Instructions: Answer the questions in the space provided. Show all work to receive partial credit if any. Unsupported work will receive no credit. Circle final answer. This quiz is due Monday, 2/10 at the beginning of class and is worth 5 points.

Solve the initial value problem

\[ y' = 0.5(1 - y/4)y, \quad y(0) = 2. \]

Graph the solution and determine the behavior of the solution as \( t \to \infty \). Show all algebraic details!

\[
\frac{y'}{y(1-y/4)} = 0.5
\]

\[
\int \frac{dy}{y(1-y/4)} = \int 0.5 \, dt
\]

\[
\ln \left| \frac{y}{1-y/4} \right| = 0.5t + C
\]

Let \( y = 0 \)

\[ 1A = 1 \quad \Rightarrow \quad A = 1 \]

\[ B = \frac{1}{4} \]

\[ y = C e^{0.5t} \quad \text{arbitrary} \]

\[ y(0) = 2 \quad \Rightarrow \quad C e^{0} = C = 4 \]

\[ y(1+y/4) = 4e^{0.5t} \]

\[ y + y e^{0.5t} = 4e^{0.5t} \quad y(1 + e^{0.5t}) = 4e^{0.5t} \quad \Rightarrow \quad y = \frac{4e^{0.5t}}{1 + e^{0.5t}} \]
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Solve the initial value problem

\[ y' = 0.5(1 - y/4)y, \quad y(0) = 2. \]

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\[
y = \frac{4e^{0.5t}}{1 + e^{0.5t}} = \frac{4}{1 + e^{-0.5t}}
\]

\[
\lim_{t \to \infty} \frac{4}{1 + e^{-0.5t}} = \frac{4}{1 + 0} = 4
\]

\[
\begin{align*}
\text{This part not necessary but} \\
\text{since} \quad y' &= 0.5y - \frac{0.5y^2}{4} \\
&= 0.5y - \frac{y^2}{8} \\
y'' &= 0.5 - \frac{2y}{8} = \frac{1}{2} - \frac{y}{4} = 0 \\
\text{Inflection point at} \quad y = 2 \\
\text{so graph is a little off}
\end{align*}
\]