

**EJERCICIOS
RESOLUCIÓN NUMÉRICA DE
PROBLEMAS DE VALOR INICIAL**

EJERCICIO 1

```

function [ xsal_colum,ysal ] = FuncionEuler(fsis,a,b,y0_colum,n)

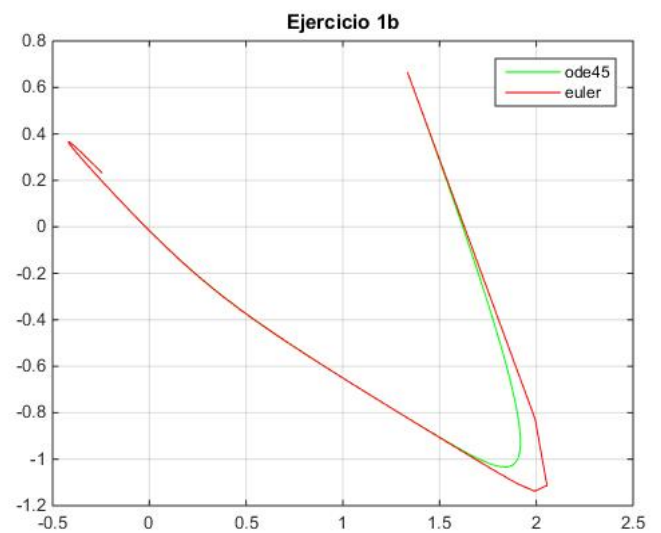
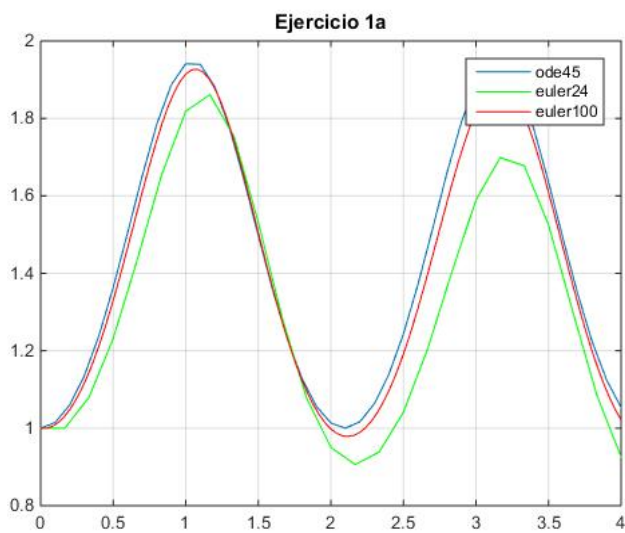
    if nargin<5
        n=100;
    end

    h=(b-a)/n;
    xsal=a:h:b;
    xsal_colum =xsal';
    ysal=[];
    ysal(1,:)= y0_colum';

    for i=1:n
        ysal(i+1,:)=ysal(i,:)+h.*fsis(xsal(i),ysal(i,:));
    end

end

```



a)

```
%Dibujar la resolución con ode45
```

```
y0_colum=[1];
```

```
a=0;
```

```
b=4;
```

```
[xsal_ode45, ysal_ode45]=ode45(@Funcion1a,[a,b], y0_colum);
```

```
plot(xsal_ode45, ysal_ode45);
```

```
grid on
```

```
hold on
```

```
%Dibujar la resolución con Euler y n=24
```

```
n=24;
```

```
[xsal_colum_24, ysal_24]=FuncionEuler(@Funcion1a,a,b, y0_colum,n);
```

```
plot(xsal_colum_24, ysal_24,'g');
```

```
hold on
```

```
%Dibujar la resolución con Euler y n=100
```

```
m=100;
```

```
[xsal_colum_100,ysal_100]=FuncionEuler(@Funcion1a,a,b, y0_colum,m);
```

```
plot(xsal_colum_100, ysal_100,'r');
```

```
title('Ejercicio 1a');
```

```
legend('ode45','euler24','euler100');
```

```
hold off
```

```
function [ yp ] = Funcion1a( t,y )
```

```
    yp=y.*sin(3*t);
```

```
end
```

b)

```

%Dibujar la resolución con ode45

y0_colum =[4/3;2/3];
a=0;
b=4;
h=0.02;
[xsal_ode45, ysal_ode45]=ode45(@Funcion1bColumnas,[a,b], y0_colum)
plot(ysal_ode45(:,1) , ysal_ode45(:,2), 'g');

hold on
grid on

%Dibujar la resolución con Euler

n=(b-a)/h;
[xsal_colum,ysal]=FuncionEuler(@Funcion1bFilas,a,b, y0_colum,n);
plot(ysal(:,1),ysal(:,2), 'r');
title('Ejercicio 1b')
legend('ode45', 'Euler')

hold off

```

```

function [ yp ] = Funcion1bFilas( t,y )

    yp(1)=9*y(1)+24*y(2)+5*cos(t)-(1/3)*sin(t);
    yp(2)=-24*y(1)-51*y(2)-9*cos(t)+(1/3)*cos(t);

end

