The Harmonic Oscillator

These exercises accompany the Java applet "Harmonic Oscillator."

Consider a second-order differential equation, $my'' + by' + ky = 0$, that models harmonic motion. An example of harmonic motion is that of a spring-mass system. Here we are interested in an analysis of the qualitative behavior.

Table 1 shows several second-order differential equations with initial conditions that model harmonic motion. Classify, find the eigenvalues, and describe the long-term behavior for each harmonic oscillator.

IVP $my'' + by' + ky = 0,\ v(0) = v0,\ y(0) = y0$	Classification	Eigenvalues $\lambda 1$ & $\lambda 2$	LTB
$y'' + 5y = 0, v(0) = 4, y(0) = 4$			
$y'' + y' + 5y = 0,\ v(0) = 4, y(0) = 4$			
$y'' + 6y' + 8y = 0,\ v(0) = 4, y(0) = 4$			
$y'' + 6y' + 9y = 0, v(0) = 4, y(0) = 4$			

Table 1: Classify, find the eigenvalues, and describe the long-term behavior for each harmonic oscillator.

Describe the relationship between the eigenvalues and the classification of the harmonic oscillator.