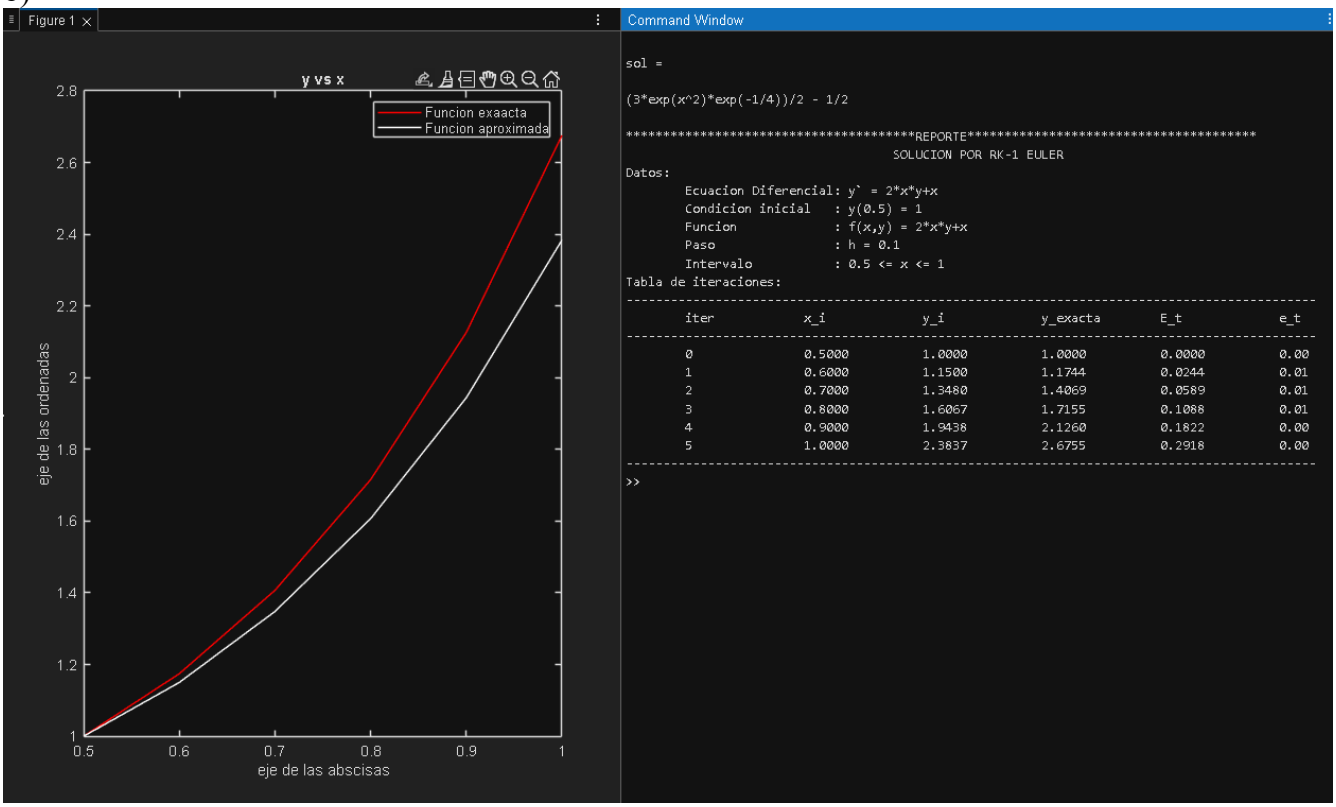
EMI ESCUELA MILITAR DE INGENIERÍA "Mcal. Antonio José de Sucre" Prestigio. Disciplina y Mejores Oportunidades	**PRÁCTICA** Nº	CÓDIGO SAGA A30853-6	Calificación
CARRERA: Ingenieria de sistemas	ASIGNATURA: Metodos numericos	FECHA DE ENTREGA:	
Apellidos y Nombres: Joaquin Jhonny Peñaloza Rojas		C.I: 13440068	
CURSO: Cuarto Semestre	DOCENTE: M. Sc. Ing. Ariel Villca Paye		

E-1:

a)

```
sol =

(3*exp(x^2)*exp(-1/4))/2 - 1/2
```

b)

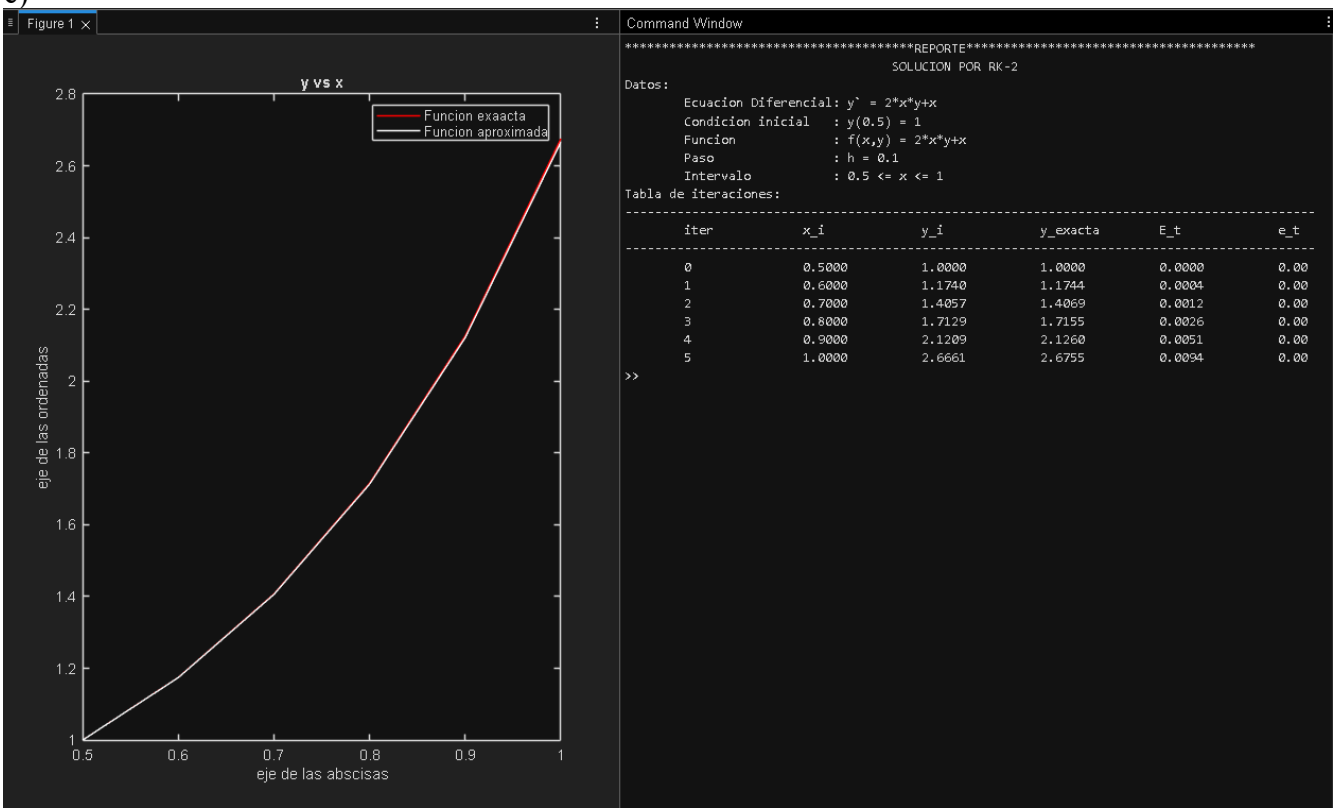



```
Command Window

sol =

(3*exp(x^2)*exp(-1/4))/2 - 1/2

**************************************REPORTE**************************************
                                SOLUCION POR RK-1 EULER
Datos:
       Ecuacion Diferencial: y` = 2*x*y+x
       Condicion inicial   : y(0.5) = 1
       Funcion             : f(x,y) = 2*x*y+x
       Paso                : h = 0.1
       Intervalo           : 0.5 <= x <= 1
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
       iter          x_i           y_i           y_exacta      E_t           e_t
-------------------------------------------------------------------------------------------
       0             0.5000        1.0000        1.0000        0.0000        0.00
       1             0.6000        1.1500        1.1744        0.0244        0.01
       2             0.7000        1.3480        1.4069        0.0589        0.01
       3             0.8000        1.6067        1.7155        0.1088        0.01
       4             0.9000        1.9438        2.1260        0.1822        0.00
       5             1.0000        2.3837        2.6755        0.2918        0.00
-------------------------------------------------------------------------------------------
>>
```

```
clc, clear all, close all;
syms y(x);

edo = diff(y,x) == 2*x*y+x;
cond = y(0.5)==1;
sol = dsolve(edo,cond)

y_exacta = @(x) (3*exp(x.^2)*exp(-1/4))/2 - 1/2;
h=0.1;
x = 0.5:h:1;
f = @(y,x) (2*x).*y+x;
```

```
n = size(x,2);
x_0 = 0.5;
y_0 = 1;
fprintf('**************************************REPORTE**************************************\n')
fprintf('\t                    SOLUCION POR RK-1 EULER\n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial:  y` = 2*x*y+x\n')
fprintf('\tCondicion  inicial   : y(%.1f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion            : f(x,y) = 2*x*y+x\n')
fprintf('\tPaso               : h = %.1f\n',h)
fprintf('\tIntervalo          : 0.5 <= x <= 1\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta       E_t          e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
y = zeros(1,n);
y(1) = y_0;
for i = 1:n
   k = h * f(y(i),x(i));
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(y(i)));
   fprintf('\t%.0f\t      \t%.4f\t     \t%.4f\t     \t%.4f\t     \t%.4f\t      \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1) = y(i)+k;
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')


plot(x,y_exacta(x),"-r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion  aproximada")
title('y  vs x'); xlabel('eje  de las abscisas'); ylabel('eje  de las ordenadas');
```

