

- (20^{pts}) 1. Consider the following initial value problem.

$$y' = -3y \cos 2t + 2 \cos 2t, \quad y(0) = 2$$

Perform each of the following tasks.

- (a) Use Matlab's **dsolve** command to solve the initial value problem. In the space provide below, write the command used and the resulting solution.

Solution:

```
>> dsolve('Dy=-3*y*cos(2*t)+2*cos(2*t)', 'y(0)=2', 't')  
ans =  
2/3+4/3*exp(-3/2*sin(2*t))
```

- (b) Write a function file for the right-hand side of your differential equation. Put a comment in your code with your full name so you can identify your function M-file when it comes off the class printer.

Solution:

```
function yprime=quiz5b(t,y)  
% your name here  
yprime=-3*y*cos(2*t)+2*cos(2*t);
```

- (c) Write a script file that will perform each of the following tasks, placing all requested plots in the same figure window. Put a comment in your script with your full name so you can identify your script M-file when it comes off the class printer.

1. Plot the exact solution on the interval $[0, 10]$.
2. Plot the euler solution on the interval $[0, 10]$, using a step size $h = 0.5$.
3. Plot the runge-kutta 2 solution on the interval $[0, 10]$, using a step size $h = 0.5$.
4. Plot the runge-kutta 4 solution on the interval $[0, 10]$, using a step size $h = 0.5$.
5. Add a legend to your plot.
6. Label the horizontal axis as t , the vertical axis as y .
7. Put your full name as a title on your figure so you can identify your plot when it comes off the class printer.

Solution:

```
% quiz5b_driver.m  
% Your name here  
  
% close all open figure windows  
close all  
  
% calculating the exact solution  
t=linspace(0,10,200);  
y=2/3+4/3*exp(-3/2*sin(2*t));  
  
% time interval, initial condition, step size  
tspan=[0,10];  
init=2;  
h=0.5;
```

```

% calculating euler solution
[teul,yeul]=eul(@quiz5b,tspan,init,h);

% calculating rk2 solution
[trk2,yrk2]=rk2(@quiz5b,tspan,init,h);

% calculating rk4 solution
[trk4,yrk4]=rk4(@quiz5b,tspan,init,h);

% plotting the solutions
plot(t,y,teul,yeul,'*',trk2,yrk2,'+',trk4,yrk4,'o')

% labels
xlabel('t')
ylabel('y')
title('Your name here')

% adding a legend
legend('Exact','Euler','RK2','Rk4')

set(gcf,'PaperPosition',[0,0,4,3])
print -depsc2 quiz5b.eps

```

(d) Obtain printouts of each of the following:

1. Your function file.
2. Your script file.
3. Your plot.

Solution:

