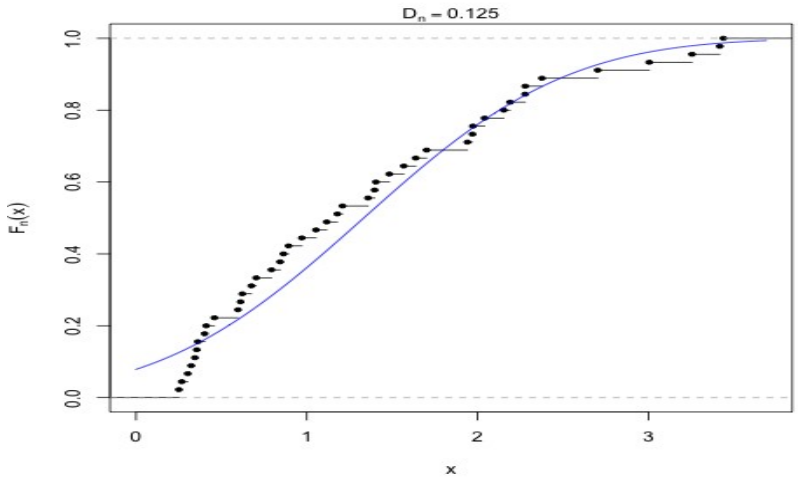
```
# Gráficos
plot(ecdf(dados) , main = "", ylab = expression(F[n](x)), pch = 20)
curve(pgamma(x, shape = f0, rate = t0), add = TRUE, col = "blue")
mtext(bquote(D[n] == .(round(tks$statistic, digits = 3))))
```




```
# H0: X ~ normal(média = f0 / t0, variância = f0 / t0^2)
# Normal com mesma média e mesma variância da dist. gama
# Default: H1 bilateral e valor-p exato
(tksn <- ks.test(dados, "pnorm", mean = f0 / t0, sd = sqrt(f0 / t0^2)))
```

```
        One-sample Kolmogorov-Smirnov test
data:  dados
D = 0.12546, p-value = 0.4423
alternative hypothesis: two-sided
```

```
plot(ecdf(dados) , main = "", ylab = expression(F[n](x)), pch = 20)
curve(pnorm(x, mean = f0 / t0, sd = sqrt(f0 / t0^2)), add = TRUE,
  col = "blue")
mtext(bquote(D[n] == .(round(tksn$statistic, digits = 3))))
```



Nota. Refaça o teste da hipótese de normalidade aumentando o valor do parâmetro de forma (f_0). Surpresa?