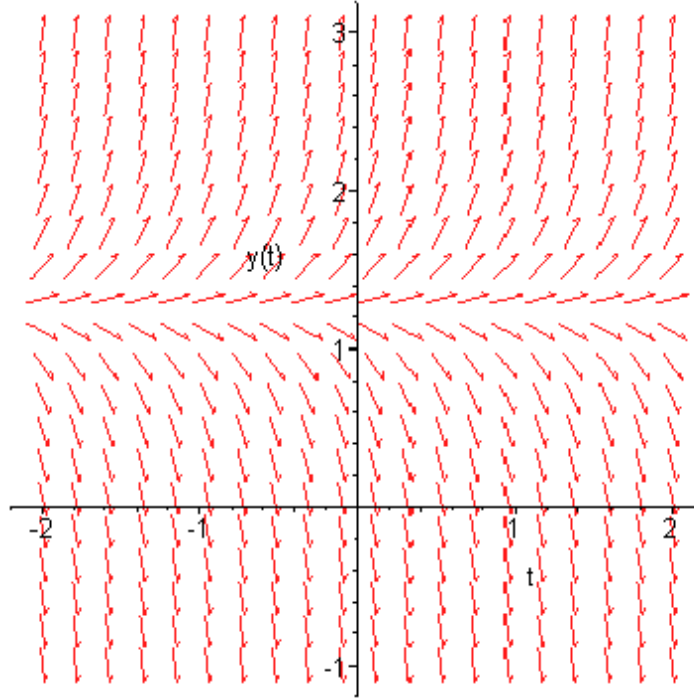


Show all work. Your answers must be fully justified.

1. Consider the differential equation:

$$\frac{dy}{dt} = 4y - 5$$

- (a) Sketch a reasonable direction field for this equation.



- (b) Describe the behavior of y as $t \rightarrow \infty$.

$$y \text{ diverges from } \frac{5}{4}$$

2. Find all values of k so that $y = e^{kt}$ is a solution to the differential equation

$$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} = -6y$$

$$\frac{dy}{dt} = ke^{kt}$$

$$\frac{d^2y}{dt^2} = k^2e^{kt}$$

So, we get :

$$k^2e^{kt} + 5ke^{kt} = -6e^{kt}$$

$$k^2 + 5k + 6 = 0 \text{ or } e^{kt} = 0$$

$$k = 2 \text{ or } k = 3.$$

3. Give an example of a nonlinear, third-order, ordinary differential equation with dependent variable y and independent variable t .

Lots of different answers possible.

Here's one: $\frac{d^3y}{dt^3} = y^2$