lab2.R

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```r
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# Introduction to Graphics

# Plot function
data("trees")
attach(trees)
plot(Height, Volume)
```
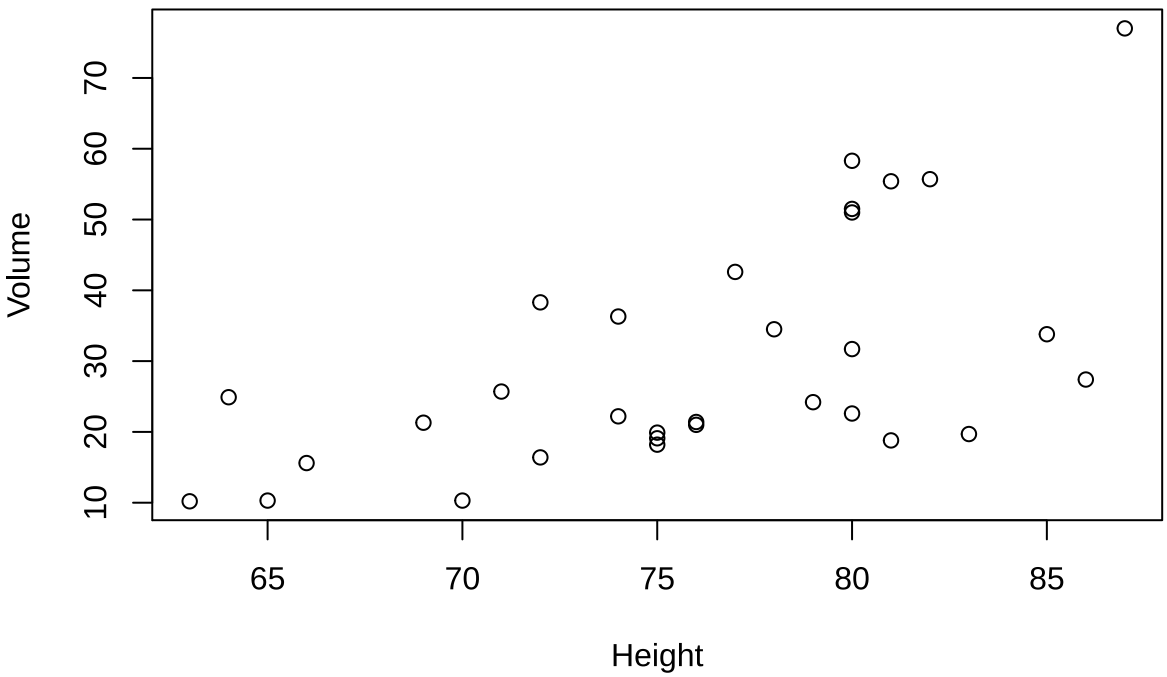
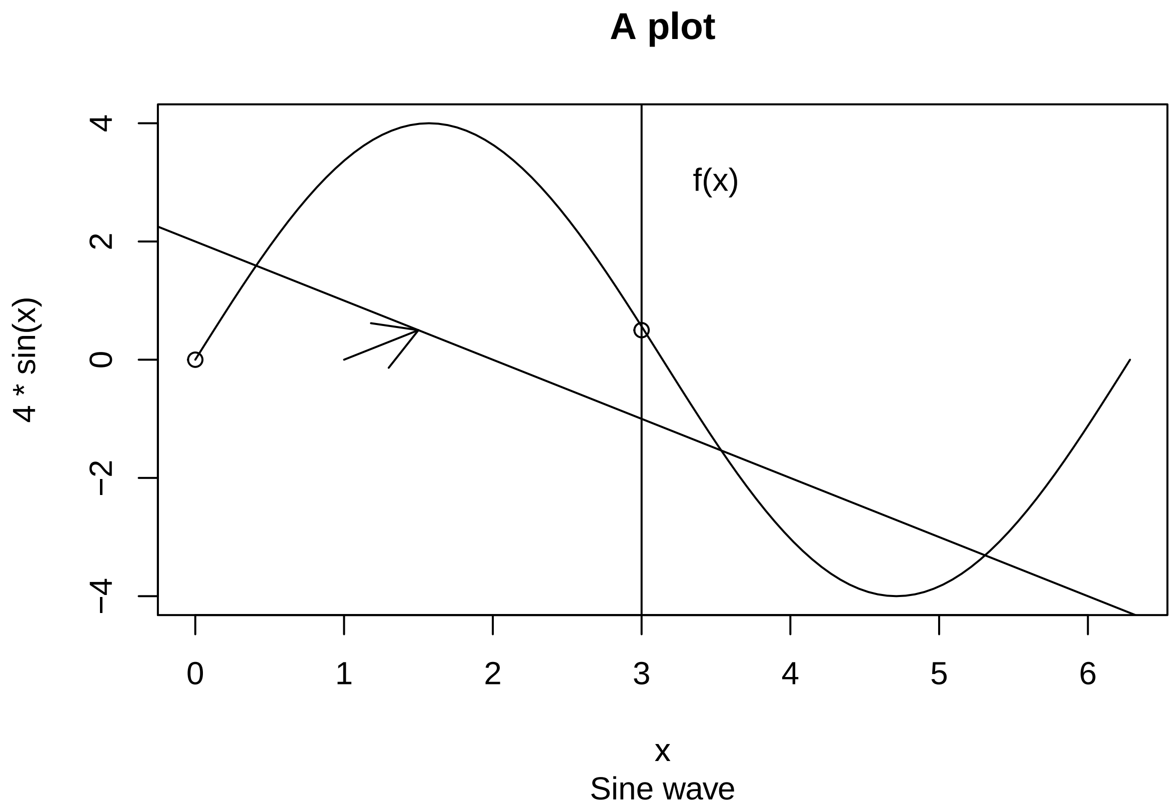
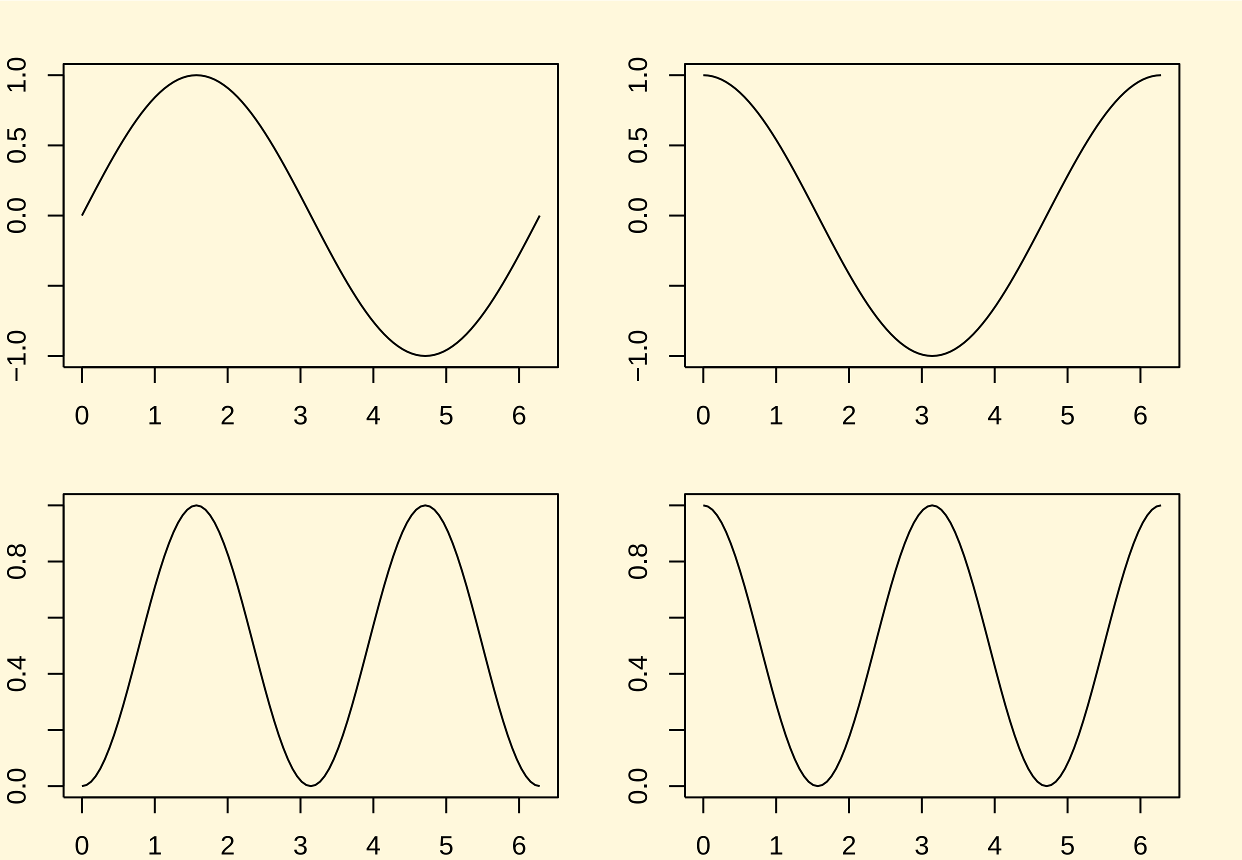




```r
# Curve function
curve(4*sin(x), from = 0, to= 2*pi)

#Embellishments
curve(4*sin(x), from = 0, to= 2*pi)
abline(a=2 , b=-1, v=3 ) # a=Slope, b=intercept, h= hor., v=vert.
arrows(x0=1,y0=0,x1=1.5,y1=0.5) # adds an arrow at a specified coordinate
#lines(x=c(0,1),y=c(0,-1),type="l") #adds lines between coordinates
points(x=c(3,0),y=c(0.5,0),type="p") #adds points at specified coordinates
#rug(x=c(2,0)) # adds a "rug" representation to one axis of the plot
#segments() # similar to lines() above
```

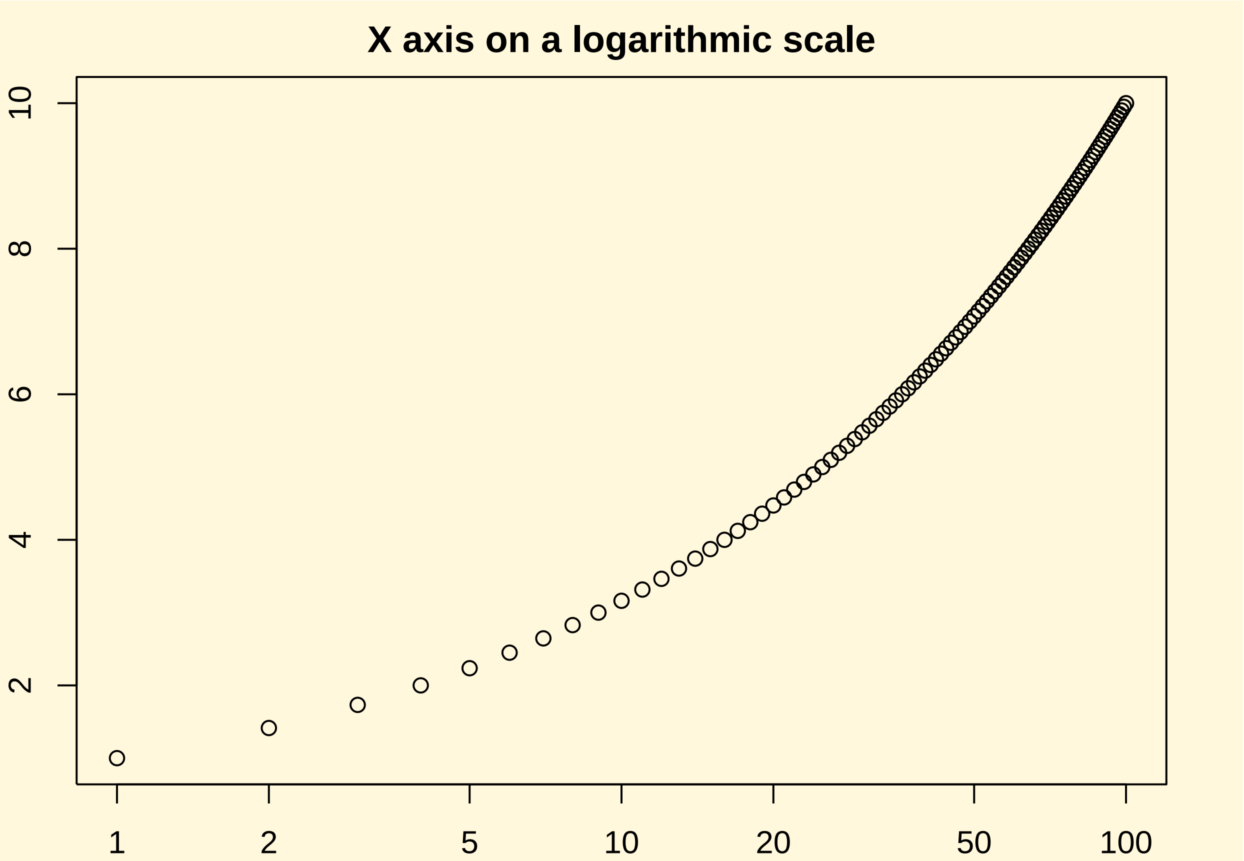
```
text(3.5,3, labels="f(x)") #adds text
title(main="A plot", sub="Sine wave", xlab="x") # titles, subtitles, etc.
```



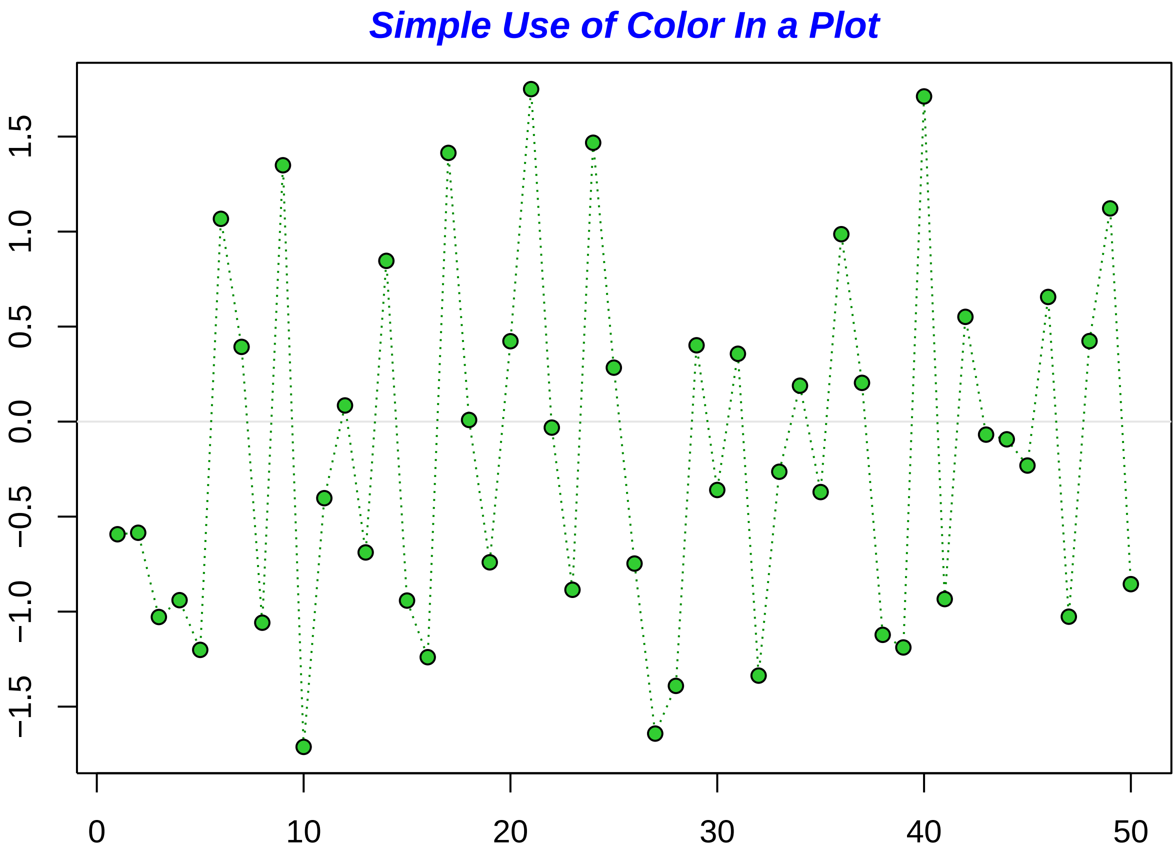

