Two charges are located on a line as shown in the figure. Locate all the points in space where the net electric field is zero. Be sure to show the \( \hat{r} \) vectors for each electric field and do this as a vector addition problem.

\[
\begin{align*}
\hat{r}_x & \quad \hat{r}_{30} \\
20 \text{ C} & \quad \rightarrow \quad 5 \text{ C} \\
9 \text{ m} & \\
\hat{r}_{\omega_0} & = +\hat{z} \\
\hat{r}_{3} & = -\hat{z}
\end{align*}
\]

\[
\bar{E}_{\omega_0} = \frac{k Q_0}{(9-x)^2} \quad \hat{r}_{\omega_0} = \frac{20k}{(9-x^2)} \hat{z}
\]

\[
\bar{E}_3 = \frac{k Q_3}{x^2} \quad \hat{r}_3 = \frac{5k}{x^2} (-\hat{z})
\]

\[
\bar{E}_{\omega_0} + \bar{E}_3 = 0
\]

\[
\frac{20k}{(9-x)^2} x - \frac{5k}{x^2} x = 0
\]

\[
4 = \frac{20}{(9-x)^2} = \frac{5}{x^2}
\]

\[
4 = \frac{(9-x)^2}{x^2}
\]

\[
\sqrt{4} = \sqrt{\frac{(9-x)^2}{x^2}}
\]

\[
2 = \frac{9-x}{x}
\]

\[
2x = 9-x \quad x = 3 \text{ m}
\]