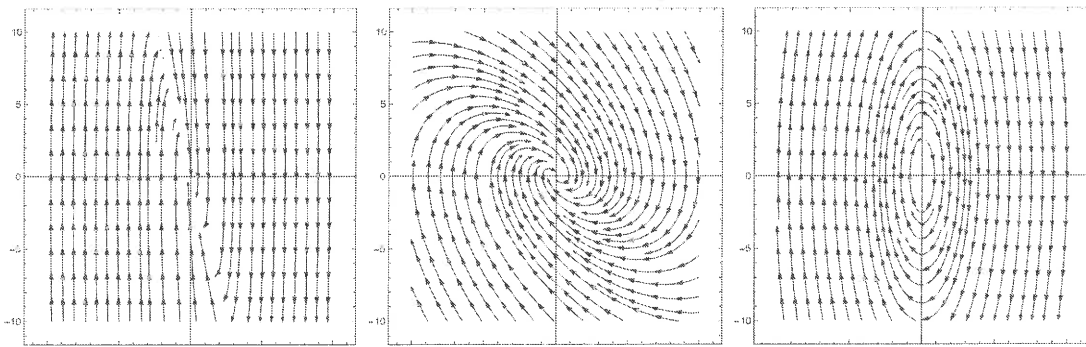
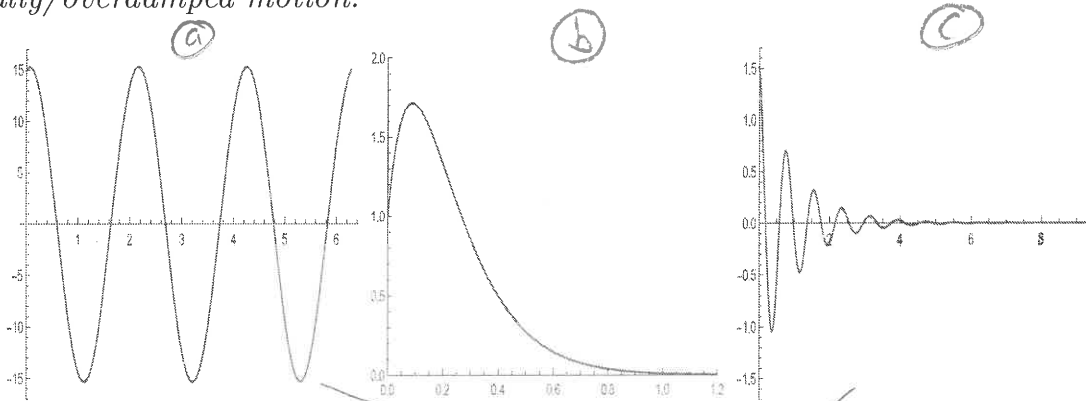


Math 307 - Differential Equations - Spring 2017

Quiz 9 April 13, 2017

Name: Solution

Problem 1. Match the position-time graphs to the phase space graphs and label them according to undamped motion, underdamped motion, and critically/overdamped motion.



critically/overdamped (b) underdamped (c) undamped (a)

Problem 2. A mass of 1kg stretches a spring 1m in equilibrium. If a driving force of $F(t) = 3 \sin \omega t$ is applied to this spring-mass system, which frequency should $F(t)$ have in order to cause resonance (unbounded amplitude)?

Resonance is when natural frequency matches driving frequency.

$$\omega_0 = \sqrt{\frac{k}{m}} \quad \text{and} \quad mg = k\Delta l \Rightarrow \frac{k}{m} = \frac{g}{\Delta l} = \frac{g}{1\text{m}} \approx 9.8 \text{ Hz}^2$$

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$$\Rightarrow \omega_0 = \sqrt{g} = \sqrt{9.8}$$