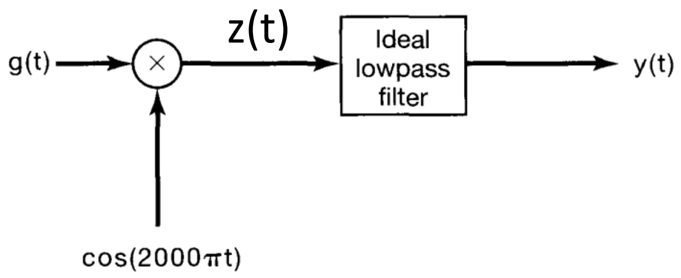
Problem 6

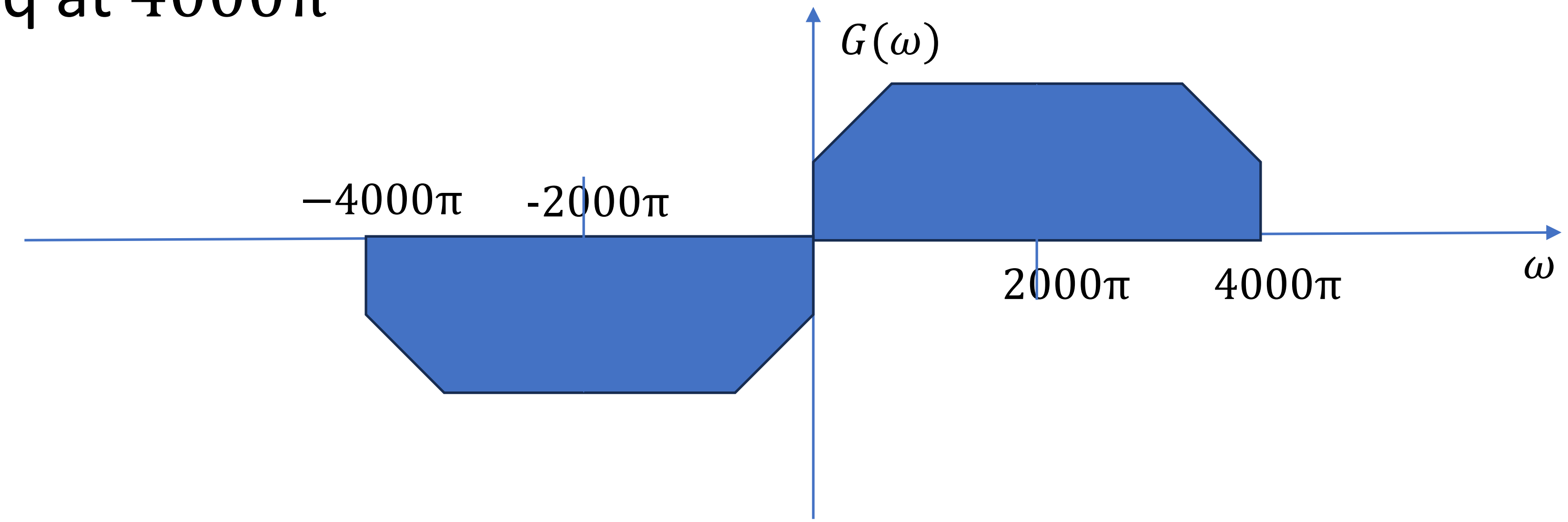
- Let x(t) be a real-valued signal for which $X(\omega) = 0$ when $|\omega| > 2{,}000\pi$. Amplitude modulation is performed to produce the signal
$$g(t) = x(t)\, sin(2000\pi t).$$
- A proposed demodulation technique is illustrated below where g(t) is the input, y(t) is the output, and the ideal lowpass filter has cutoff frequency 2000 π and passband gain of 2. Determine y(t).



