

### Quiz #1

MTH 351/651: Fall 2025

Instructor: John Gemmer

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**Problem 1.** Suppose  $f(x)$  is a continuous function satisfying

1.  $f(-1) = 0$
2.  $f(0) = 0$ ,
3.  $f(1) = 0$ ,
4.  $\lim_{x \rightarrow \infty} f(x) = \infty$ .

If the system  $\dot{x} = f(x)$  has no semi-stable fixed points, sketch a phase portrait for this system.



**Problem 2.** Suppose  $f(x)$  is a continuous function satisfying

1.  $f(-1) = 0$
2.  $f(0) = 0$ ,
3.  $f(1) = 0$ ,
4.  $f'(0) = 1$ .

If the system  $\dot{x} = f(x)$  has no semi-stable fixed points, sketch a phase portrait for this system.



**Problem 1.** Suppose  $f(x)$  is a continuous function satisfying

1.  $f(-1) = 0$
2.  $f(0) = 0$ ,
3.  $f(1) = 0$ ,
4.  $\lim_{x \rightarrow \infty} f(x) = -\infty$ .

If the system  $\dot{x} = f(x)$  has no semi-stable fixed points, sketch a phase portrait for this system.



**Problem 2.** Suppose  $f(x)$  is a continuous function satisfying

1.  $f(-1) = 0$
2.  $f(0) = 0$ ,
3.  $f(1) = 0$ ,
4.  $f'(0) = -1$ .

If the system  $\dot{x} = f(x)$  has no semi-stable fixed points, sketch a phase portrait for this system.