```
#Changing Graphics Parameters
par(mfrow = c(2, 2)) #gives a 2 x 2 layout of plots
par(mar = rep(2, 4)) #change margins to fit all 4 subplots
par(bg = "cornsilk") #plots drawn with this colored background
par(lend = 1) #gives "butt" line end caps for line plots 2
curve(sin(x), from = 0, to= 2*pi)
curve(cos(x), from = 0, to= 2*pi)
curve(sin(x)^2, from = 0, to= 2*pi)
curve(cos(x)^2, from = 0, to= 2*pi)
```



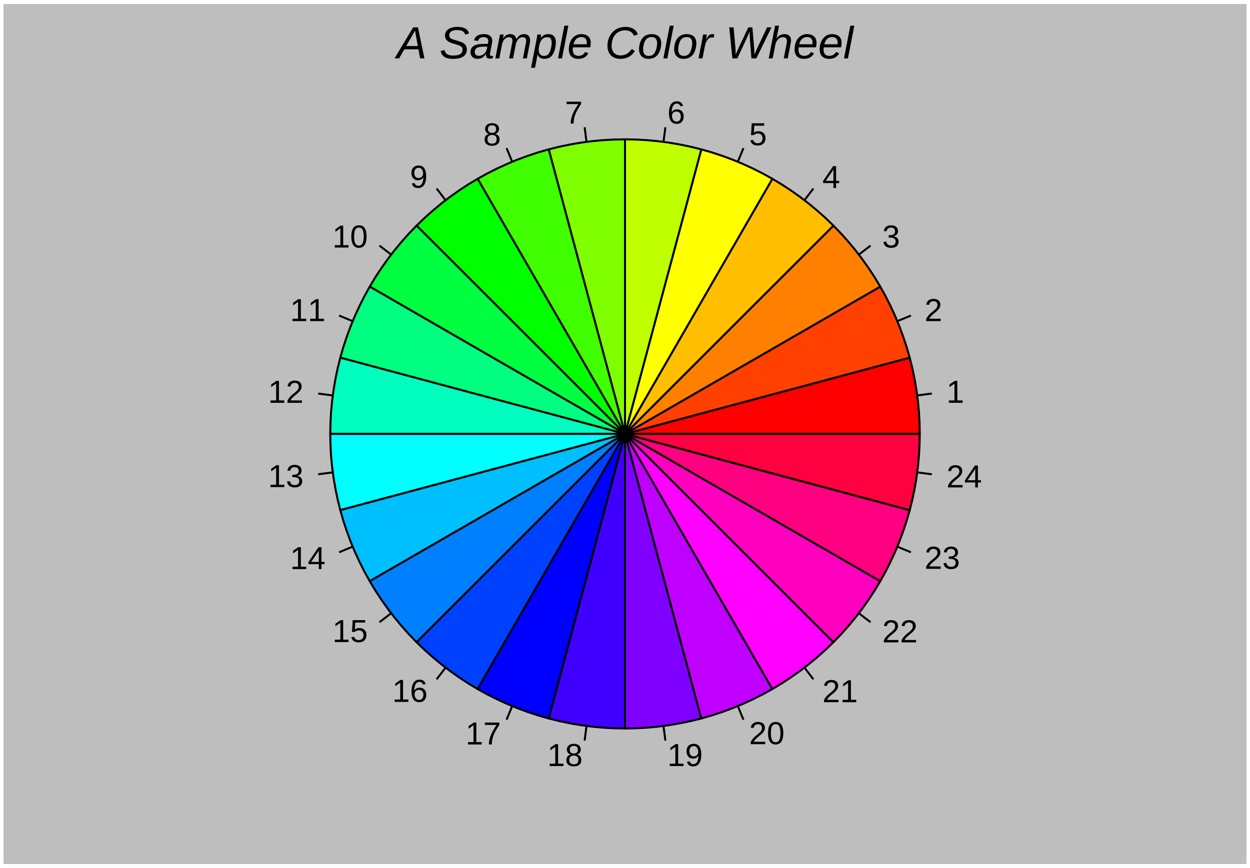

```r
par(mfrow=c(1,1)) # reset mfrow

par(xlog = TRUE) #always plot x axis on a logarithmic scale
x=1:100
y= sqrt(x)
plot(x,y,log="x")
title(main = "X axis on a logarithmic scale")
```



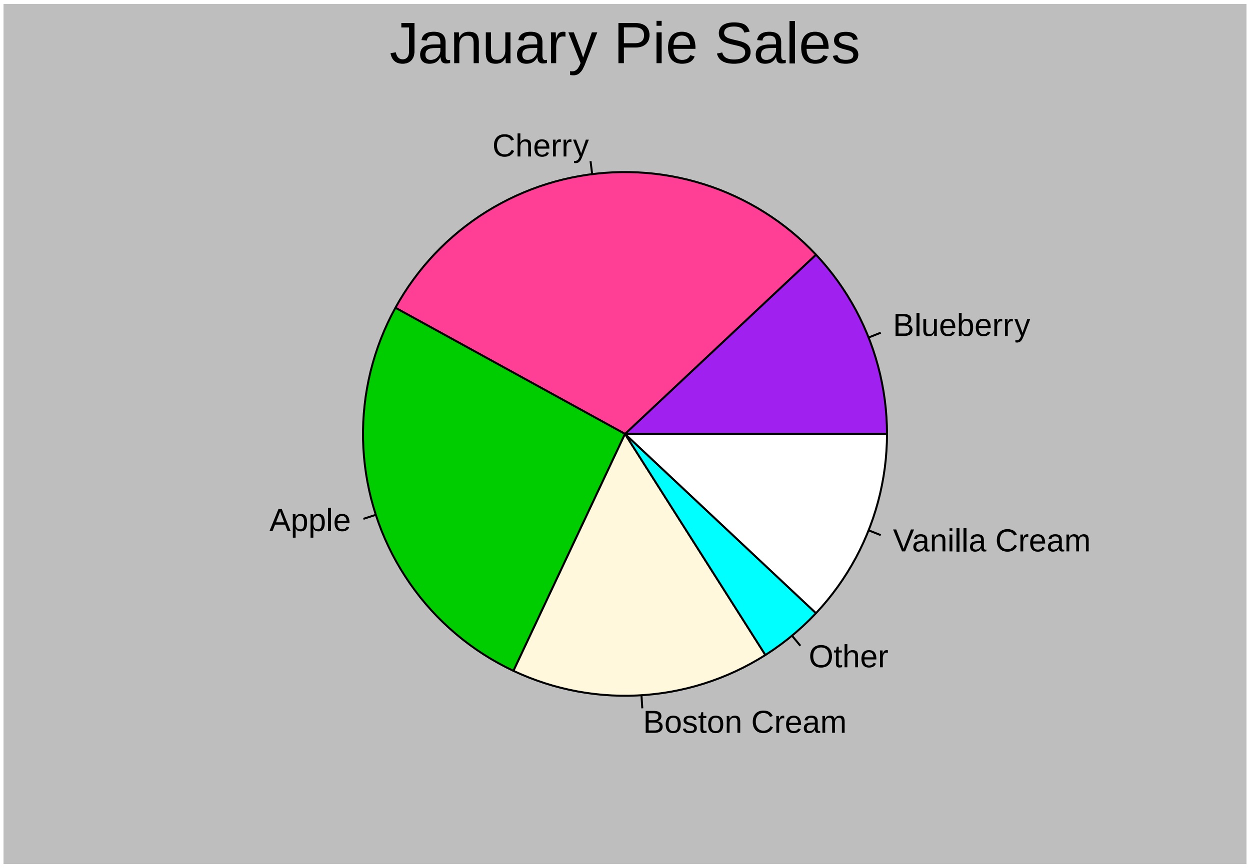

```
#Exercises

#demo(graphics)
x <- stats::rnorm(50)
opar <- par(bg = "white")
plot(x, ann = FALSE, type = "n")
abline(h = 0, col = gray(.90))
lines(x, col = "green4", lty = "dotted")
points(x, bg = "limegreen", pch = 21)
title(main = "Simple Use of Color In a Plot",xlab = "Just a Whisper of a Label",col.main = "blue", col.l
```



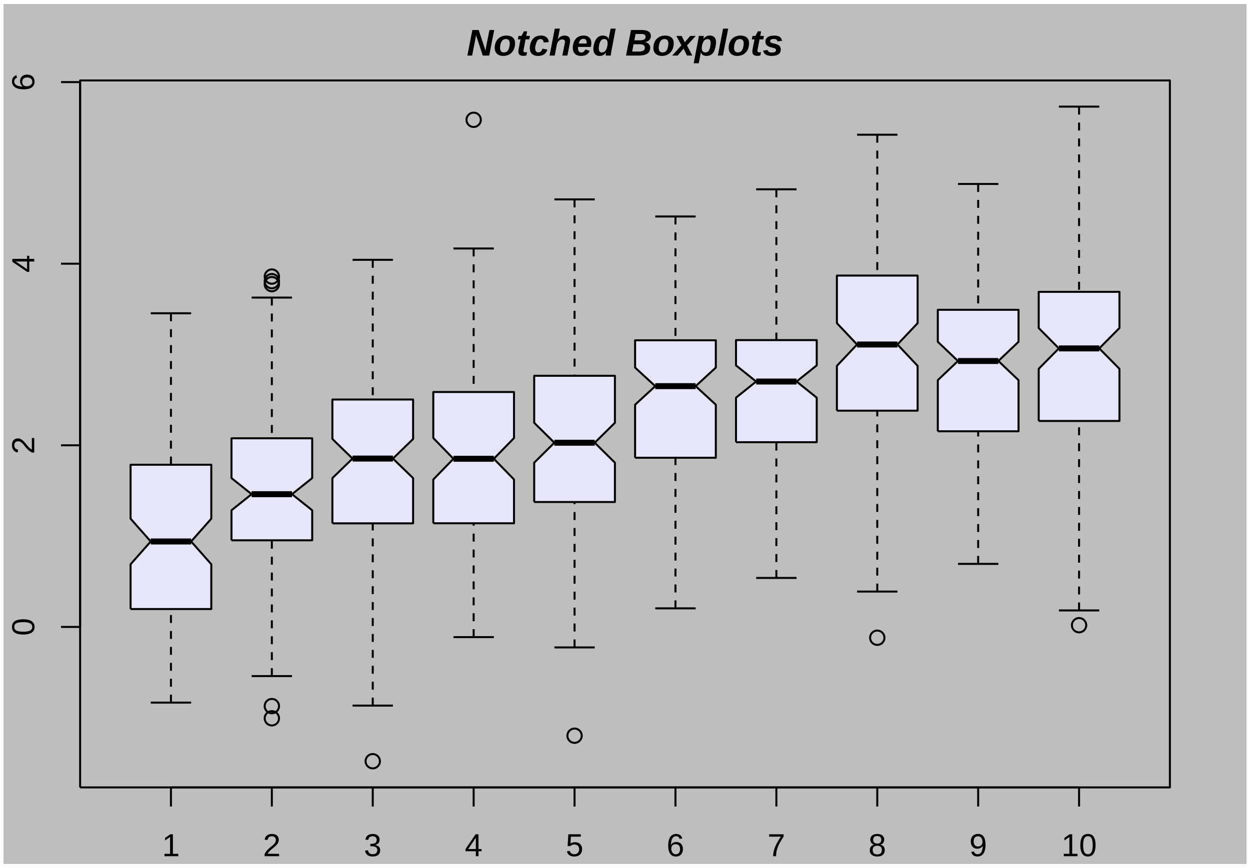