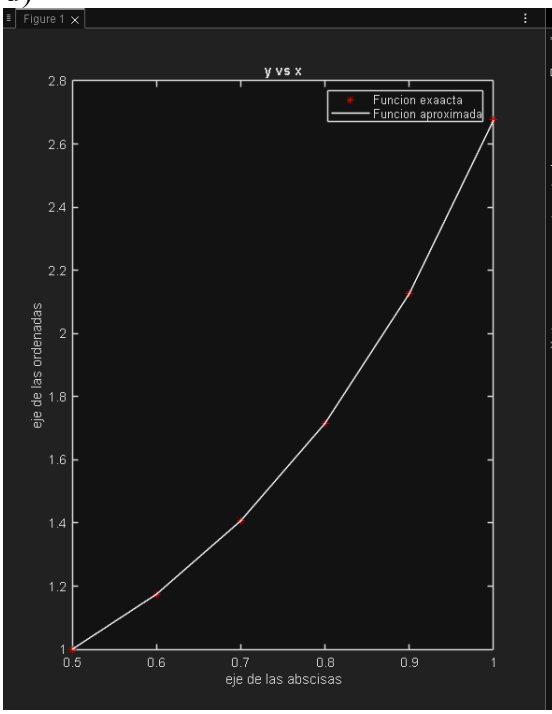
c)




```
Command Window
**************************************REPORTE**************************************
                                    SOLUCION POR RK-2
Datos:
       Ecuacion Diferencial: y` = 2*x*y+x
       Condicion inicial   : y(0.5) = 1
       Funcion             : f(x,y) = 2*x*y+x
       Paso                : h = 0.1
       Intervalo           : 0.5 <= x <= 1
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
       iter          x_i          y_i          y_exacta       E_t          e_t
-------------------------------------------------------------------------------------------
       0             0.5000       1.0000       1.0000         0.0000       0.00
       1             0.6000       1.1740       1.1744         0.0004       0.00
       2             0.7000       1.4057       1.4069         0.0012       0.00
       3             0.8000       1.7129       1.7155         0.0026       0.00
       4             0.9000       2.1209       2.1260         0.0051       0.00
       5             1.0000       2.6661       2.6755         0.0094       0.00
>>
```

```
clc, clear all, close all;

y_exacta = @(x) (3*exp(x.^2)*exp(-1/4))/2 - 1/2;
h=0.1;
x = 0.5:h:1;
f = @(y,x) (2*x).*y+x;
x_0 = 0.5;
y_0 = 1;
n = size(x,2);
y = zeros(1,n);
y(1)=y_0;
fprintf('****************************************REPORTE****************************************\n')
fprintf('\t                    SOLUCION POR RK-2 \n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = 2*x*y+x\n')
fprintf('\tCondicion  inicial   : y(%.1f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion              : f(x,y) = 2*x*y+x\n')
fprintf('\tPaso                 : h = %.1f\n',h)
fprintf('\tIntervalo            : 0.5 <= x <= 1\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta       E_t          e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
for i = 1:n
   k = h*f(y(i),x(i));
   k_2 = h*f(y(i)+k,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t      \t%.4f\t    \t%.4f\t    \t%.4f\t    \t%.4f\t      \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1) = y(i)+(1/2)*(k+k_2);
end
y(n+1)=[];

plot(x,y_exacta(x),"-r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion aproximada")
title('y  vs x'); xlabel('eje  de las abscisas'); ylabel('eje  de las ordenadas');
```

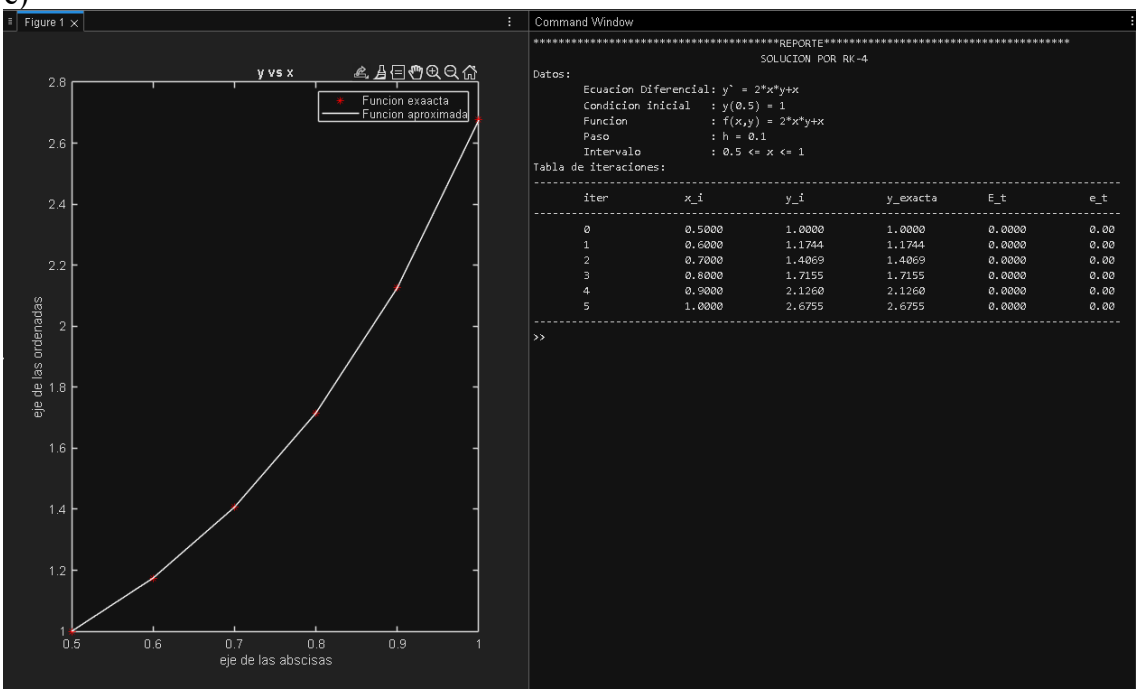
d)




```
Command Window
****************************************REPORTE****************************************
                                    SOLUCION POR RK-3
Datos:
       Ecuacion Diferencial: y` = 2*x*y+x
       Condicion inicial   : y(0.5) = 1
       Funcion             : f(x,y) = 2*x*y+x
       Paso                : h = 0.1
       Intervalo           : 0.5 <= x <= 1
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
       iter          x_i          y_i          y_exacta       E_t          e_t
-------------------------------------------------------------------------------------------
       0             0.5000       1.0000       1.0000       0.0000       0.00
       1             0.6000       1.1744       1.1744       0.0000       0.00
       2             0.7000       1.4069       1.4069       0.0000       0.00
       3             0.8000       1.7155       1.7155       0.0000       0.00
       4             0.9000       2.1260       2.1260       0.0000       0.00
       5             1.0000       2.6753       2.6755       0.0002       0.00
-------------------------------------------------------------------------------------------
>>
```

```
clc, clear all, close all;

y_exacta = @(x) (3*exp(x.^2)*exp(-1/4))/2 - 1/2;
h=0.1;
x=0.5:h:1;
n =size(x,2);
f = @(y,x) (2*x).*y+x;
x_0 = 0.5;y_0 = 1;
y = zeros(1,n);
y(1) = y_0;

fprintf('****************************************REPORTE****************************************\n')
fprintf('\t                    SOLUCION POR RK-3 \n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = 2*x*y+x\n')
fprintf('\tCondicion  inicial   : y(%.1f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion              : f(x,y) = 2*x*y+x\n')
fprintf('\tPaso                 : h = %.1f\n',h)
fprintf('\tIntervalo            : 0.5 <= x <= 1\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta       E_t          e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
for i = 1:n
   k = h*f(y(i),x(i));
   k_2 = h*f(y(i)+(1/2)*k,x(i)+(1/2)*h);
   k_3 = h*f(y(i)-k+2*k_2,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t      \t%.4f\t    \t%.4f\t    \t%.4f\t    \t%.4f\t      \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1) = y(i)+(1/6)*(k+4*k_2+k_3);
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')

plot(x,y_exacta(x),"*r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion aproximada")
title('y  vs x'); xlabel('eje  de las abscisas'); ylabel('eje  de las ordenadas');
```