Solution 1

- $G(\omega) = \frac{1}{2j}[X(w - 2000\pi) - X(w + 2000\pi)]$

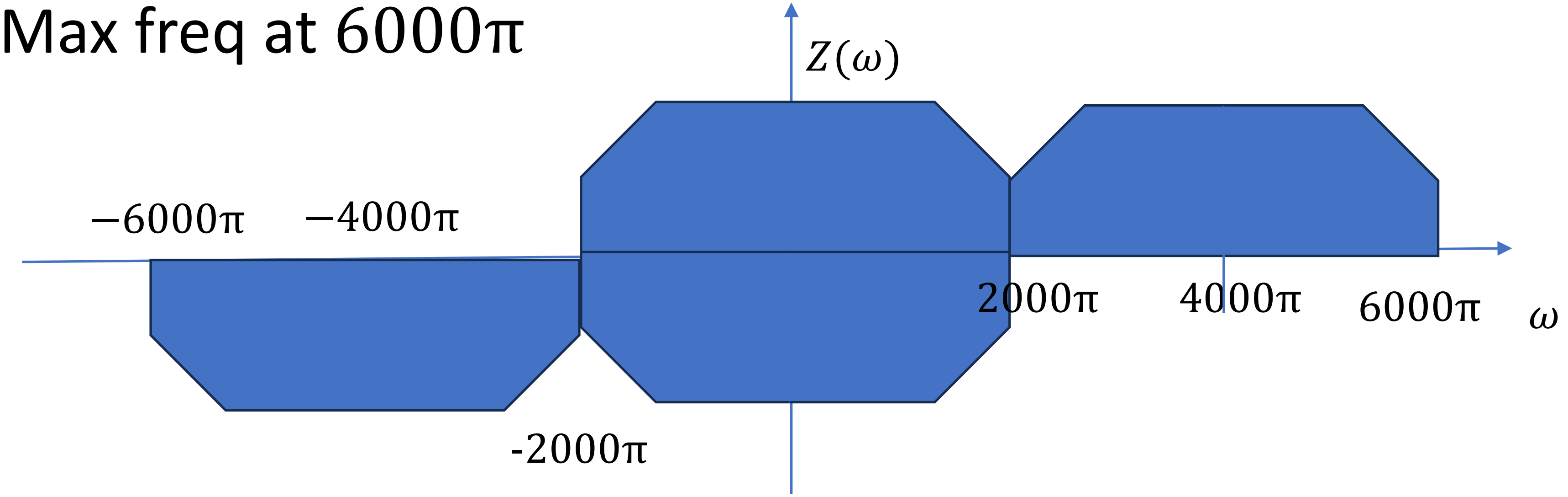
Max freq at 4000π

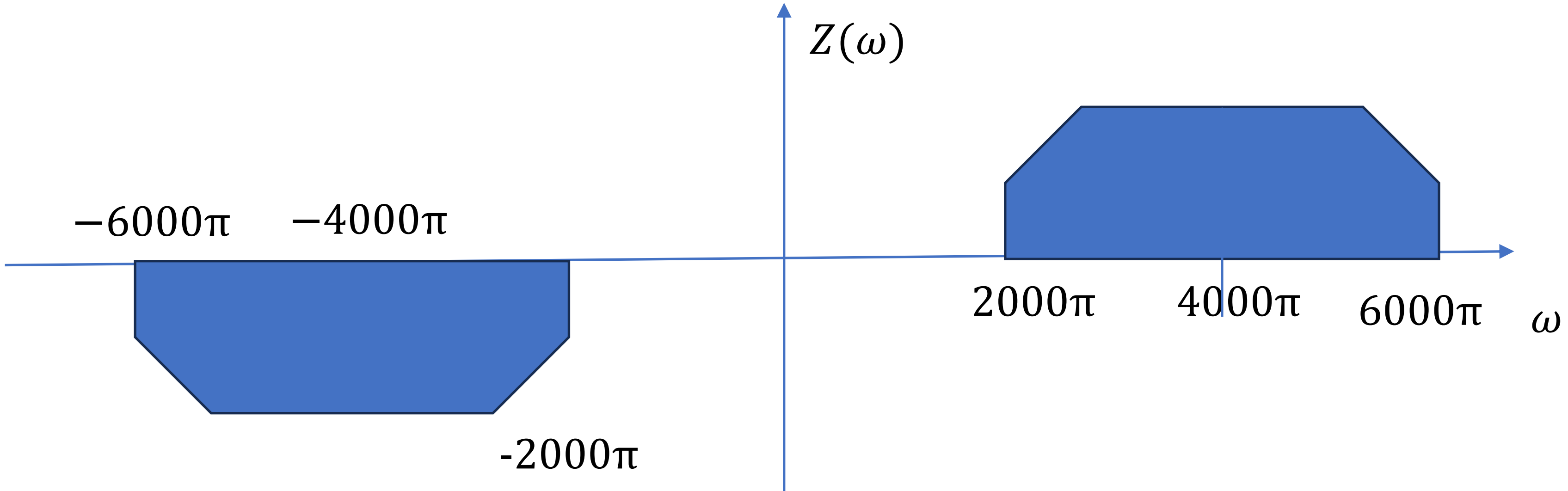


Solution 1 (cont)