```
par(bg = "gray")
pie(rep(1,24), col = rainbow(24), radius = 0.9)
title(main = "A Sample Color Wheel", cex.main = 1.4, font.main = 3)
```



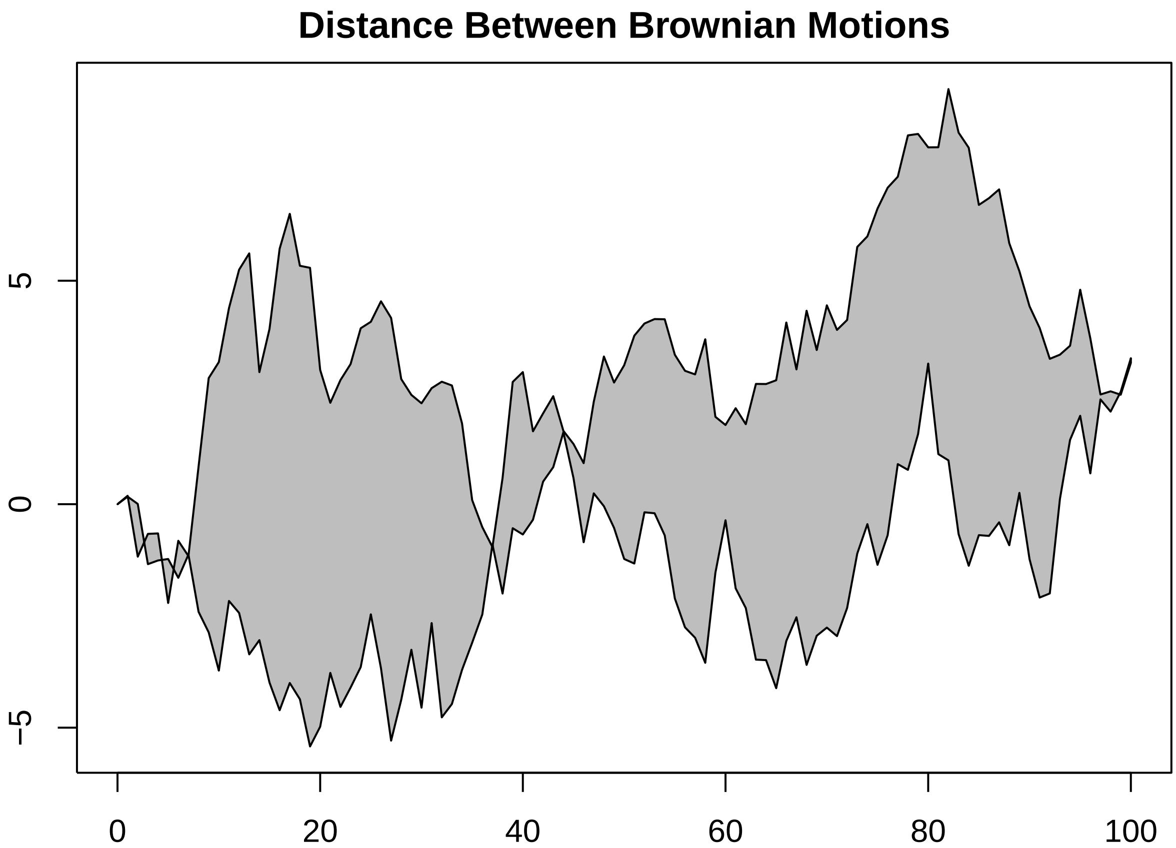

```r
pie.sales <- c(0.12, 0.3, 0.26, 0.16, 0.04, 0.12)
names(pie.sales) <- c("Blueberry", "Cherry","Apple", "Boston Cream", "Other", "Vanilla Cream")
pie(pie.sales,col = c("purple","violetred1","green3","cornsilk","cyan","white"))
title(main = "January Pie Sales", cex.main = 1.8, font.main = 1)
```



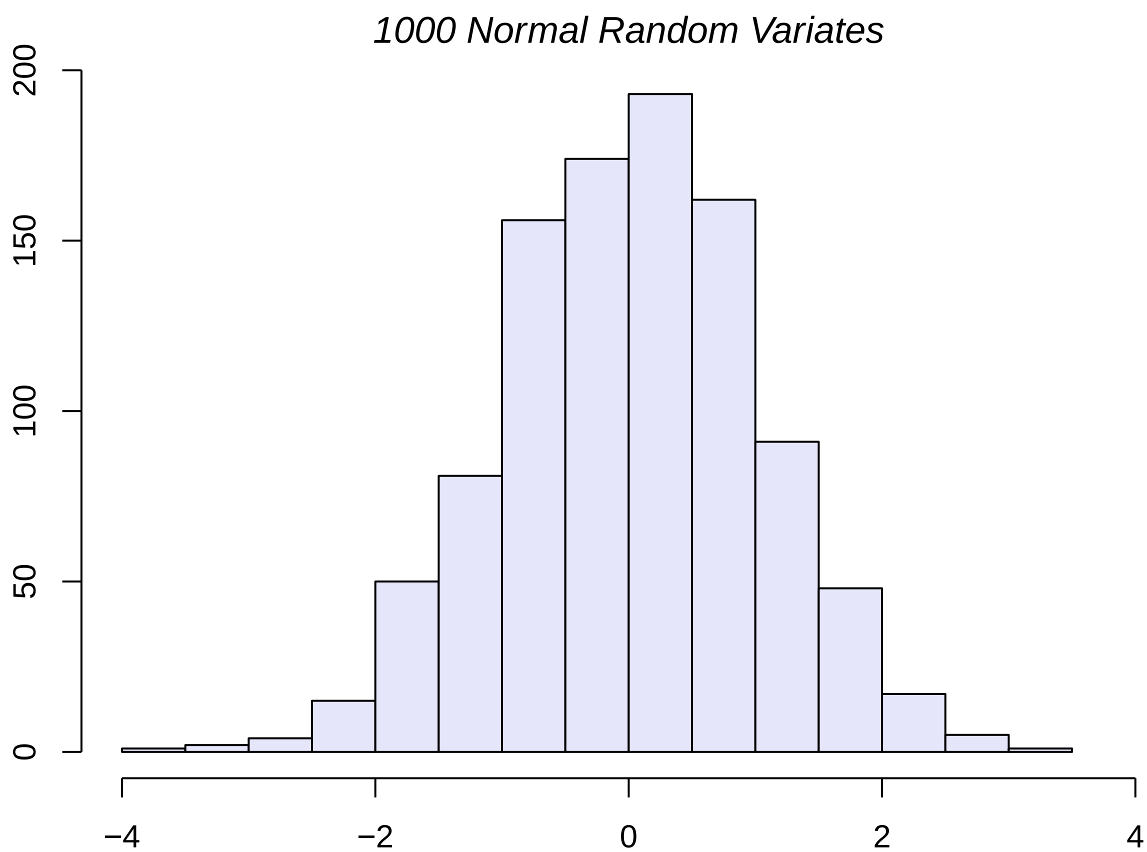

```r
n <- 10
g <- gl(n, 100, n*100)
x <- rnorm(n*100) + sqrt(as.numeric(g))
boxplot(split(x,g), col="lavender", notch=TRUE)
title(main="Notched Boxplots", xlab="Group", font.main=4, font.lab=1)
```



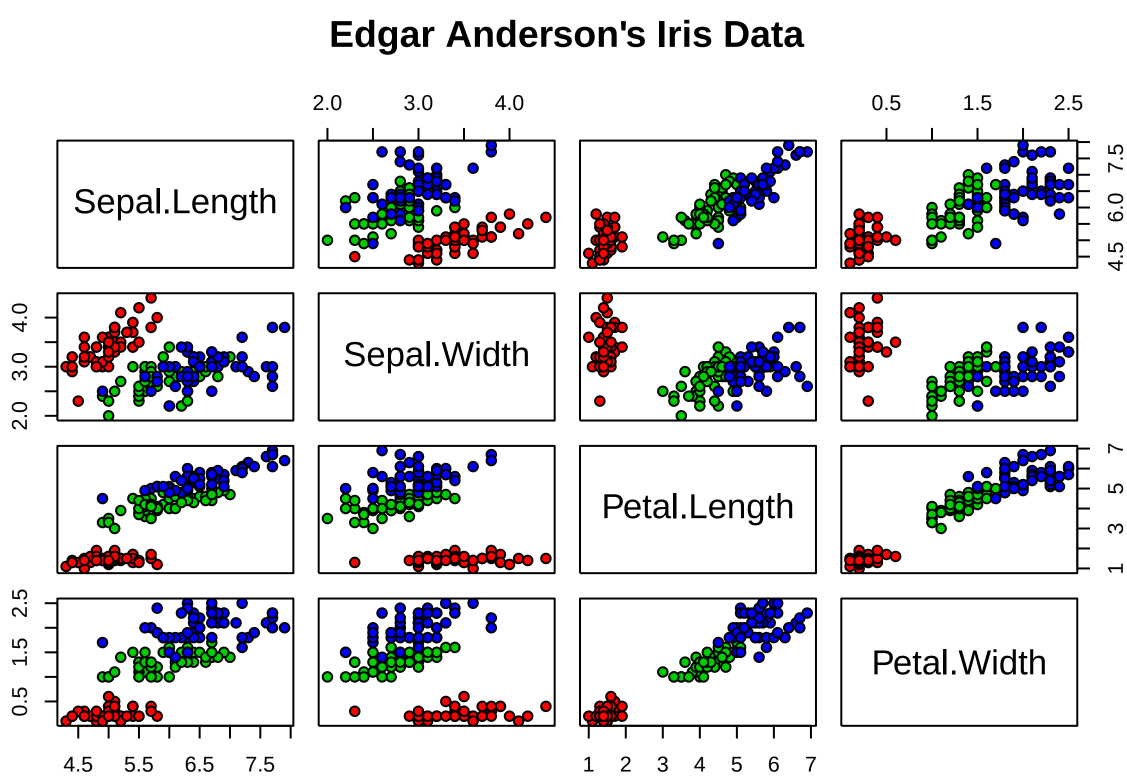

```r
par(bg="white")
n <- 100
x <- c(0,cumsum(rnorm(n)))
y <- c(0,cumsum(rnorm(n)))
xx <- c(0:n, n:0)
yy <- c(x, rev(y))
plot(xx, yy, type="n", xlab="Time", ylab="Distance")
polygon(xx, yy, col="gray")
title("Distance Between Brownian Motions")
```



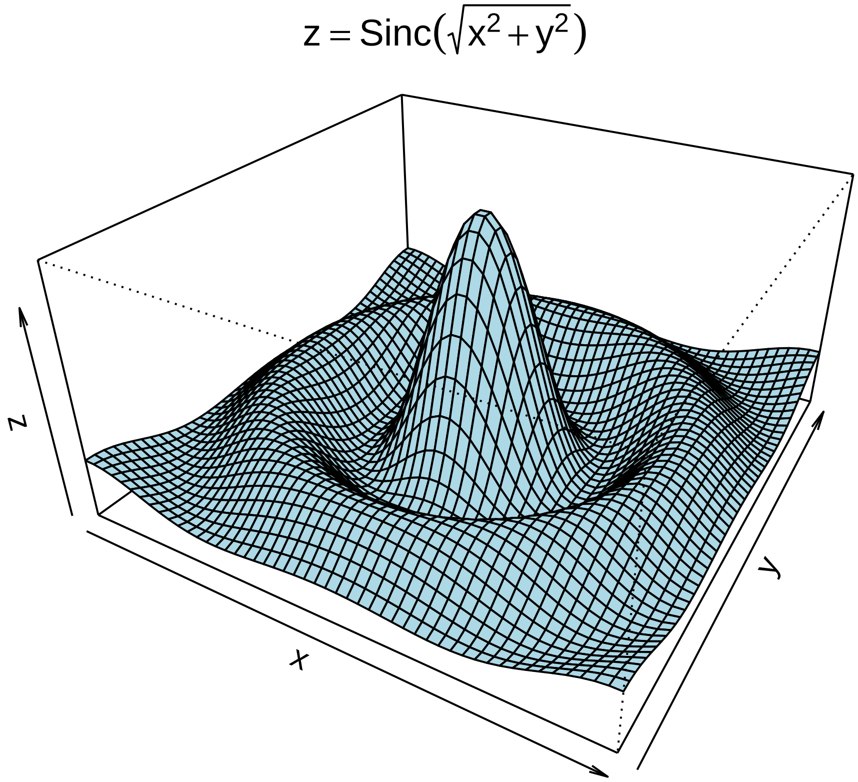

