PROBLEM:
The following signal flow graph structure defines a linear time-invariant system:

Write a simple formula for the difference equation defined by the signal flow graph.

SOLUTION

The following signal flow graph structure defines a linear time-invariant system:

\[
\begin{align*}
x[n] & \xrightarrow{-5} \times \xrightarrow{\text{UNIT DELAY}} x[n-1] \\
\xrightarrow{\text{UNIT DELAY}} v[n] & \xrightarrow{\times} v[n-1] \\
\xrightarrow{\times} v[n-2] & \xrightarrow{\text{UNIT DELAY}} y[n]
\end{align*}
\]

Write a simple formula for the difference equation defined by the signal flow graph.

Assign variable \( v[n] \) to input of unit delay in the middle.

\[
\begin{align*}
v[n] &= -5x[n] + x[n-1] \\
y[n] &= 2x[n] + v[n-2] \\
v[n-2] &= -5x[n-2] + x[n-3]
\end{align*}
\]

\[
\Rightarrow y[n] = 2x[n] - 5x[n-2] + x[n-3]
\]

**NOTE:** this is an FIR Filter of length 4.