Assignment Week 13

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8.4 $g(t)(\sin 400\pi t) = x(t)(\sin 400\pi t)^2 = x(t)\frac{1-\cos 800\pi t}{2} = \frac{1}{2}\sin 200\pi t + \sin 400\pi t - \frac{1}{2}\sin 200\pi t\cos 800\pi t$

$- \sin 400\pi t\cos 800\pi t$

$= \frac{1}{2}\sin 200\pi t + \sin 400\pi t - \frac{1}{4}(\sin 1000\pi t - \sin 600\pi t)$

$- \frac{1}{2}(\sin 1200\pi t - \sin 400\pi t)$

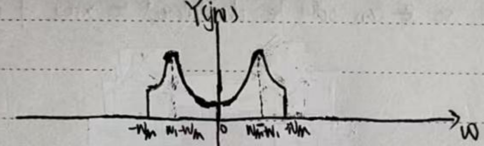
$= \frac{1}{2}\sin 200\pi t + \frac{3}{2}\sin 400\pi t + \frac{1}{4}\sin 600\pi t - \frac{1}{4}\sin 1000\pi t$

$- \frac{1}{2}\sin 1200\pi t$

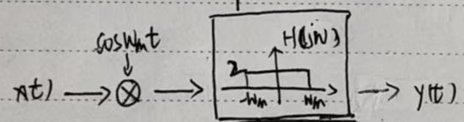
After passing an ideal lowpass filter with cutoff frequency 400π and passband gain of 2, the output is $y(t) = \sin 200\pi t$

8.25

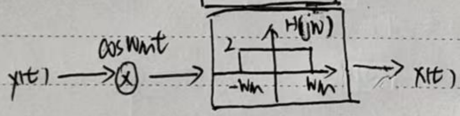
(a)



(b)

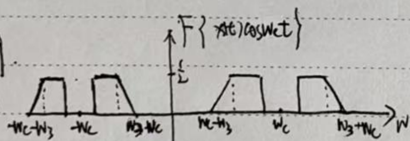


(c)

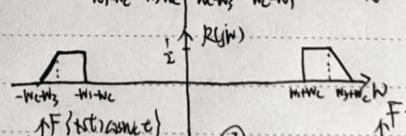


8.29

(a)

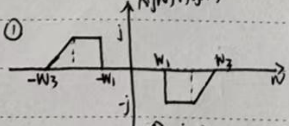


∴

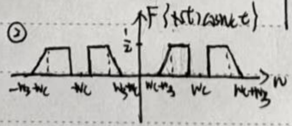


(b)

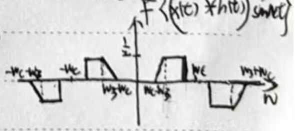
①



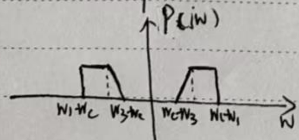
②



③



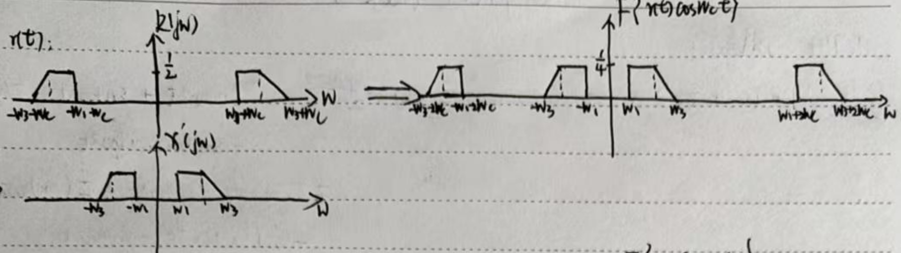
④



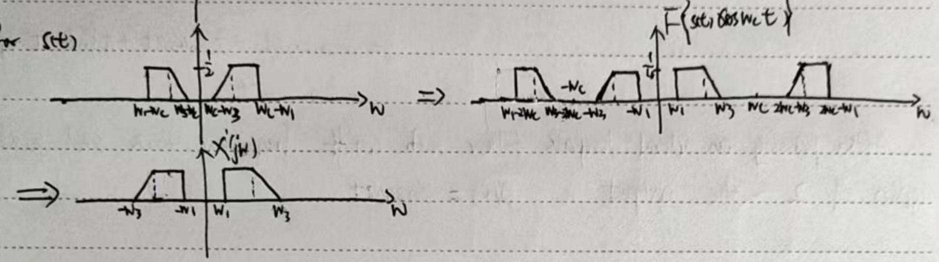
$\Rightarrow P(jw) = 2S(jw)$ ∴ $p(t)$ is proportional to $s(t)$

(c)

for $r(t)$:



for $s(t)$



and for $p(t)$, it's proportional to $s(t)$, so it can also be demodulated to $x(t)$ if changing the passband gain from 4 to 2.