e)




```
Command Window
****************************************REPORTE****************************************
                                SOLUCION POR RK-4
Datos:
        Ecuacion Diferencial: y` = 2*x*y+x
        Condicion inicial   : y(0.5) = 1
        Funcion             : f(x,y) = 2*x*y+x
        Paso                : h = 0.1
        Intervalo           : 0.5 <= x <= 1
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
        iter          x_i          y_i          y_exacta       E_t          e_t
-------------------------------------------------------------------------------------------
        0             0.5000       1.0000       1.0000       0.0000       0.00
        1             0.6000       1.1744       1.1744       0.0000       0.00
        2             0.7000       1.4069       1.4069       0.0000       0.00
        3             0.8000       1.7155       1.7155       0.0000       0.00
        4             0.9000       2.1260       2.1260       0.0000       0.00
        5             1.0000       2.6755       2.6755       0.0000       0.00
-------------------------------------------------------------------------------------------
>>
```

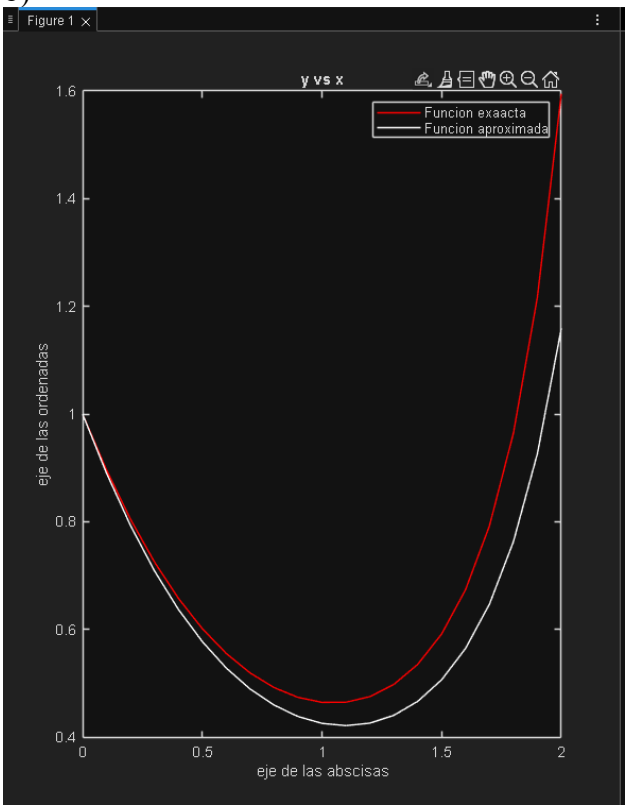
```
clc, clear all, close all;

y_exacta = @(x) (3*exp(x.^2)*exp(-1/4))/2 - 1/2;
h=0.1;
x=0.5:h:1;
n =size(x,2);
f = @(y,x) (2*x).*y+x;
x_0 = 0.5;y_0 = 1;
y = zeros(1,n);
y(1) = y_0;

fprintf('****************************************REPORTE****************************************\n')
fprintf('\t                    SOLUCION POR RK-4 \n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = 2*x*y+x\n')
fprintf('\tCondicion  inicial   : y(%.1f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion            : f(x,y) = 2*x*y+x\n')
fprintf('\tPaso              : h = %.1f\n',h)
fprintf('\tIntervalo          : 0.5 <= x <= 1\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta       E_t          e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
for i=1:n
   k_1=h*f(y(i),x(i));
   k_2=h*f(y(i)+(1/2)*k_1,x(i)+(1/2)*h);
   k_3=h*f(y(i)+(1/2)*k_2,x(i)+(1/2)*h);
   k_4=h*f(y(i)+k_3,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t      \t%.4f\t    \t%.4f\t    \t%.4f\t    \t%.4f\t      \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1)=y(i)+(1/6)*(k_1+2*k_2+2*k_3+k_4);
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')

plot(x,y_exacta(x),"*r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion  aproximada")
title('y  vs x'); xlabel('eje  de las abscisas'); ylabel('eje  de las ordenadas');
```

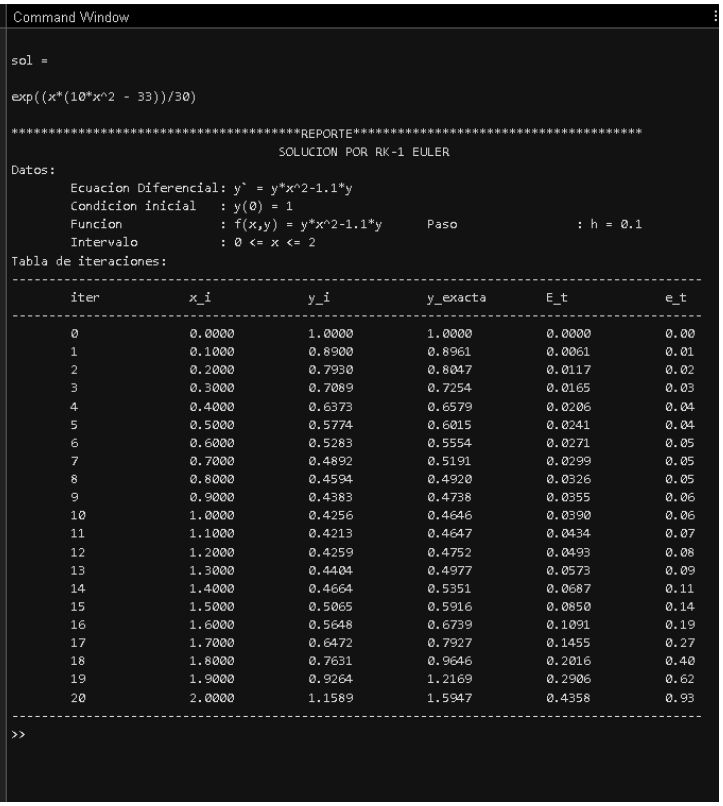
EJ-2:

a)

```
sol =

exp((x*(10*x^2 - 33))/30)
```

b)

