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5.74 Introductory Quantum Mechanics II  
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## Time development of a coupled two level system

The Hamiltonian for this case is:

$$\begin{pmatrix} \varepsilon_a & V_{ab} \\ V_{ba} & \varepsilon_b \end{pmatrix}$$

$$E = \frac{\varepsilon_a + \varepsilon_b}{2}$$

$$\Delta = \frac{\varepsilon_a - \varepsilon_b}{2}$$

Given that you start in state  $|a\rangle$ , what is the time-dependent probability of ending up in state  $|b\rangle$ ?

Frequency splitting:  $\Delta := 1$

Rabi frequency:  $\Omega(V) := \sqrt{V^2 + \Delta^2}$

Note here I have expressed energy as inverse time.  $E/\hbar$

$$P(t, V) := \left[ \frac{V^2}{(V^2 + \Delta^2)} \right] \cdot \sin(\Omega(V) \cdot t)^2$$

Define a time grid:  $i := 0..500$      $\tau_i := \frac{i}{50}$

Calculate probabilities for different values of the coupling:  $V/\Delta = 0.1, 0.5, 1, 5$

$P1_i := P(\tau_i, 5)$      $P2_i := P(\tau_i, 1)$      $P3_i := P(\tau_i, 0.5)$      $P4_i := P(\tau_i, 0.1)$

