EXERCISE 5.11: By making the substitution $k = n - \ell$ in (5.22), show that $y[n]$ can also be expressed in the same form as (5.10), $y[n] = \sum\limits_{k=0}^{M} h[k]x[n-k]$

SOLUTION

Start with $\quad y[n] = \displaystyle\sum_{\ell=n-M}^{n} h[n-\ell]\, x[\ell]$

With $k = n-\ell$, the limits on the sum are:

$\ell = n-M \implies k = n-\ell = n-(n-M) = M$

$\ell = n \implies k = n-\ell = n-n = 0$

$\therefore \quad y[n] = \displaystyle\sum_{k=0}^{M} h[k]\, x[n-k]$