#3: Recall: Hooke's Law tells us that a spring stretched \( x \) units beyond its natural length pulls back with a force of

\[
F(x) = kx.
\]

\( k \) is the "spring constant".

(a) Natural length: 2 ft

When stretched a total of 2.4 ft, \( x = 0.4 \) ft.

\[
F(0.4) = k(0.4) = 10 \text{ lb}
\]

\[
0.4k = 10 \quad \Rightarrow \quad k = \frac{10}{0.4} = 25
\]

(b) Solve \( F(x) = 50 \) for \( x \):

\[
50 = (25)x
\]

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

Stretched 2 ft beyond natural length.

(c) When length is 3 ft, \( x = 1 \):

\[
W = \int_0^1 25x \, dx
\]

\[
= \left. \frac{25x^2}{2} \right|_0^1
\]

\[
= \frac{25}{2}
\]

The work required is \( \frac{25}{2} \) ft.lbf.