Lecture 10: First Order Continuation (02/02/2026)

Example

$y' = y(2 - y)$

Here $f(y) = y(2 - y)$

We use a **Phase Diagram/Portrait Diagram** to identify *stable, semi-stable, and unstable* equilibrium. The phase diagram tells us the asymptotic behaviors of the solution.

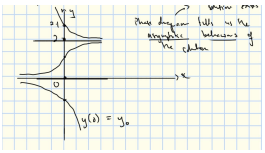

Figure 6: Asymptotic Behavior

0.4 Euler's Method

$$y'(x_0) = f(x_0, y(x_0)) = f(x_0, y_o)$$

$$y'(x_0) \approx \frac{y(x_0 + h) - y(x_0)}{h}$$

$$\frac{y(x_0 + h) - y(x_0)}{h} \approx f(x_0, y_o)$$

$$y\underbrace{(x_0 + h)}_{y_1} \approx y_o + hf(x_0, y_o)$$

$$y_2 = y(x_2 + 2h)$$

$$y_2 = y_1 + hf(2_1, y_1)$$