

Homework 5

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Phys 684

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Problem 1

Starting with the Maxwell wave equation

Problem 2

In the steady state, the OBE are

$$\left. \begin{aligned} 0 &= -\gamma u(t) - \delta v(t) \\ 0 &= \delta u(t) - \gamma v(t) - \Omega_0 w(t) \\ 0 &= -\gamma_2(w(t) + 1) + \frac{\Omega_0}{2} v(t) \end{aligned} \right\} \implies \begin{pmatrix} -\gamma & -\delta & 0 \\ \delta & -\gamma & -\Omega_0 \\ 0 & \Omega_0/2 & -\gamma \end{pmatrix} \begin{pmatrix} u \\ v \\ w \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ \gamma_2 \end{pmatrix}$$

Problem 3

(a)

Problem 4

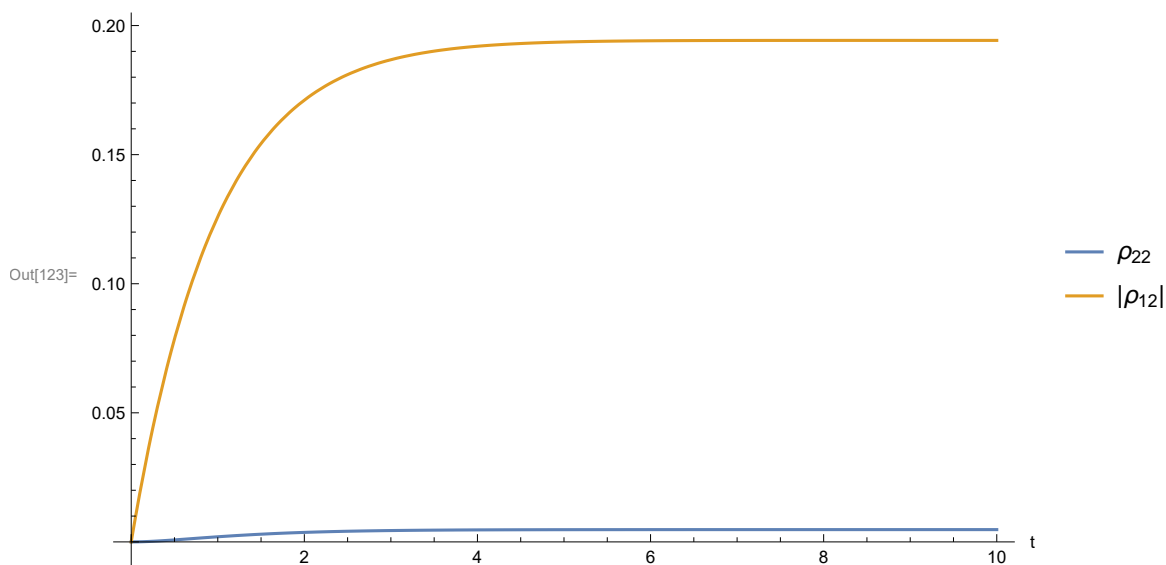
(a)

Problem 4 (Berman 4.3)

```
In[122]:= SolveAndPlot[ $\gamma$ _,  $\chi$ _,  $\delta$ _] :=
  ({{uSoln, vSoln, wSoln}} = NDSolve[{u'[t] == - $\gamma$  u[t] -  $\delta$  v[t],
    v'[t] ==  $\delta$  u[t] -  $\gamma$  v[t] - (2  $\chi$ ) w[t], w'[t] == - (2  $\gamma$ ) (w[t] + 1) +  $\chi$  v[t],
    u[0] == 0, v[0] == 0, w[0] == -1}, {u, v, w}, {t, 0, 10}];
  Plot[ $\left\{\frac{1}{2} (w[x] + 1) /. wSoln, \sqrt{u[x]^2 + v[x]^2} /. uSoln /. vSoln\right\}$ , {x, 0, 10},
    PlotRange -> All, PlotLegends -> {" $\rho_{22}$ ", " $|\rho_{12}|$ "}, AxesLabel -> {"t", ""}]);
```

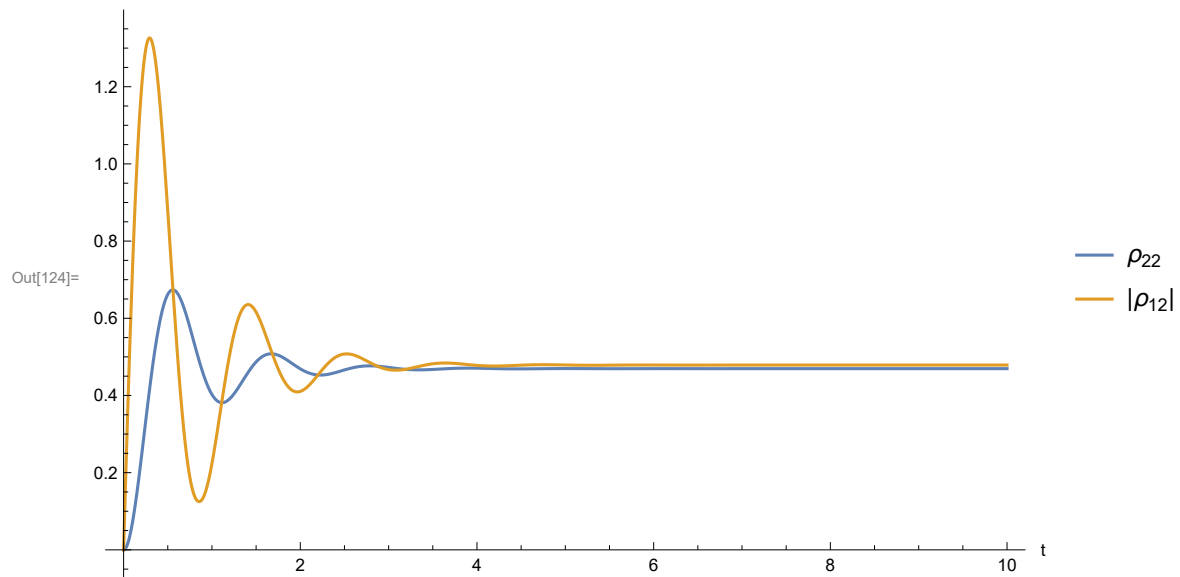
$\gamma = 1$; $\Omega_0 = 0.2$, $\delta = 0.2$

```
In[123]:= SolveAndPlot[1, 0.1, 0.2]
```



$$\gamma = 1; \Omega_0 = 8, \delta = 0.2$$

In[124]:= **SolveAndPlot**[1, 4, 0.2]



$$\gamma = 1; \Omega_0 = 8, \delta = 50$$

In[125]:= **SolveAndPlot**[1, 4, 50]