```r
x <- rnorm(1000)
hist(x, xlim=range(-4, 4, x), col="lavender", main="")
title(main="1000 Normal Random Variates", font.main=3)
```



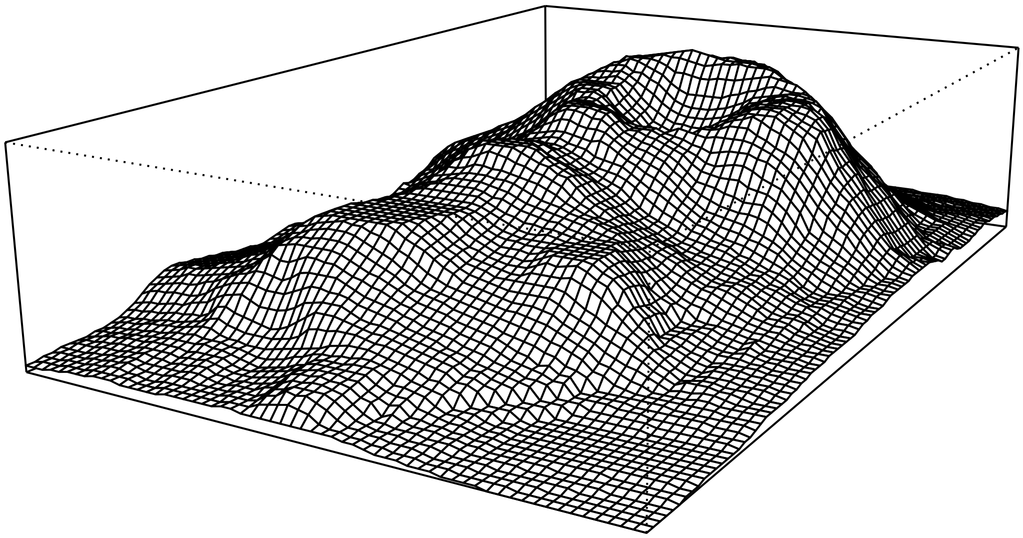

```
pairs(iris[1:4], main="Edgar Anderson's Iris Data", pch=21,bg = c("red", "green3", "blue")[unclass(iris
```



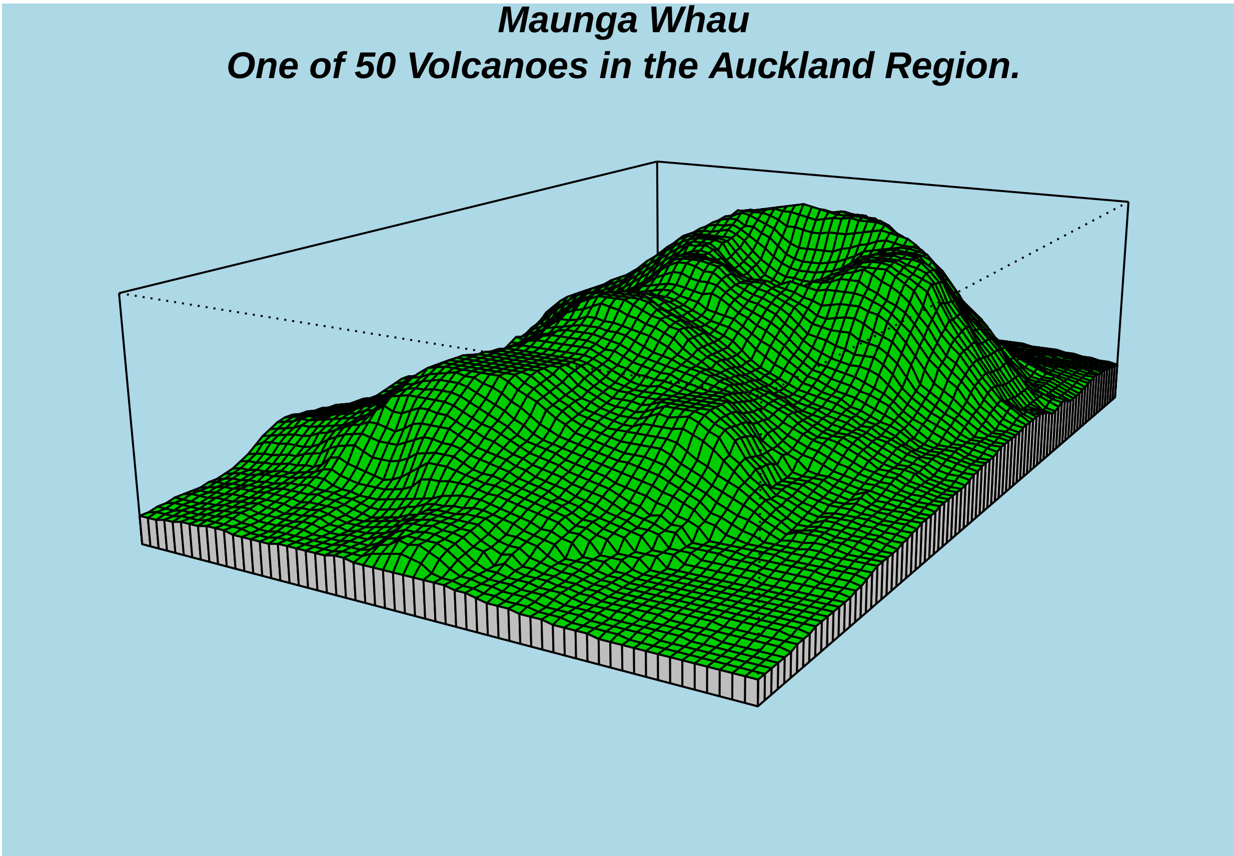
```r
#demo(persp)
x <- seq(-10, 10, length.out = 50)
y <- x

rotsinc <- function(x,y)
{
    sinc <- function(x) { y <- sin(x)/x ; y[is.na(y)] <- 1; y }
    10 * sinc( sqrt(x^2+y^2) )
}

sinc.exp <- expression(z == Sinc(sqrt(x^2 + y^2)))
z <- outer(x, y, rotsinc)
oldpar <- par(bg = "white")
persp(x, y, z, theta = 30, phi = 30, expand = 0.5, col = "lightblue")
title(sub=".")## work around persp+plotmath bug
title(main = sinc.exp)
```



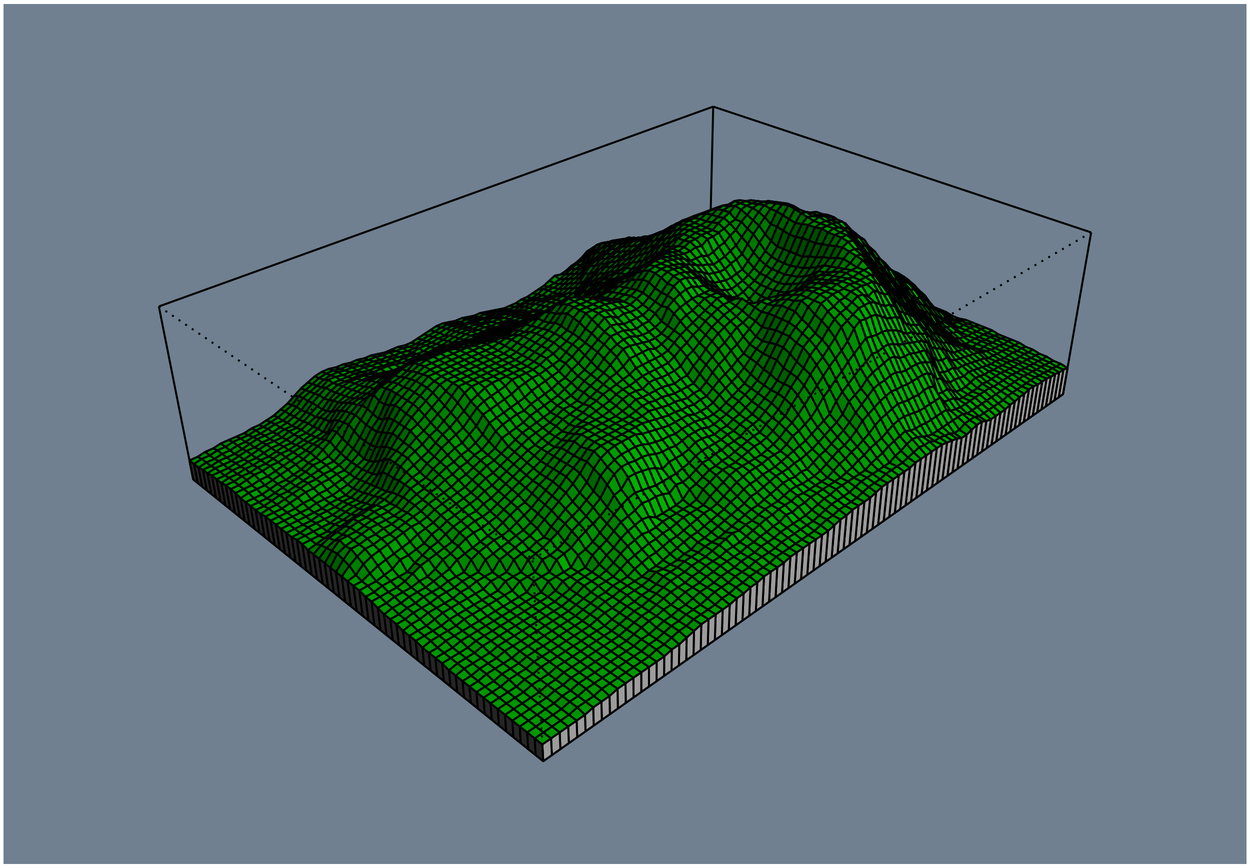

```r
z <- 2 * volcano        # Exaggerate the relief
x <- 10 * (1:nrow(z))   # 10 meter spacing (S to N)
y <- 10 * (1:ncol(z))   # 10 meter spacing (E to W)
persp(x, y, z, theta = 120, phi = 15, scale = FALSE, axes = FALSE)
```



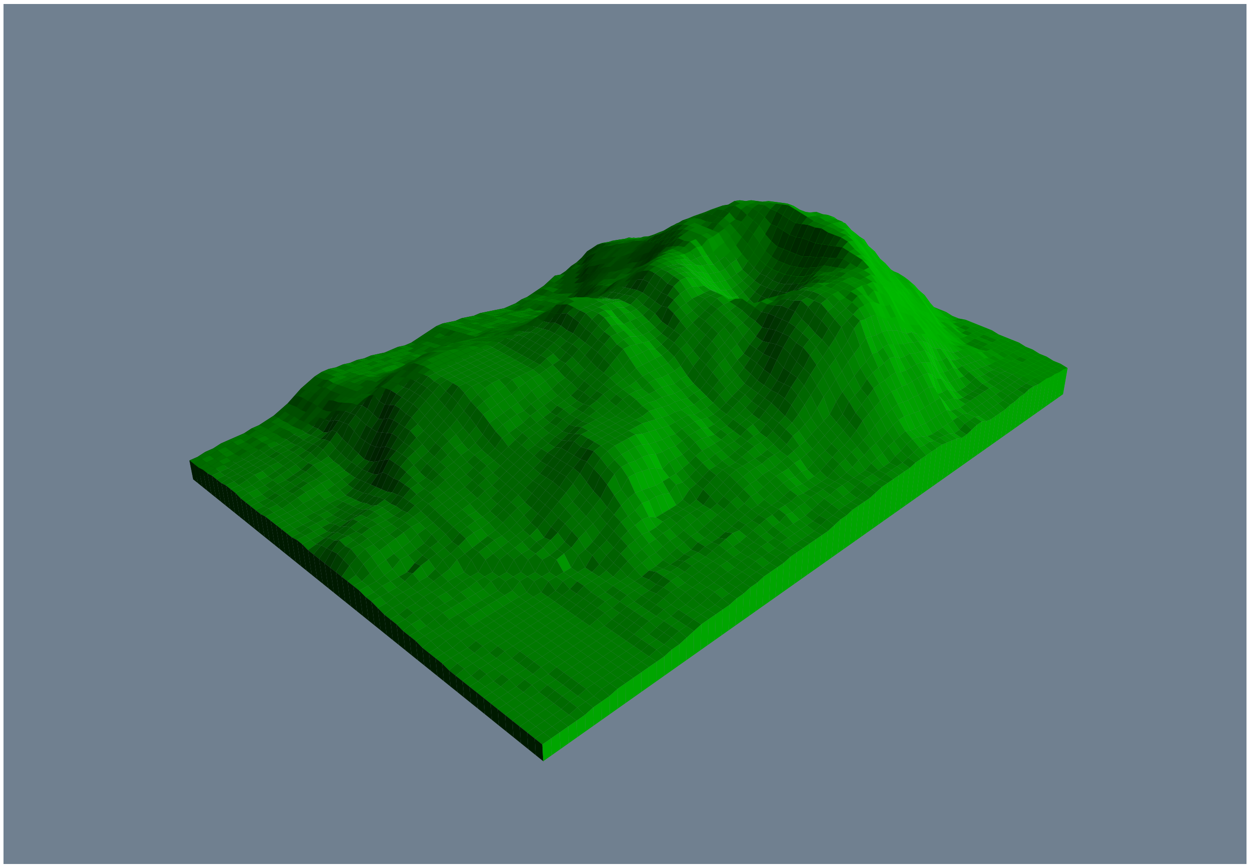
```r
##   We border the surface, to make it more "slice like"
##  and color the top and sides of the surface differently.