- $Z(\omega) = \frac{1}{2}[\mathrm{G}(\mathrm{w} - 2000\pi) + \mathrm{G}(\mathrm{w} + 2000\pi)]$

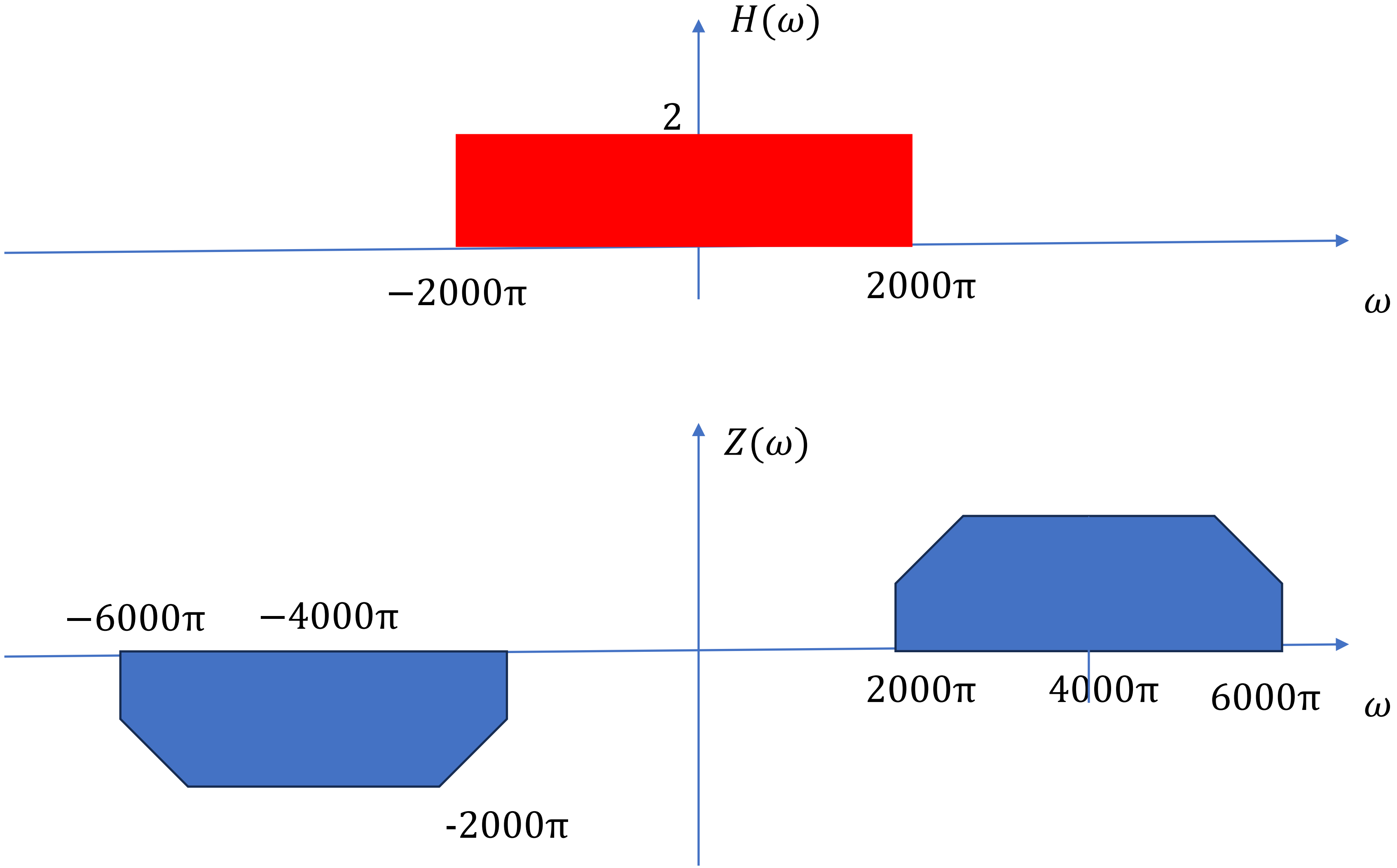
Max freq at 6000π





Solution 1 (cont)

$$Y(\omega) = H(\omega) \times G(\omega) = 0 \qquad y(t) = 0$$



Solution 2

$$z(t) = x(t)\sin(2000\pi) \times \cos(2000\pi)$$
$$= 1/2\ \mathrm{x(t)sin(4000\pi)}$$

$$Z(\omega) = \frac{1}{2}[\mathrm{X(w - 4000\pi) + X(w + 4000\pi)}]$$

Max freq at 6000π