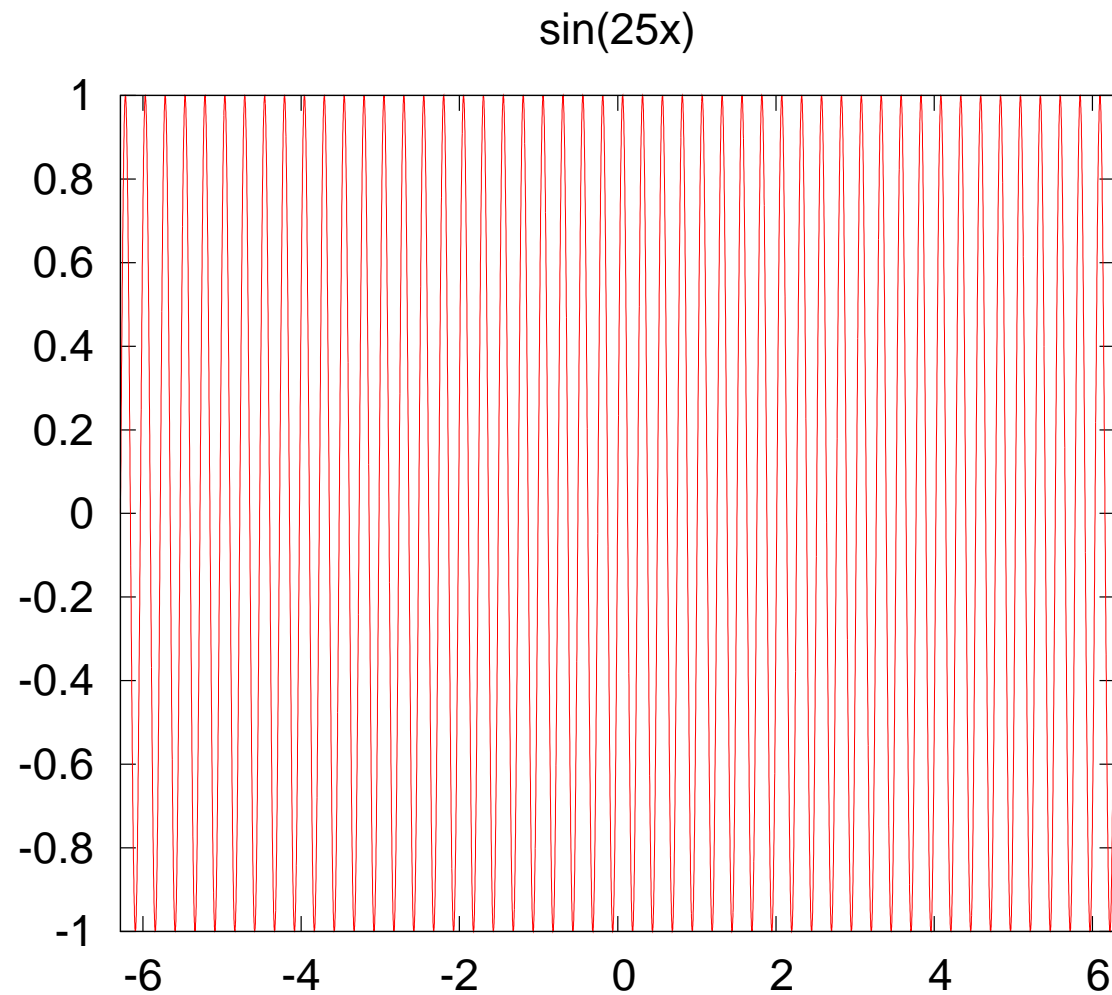
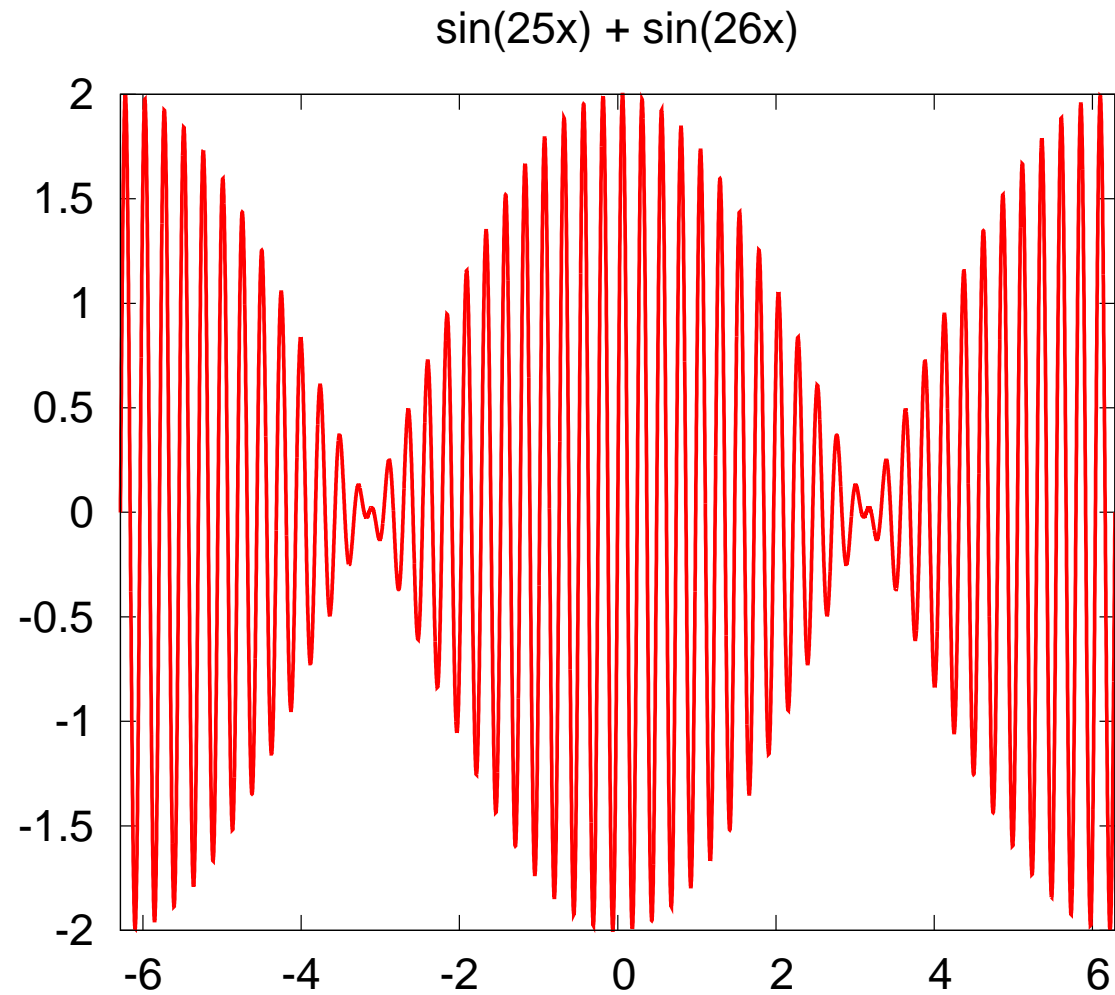