z0 <- min(z) - 20
z <- rbind(z0, cbind(z0, z, z0), z0)
x <- c(min(x) - 1e-10, x, max(x) + 1e-10)
y <- c(min(y) - 1e-10, y, max(y) + 1e-10)

fill <- matrix("green3", nrow = nrow(z)-1, ncol = ncol(z)-1)
fill[ , i2 <- c(1,ncol(fill))] <- "gray"
fill[i1 <- c(1,nrow(fill)) , ] <- "gray"
par(bg = "lightblue")

persp(x, y, z, theta = 120, phi = 15, col = fill, scale = FALSE, axes = FALSE)
title(main = "Maunga Whau\nOne of 50 Volcanoes in the Auckland Region.",font.main = 4)
```



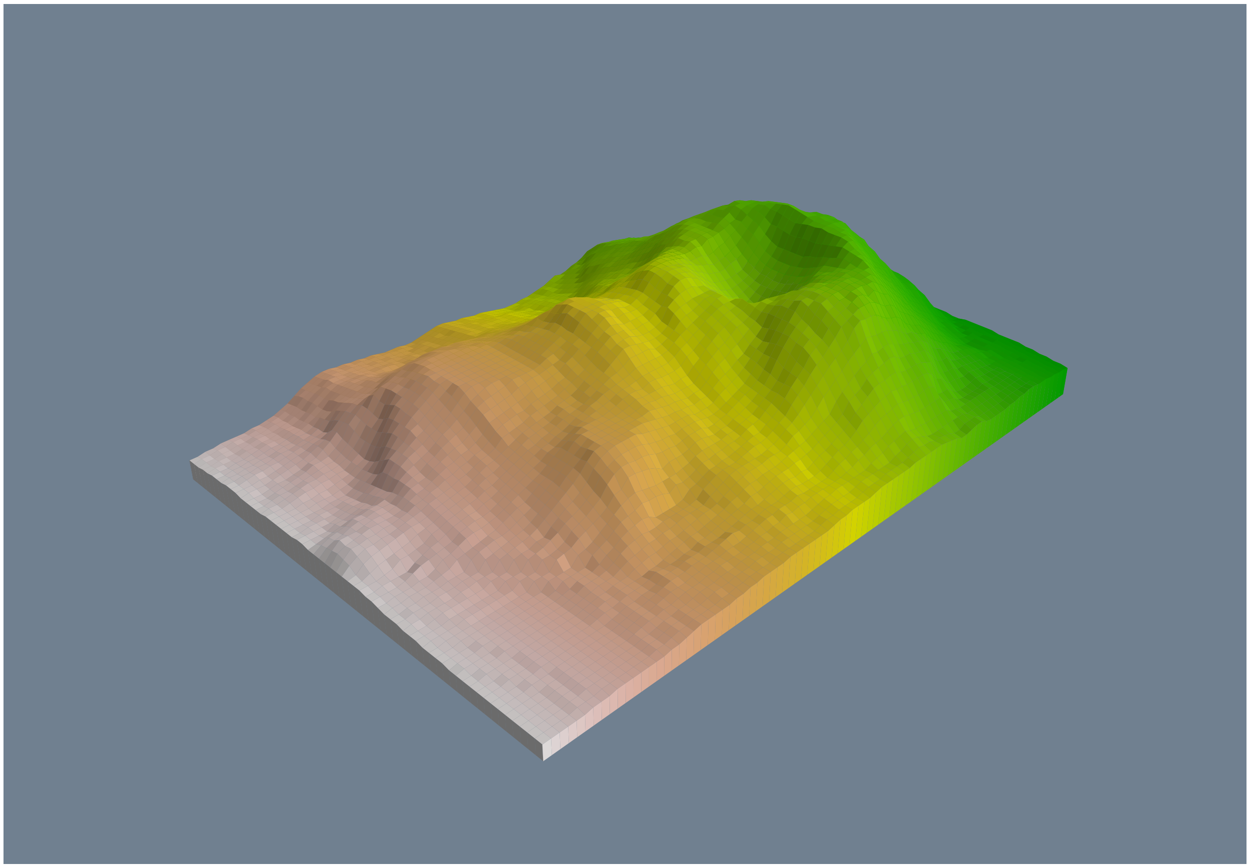

```
par(bg = "slategray")
persp(x, y, z, theta = 135, phi = 30, col = fill, scale = FALSE,ltheta = -120, lphi = 15, shade = 0.65,
```



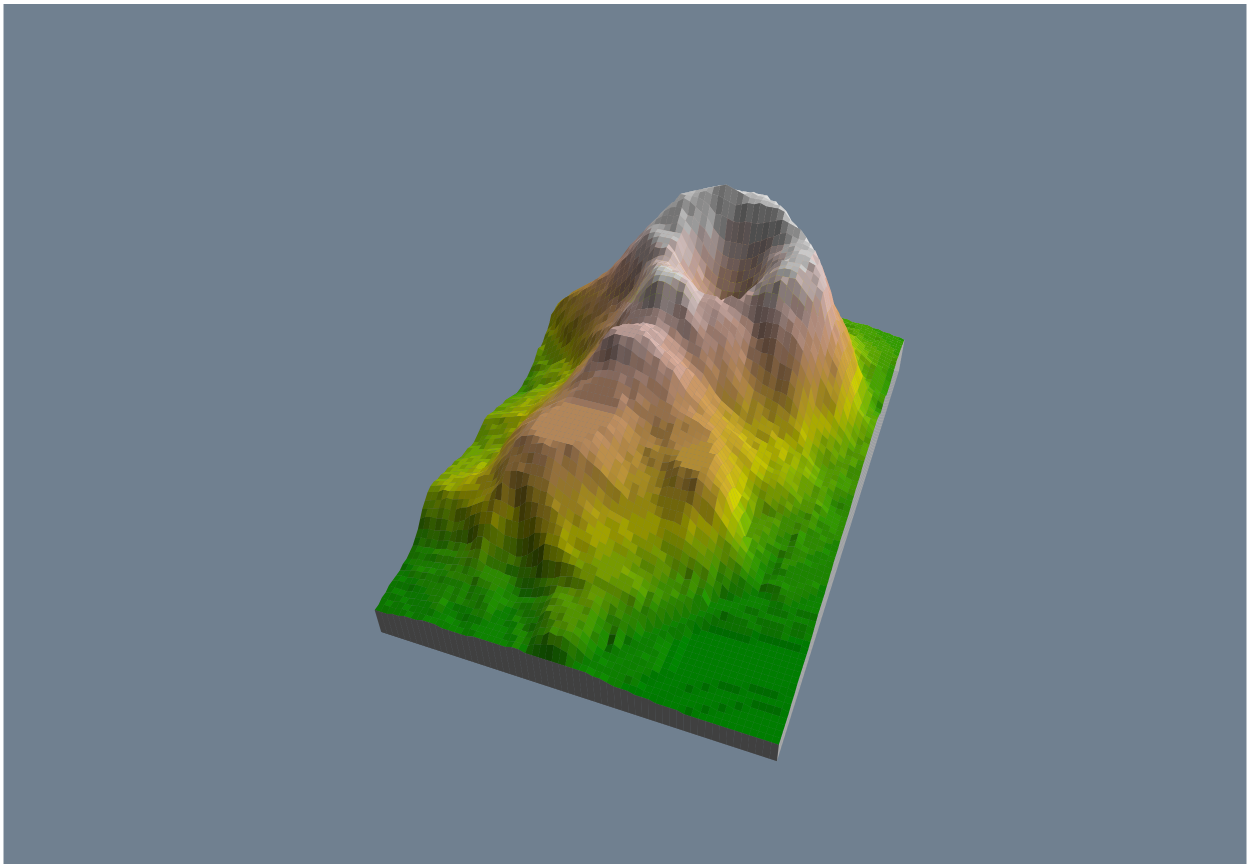
```
persp(x, y, z, theta = 135, phi = 30, col = "green3", scale = FALSE,ltheta = -120, shade = 0.75, border
```



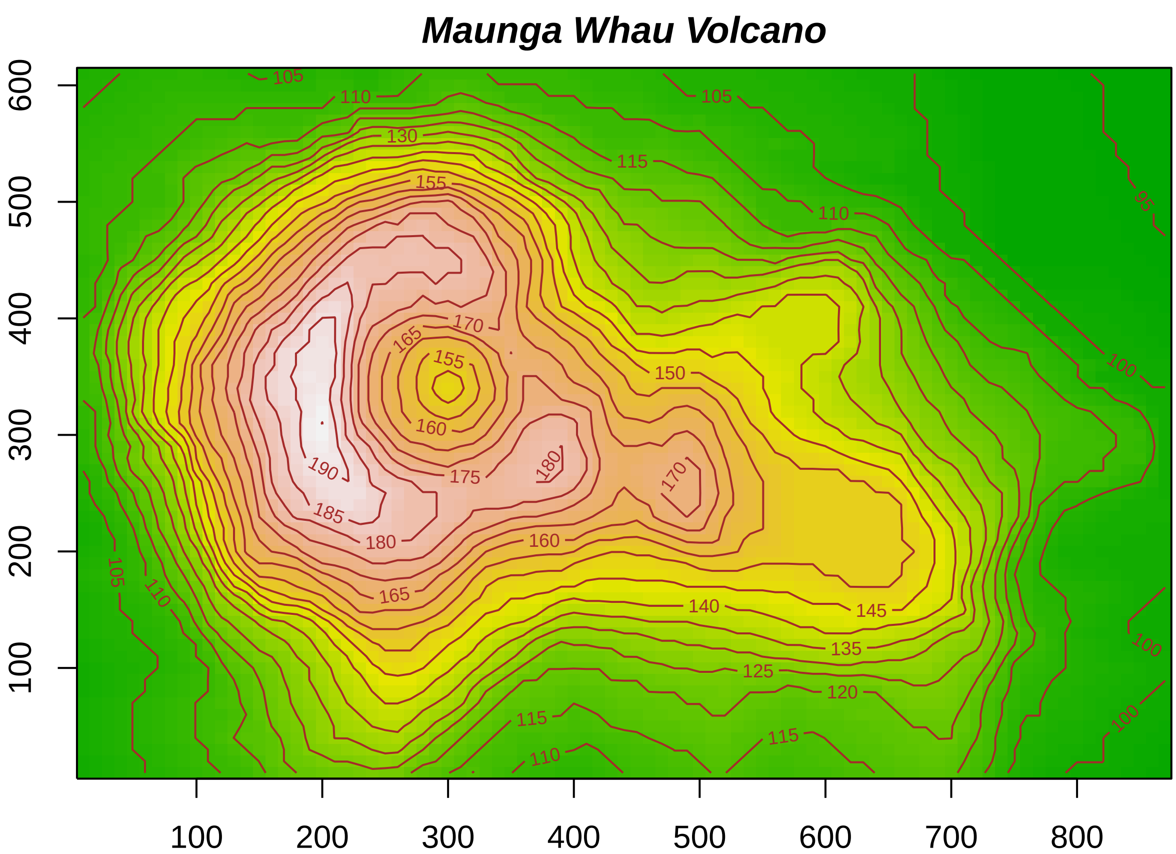
```
## `color gradient in the soil' :
fcol <- fill ; fcol[] <- terrain.colors(nrow(fcol))
persp(x, y, z, theta = 135, phi = 30, col = fcol, scale = FALSE,ltheta = -120, shade = 0.3, border = NA
```



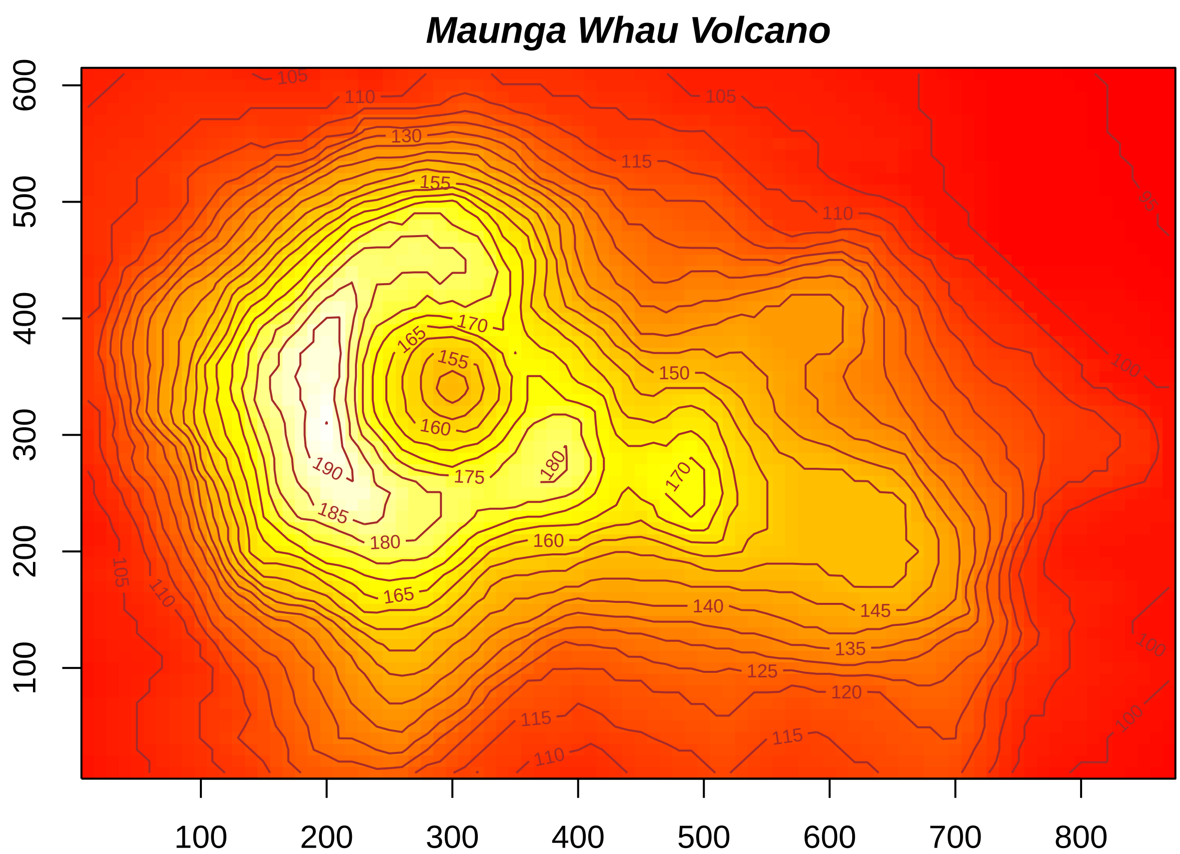
```r
## `image like' colors on top :
fcol <- fill
zi <- volcano[ -1,-1] + volcano[ -1,-61] + volcano[-87,-1] + volcano[-87,-61]  ## / 4
fcol[-i1,-i2] <-
terrain.colors(20)[cut(zi,stats::quantile(zi, seq(0,1, length.out = 21)),include.lowest = TRUE)]
persp(x, y, 2*z, theta = 110, phi = 40, col = fcol, scale = FALSE,ltheta = -120, shade = 0.4, border = 
```



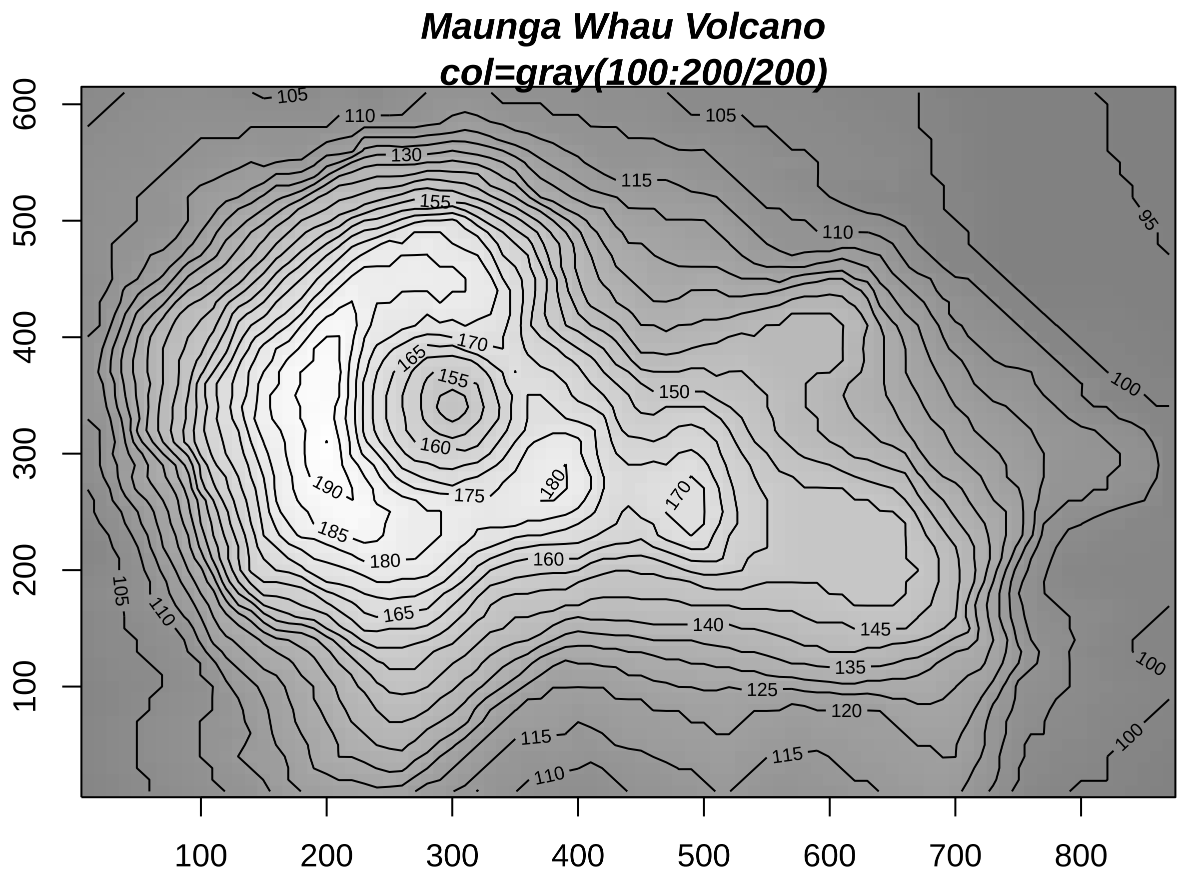
```
par(oldpar)

