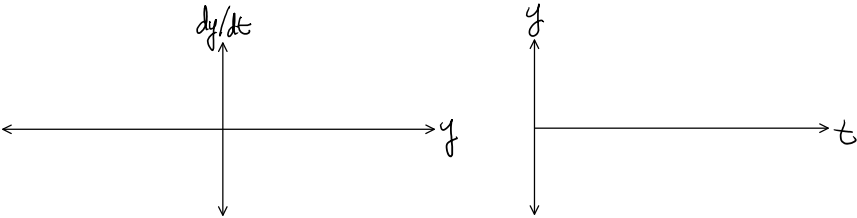


Phase Portraits: Example 2

Friday, July 3, 2020 1:36 PM

ODE and Initial Condition	Fixed Points	Stability
$\frac{dy}{dt} = \sin(y)$		



- 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).