

# The Phase Line

Math 230

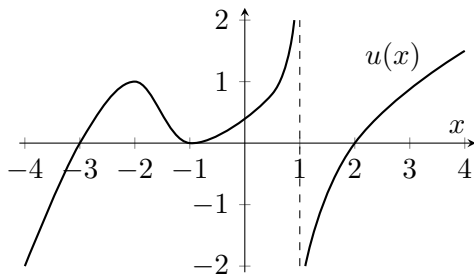
In problems 1–4, sketch the phase line for each differential equation. Identify equilibrium points as sources, sinks, or nodes. Then sketch the family of solution curves  $y(t)$ .

1.  $\frac{dy}{dt} = (y - 3)(y + 5)$

2.  $\frac{dy}{dt} = \sin(y)$

3.  $\frac{dy}{dt} = \frac{1}{y}$

4.  $\frac{dy}{dt} = f(y)$ , where  $f(y)$  is given by the following graph:



5. Consider the differential equation  $\frac{dy}{dt} = f(y)$ , where  $f$  is a differentiable function with  $f(y_0) = 0$ .

(a) If  $f'(y_0) < 0$ , then what can you say about the equilibrium point  $y_0$ ?

(b) If  $f'(y_0) > 0$ , then what can you say about the equilibrium point  $y_0$ ?

(c) If  $f'(y_0) = 0$ , then what can you say about the equilibrium point  $y_0$ ?