#demo(image)
x <- 10*(1:nrow(volcano)); x.at <- seq(100, 800, by=100)
y <- 10*(1:ncol(volcano)); y.at <- seq(100, 600, by=100)
image(x, y, volcano, col=terrain.colors(100),axes=FALSE)
contour(x, y, volcano, levels=seq(90, 200, by=5), add=TRUE, col="brown")
axis(1, at=x.at)
axis(2, at=y.at)
box()
title(main="Maunga Whau Volcano", sub = "col=terrain.colors(100)", font.main=4)
```




```r
# Using Heat Colors
image(x, y, volcano, col=heat.colors(100), axes=FALSE)
contour(x, y, volcano, levels=seq(90, 200, by=5), add=TRUE, col="brown")
axis(1, at=x.at)
axis(2, at=y.at)
box()
title(main="Maunga Whau Volcano", sub = "col=heat.colors(100)", font.main=4)
```




```
# Using Gray Scale
image(x, y, volcano, col=gray(100:200/200), axes=FALSE)
contour(x, y, volcano, levels=seq(90, 200, by=5), add=TRUE, col="black")
axis(1, at=x.at)
axis(2, at=y.at)
box()
title(main="Maunga Whau Volcano \n col=gray(100:200/200)", font.main=4)
```




```r
#Summarizing Data
data("mtcars")  #Load dataset
attach(mtcars)
mtcars
```

```
##                      mpg cyl  disp  hp drat    wt  qsec vs am gear carb
## Mazda RX4           21.0   6 160.0 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag       21.0   6 160.0 110 3.90 2.875 17.02  0  1    4    4
## Datsun 710          22.8   4 108.0  93 3.85 2.320 18.61  1  1    4    1
## Hornet 4 Drive      21.4   6 258.0 110 3.08 3.215 19.44  1  0    3    1
## Hornet Sportabout   18.7   8 360.0 175 3.15 3.440 17.02  0  0    3    2
## Valiant             18.1   6 225.0 105 2.76 3.460 20.22  1  0    3    1
## Duster 360          14.3   8 360.0 245 3.21 3.570 15.84  0  0    3    4
## Merc 240D           24.4   4 146.7  62 3.69 3.190 20.00  1  0    4    2
## Merc 230            22.8   4 140.8  95 3.92 3.150 22.90  1  0    4    2
## Merc 280            19.2   6 167.6 123 3.92 3.440 18.30  1  0    4    4
## Merc 280C           17.8   6 167.6 123 3.92 3.440 18.90  1  0    4    4
## Merc 450SE          16.4   8 275.8 180 3.07 4.070 17.40  0  0    3    3
## Merc 450SL          17.3   8 275.8 180 3.07 3.730 17.60  0  0    3    3
## Merc 450SLC         15.2   8 275.8 180 3.07 3.780 18.00  0  0    3    3
## Cadillac Fleetwood  10.4   8 472.0 205 2.93 5.250 17.98  0  0    3    4
## Lincoln Continental 10.4   8 460.0 215 3.00 5.424 17.82  0  0    3    4
## Chrysler Imperial   14.7   8 440.0 230 3.23 5.345 17.42  0  0    3    4
## Fiat 128            32.4   4  78.7  66 4.08 2.200 19.47  1  1    4    1
## Honda Civic         30.4   4  75.7  52 4.93 1.615 18.52  1  1    4    2
## Toyota Corolla      33.9   4  71.1  65 4.22 1.835 19.90  1  1    4    1
## Toyota Corona       21.5   4 120.1  97 3.70 2.465 20.01  1  0    3    1
```

```
## Dodge Challenger    15.5   8 318.0 150 2.76 3.520 16.87  0  0    3    2
## AMC Javelin         15.2   8 304.0 150 3.15 3.435 17.30  0  0    3    2
## Camaro Z28          13.3   8 350.0 245 3.73 3.840 15.41  0  0    3    4
## Pontiac Firebird    19.2   8 400.0 175 3.08 3.845 17.05  0  0    3    2
## Fiat X1-9           27.3   4  79.0  66 4.08 1.935 18.90  1  1    4    1
## Porsche 914-2       26.0   4 120.3  91 4.43 2.140 16.70  0  1    5    2
## Lotus Europa        30.4   4  95.1 113 3.77 1.513 16.90  1  1    5    2
## Ford Pantera L      15.8   8 351.0 264 4.22 3.170 14.50  0  1    5    4
## Ferrari Dino        19.7   6 145.0 175 3.62 2.770 15.50  0  1    5    6
## Maserati Bora       15.0   8 301.0 335 3.54 3.570 14.60  0  1    5    8
## Volvo 142E          21.4   4 121.0 109 4.11 2.780 18.60  1  1    4    2
```

```
#Numerical Summaries
mean(hp)
```

```
## [1] 146.6875
```

```
var(mpg)
```

```
## [1] 36.3241
```

```
quantile(qsec, probs = c(.20, .80))
```

```
##    20%    80%
## 16.734 19.332
```

```
cor(wt,mpg)
```

```
## [1] -0.8676594
```

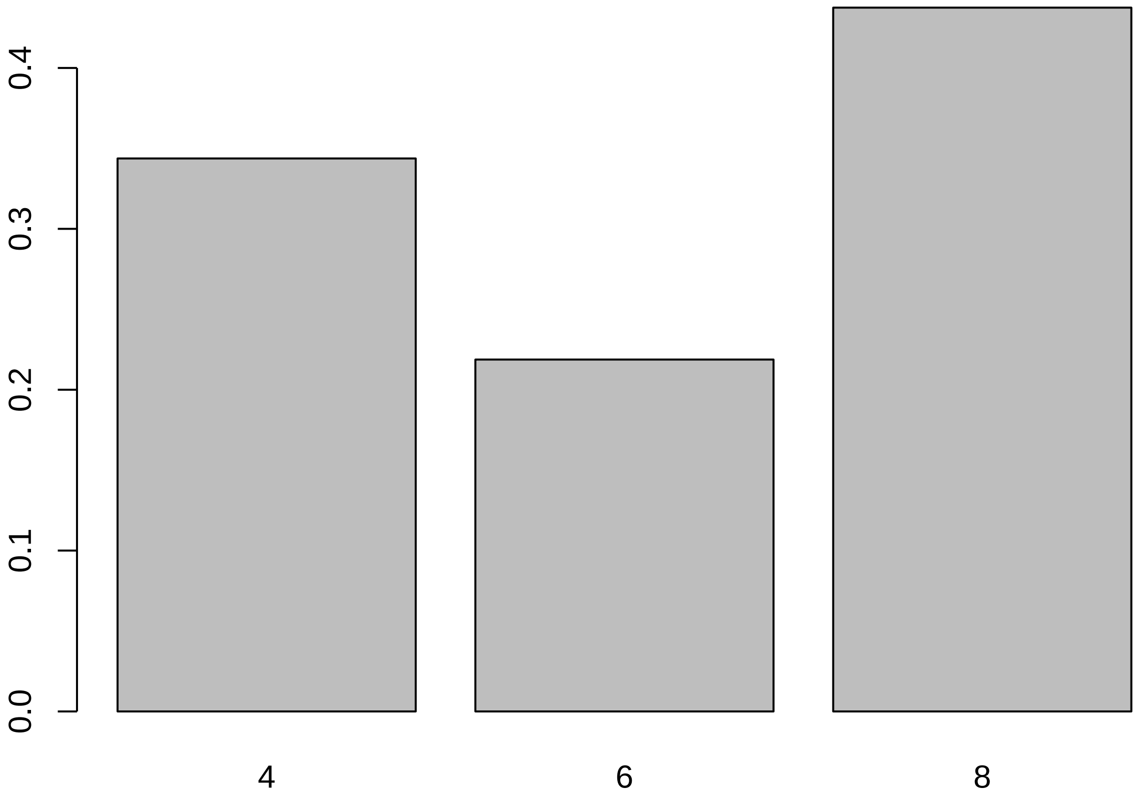
```
table(cyl)
```

