Note ♯7: Section 3.7

Problem 1. Determine frequency ω_0, amplitude R, and phase δ so as to write the given expression in the form $u = R\cos(\omega_0 t - \delta)$ with $0 < \delta < 2\pi$.

(a) $u = 3\cos(2t) + 4\sin(2t)$

(b) $u = -2\cos(\pi t) - 3\sin(\pi t)$

Problem 2. A mass weighing 3 lb stretches a spring 3 in. If the mass is pushed upward, contracting the spring a distance of 1 in and then set in motion with a downward velocity of 2 ft/s, and if there is no damping, find the position u of the mass at any time t. Determine the frequency, period, amplitude, and phase of the motion.

Problem 3. A spring is stretched 10 cm by a force of 3 N. A mass of 2 kg is hung from the spring and is also attached to a viscous damper that exerts a force of 3 N when the velocity of the mass is 5 m/s. If the mass is pulled down 5 cm below its equilibrium position and given an initial downward velocity of 10 cm/s, determine its position u at any time t.