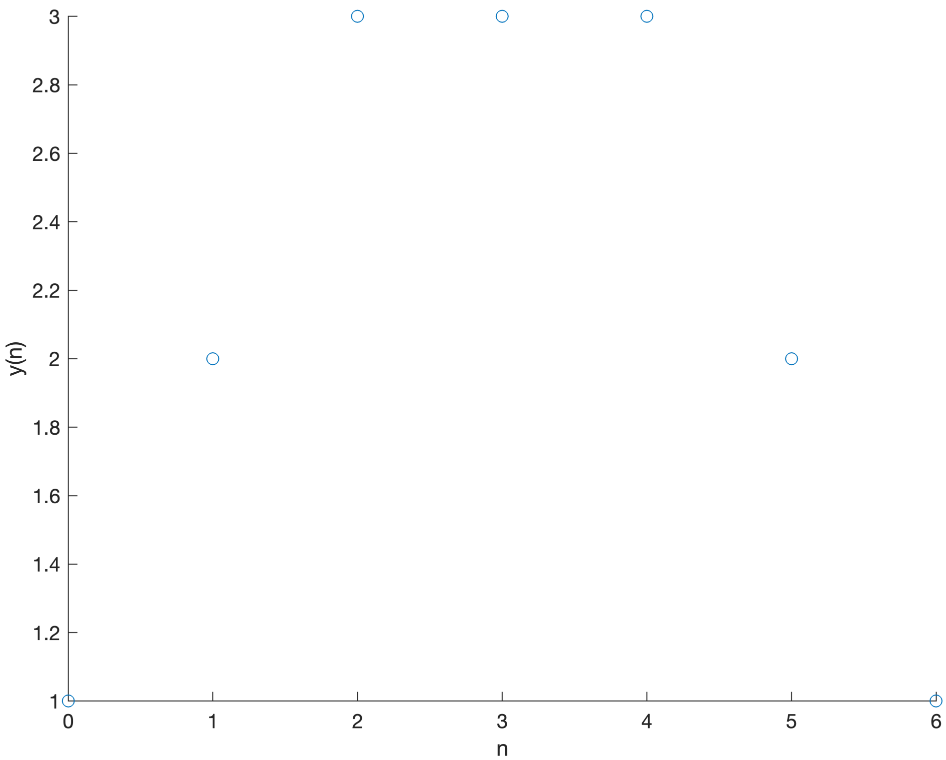
1a. $x(n) = 1, 1, 1, 1, 1$ and $h(n) = 1, 1, 1$. find convolution of $y(n) = x(n) \star h(n)$

```
x = ones(5, 1);
h = ones(3, 1);
y = conv(x, h);
scatter(0:size(y)-1, y)
xlabel('n')
ylabel('y(n)')
```



1b. solving it by hand, we have $x(n) = u(n) - u(n-5)$ and $h(n) = u(n) - u(n-3)$.

Taking the convolution we get $x(n) \star h(n) = \sum_{k=-\infty}^{\infty} [u(k) - u(k-5)] \cdot [u(n-k) - u(n-3-k)]$

$$= \sum_{k=0}^{\infty} [u(n-k) - u(n-3-k)] + \sum_{k=5}^{\infty} [-u(n-k) + u(n-3-k)]$$

$= \sum_{k=0}^{n} [1] - \sum_{k=0}^{n-3} [1] + \sum_{k=5}^{n} [-1] + \sum_{k=5}^{n-3} [1]$

$= 0$ for $n < 0$,

$n + 1$ for $0 \leq n \leq 2$,

3 for $2 \leq n \leq 4$,

$7 - n$ for $4 \leq n \leq 6$,

and 0 for $n \geq 7$

we end up with 0, 1, 2, 3, 3, 2, 1, 0 for y which does match up with the graph!

1c. the duration of $y(n)$ is 7, or the sum of the durations of x and h minus 1. x and h start at 0, so y will start at 0 therefore ending at 6.

1d. with new values of x and h find y

```
x = [3, 11, 7, 0, -1, 4, 2];
h = [2, 3, 0, 5, 2, 1];
y = conv(x, h);
scatter(-3-1:-3-1+length(y)-1, y)
xlabel('n')
ylabel('y(n)')
```