Plotting Solutions to First Order Initial Value Problems [1]

Enter the following sequence of commands:

```
F = inline('sin(y)', 't', 'y')
T = 0:.01:10;
[T, Y] = ode45(F, T, 1);
plot(T, Y)
```

`F = inline('sin(y)', 't', 'y')` .... Defines a function of two variables.
`T = 0:.01:10;` .... Defines a vector. Do not skip the semicolon.

Remarks

1. If you skip the semicolon, you will get a list of the values in T.

2. The third statement tells MATLAB to numerically solve the IVP:

$$y' = F(t, y), \quad y(0) = 1.$$

By using T as the second argument in the call to `ode45` we are indicating that we want the values of Y at the times given in the vector T. If you want more info on the use of `ode45`, issue the command `help ode45`.

3. The fourth statement plots a graph of the points

$$(T(1), Y(1)), (T(2), Y(2)), \ldots, (T(1000), Y(1000)).$$

It should appear that the solution has a horizontal asymptote. Try extending the range of the t values to go from 0 to 20. You can re-type the second statement as `T = 0:.01:20;` or you can use the up-arrow key until the statement `T = 0:.01:10;` reappears and then use the left-arrow key to move the cursor left and change the 10 to 20, then press the Enter key. Next you can again use the up-arrow key to recall `ode45` and then press the Enter key. Plot the new values. The up-arrow key and the down-arrow key allow the user to move up and down through the list of previous commands. A command does not get entered until you press the Enter key.

4. What would you guess for the value of the horizontal asymptote?

Using the methodology described above, sketch *by hand*, on a separate piece of paper, the solution of the given initial-value problem on the given interval. DO **not** get a printout.
Make sure you include appropriate numerical values along the axes.

1. $y' = \frac{1}{2} - \cos t, \qquad y(0) = 1, \qquad [0, 30]$
2. $\frac{dy}{dt} = \frac{2}{t+1} - y^2, \qquad y(0) = 2, \qquad [0, 30]$
3. $y' - y = t\cos t, \qquad y(0) = 0, \qquad [0, 20]$
4. $t\frac{dy}{dt} + y = t, \qquad y(1) = 2, \qquad [1, 10]$