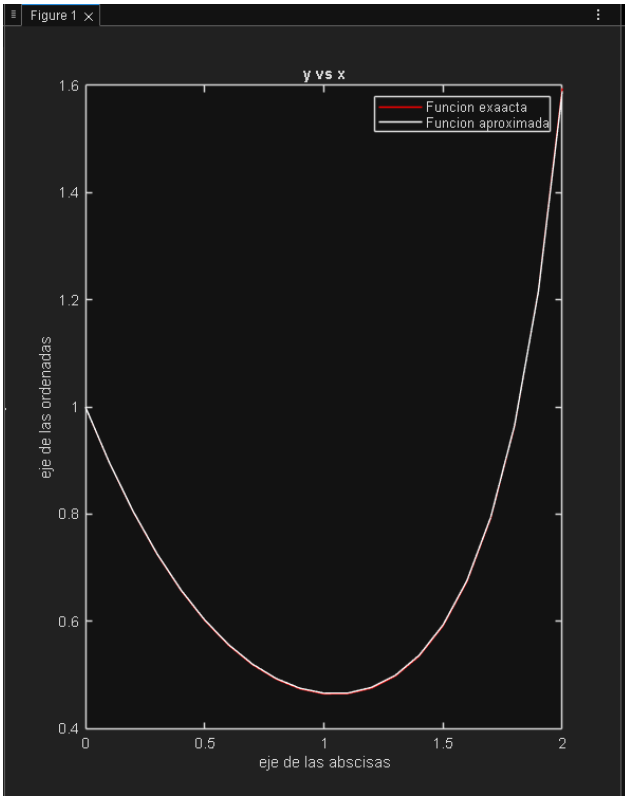





```
clc, clear all, close all;

syms y(x);


edo = diff(y,x) == y*x^2-1.1*y;

cond = y(0)==1;

sol = dsolve(edo,cond)


y_exacta = @(x) exp((x.*(10*x.^2 - 33))/30);

h=0.1;

x = 0:h:2;

f = @(y,x) y.*(x.^2)-1.1*y;

n = size(x,2);

x_0 = 0;

y_0 = 1;

fprintf('**********REPORTE**********\n')

fprintf('\t                    SOLUCION POR RK-1 EULER\n')

fprintf('Datos: \n')

fprintf('\tEcuacion  Diferencial:  y` = y*x^2-1.1*y\n')
```

```
fprintf('\tCondicion  inicial    : y(%.0f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion              : f(x,y) = y*x^2-1.1*y')
fprintf('\tPaso                 : h = %.1f\n',h)
fprintf('\tIntervalo            : 0 <= x <= 2\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer            x_i            y_i            y_exacta        E_t            e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
y = zeros(1,n);
y(1) = y_0;
for i = 1:n
   k = h * f(y(i),x(i));
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(y(i)));
   fprintf('\t%.0f\t       \t%.4f\t     \t%.4f\t      \t%.4f\t     \t%.4f\t      \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1) = y(i)+k;
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')



plot(x,y_exacta(x),"-r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion  aproximada")
title('y  vs x'); xlabel('eje  de las abscisas'); ylabel('eje  de las ordenadas');
```

c)

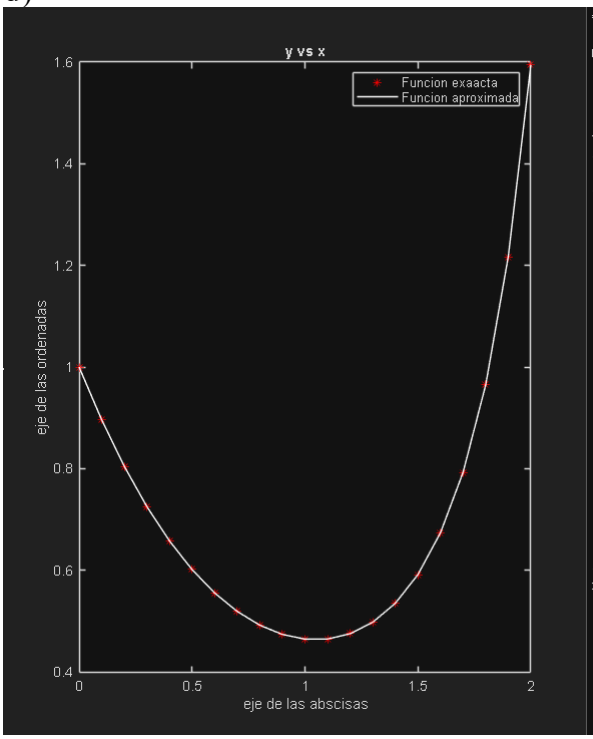



```
**********************************REPORTE**********************************
                                SOLUCION POR RK-2
Datos:
       Ecuacion Diferencial: y` = y*x^2-1.1*y
       Condicion inicial   : y(0) = 1
       Funcion             : f(x,y) = y*x^2-1.1*y      Paso               : h = 0.1
       Intervalo           : 0 <= x <= 2
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
       iter           x_i            y_i            y_exacta       E_t            e_t
-------------------------------------------------------------------------------------------
       0              0.0000         1.0000         1.0000         0.0000         0.00
       1              0.1000         0.8965         0.8961         0.0004         0.00
       2              0.2000         0.8053         0.8047         0.0006         0.00
       3              0.3000         0.7263         0.7254         0.0008         0.00
       4              0.4000         0.6589         0.6579         0.0010         0.00
       5              0.5000         0.6026         0.6015         0.0011         0.00
       6              0.6000         0.5566         0.5554         0.0011         0.00
       7              0.7000         0.5202         0.5191         0.0011         0.00
       8              0.8000         0.4931         0.4920         0.0012         0.00
       9              0.9000         0.4750         0.4738         0.0012         0.00
       10             1.0000         0.4658         0.4646         0.0012         0.00
       11             1.1000         0.4660         0.4647         0.0013         0.00
       12             1.2000         0.4766         0.4752         0.0014         0.00
       13             1.3000         0.4992         0.4977         0.0015         0.00
       14             1.4000         0.5367         0.5351         0.0016         0.00
       15             1.5000         0.5932         0.5916         0.0017         0.00
       16             1.6000         0.6756         0.6739         0.0017         0.00
       17             1.7000         0.7943         0.7927         0.0016         0.00
       18             1.8000         0.9655         0.9646         0.0009         0.00
       19             1.9000         1.2160         1.2169         0.0010         0.00
       20             2.0000         1.5891         1.5947         0.0055         0.00
-------------------------------------------------------------------------------------------
>>
```

```
clc, clear all, close all;


y_exacta = @(x) exp((x.*(10*x.^2 - 33))/30);

h=0.1;

x = 0:h:2;

f = @(y,x) y.*(x.^2)-1.1*y;

n = size(x,2);

x_0 = 0;

y_0 = 1;

y = zeros(1,n);

y(1) = y_0;

fprintf('**********************************REPORTE**********************************\n')

fprintf('\t                        SOLUCION POR RK-2 \n')

fprintf('Datos: \n')

fprintf('\tEcuacion  Diferencial:  y` = y*x^2-1.1*y\n')

fprintf('\tCondicion  inicial    : y(%.0f) = %.0f\n',[x_0 y_0])

fprintf('\tFuncion              : f(x,y) = y*x^2-1.1*y')
```

```
fprintf('\tPaso              : h = %.1f\n',h)
fprintf('\tIntervalo         : 0 <= x <= 2\n')
fprintf('Tabla de iteraciones: \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta      E_t          e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
for i = 1:n
   k = h*f(y(i),x(i));
   k_2 = h*f(y(i)+k,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t      \t%.4f\t    \t%.4f\t    \t%.4f\t    \t%.4f\t    \t%.2f\t\n',[i-1 x(i) y(i) y_exacta(x(i)) E_t e_t])
   y(i+1) = y(i)+(1/2)*(k+k_2);
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')



plot(x,y_exacta(x),"-r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion aproximada")
title('y vs x'); xlabel('eje de las abscisas'); ylabel('eje de las ordenadas');
```

d)