```

```

function [ yp ] = Funcion1bColumnas( t,y )

    yp(1)=9*y(1)+24*y(2)+5*cos(t)-(1/3)*sin(t);
    yp(2)=-24*y(1)-51*y(2)-9*cos(t)+(1/3)*cos(t);
    yp=yp';

end

```

EJERCICIO 2

```
function [ xsal_colum,ysal ] = FuncionEulerMejorado(fsis,a,b,y0_colum,n)

    if nargin<5
        n=100;
    end

    h=(b-a)/n;
    xsal=a:h:b;
    xsal_colum=xsal';
    ysal=[];
    ysal(1,:)=y0_colum';

    for i=1:n
        k1=fsis(xsal(i),ysal(i,:));
        k2=fsis(xsal(i+1),ysal(i,:)+h.*k1);
        ysal(i+1,:)=ysal(i,:)+(h/2)*(k1+k2);
    end
end
```

```
function [ xsal_colum,ysal ] = FuncionRungeKutta(fsis,a,b,y0_colum,n)

    if nargin<5
        n=100;
    end

    h=(b-a)/n;
    xsal=a:h:b;
    xsal_colum=xsal';
    ysal=[];
    ysal(1,:)=y0_colum';

    for i=1:n
        k1=fsis(xsal(i),ysal(i,:));
        k2=fsis(xsal(i)+(h/2),ysal(i,:)+(h/2)*k1);
        k3=fsis(xsal(i)+(h/2),ysal(i,:)+(h/2)*k2);
        k4=fsis(xsal(i)+h,ysal(i,:)+h*k3);
        ysal(i+1,:)=ysal(i,:)+(h/6)*(k1+2*k2+2*k3+k4);
    end

end
```

a)

Hacer el dibujo con ode45

```

y0_colum=[0];
a=0;
b=6;

[xsal_ode45,ysal_ode45]=ode45(@Funcion2a,[a,b],y0_colum);
plot(xsal_ode45,ysal_ode45);

grid on
hold on

```

Hacer el dibujo con Euler Mejorado

```

n=52;
[xsal_colum_EM,ysal_EM]=FuncionEulerMejorado(@Funcion2a,a,b,y0_colum,n);
plot(xsal_colum_EM,ysal_EM,'r');

```

Hacer el dibujo con Runge Kutta

```

[xsal_colum_RK,ysal_RK]=FuncionRungeKutta(@Funcion2a,a,b,y0_colum,n);
plot(xsal_colum_RK,ysal_RK,'g');

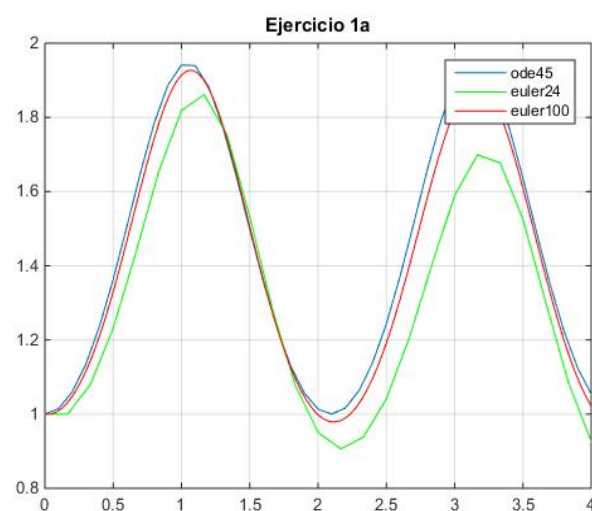
title('Ejercicio 2a');
legend('Ode45','Euler Mejorado','Runge-Kutta')
hold off

```

```

function [ yp ] = Funcion2a( t,y )
    yp=(1+y^2)*cos(t);
end

```



b)

Hacer el dibujo con ode45

```
y0_colum=[1/2 -1/2];
```

```
a=1;
```

```
b=4;
```

```
[xsal_ode45,ysal_ode45]=ode45(@Funcion2bColumnas,[a,b],y0_colum);
```

```
plot(ysal_ode45(:,1),ysal_ode45(:,2));
```

```
grid on
```

```
hold on
```

%Hacer el dibujo con Euler Mejorado

```
h=0.01;
```

```
n=(b-a)/h;
```

```
[xsal_colum_EM,ysal_EM]=FuncionEulerMejorado(@Funcion2bFilas,a,b,y0_colum,n);
```

```
plot(ysal_EM(:,1),ysal_EM(:,2),'r');
```

%Hacer el dibujo con Runge Kutta

```
[xsal_colum_RK,ysal_RK]=FuncionRungeKutta(@Funcion2bFilas,a,b,y0_colum,n);
```

```
plot(ysal_RK(:,1),ysal_RK(:,2),'g');
```

```
title('Ejercicio 2b');
```

```
legend('Ode45','Euler mejorado','Runge-Kutta')
```

```
hold off
```

```
function [ yp ] = Funcion2bFilas( t,y )
```

```
yp(1)=y(2);
```

```
yp(2)=(1/t)*(y(2)+8*(t^3)*y(1)^3);
```

```
end
```



```
function [ yp ] = Funcion2bColumnas( t,y )  
    yp(1)=y(2);  
    yp(2)=(1/t)*(y(2)+8*(t^3)*y(1)^3);  
    yp=yp';  
  
end
```

