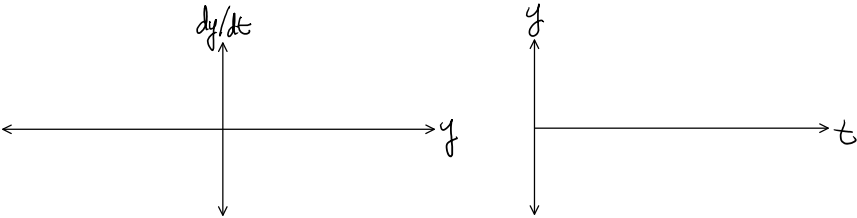


Phase Portraits: Example 1

Friday, July 3, 2020 1:36 PM

ODE and Initial Condition	Fixed Points	Stability
$\frac{dy}{dt} = -y + 2$ $y_0 = -1, t = 0$		



- 1) Draw the *phase portrait*. Sketch $\frac{dy}{dt}$ vs. y ($\frac{dy}{dt}$ on the y-axis, y on the x-axis)
- 2) Determine the fixed points.
 - a. Find all the points where $\frac{dy}{dt} = 0$.
 - b. Mark those points on the phase portrait.
- 3) Determine the stability of each fixed point.
 - a. Draw a right arrow (\rightarrow) in all regions where $\frac{dy}{dt} > 0$
 - b. Draw a left arrow (\leftarrow) in all regions where $\frac{dy}{dt} < 0$
 - c. Fixed point is *stable* if the arrows converge to the point: $\rightarrow * \leftarrow$
 - d. Fixed point is *unstable* if the arrows diverge from the point: $\leftarrow * \rightarrow$
- 4) Draw the anticipated solution based on completed phase portrait.
 - a. $y(t)$ trends *towards* a *stable* fixed point
 - b. $y(t)$ trends *away* from an *unstable* fixed point
 - c. All fixed points are horizontal lines (by definition, a fixed point doesn't change with time, so that's just a horizontal line).