```
## cyl
##  4  6  8
## 11  7 14
```

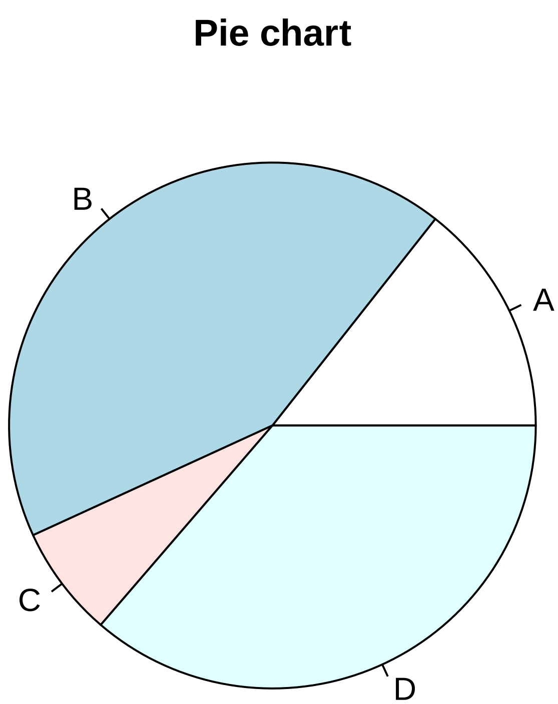
```
table(cyl)/length(cyl)
```

```
## cyl
##       4       6       8
## 0.34375 0.21875 0.43750
```

```
#Graphical Summaries
# Bar plot
barplot(table(cyl)/length(cyl))
```

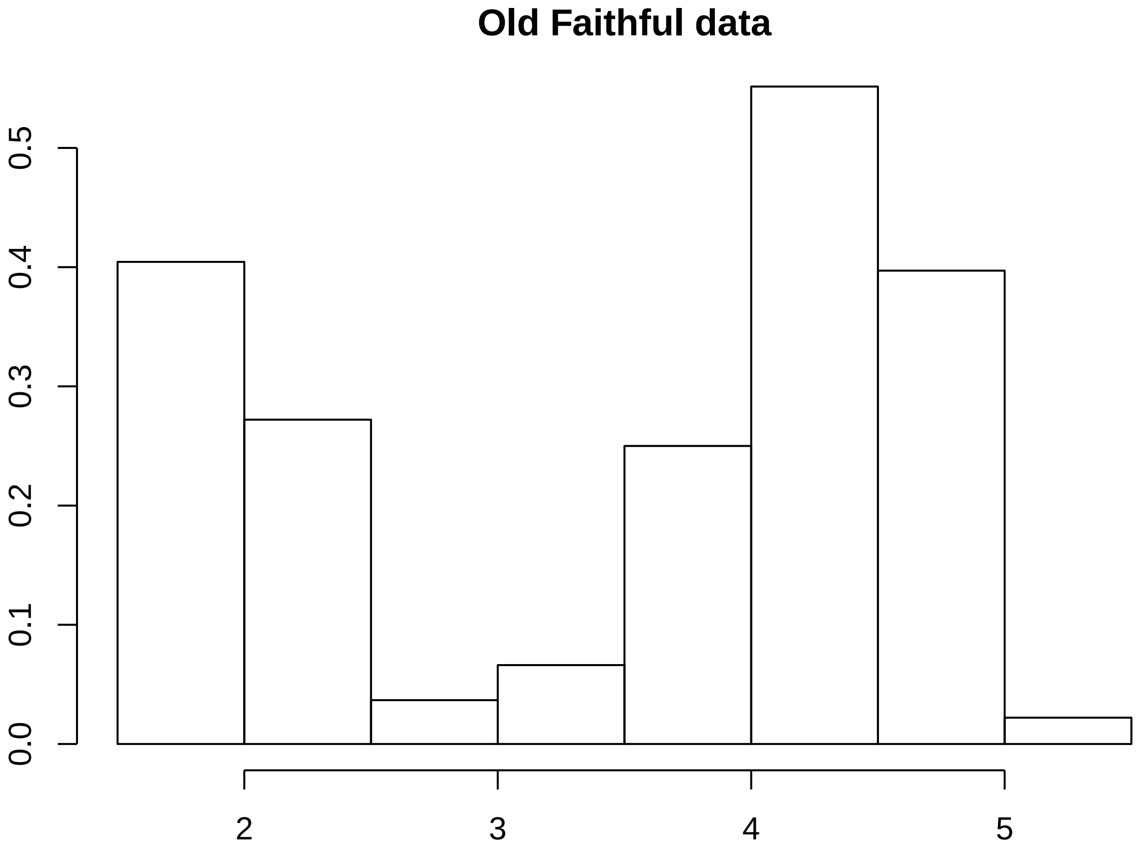



```r
# Pie chart
x <- c(21, 62, 10, 53)
labels <- c("A", "B", "C", "D")
pie(x,labels,main = "Pie chart")
```

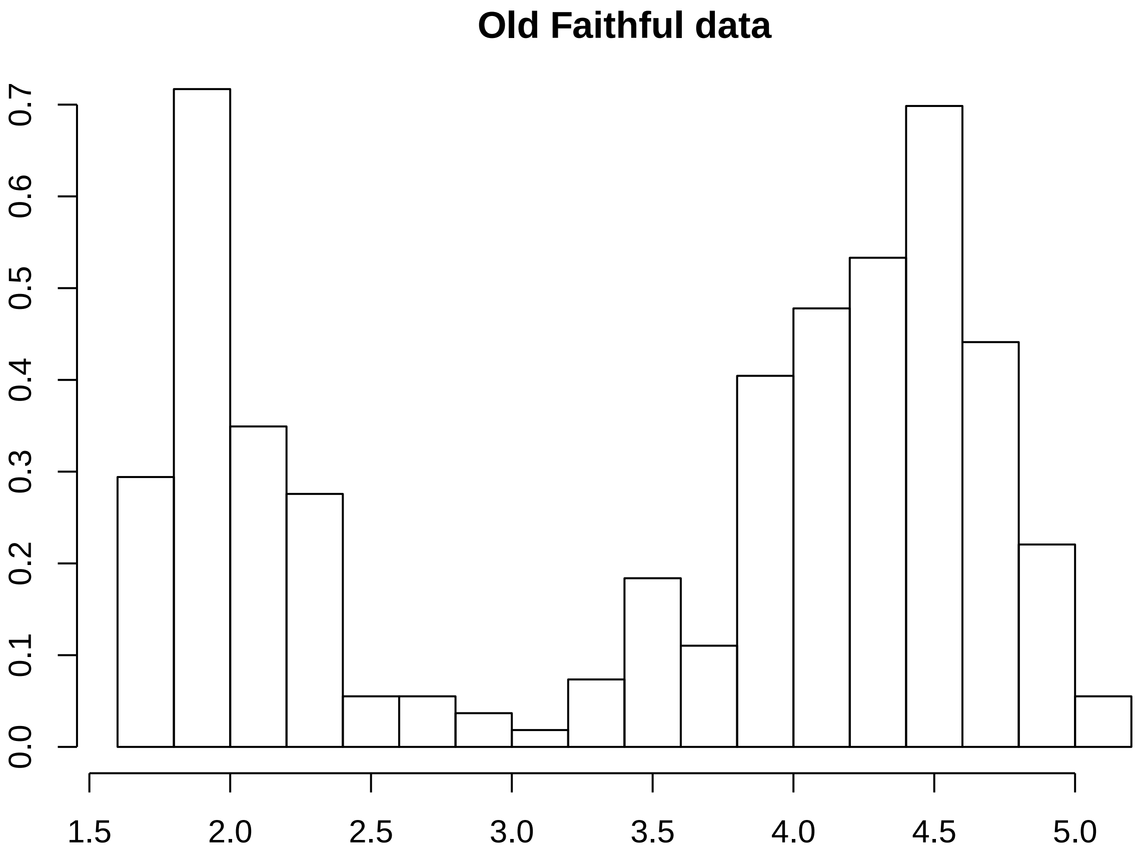



```r
data("faithful")
attach(faithful)
```

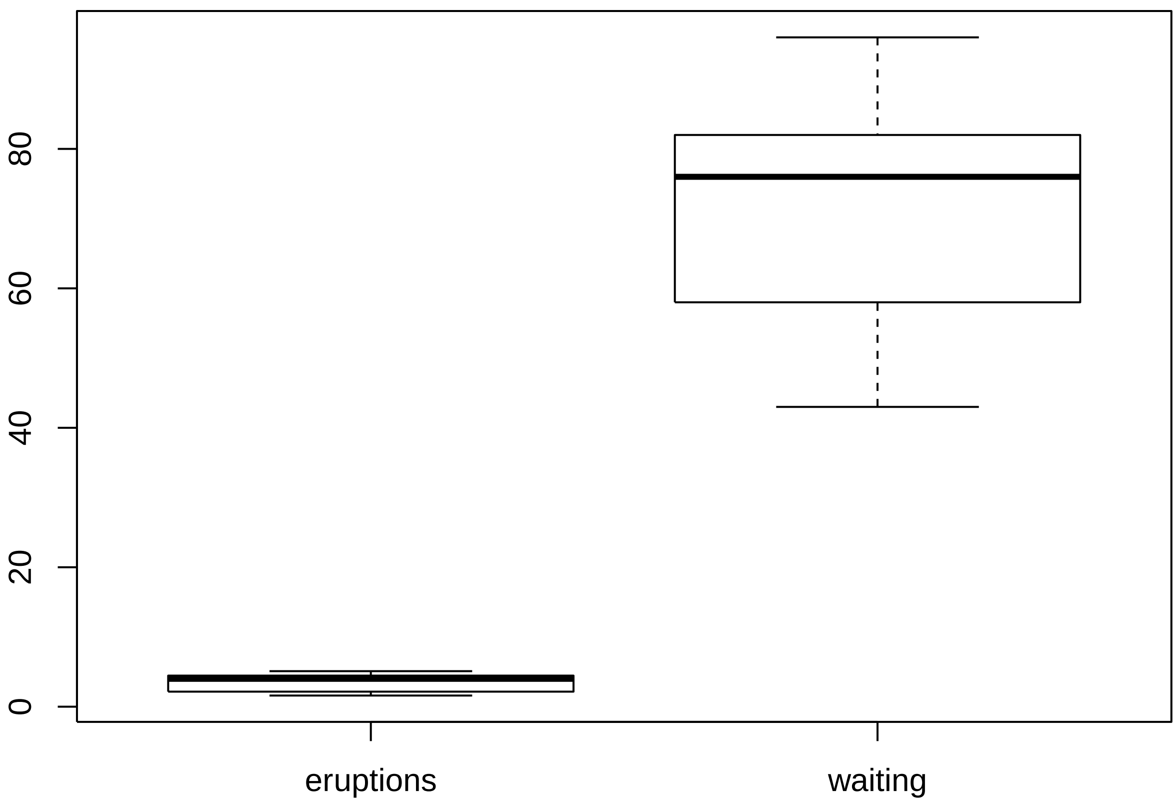
```r
hist(eruptions, main = "Old Faithful data", prob = T)
```



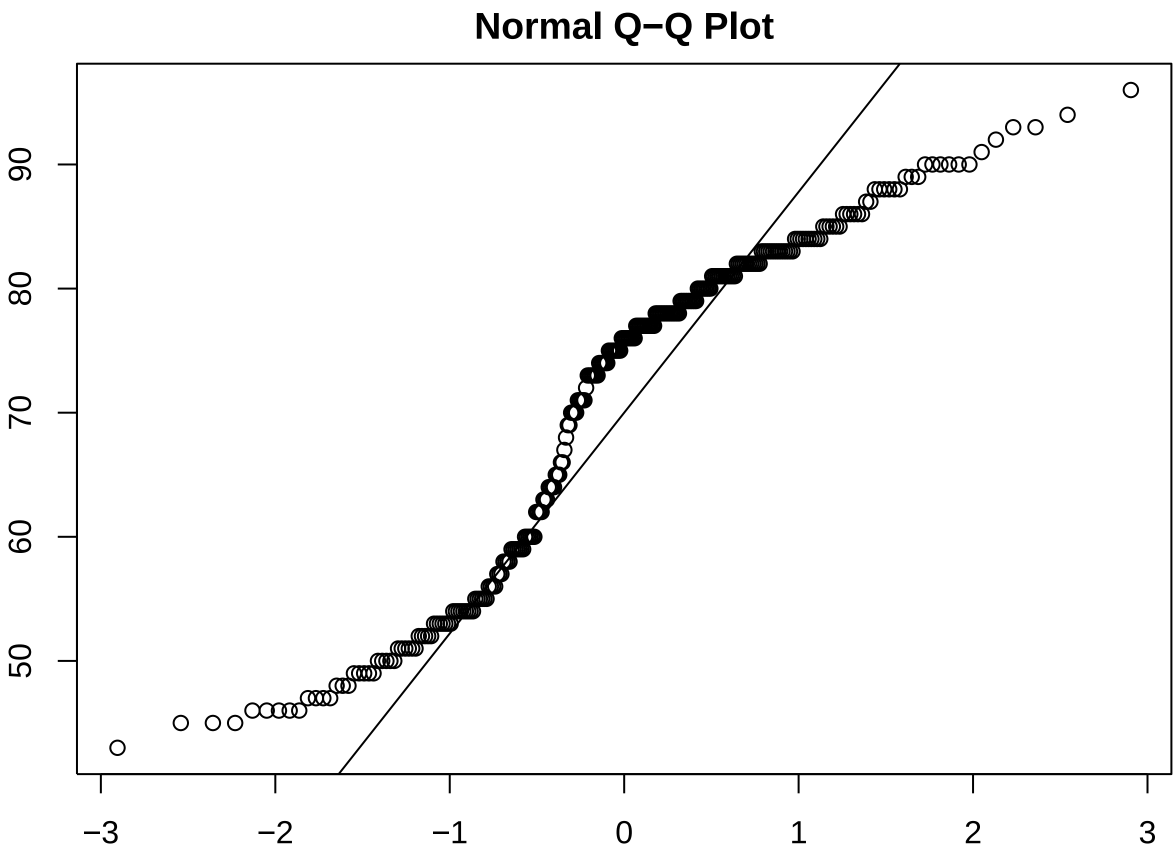

