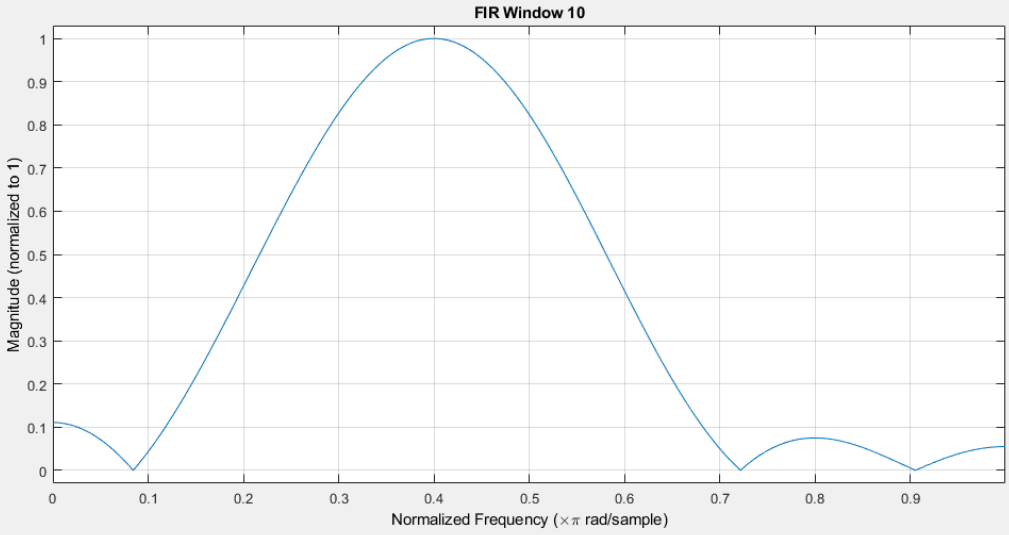
Consider the multiband ideal filter given by the amplitude response:

$$A(e^{j\omega}) = \begin{cases} 0, & 0 < |\omega| < 0.2\pi \\ 0.5, & 0.2\pi < |\omega| < 0.4\pi \\ 1, & 0.4\pi < |\omega| < 0.6\pi \\ 0.5, & 0.6\pi < |\omega| < 0.8\pi \\ 1. & 0.8\pi < |\omega| < \pi. \end{cases}$$

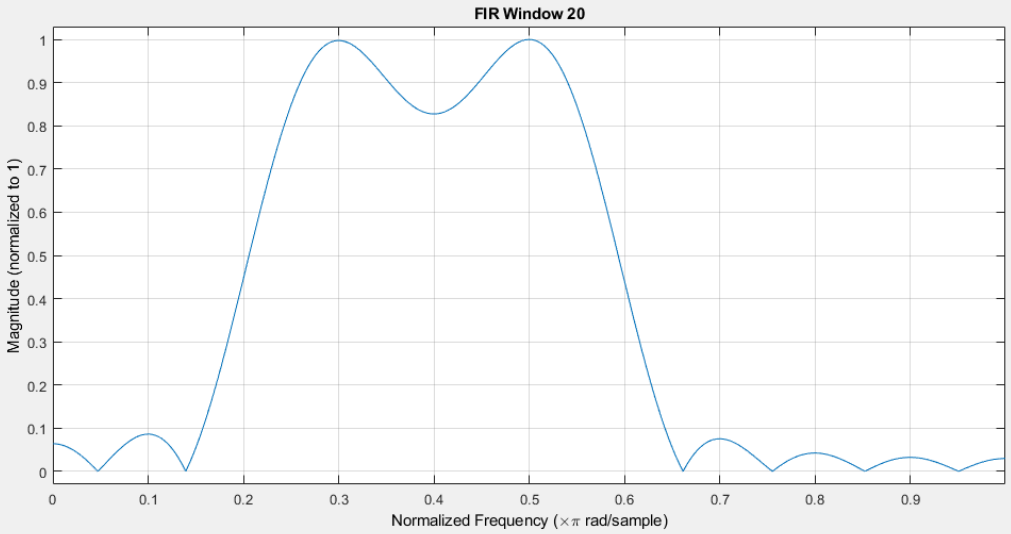
(a) Obtain a linear-phase FIR filter using the rectangular window of order M = 10. Compute and plot the amplitude response over −π ≤ ω ≤ π.

(b) Repeat (a) using M = 20, M = 40, and M = 60.

