

Problem 7.12

Part b.

```
ClearAll["Global`*"]
```

$$\text{exp} = \frac{\omega p x}{1 - I \omega \tau} - I \omega == 0$$

$$-I \omega + \frac{x \omega p}{1 - I \tau \omega} == 0$$

```
sol = Solve[exp, \omega] // FullSimplify
```

$$\left\{ \left\{ \omega \rightarrow \frac{i \left(-1 + \sqrt{1 - 4 x \tau \omega p} \right)}{2 \tau} \right\}, \left\{ \omega \rightarrow -\frac{i \left(1 + \sqrt{1 - 4 x \tau \omega p} \right)}{2 \tau} \right\} \right\}$$

```
\omega1 = sol[[1, 1, 2]]
```

```
\omega2 = sol[[2, 1, 2]]
```

$$\frac{i \left(-1 + \sqrt{1 - 4 x \tau \omega p} \right)}{2 \tau}$$

$$-\frac{i \left(1 + \sqrt{1 - 4 x \tau \omega p} \right)}{2 \tau}$$

```
\omega1 = Normal[FullSimplify[Series[\omega1, {x, Infinity, 0}],  
Assumptions -> \tau \in Reals && x \in Reals && \omega p \in Reals]]
```

```
\omega2 = Normal[FullSimplify[Series[\omega2, {x, Infinity, 0}],  
Assumptions -> \tau \in Reals && x \in Reals && \omega p \in Reals]]
```

$$-\frac{i}{2 \tau} - \frac{i \omega p}{\sqrt{\frac{1}{x}} \sqrt{-\tau \omega p}}$$

$$-\frac{i}{2 \tau} + \frac{i \omega p}{\sqrt{\frac{1}{x}} \sqrt{-\tau \omega p}}$$

$$\text{Eq1} = \left(\frac{\omega p^2 \tau}{1 - I \omega \tau} - I \omega \right)$$