



$$b = 0$$

$$b < 0$$

$$b > 0$$

$$2\ddot{x} + 5\dot{x} = 0, \quad x(0) = 1, \quad \dot{x}(0) = 0$$

$$b > 0$$

$$\ddot{x} + 5\dot{x} + 6x = 0, \quad x(0) = 1, \quad \dot{x}(0) = 0$$

$$b > 0$$

$$\ddot{x} + 4\dot{x} + 4x = 0, \quad x(0) = 1, \quad \dot{x}(0) = 0$$

$$b^2 - 4ac > 0$$

$$\ddot{x} - 6\dot{x} + 13x = 0, \quad x(0) = 2, \quad \dot{x}(0) = 0$$

$$b^2 - 4ac > 0$$

$$\ddot{x} + 2\dot{x} + 26x = 0, \quad x(0) = 1, \quad \dot{x}(0) = 0$$

Simple harmonic motion

$$x(t) = \cos\left(\frac{\sqrt{5}}{2}t\right)$$

$$b^2 - 4ac > 0$$

$$x(t) = e^{-3t}(3e^t - 2)$$

Under damping

$$x(t) = e^{-2t}(2t + 1)$$

Over damping

$$x(t) = e^{3t} (2 \cos(2t) - 3 \sin(2t))$$

Critical damping

$$x(t) = \frac{1}{5}e^{-t} (\sin(5t) + 5 \cos(5t))$$

Increasing oscillations

