TAREA 1

1. Grafique las siguientes funciones

(a) $f(x) = x^3 - 2x^2 - 1$ ***en el intervalo*** $[-5, 5]$

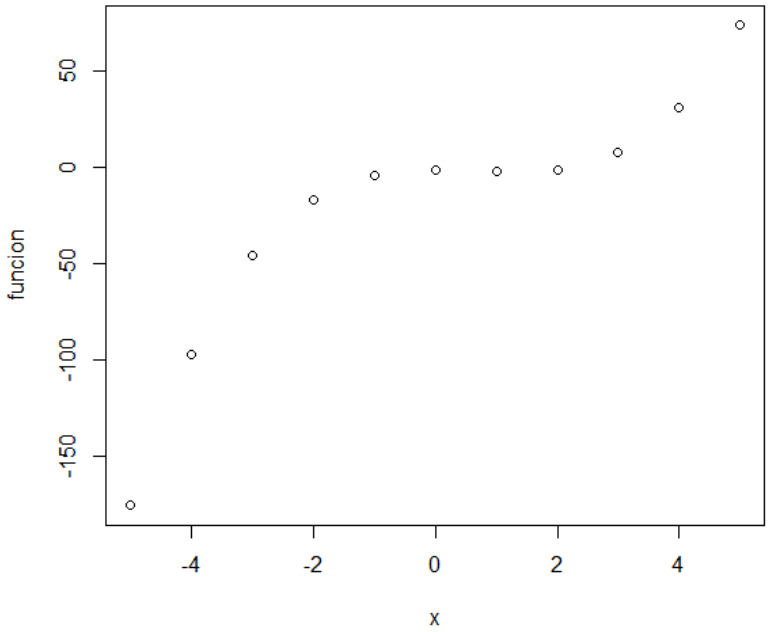
Resolución

$$(-5:5)^3 - 2(-5:5)^2 - 1$$

= -176 -97 -46 -17 -4 -1 -2 -1 8 31 74

Script

```
> x <- c(-5:5)
> funcion <-  ((x^3) – (2*(x^2)) -1)
> Plot(x, funcion)
```



(b) $g(x) = \frac{1}{(x-1)(1+x)}$ ***en el intervalo*** $[-5, 5]$

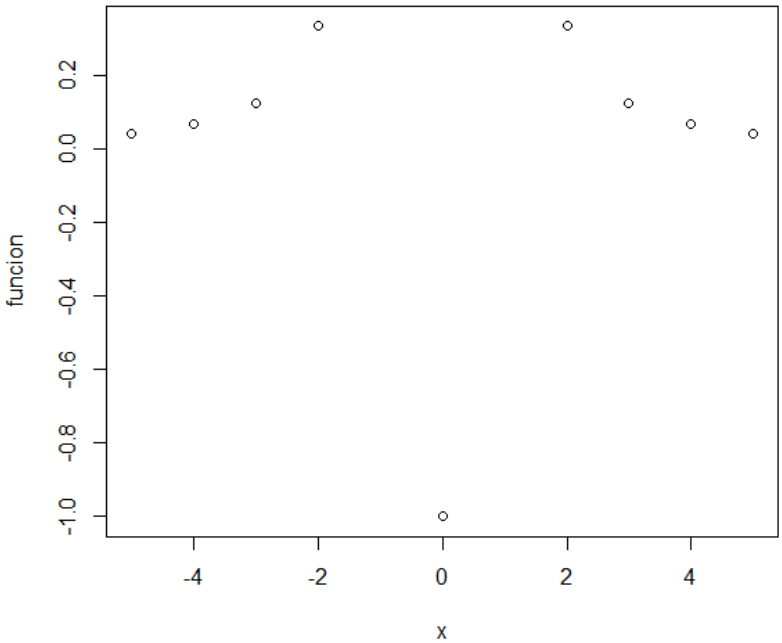
Resolución

$\frac{1}{((-5:5)-1)(1+(-5:5))}$ =

0.04166667, 0.06666667, 0.12500000, 0.33333333, -Inf, -1.00000000, Inf, 0.33333333, 0.12500000, 0.06666667, 0.04166667

Script

```
> x <- c(-5:5)
> funcion <- (1/((x-1)*(1+x)))
> plot(x,funcion)
```



2. Calcule los siguientes límites

(a) $\lim_{x \to 0} \frac{(e^x - 1)}{e^x}$

Resolución

$$\frac{\left(e^{(0)} - 1\right)}{e^{(0)}} = 0$$

Script

```
> library(Ryacas)
> x<- Sym("x")
> Limit((((exp(x))-1)/(exp(x))),x,0)
expression(0)
```