```r
hist(eruptions, main = "Old Faithful data", prob = T, breaks=18)
```




```
boxplot(faithful)
```



```r
qqnorm(waiting)
qqline(waiting)
```




```r
#Exercises

#Using the stackloss dataset that is available from within R :
#1. Compute the mean, variance, and 5 number summary of the variable stack.loss
data("stackloss")
attach(stackloss)
```

```
## The following object is masked _by_ .GlobalEnv:
##
##     stack.loss
```

```
## The following object is masked from package:datasets:
##
##     stack.loss
```

```r
stack.loss
```

```
##  [1] 42 37 37 28 18 18 19 20 15 14 14 13 11 12  8  7  8  8  9 15 15
```

```r
mean(stack.loss)
```

```
## [1] 17.52381
```

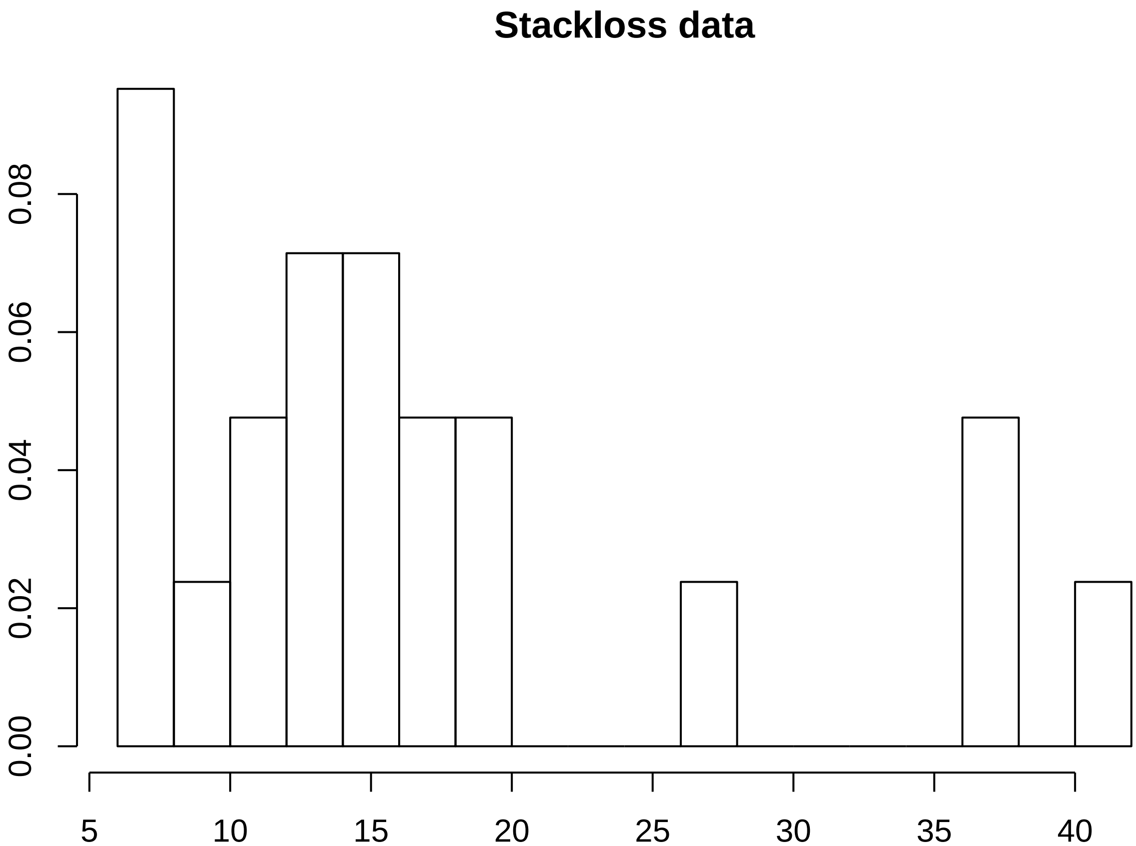
```r
var(stack.loss)
```

```
## [1] 103.4619
```

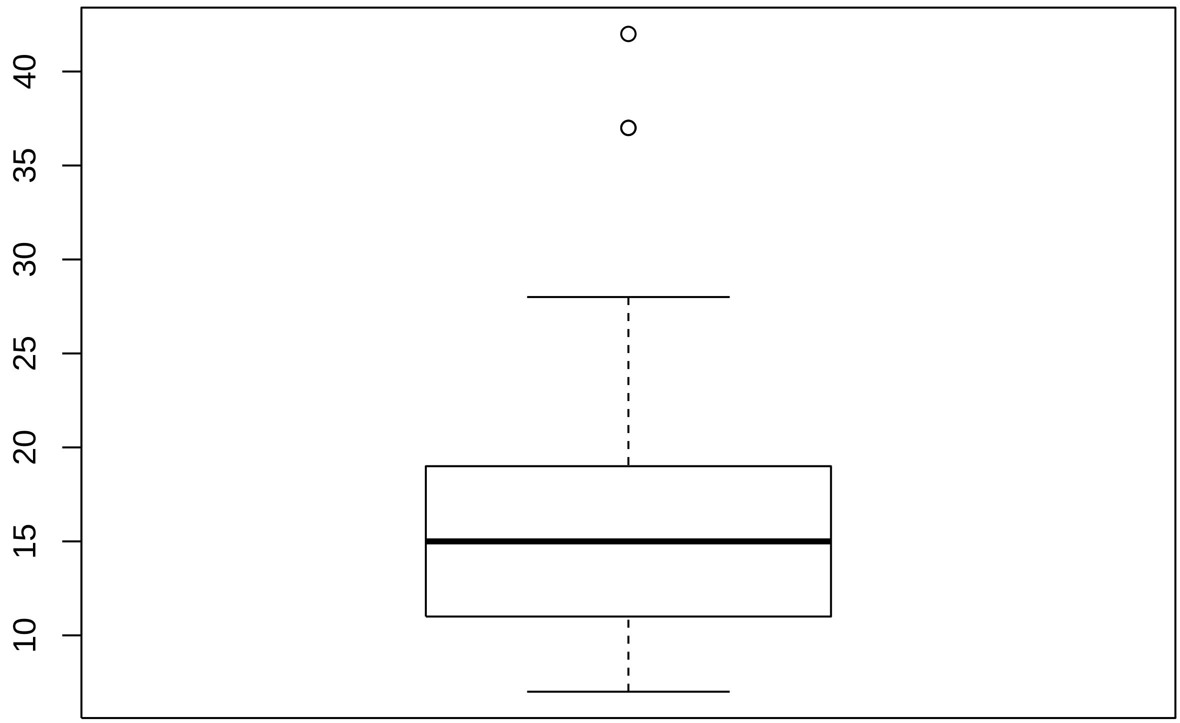
```r
fivenum(stack.loss) # (minimum, lower-hinge, median, upper-hinge, maximum)
```

```
## [1]  7 11 15 19 42
```

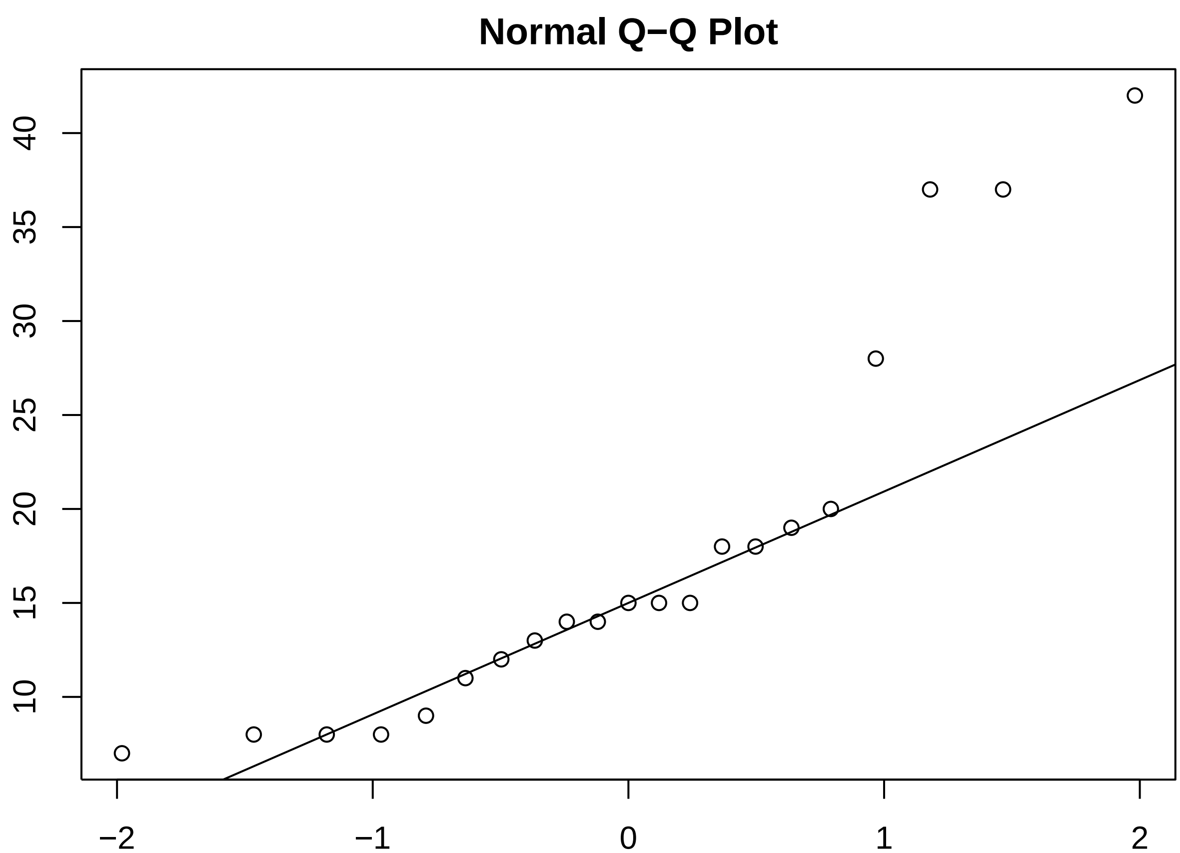
```r
#2. Create a histogram, boxplot, and normal probability plot for the variable stack.loss .
#Does an assumption of normality seem appropriate for this sample?
hist(stack.loss, main = "Stackloss data", prob = T,breaks=18)
```




```r
boxplot(stack.loss)
```




```r
qqnorm(stack.loss) # Plot NPP
qqline(stack.loss) # Plot the reference line
```



```
# No. The data appears to be skewed.
```