You have 20 minutes to do this quiz. You may not use any books or notes while you do the quiz nor discuss the quiz with anyone. You may not use a calculator. Show your work clearly.

1. Use Euler’s Method to estimate the solution of \( \frac{dy}{dt} = 2t + 3t^2 y + 1 \). Take the initial value to be \((t_0 = 0, y_0 = 1)\). Take the step size to be \(\Delta t = 1\). Take \(N = 2\) steps so that you end up at \(t = 2\). What are the \(y\) values you get for \(t = 1\) and for \(t = 2\). Make a plot of your values \((t_0, y_0), (t_1, y_1), (t_2, y_2)\).

WHEN you connect the dots, do so by straight lines. Label the graph. Write down on the graph the key numerical values.

2. For \( \frac{dy}{dt} = f(y) = y^2 - y - 6 \)

a. Determine the equilibrium solutions for this differential equation.

(see next page)
b. Sketch the graph of $f(y)$ in the $y - f$ plane.

WHEN you sketch the graph, label the key points with their numerical values. In this case, the key points are where $f$ crosses the $y$ axis: i.e. the roots of $f$.

c. Draw the phase line diagram. Indicate if equilibrium solutions are attracting, repelling or nodes.

d. Summarize the long term behavior of solutions of the differential equation in terms of their initial conditions. Phrase your answers in the form “if the initial condition $y_0$ is in a certain region then $\lim_{t \to \infty} y(t) = \ldots$

EXAMPLE: If $y_0 < -2$, then $\lim_{t \to \infty} y(t) = -2$

If $-2 < y_0 < 3$ then $\lim_{t \to \infty} y(t) =$

To be totally complete, you should also say: If $y_0 = -2$ then $y(t) = 2$. If $y_0 = 3$ then $y(t) =$.

Self evaluation: (Circle) Rate your level of understanding of the material on the quiz:

Mastery       Developing       Not Yet

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