(b) $\lim_{x \to \infty} \frac{x}{x+1}$

Resolución

$$\frac{(\infty)}{(\infty) + 1}$$

Script

```
> library(Ryacas)
> x<- Sym("x")
> Limit(((x)/(x+1)), x, Inf)
expression(Inf/(Inf + 1))
```

3. Encontrar las soluciones de las siguientes ecuaciones

(a) $x^2 - 2x + 1 = 0$

Resolución

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(1)}}{2(1)} \qquad x = \frac{2 \pm \sqrt{(4) - 4}}{2} \qquad x = \frac{2}{2} \qquad x = 1$$

Script

```
> a <-1
> b <- (-2)
> c <- 1
> x1 <- (((-b)+(sqrt((b^2)-(4*a*c))))/(2*1))
> x2 <- (((-b)-(sqrt((b^2)-(4*a*c))))/(2*1))
> x1
[1] 1
> x2
[1] 1
```

(b) $\boldsymbol{x^3 - x = 0}$

Resolución

$$ax^3 + bx^2 + cx + d = 0$$

$x^3 - x = 0$ $\quad$ $x(x^2 - 1) = 0$ $\quad$ $x(x+1)(x-1) = 0$

$x = 0$ $\quad$ $x = 1$ $\quad$ $x = -1$

Script

```
> a <- 1
> b <- 0
> c <- -1
> x1 <- (((-b)+(sqrt((b^2)-(4*a*c))))/(2*1))
> x2 <- (((-b)-(sqrt((b^2)-(4*a*c))))/(2*1))
> x1
[1] 1
> x2
[1] -1
X3 = 0
```

4. Encontrar las soluciones de los siguientes sistemas de ecuaciones

(a) $\boldsymbol{x - 2y = 0}$

$\boldsymbol{-3x + 2y = -1}$

Resolución

$\begin{bmatrix} 1 & -2 \\ -3 & 2 \end{bmatrix} = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$ fila2 – (fila1*(-3)) $\begin{bmatrix} 1 & -2 \\ 0 & -4 \end{bmatrix} = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$ fila2/-4 $\begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 \\ \frac{1}{4} \end{bmatrix}$

fila1 – (fila2*(-2)) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} \\ \frac{1}{4} \end{bmatrix}$

$x = \frac{1}{2}$

$y = \frac{1}{4}$

Script

```
> Datos1 <- matrix(c(1,-2,-3,2), ncol=2, by=T)
> Datos2 <- c(0,-1)
> solve(Datos1,Datos2)
[1] 0.50 0.25
```

(a) $\boldsymbol{2x + 3y = 0}$

$\boldsymbol{3x - 2y = 1}$

Resolución

$\begin{bmatrix}2 & 3\\ 3 & -2\end{bmatrix} = \begin{bmatrix}0\\ 1\end{bmatrix}$ fila1/2 $\begin{bmatrix}1 & \frac{3}{2}\\ 3 & -2\end{bmatrix} = \begin{bmatrix}0\\ 1\end{bmatrix}$ fila2 – (fila1*3) $\begin{bmatrix}1 & \frac{3}{2}\\ 0 & \frac{-13}{2}\end{bmatrix} = \begin{bmatrix}0\\ 1\end{bmatrix}$

fila2/(-13/2) $\begin{bmatrix}1 & \frac{3}{2}\\ 0 & 1\end{bmatrix} = \begin{bmatrix}0\\ \frac{-2}{13}\end{bmatrix}$ fila1-(fila2*(3/2) $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix} = \begin{bmatrix}\frac{3}{13}\\ \frac{-2}{13}\end{bmatrix}$

$x = \frac{3}{13}$

$y = \frac{-2}{13}$

Script

```
> Datos1 <- matrix(c(2,3,3,-2), ncol=2, by=T)
> Datos2 <- c(0,1)
> solve(Datos1, Datos2)
[1]  0.2307692 -0.1538462
```

5. **Sea X la variable aleatoria que representa la suma del resultado al lanzar dos dados. Encontrar las siguientes probabilidades.**