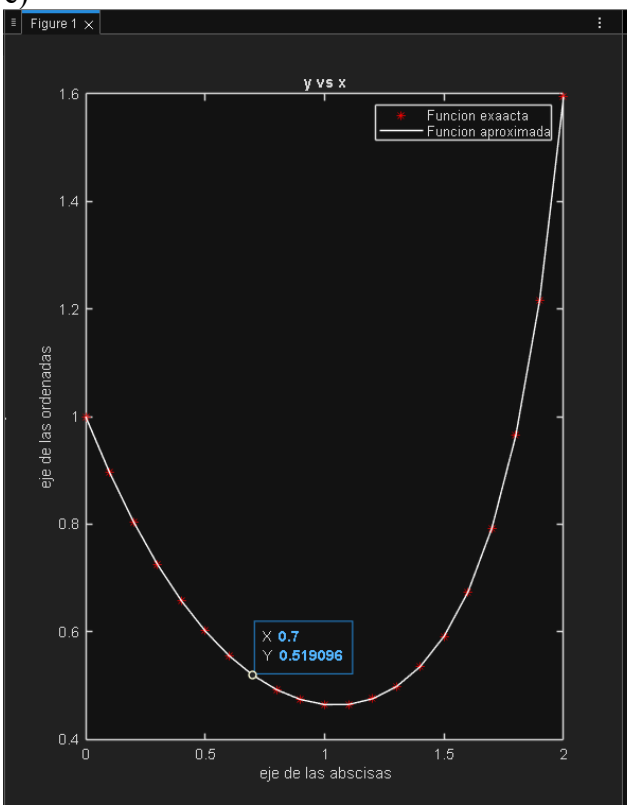



```
**********************************REPORTE**********************************
                        SOLUCION POR RK-3
Datos:
        Ecuacion Diferencial: y` = y*x^2-1.1*y
        Condicion inicial   : y(0) = 1
        Funcion             : f(x,y) = y*x^2-1.1*y      Paso              : h = 0.1
        Intervalo           : 0 <= x <= 2
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
        iter            x_i             y_i             y_exacta        E_t             e_t
-------------------------------------------------------------------------------------------
        0               0.0000          1.0000          1.0000          0.0000          0.00
        1               0.1000          0.8961          0.8961          0.0000          0.00
        2               0.2000          0.8047          0.8047          0.0000          0.00
        3               0.3000          0.7254          0.7254          0.0000          0.00
        4               0.4000          0.6579          0.6579          0.0000          0.00
        5               0.5000          0.6015          0.6015          0.0000          0.00
        6               0.6000          0.5554          0.5554          0.0000          0.00
        7               0.7000          0.5191          0.5191          0.0000          0.00
        8               0.8000          0.4920          0.4920          0.0000          0.00
        9               0.9000          0.4738          0.4738          0.0000          0.00
        10              1.0000          0.4646          0.4646          0.0000          0.00
        11              1.1000          0.4647          0.4647          0.0000          0.00
        12              1.2000          0.4752          0.4752          0.0000          0.00
        13              1.3000          0.4978          0.4977          0.0000          0.00
        14              1.4000          0.5351          0.5351          0.0001          0.00
        15              1.5000          0.5916          0.5916          0.0001          0.00
        16              1.6000          0.6740          0.6739          0.0001          0.00
        17              1.7000          0.7928          0.7927          0.0001          0.00
        18              1.8000          0.9648          0.9646          0.0002          0.00
        19              1.9000          1.2170          1.2169          0.0001          0.00
        20              2.0000          1.5946          1.5947          0.0001          0.00
-------------------------------------------------------------------------------------------
>>
```

```
clc, clear all, close all;

y_exacta = @(x) exp((x.*(10*x.^2 - 33))/30);
h=0.1;
x = 0:h:2;
f = @(y,x) y.*(x.^2)-1.1*y;
n = size(x,2);
x_0 = 0;
y_0 = 1;
y = zeros(1,n);
y(1) = y_0;
fprintf('**********************************REPORTE**********************************\n')
fprintf('\t                        SOLUCION POR RK-3 \n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = y*x^2-1.1*y\n')
fprintf('\tCondicion  inicial   : y(%.0f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion             : f(x,y) = y*x^2-1.1*y')
fprintf('\tPaso               : h = %.1f\n',h)
fprintf('\tIntervalo          : 0 <= x <= 2\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer            x_i            y_i            y_exacta        E_t            e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
for i = 1:n
   k = h*f(y(i),x(i));
   k_2 = h*f(y(i)+(1/2)*k,x(i)+(1/2)*h);
   k_3 = h*f(y(i)-k+2*k_2,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t       \t%.4f\t      \t%.4f\t      \t%.4f\t      \t%.4f\t       \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1) = y(i)+(1/6)*(k+4*k_2+k_3);
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')

plot(x,y_exacta(x),"*r");
hold on
plot(x,y,"-w")
```

legend("Funcion exaacta","Funcion aproximada")
title('y vs x'); xlabel('eje de las abscisas'); ylabel('eje de las ordenadas');

e)




```
**********************************REPORTE**********************************
                          SOLUCION POR RK-4
Datos:
       Ecuacion Diferencial: y` = y*x^2-1.1*y
       Condicion inicial   : y(0) = 1
       Funcion             : f(x,y) = y*x^2-1.1*y      Paso              : h = 0.1
       Intervalo           : 0 <= x <= 2
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
       iter          x_i           y_i           y_exacta      E_t           e_t
-------------------------------------------------------------------------------------------
       0             0.0000        1.0000        1.0000        0.0000        0.00
       1             0.1000        0.8961        0.8961        0.0000        0.00
       2             0.2000        0.8047        0.8047        0.0000        0.00
       3             0.3000        0.7254        0.7254        0.0000        0.00
       4             0.4000        0.6579        0.6579        0.0000        0.00
       5             0.5000        0.6015        0.6015        0.0000        0.00
       6             0.6000        0.5554        0.5554        0.0000        0.00
       7             0.7000        0.5191        0.5191        0.0000        0.00
       8             0.8000        0.4920        0.4920        0.0000        0.00
       9             0.9000        0.4738        0.4738        0.0000        0.00
       10            1.0000        0.4646        0.4646        0.0000        0.00
       11            1.1000        0.4647        0.4647        0.0000        0.00
       12            1.2000        0.4752        0.4752        0.0000        0.00
       13            1.3000        0.4977        0.4977        0.0000        0.00
       14            1.4000        0.5351        0.5351        0.0000        0.00
       15            1.5000        0.5916        0.5916        0.0000        0.00
       16            1.6000        0.6739        0.6739        0.0000        0.00
       17            1.7000        0.7927        0.7927        0.0000        0.00
       18            1.8000        0.9646        0.9646        0.0000        0.00
       19            1.9000        1.2169        1.2169        0.0000        0.00
       20            2.0000        1.5946        1.5947        0.0000        0.00
-------------------------------------------------------------------------------------------
>>
```

clc, clear all, close all;

```
y_exacta = @(x) exp((x.*(10*x.^2 - 33))/30);
h=0.1;
x = 0:h:2;
f = @(y,x) y.*(x.^2)-1.1*y;
n = size(x,2);
x_0 = 0;
y_0 = 1;
y = zeros(1,n);
y(1) = y_0;
fprintf('**********************************REPORTE**********************************\n')
fprintf('\t                    SOLUCION POR RK-4 \n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = y*x^2-1.1*y\n')
fprintf('\tCondicion  inicial   : y(%.0f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion             : f(x,y) = y*x^2-1.1*y')
fprintf('\tPaso              : h = %.1f\n',h)
fprintf('\tIntervalo           : 0 <= x <= 2\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta       E_t          e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
for i=1:n
   k_1=h*f(y(i),x(i));
   k_2=h*f(y(i)+(1/2)*k_1,x(i)+(1/2)*h);
   k_3=h*f(y(i)+(1/2)*k_2,x(i)+(1/2)*h);
   k_4=h*f(y(i)+k_3,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t      \t%.4f\t    \t%.4f\t    \t%.4f\t    \t%.4f\t      \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1)=y(i)+(1/6)*(k_1+2*k_2+2*k_3+k_4);
```

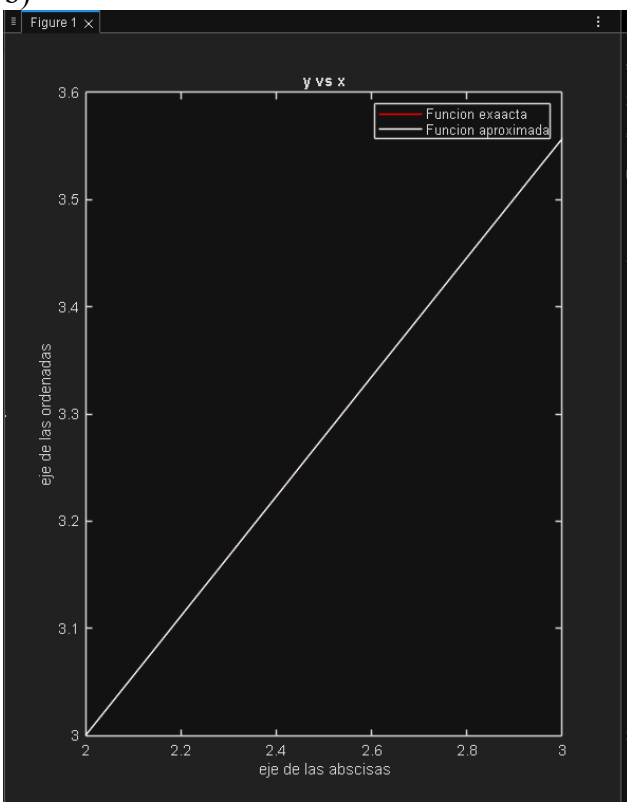
```
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')

plot(x,y_exacta(x),"*r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion aproximada")
title('y vs x'); xlabel('eje de las abscisas'); ylabel('eje de las ordenadas');
```

