Name: _____

Math 310 - Differential Equations - Summer 2020

Matlab Project # 1 – due by June 22

You would need to use a Matlab program **dfield** written by John C. Polking, Department of Mathematics, Rice University. Matlab software is available through VLAB at http://vlab.uidaho.edu. Students are encouraged to contact IT help desk at http://www.uidaho.edu/its/ if help is needed to find where to store files and how to access Matlab as soon as possible. Some Matlab tutorials are available on the course web site.

Start Matlab. Program dfield is available at

`http://www.webpages.uidaho.edu/~barannyk/Teaching/dfield9.m`

You would need to download and save to your working folder the file dfield9.m. To run **dfield9**, type in the command line **dfield9** or press green arrow button from the file when you open it. This should open a window similar to that shown in class. There is a bit of information about **dfield** program on pages 28–29 of the textbook.

There is also a java version of dfield available at

`http://math.rice.edu/~dfield/dfpp.html`

1. Use **dfield** Matlab module (or equivalent) to construct a slope field for the given differential equation. Plot several solution curves that go through points indicated in the textbook.

   (a) $y' = -y - \sin x$ (see problem 1 from section 1.3)

   (b) $y' = -x^2 + \sin y$ (see problem 10 from section 1.3)

2. Use **dfield** Matlab module (or equivalent) to construct a slope field for the given differential equation. Plot the solution curve corresponding to the given initial condition. Finally, use this solution to estimate the desired value of the solution $y(x)$.

   (a) $y' = x + y, \quad y(0) = 0; \quad y(-4) =?$ (see problem 21 from section 1.3)

   (b) $y' = x + \frac{1}{2}y^2, \quad y(-2) = 0; \quad y(2) =?$ (see problem 24 from section 1.3)

3. Find an explicit solution of the initial value problem (see problem 19 from section 1.4)

   $$\frac{dy}{dx} = y\,\mathrm{e}^x, \quad y(0) = 2\,\mathrm{e}$$

   and plot your solution using Matlab directly, i.e. without using **dfield** that solves a differential equation approximately. Please include derivation of the exact solution. An example on how to plot a curve is given below. Please submit either .m file with your commands or the list of commands from the command line you used to plot the curve.

Example. To plot a Gaussian function $y = \exp(-x^2)$, type the following lines:

```
x=-3:.01:3;
y=exp(-x.*x);
plot(x,y)
ylim([-0.5 1.5])
```

For more information about Matlab, please visit

`http://www.webpages.uidaho.edu/~barannyk/Teaching/Math310.html#handouts`

on the course web site. Please use commands `xlim` and `ylim` to control your x- and y-ranges on your plot.

Note: make sure that the values of y on your plot are not huge by choosing an appropriate `ylim` value.