(a) P(X = 3) =

Script

```
> x <- c(1:6)
> xx <- c(x[1]+x[1:6],x[2]+x[1:6],x[3]+x[1:6],x[4]+x[1:6],x[5]+x[1:6],x[6]+x[1:6])
> xx
 [1]  2  3  4  5  6  7  3  4  5  6  7  8  4  5  6  7  8  9  5  6  7  8  9 10  6
[26]  7  8  9 10 11  7  8  9 10 11 12
> sum(xx==3)/length(xx)
[1] 0.05555556
```

(b) P(X = 15) =

Script

```
> sum(xx==15)/length(xx)
[1] 0
```

(c) P(X = 4 ó 6) =

Script

```
> sum(xx==4 | xx==6)/length(xx)
[1] 0.2222222
```

(d) P(X <= 4) =

Script

```
> sum(xx<=4)/length(xx)
[1] 0.1666667
```

(e) P(X > 4) =

Script

```
> sum(xx>4)/length(xx)
[1] 0.8333333
```

TAREA 2

1. **Escriba las instrucciones en R que calcule lo siguiente:**

(a) $\sum_{i=1}^{500}(2i-1) =$

Resolución

$\big(2(1,2,3,\ldots,500)\big) - 1 = 1 + 3 + 5 + \ \ldots + 999$ = 250000

Script

```
> i <- c(1:500)
> sum((2*i)-1)
[1] 250000
```

(b) $\sum_{i=1}^{500}(-1)^{(i+1)}(2i-1) =$

Resolución

$(-1)^{((1,2,3,..\ 500)+1)}\big(2(1,2,3,\ldots 500)\big) - 1 = (1,-3,5\ldots 999)$= -500

Script

```
> i <- c(1:500)
> sum(((-1)^(i+1))*((2*i)-1))
[1] -500
```

(c) $\sum_{i=1}^{500}(i)^2 =$

Resolución

$(1,2,3\ldots 500)^2$ = $1^2 + 2^2 + 3^2 + \ldots + 1000^2$=41791750

Script

```
> i <- c(1:500)
> sum(i^2)
[1] 41791750
```

2. Dados los vectores *x = c(3, 5, 6, 4, 2, 7, 8, 9)* y *y = c(4, 3, 2, 5, 7, 4, 3, 8)* escribir las instrucciones en R para que calcule lo siguiente:

(a) $\frac{\bar{x}=\sum_i^8 X_i}{n} = \frac{x1+x2+x3+x4+x5+x6+x7+x8}{n}$ $\qquad$ $\frac{\bar{y}=\sum_i^8 y_i}{n} = \frac{y1+y2+y3+y4+y5+y6+y7+y8}{n}$

Resolución

$$\frac{\bar{x} = \sum_i^8 X_i}{n} = \frac{3+5+6+4+2+7+8+9}{8} = 5.5$$

$$\frac{\bar{y}=\sum_i^8 y_i}{n} = \frac{4+3+2+5+7+4+3+8}{8} = 4.5$$

Script

```
> x <- c(3, 5, 6, 4, 2, 7, 8, 9)
> sum(x)/(length(x))
[1] 5.5

> mean(x)
[1] 5.5

> y <- c(4,3,2,5,7,4,3,8)
> sum(y)/(length(y))
[1] 4.5

> mean(y)
[1] 4.5
```

(b) $\boldsymbol{va} = \frac{\sum_{i=1}^{8} (x_i - \bar{x})^2}{n-1}$

Script

```
> x <- c(3, 5, 6, 4, 2, 7, 8, 9)
> mx <- sum(x)/(length(x))
> sum(((x - mx)^2))/((length(x))-1)
[1] 6

> var(x)
[1] 6
```

(c)

$$\boldsymbol{ss} = \frac{\boldsymbol{\Sigma_{i=1}^{8}} (\boldsymbol{x_i} - \bar{\boldsymbol{x}})(\boldsymbol{y_i} - \bar{\boldsymbol{y}})}{\sqrt{\sum_{i=1}^{8} (\boldsymbol{x_i} - \bar{\boldsymbol{x}})^2} \sqrt{\sum_{i=1}^{8} (\boldsymbol{y_i} - \bar{\boldsymbol{y}})^2}}$$

Script

```
> x <- c (3, 5, 6, 4, 2, 7, 8, 9)
> mx <- sum(x)/(length(x))
> my <- sum(y)/length(y)
> ss <- sum((x-mx)*(y-my))/((sqrt(sum((x-mx)^2)))*(sqrt(sum((y-my)^2))))
> ss
[1] -0.02817181
```