Ej-3:

a)

```
sol =

3^(1/3)*(x^2 + x + 3)^(1/3)
```

b)

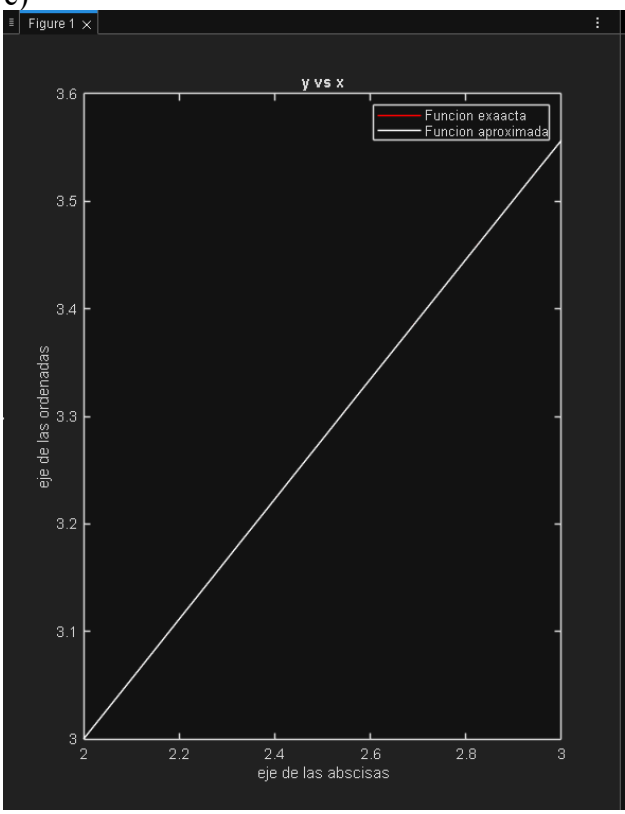



```
Command Window

sol =

3^(1/3)*(x^2 + x + 3)^(1/3)

**************************************REPORTE**************************************
                                SOLUCION POR RK-1 EULER
Datos:
       Ecuacion Diferencial: y` = (1+2*x)/y^2
       Condicion inicial   : y(2) = 3
       Funcion             : f(x,y) = (1+2*x)/y^2      Paso               : h = 0.1
       Intervalo           : 2 <= x <= 3
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
       iter           x_i            y_i            y_exacta       E_t            e_t
-------------------------------------------------------------------------------------------
       0              2.0000         3.0000         3.0000         0.0000         0.00
       1              2.0500         3.0278         3.0278         0.0000         0.00
       2              2.1000         3.0556         3.0556         0.0000         0.00
       3              2.1500         3.0834         3.0835         0.0000         0.00
       4              2.2000         3.1113         3.1114         0.0001         0.00
       5              2.2500         3.1392         3.1393         0.0001         0.00
       6              2.3000         3.1671         3.1672         0.0001         0.00
       7              2.3500         3.1950         3.1951         0.0001         0.00
       8              2.4000         3.2229         3.2230         0.0001         0.00
       9              2.4500         3.2509         3.2509         0.0001         0.00
       10             2.5000         3.2788         3.2788         0.0001         0.00
       11             2.5500         3.3067         3.3067         0.0001         0.00
       12             2.6000         3.3346         3.3346         0.0000         0.00
       13             2.6500         3.3625         3.3625         0.0000         0.00
       14             2.7000         3.3903         3.3903         0.0000         0.00
       15             2.7500         3.4182         3.4182         0.0000         0.00
       16             2.8000         3.4460         3.4460         0.0000         0.00
       17             2.8500         3.4738         3.4737         0.0000         0.00
       18             2.9000         3.5015         3.5015         0.0000         0.00
       19             2.9500         3.5293         3.5292         0.0000         0.00
       20             3.0000         3.5570         3.5569         0.0001         0.00
-------------------------------------------------------------------------------------------
>>
```

```
clc, clear all, close all;
syms y(x);

edo = diff(y,x) == (1+2*x)/y^2;
cond = y(2)==3;
sol = dsolve(edo,cond)

y_exacta = @(x) 3^(1/3)*(x.^2 + x + 3).^(1/3);
h=0.05;
x = 2:h:3;
f = @(y,x) (1+2*x)./y^2;
n = size(x,2);
x_0 = 2;
y_0 = 3;
y = zeros(1,n);
y(1) = y_0;
```

```
fprintf('**************************************REPORTE**************************************\n')
fprintf('\t                    SOLUCION POR RK-1 EULER\n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = (1+2*x)/y^2\n')
fprintf('\tCondicion  inicial   : y(%.0f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion            : f(x,y) = (1+2*x)/y^2')
fprintf('\tPaso               : h = %.1f\n',h)
fprintf('\tIntervalo          : 2 <= x <= 3\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta       E_t          e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
for i = 1:n
   k = h * f(y(i),x(i));
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(y(i)));
   fprintf('\t%.0f\t      \t%.4f\t     \t%.4f\t     \t%.4f\t     \t%.4f\t      \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1) = y(i)+k;
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')


plot(x,y_exacta(x),"-r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion  aproximada")
title('y  vs x'); xlabel('eje  de las abscisas'); ylabel('eje  de las ordenadas');
```

c)



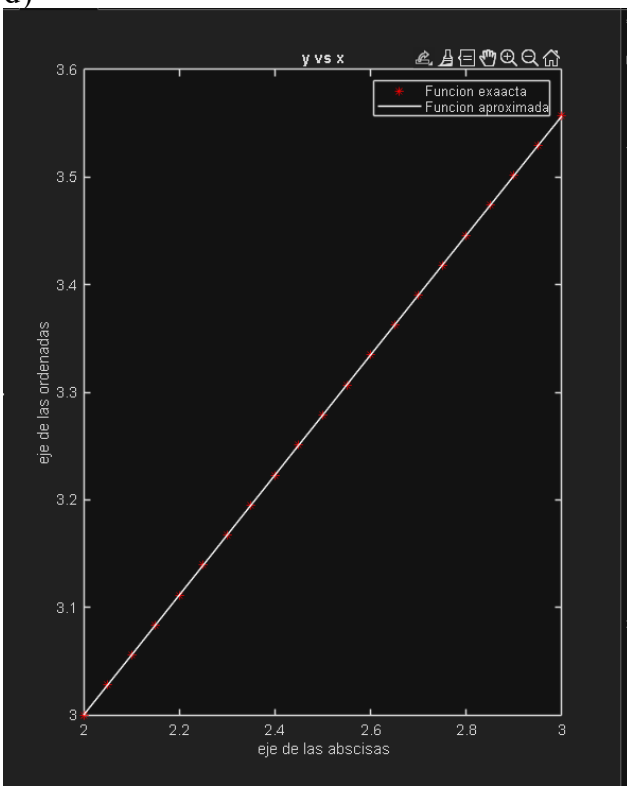
Command Window

```
**************************************REPORTE**************************************
                                    SOLUCION POR RK-2
Datos:
       Ecuacion Diferencial: y` = (1+2*x)/y^2
       Condicion inicial   : y(2) = 3
       Funcion             : f(x,y) = (1+2*x)/y^2      Paso                : h = 0.1
       Intervalo           : 2 <= x <= 3
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
       iter          x_i          y_i          y_exacta       E_t          e_t
-------------------------------------------------------------------------------------------
       0             2.0000       3.0000       3.0000       0.0000       0.00
       1             2.0500       3.0278       3.0278       0.0000       0.00
       2             2.1000       3.0556       3.0556       0.0000       0.00
       3             2.1500       3.0835       3.0835       0.0000       0.00
       4             2.2000       3.1114       3.1114       0.0000       0.00
       5             2.2500       3.1393       3.1393       0.0000       0.00
       6             2.3000       3.1672       3.1672       0.0000       0.00
       7             2.3500       3.1951       3.1951       0.0000       0.00
       8             2.4000       3.2230       3.2230       0.0000       0.00
       9             2.4500       3.2509       3.2509       0.0000       0.00
       10            2.5000       3.2788       3.2788       0.0000       0.00
       11            2.5500       3.3067       3.3067       0.0000       0.00
       12            2.6000       3.3346       3.3346       0.0000       0.00
       13            2.6500       3.3625       3.3625       0.0000       0.00
       14            2.7000       3.3903       3.3903       0.0000       0.00
       15            2.7500       3.4182       3.4182       0.0000       0.00
       16            2.8000       3.4460       3.4460       0.0000       0.00
       17            2.8500       3.4737       3.4737       0.0000       0.00
       18            2.9000       3.5015       3.5015       0.0000       0.00
       19            2.9500       3.5292       3.5292       0.0000       0.00
       20            3.0000       3.5569       3.5569       0.0000       0.00
-------------------------------------------------------------------------------------------
>>
```

```
clc, clear all, close all;

y_exacta = @(x) 3^(1/3)*(x.^2 + x + 3).^(1/3);
h=0.05;
x = 2:h:3;
f = @(y,x) (1+2*x)./y^2;
n = size(x,2);
```

```
x_0 = 2;
y_0 = 3;
y = zeros(1,n);
y(1) = y_0;
fprintf('**************************************REPORTE**************************************\n')
fprintf('\t                    SOLUCION POR RK-2\n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = (1+2*x)/y^2\n')
fprintf('\tCondicion  inicial   : y(%.0f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion             : f(x,y) = (1+2*x)/y^2')
fprintf('\tPaso                : h = %.1f\n',h)
fprintf('\tIntervalo           : 2 <= x <= 3\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta       E_t          e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
for i = 1:n
   k = h*f(y(i),x(i));
   k_2 = h*f(y(i)+k,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t      \t%.4f\t     \t%.4f\t     \t%.4f\t     \t%.4f\t      \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1) = y(i)+(1/2)*(k+k_2);
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')


plot(x,y_exacta(x),"-r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion aproximada")
title('y vs x'); xlabel('eje de las abscisas'); ylabel('eje de las ordenadas');
```