Sin wave unlocalized in space



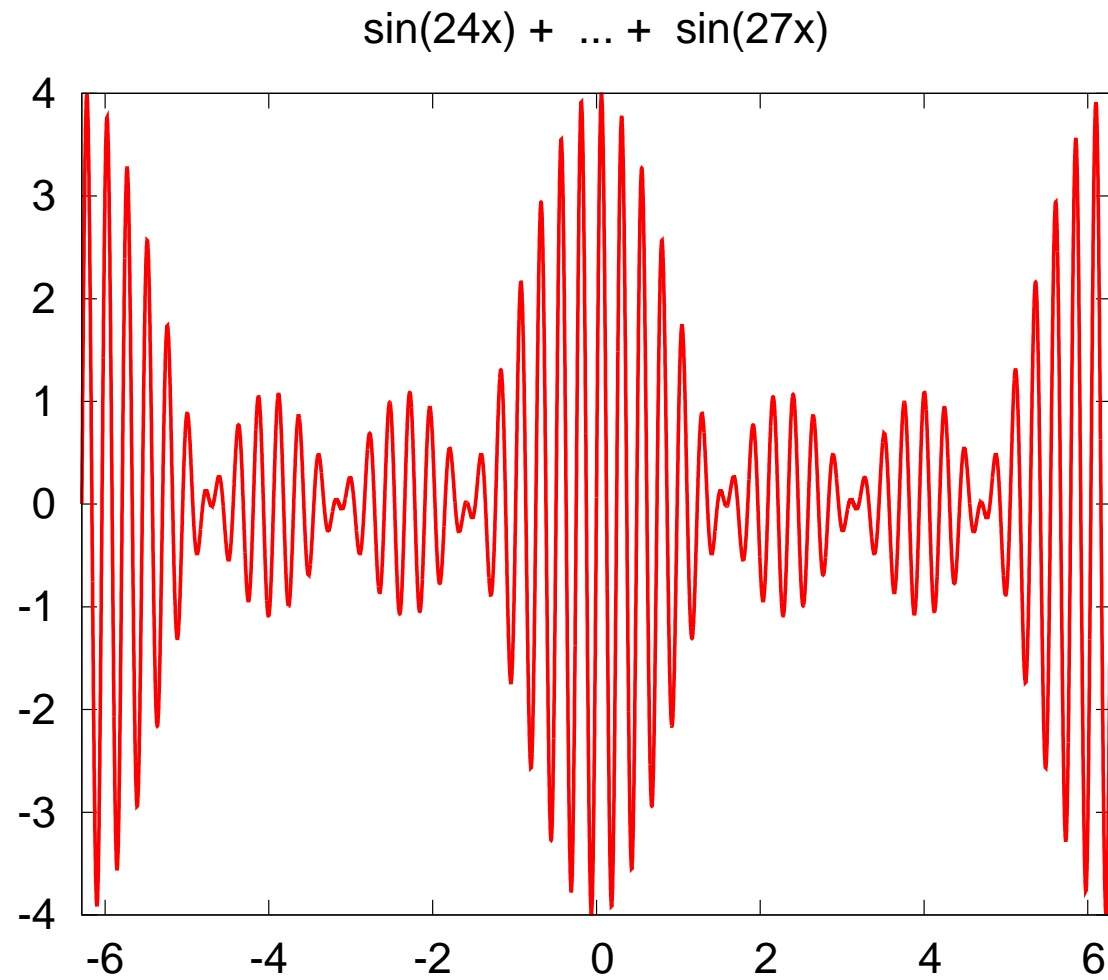
We know the frequency  $\omega = 25$

## Sin wave unlocalized in space



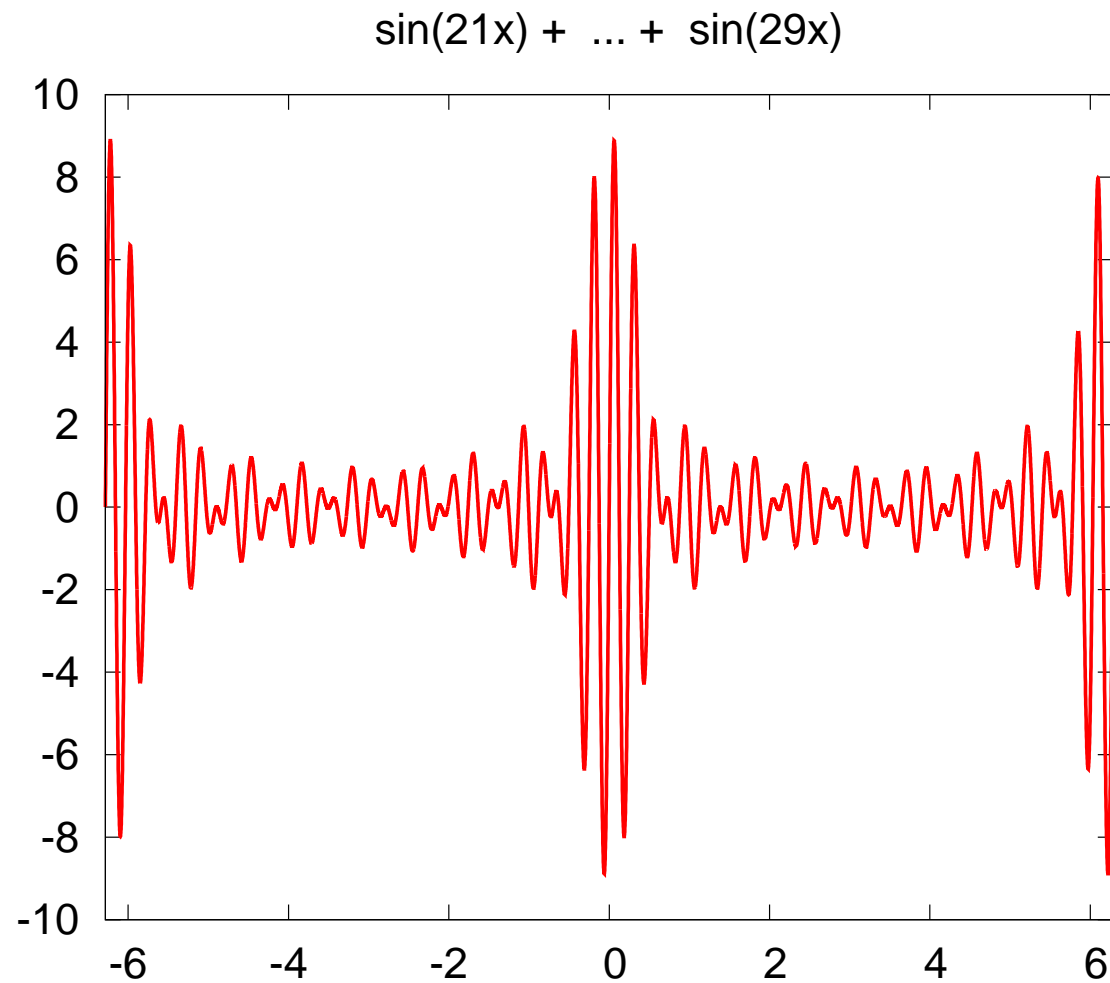
$\omega \simeq 25.5$  but uncertain  $\Delta\omega = 0.5$  and  $\Delta t \simeq 2$

More sin waves better localized



$\omega \simeq 25.5$  but uncertain  $\Delta\omega = 2$  and  $\Delta t \simeq 0.5$

More sin waves better localized



$\omega \simeq 25.5$  but uncertain  $\Delta\omega = 5$  and  $\Delta t \simeq 0.2$

Group velocity – see Michael Fowler's applet