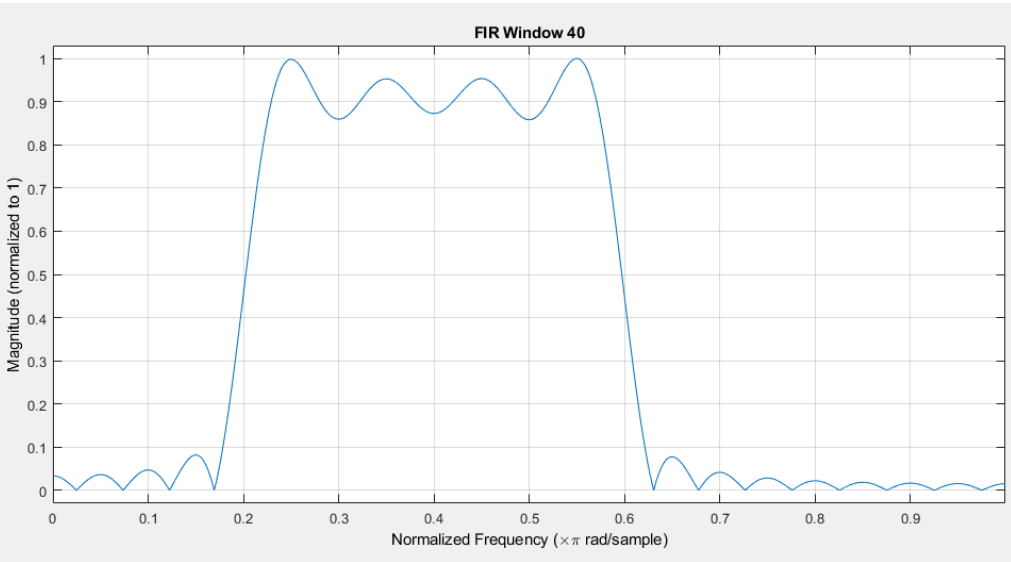
```
fir10 = fir1(10,[0.2 0.6],"bandpass",rectwin(11));
fvtool(fir10)
title("FIR Window 10")
```



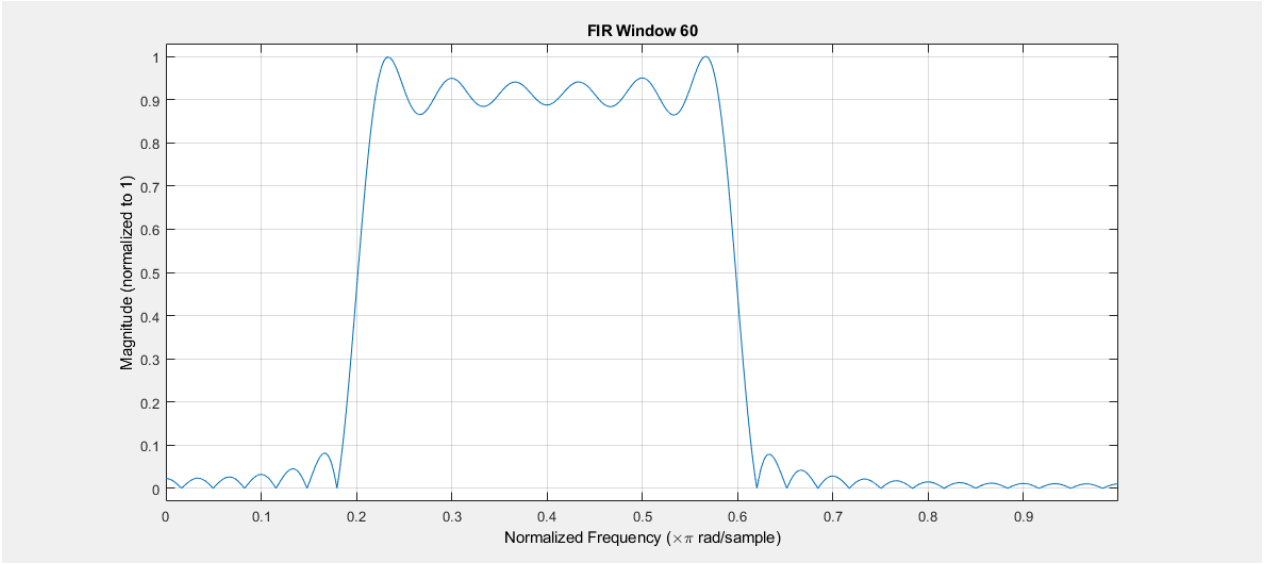

```
fir20 = fir1(20,[0.2 0.6],"bandpass",rectwin(21));
fvtool(fir20)
title("FIR Window 20")
```




```
fir40 = fir1(40,[0.2 0.6],"bandpass",rectwin(41));
fvtool(fir40)
title("FIR Window 40")
```




```
fir60 = fir1(60,[0.2 0.6],"bandpass",rectwin(61));
fvtool(fir60)
title("FIR Window 60")
```


FIR Window 60
Magnitude (normalized to 1)
Normalized Frequency (×π rad/sample)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1