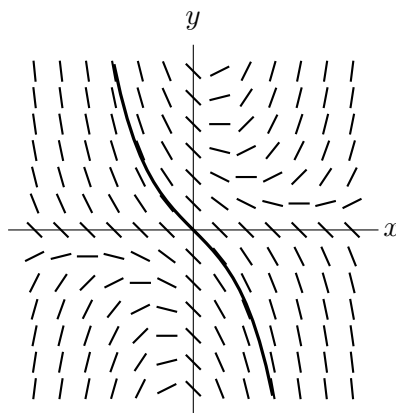


1. [10 points] Consider the differential equation $y' = xy - 1$.
- a. [2 points] The slope field of $y' = xy - 1$ is shown below. On the graph, sketch a solution curve passing through the point $(0, 0)$.



- b. [5 points] Starting with the initial condition $y(0) = 0$, use Euler's method with 3 steps to estimate $y(3/2)$. Show your work for each step.

Solution:

$$\begin{aligned} y(1/2) &\approx y(0) + \frac{1}{2}y'(0) = -\frac{1}{2} \\ y(1) &\approx y(1/2) + \frac{1}{2}y'(1/2) \approx -9/8 \\ y(3/2) &\approx y(1) + \frac{1}{2}y'(1) \approx -35/16. \end{aligned}$$

- c. [3 points] Can you determine if your estimate of $y(3/2)$ is an underestimate or overestimate? Circle your answer and **explain** your reasoning in one sentence.

Underestimate

Overestimate

Not enough information

Solution:

y is concave down on the interval $(0, \infty)$ therefore Euler's method will give an overestimate.