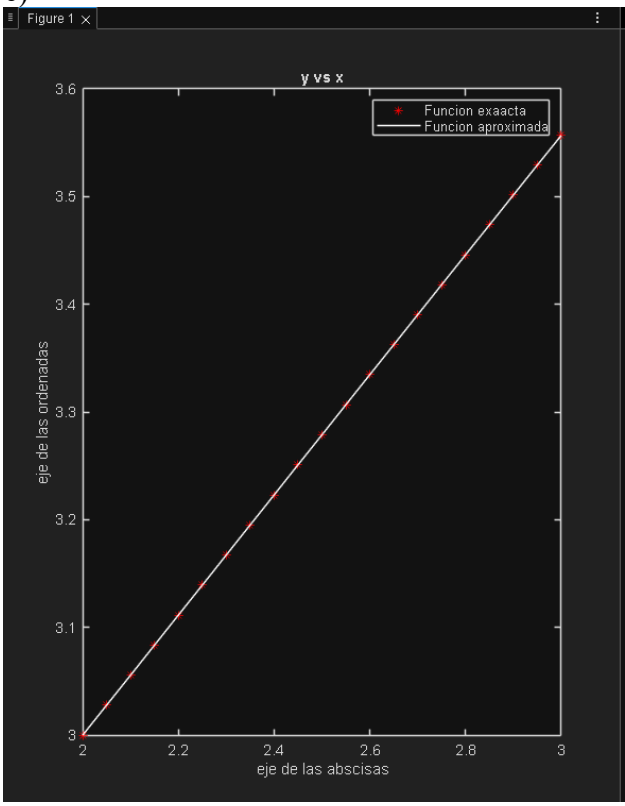
d)




```
**************************************REPORTE**************************************
                                    SOLUCION POR RK-2
Datos:
       Ecuacion Diferencial: y` = (1+2*x)/y^2
       Condicion inicial   : y(2) = 3
       Funcion             : f(x,y) = (1+2*x)/y^2      Paso                : h = 0.1
       Intervalo           : 2 <= x <= 3
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
       iter          x_i          y_i          y_exacta       E_t          e_t
-------------------------------------------------------------------------------------------
       0             2.0000       3.0000       3.0000       0.0000       0.00
       1             2.0500       3.0278       3.0278       0.0000       0.00
       2             2.1000       3.0556       3.0556       0.0000       0.00
       3             2.1500       3.0835       3.0835       0.0000       0.00
       4             2.2000       3.1114       3.1114       0.0000       0.00
       5             2.2500       3.1393       3.1393       0.0000       0.00
       6             2.3000       3.1672       3.1672       0.0000       0.00
       7             2.3500       3.1951       3.1951       0.0000       0.00
       8             2.4000       3.2230       3.2230       0.0000       0.00
       9             2.4500       3.2509       3.2509       0.0000       0.00
       10            2.5000       3.2788       3.2788       0.0000       0.00
       11            2.5500       3.3067       3.3067       0.0000       0.00
       12            2.6000       3.3346       3.3346       0.0000       0.00
       13            2.6500       3.3625       3.3625       0.0000       0.00
       14            2.7000       3.3903       3.3903       0.0000       0.00
       15            2.7500       3.4182       3.4182       0.0000       0.00
       16            2.8000       3.4460       3.4460       0.0000       0.00
       17            2.8500       3.4737       3.4737       0.0000       0.00
       18            2.9000       3.5015       3.5015       0.0000       0.00
       19            2.9500       3.5292       3.5292       0.0000       0.00
       20            3.0000       3.5569       3.5569       0.0000       0.00
-------------------------------------------------------------------------------------------
>>
```

```
clc, clear all, close all;

y_exacta = @(x) 3^(1/3)*(x.^2 + x + 3).^(1/3);
h=0.05;
x = 2:h:3;
f = @(y,x) (1+2*x)./y^2;
n = size(x,2);
x_0 = 2;
y_0 = 3;
y = zeros(1,n);
y(1) = y_0;
fprintf('****************************************REPORTE****************************************\n')
fprintf('\t                    SOLUCION POR RK-2\n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = (1+2*x)/y^2\n')
fprintf('\tCondicion  inicial   : y(%.0f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion            : f(x,y) = (1+2*x)/y^2')
fprintf('\tPaso               : h = %.1f\n',h)
fprintf('\tIntervalo          : 2 <= x <= 3\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta       E_t          e_t\n')
fprintf('-------------------------------------------------------------------------------------------\n')
for i = 1:n
   k = h*f(y(i),x(i));
   k_2 = h*f(y(i)+(1/2)*k,x(i)+(1/2)*h);
   k_3 = h*f(y(i)-k+2*k_2,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t      \t%.4f\t    \t%.4f\t    \t%.4f\t    \t%.4f\t      \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1) = y(i)+(1/6)*(k+4*k_2+k_3);
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------\n')

plot(x,y_exacta(x),"*r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion  aproximada")
title('y  vs x'); xlabel('eje  de las abscisas'); ylabel('eje  de las ordenadas');
```

e)



