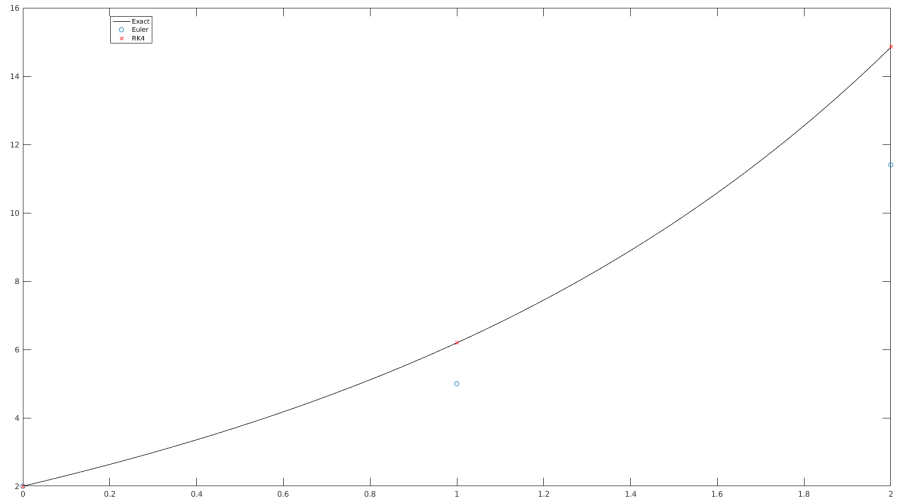
```
%Cory Wolfe
```

Manual RK4

```
dydt = @(t,y) 4*exp(.8*t)-.5*y;
t = 0:2;h=1
y = zeros(3,1);y(1)=2;
%First time step
i = 1; k1 = dydt(t(i),y(i));
k2 = dydt(t(i)+0.5*h,y(i)+0.5*k1*h);
k3 = dydt(t(i)+0.5*h,y(i)+0.5*k2*h);
k4 = dydt(t(i)+h,y(i)+k3*h);
phi = (k1+2*k2+2*k3+k4)/6;
y(i+1) = y(i) + phi*h
%Second time step
i =2;
k1 = dydt(t(i),y(i));
k2 = dydt(t(i)+0.5*h,y(i)+0.5*k1*h);
k3 = dydt(t(i)+0.5*h,y(i)+0.5*k2*h);
k4 = dydt(t(i)+h,y(i)+k3*h);
phi = (k1+2*k2+2*k3+k4)/6;
y(i+1) = y(i) + phi*h
%Exact and Euler
tx = linspace(0,2);
yx = (40*exp(.8*tx)-14*exp(-.5*tx))/13;
[te, ye] = eulode(dydt, [0 2], 2, 1);
[xe,ue] = eulsys(@ws19_ode,[0 3],[1 1],.1);
plot(tx,yx,'k',te,ye,'o',t,y,'rx')
legend('Exact','Euler','RK4','Location','best')
```

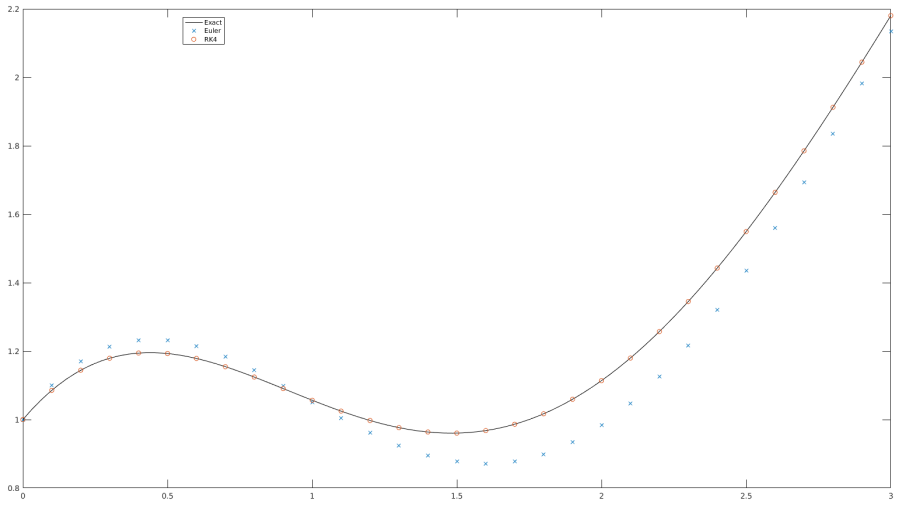
```
h =

     1


y =

    2.0000
    6.2010
         0


y =

    2.0000
    6.2010
   14.8625
```



2nd order ODE

```
[x,u] = rk4sys(@ws19_ode,[0 3],[1 1],.1);
xx=linspace(0,3); s7 = sqrt(7)/2;
ux = xx + (3*cos(s7*xx)+6/7*s7*sin(s7*xx))./(2*exp(xx/2))-0.5;
plot(xx,ux,'k',xe,ue(:,1),'x',x,u(:,1),'o')
legend('Exact','Euler','RK4','Location','best')
fprintf('Exact solution at t=2: %7.4f\n',ux(end))
fprintf('Euler solution at t=2: %7.4f\n',ue(end,1))
fprintf('RK4   solution at t=2: %7.4f\n',u(end,1))
```

```
Exact solution at t=2:  2.1803
Euler solution at t=2:  2.1339
RK4   solution at t=2:  2.1803
```



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