1. Modify the Matlab function *feuler.m* to implement the modified Euler method:

$$y_{n+1}^* = y_n + hf(t_n, y_n)$$
$$y_{n+1} = y_n + \frac{h}{2}\big(f(t_n, y_n) + f(t_{n+1}, y_{n+1}^*)\big)$$

Apply the Euler and modified Euler methods to solve the intial value problem:

$$y' = \frac{2}{t}y + t^2 e^t, \quad 1 \leq t \leq 2, \quad y(1) = 0.$$

The exact solution is $y(t) = t^2(e^t - e)$.

In Matlab, use the commands in the next page to run *feuler.m* (and your Matlab function for the modified Euler method).

2. Repeat Q1 using the forth-order Runge-Kutta method.

```
>> tspan=[1,2]; y0=0;
>> f=inline('2*y/t + t^2*exp(t)', 't', 'y');
>> yexact=inline('t^2*(exp(t)-exp(1))', 't');
>> Nh=10;
>> for k=1:8
       [t,u]=feuler(f,tspan,y0,Nh);
       error(k)= abs(u(end)-feval(yexact, t(end)));
       Nh=2*Nh;
   end
>> plot(t,u)
>> p=log(abs(error(1:end-1)./error(2:end)))/log(2)
```