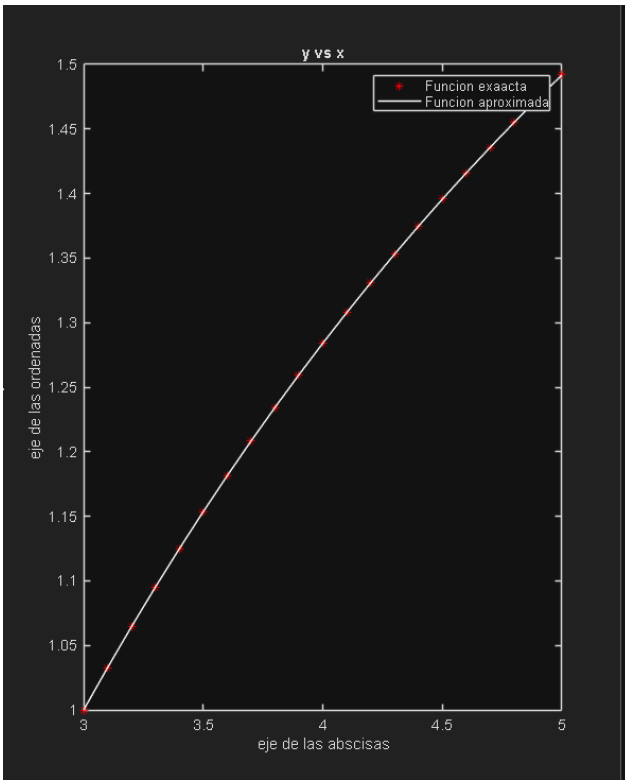
Command Window

```
**************************************REPORTE*************************************
                                SOLUCION POR RK-4
Datos:
       Ecuacion Diferencial: y` = (1+2*x)/y^2
       Condicion inicial   : y(2) = 3
       Funcion             : f(x,y) = (1+2*x)/y^2      Paso               : h = 0.1
       Intervalo           : 2 <= x <= 3
Tabla de iteraciones:
-------------------------------------------------------------------------------------------------
       iter           x_i            y_i            y_exacta       E_t            e_t
-------------------------------------------------------------------------------------------------
       0              2.0000         3.0000         3.0000         0.0000         0.00
       1              2.0500         3.0278         3.0278         0.0000         0.00
       2              2.1000         3.0556         3.0556         0.0000         0.00
       3              2.1500         3.0835         3.0835         0.0000         0.00
       4              2.2000         3.1114         3.1114         0.0000         0.00
       5              2.2500         3.1393         3.1393         0.0000         0.00
       6              2.3000         3.1672         3.1672         0.0000         0.00
       7              2.3500         3.1951         3.1951         0.0000         0.00
       8              2.4000         3.2230         3.2230         0.0000         0.00
       9              2.4500         3.2509         3.2509         0.0000         0.00
       10             2.5000         3.2788         3.2788         0.0000         0.00
       11             2.5500         3.3067         3.3067         0.0000         0.00
       12             2.6000         3.3346         3.3346         0.0000         0.00
       13             2.6500         3.3625         3.3625         0.0000         0.00
       14             2.7000         3.3903         3.3903         0.0000         0.00
       15             2.7500         3.4182         3.4182         0.0000         0.00
       16             2.8000         3.4460         3.4460         0.0000         0.00
       17             2.8500         3.4737         3.4737         0.0000         0.00
       18             2.9000         3.5015         3.5015         0.0000         0.00
       19             2.9500         3.5292         3.5292         0.0000         0.00
       20             3.0000         3.5569         3.5569         0.0000         0.00
-------------------------------------------------------------------------------------------------
>>
```

```
clc, clear all, close all;

y_exacta = @(x) 3^(1/3)*(x.^2 + x + 3).^(1/3);
h=0.05;
x = 2:h:3;
f = @(y,x) (1+2*x)./y^2;
n = size(x,2);
x_0 = 2;
y_0 = 3;
y = zeros(1,n);
y(1) = y_0;
fprintf('**************************************REPORTE**************************************\n')
fprintf('\t                        SOLUCION POR RK-4\n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = (1+2*x)/y^2\n')
fprintf('\tCondicion  inicial   : y(%.0f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion              : f(x,y) = (1+2*x)/y^2')
fprintf('\tPaso                 : h = %.1f\n',h)
fprintf('\tIntervalo            : 2 <= x <= 3\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------------\n')
fprintf('\titer           x_i           y_i           y_exacta       E_t           e_t\n')
fprintf('-------------------------------------------------------------------------------------------------\n')
for i=1:n
   k_1=h*f(y(i),x(i));
   k_2=h*f(y(i)+(1/2)*k_1,x(i)+(1/2)*h);
   k_3=h*f(y(i)+(1/2)*k_2,x(i)+(1/2)*h);
   k_4=h*f(y(i)+k_3,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t       \t%.4f\t      \t%.4f\t      \t%.4f\t      \t%.4f\t       \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1)=y(i)+(1/6)*(k_1+2*k_2+2*k_3+k_4);
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------------\n')
```

```
plot(x,y_exacta(x),"*r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion aproximada")
title('y vs x'); xlabel('eje de las abscisas'); ylabel('eje de las ordenadas');
```

Ej-4:




```
sol =

exp(1)*exp(-3/x)

**************************************REPORTE**************************************
                                SOLUCION POR RK-3
Datos:
       Ecuacion Diferencial: y` = ((3*y)/x^2
       Condicion inicial   : y(3) = 1
       Funcion             : f(x,y) = (3*y)/x^2
       Paso                : h = 0.1
       Intervalo           : 3 <= x <= 5
Tabla de iteraciones:
-------------------------------------------------------------------------------------------
       iter          x_i           y_i           y_exacta      E_t           e_t
-------------------------------------------------------------------------------------------
       0             3.0000        1.0000        1.0000        0.0000        0.00
       1             3.1000        1.0328        1.0328        0.0000        0.00
       2             3.2000        1.0645        1.0645        0.0000        0.00
       3             3.3000        1.0952        1.0952        0.0000        0.00
       4             3.4000        1.1248        1.1248        0.0000        0.00
       5             3.5000        1.1536        1.1536        0.0000        0.00
       6             3.6000        1.1814        1.1814        0.0000        0.00
       7             3.7000        1.2083        1.2083        0.0000        0.00
       8             3.8000        1.2343        1.2343        0.0000        0.00
       9             3.9000        1.2596        1.2596        0.0000        0.00
       10            4.0000        1.2840        1.2840        0.0000        0.00
       11            4.1000        1.3077        1.3077        0.0000        0.00
       12            4.2000        1.3307        1.3307        0.0000        0.00
       13            4.3000        1.3530        1.3530        0.0000        0.00
       14            4.4000        1.3746        1.3746        0.0000        0.00
       15            4.5000        1.3956        1.3956        0.0000        0.00
       16            4.6000        1.4160        1.4160        0.0000        0.00
       17            4.7000        1.4358        1.4358        0.0000        0.00
       18            4.8000        1.4550        1.4550        0.0000        0.00
       19            4.9000        1.4737        1.4737        0.0000        0.00
       20            5.0000        1.4918        1.4918        0.0000        0.00
-------------------------------------------------------------------------------------------
>>
```

```
clc, clear all, close all;
```

```
clc, clear all, close all;
syms y(x);

edo = diff(y,x) == (3*y)/x^2;
cond = y(3)==1;
sol = dsolve(edo,cond)

y_exacta = @(x) exp(1)*exp(-3./x);
h=0.1;
x = 3:h:5;
f = @(y,x) (3*y)./x.^2;
n = size(x,2);
x_0 = 3;
y_0 = 1;
y = zeros(1,n);
y(1) = y_0;
fprintf('**************************************REPORTE**************************************\n')
fprintf('\t                        SOLUCION POR RK-3\n')
fprintf('Datos: \n')
fprintf('\tEcuacion  Diferencial: y` = ((3*y)/x^2\n')
fprintf('\tCondicion  inicial   : y(%.0f) = %.0f\n',[x_0 y_0])
fprintf('\tFuncion             : f(x,y) = (3*y)/x^2\n')
fprintf('\tPaso               : h = %.1f\n',h)
fprintf('\tIntervalo          : 3 <= x <= 5\n')
fprintf('Tabla  de iteraciones:  \n')
fprintf('-------------------------------------------------------------------------------------------\n')
fprintf('\titer          x_i          y_i          y_exacta       E_t          e_t\n')
```

```
fprintf('-------------------------------------------------------------------------------------------------\n')
for i = 1:n
   k = h*f(y(i),x(i));
   k_2 = h*f(y(i)+(1/2)*k,x(i)+(1/2)*h);
   k_3 = h*f(y(i)-k+2*k_2,x(i)+h);
   E_t = abs(y_exacta(x(i))-y(i));
   e_t = abs((y_exacta(x(i))-y(i))/y_exacta(x(i)));
   fprintf('\t%.0f\t       \t%.4f\t     \t%.4f\t     \t%.4f\t     \t%.4f\t       \t%.2f\t\n',[i-1  x(i) y(i) y_exacta(x(i))  E_t e_t])
   y(i+1) = y(i)+(1/6)*(k+4*k_2+k_3);
end
y(n+1)=[];
fprintf('-------------------------------------------------------------------------------------------------\n')

plot(x,y_exacta(x),"*r");
hold on
plot(x,y,"-w")
legend("Funcion exaacta","Funcion  aproximada")
title('y  vs x'); xlabel('eje  de las abscisas'); ylabel('eje  de las ordenadas');
```

Ej-5: