Name _____ KEY _____

Instructions: Show all work. Answers without work required to obtain the solution will not receive full credit. Some questions may contain multiple parts: be sure to answer all of them. Give exact answers unless specifically asked to estimate.

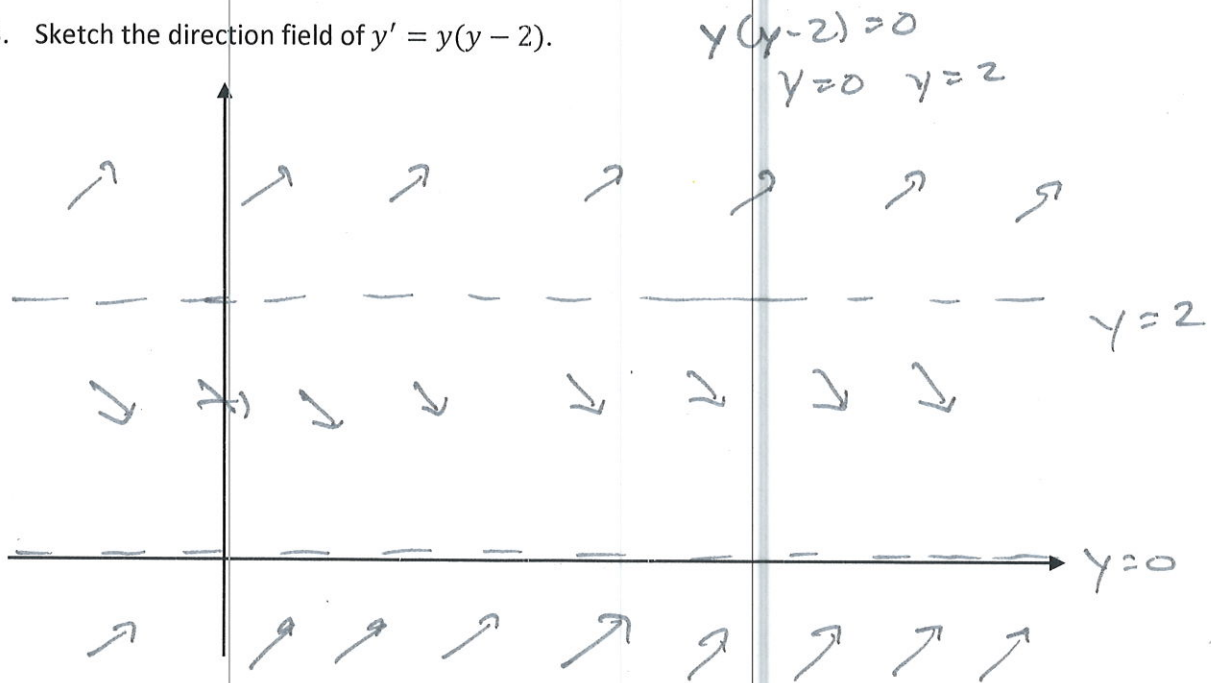1. Verify that $y = \frac{2}{3}e^x + e^{-2x}$ is a solution to the differential equation $y' + 2y = 2e^x$.

$$y' = \frac{2}{3}x - 2e^{-2x}$$

$$\frac{2}{3}e^x - 2e^{-2x} + \frac{4}{3}e^x + 2e^{-2x} = \frac{6}{3}e^x = \boxed{2e^x} \checkmark$$

2. A graph of a direction field is shown below. Choose 4 starting points that produce different paths in the direction field and trace the graph of the solution forwards and backwards from each point.
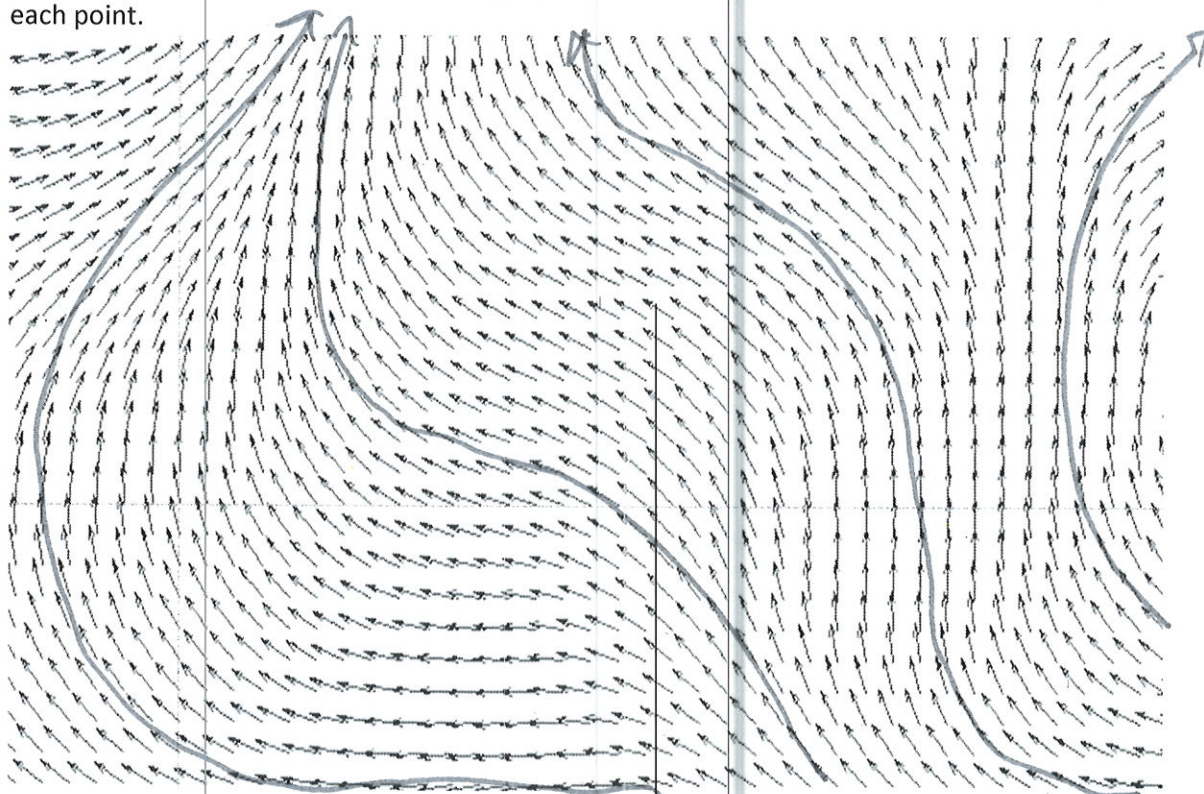
3. Sketch the direction field of $y' = y(y - 2)$.

$y(y - 2) = 0$
$y = 0 \quad y = 2$

$y = 2$

$y = 0$

$y = -1$
$(-1)(-3) \quad +$
$y = 1$
$\quad (1)(-1) = (-)$
$y = 3$
$3(1) = +$