ECS 332: In-Class Exercise 3 **Solution**

Sep 6, 2017

Instructions

1. Separate into groups of no more than three persons.
2. **The group cannot be the same as your former group.**
3. Only one submission is needed for each group.
4. **Only this page will be scanned and graded. Work only on this page.**
5. **Do not panic.**

Name	ID
Prapun	**555**

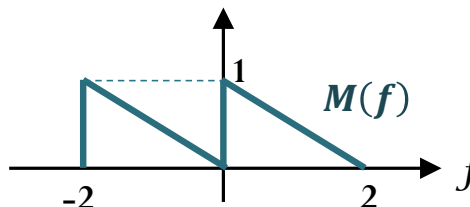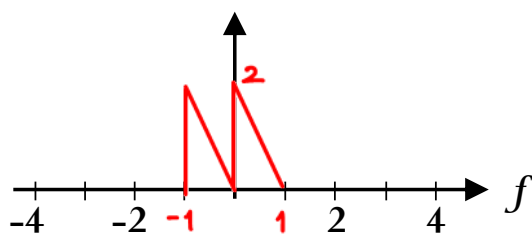The *Fourier transform* $M(f)$ of a signal $m(t)$ is shown in Figure 1.

a. (1 pt) Is $m(t)$ a real-valued signal?

> **No. For x(t) to be real-valued, its Fourier transform must satisfy the conjugate symmetry property.**

Figure 1

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b. Let $y(t) = m\left(\dfrac{t}{2}\right)$. Carefully sketch $|Y(f)|$.
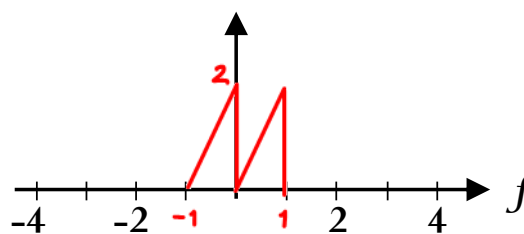

Scale-change theorem

$$m(at) \xrightarrow{\ \mathscr{F}\ } \frac{1}{|a|}M\left(\frac{f}{a}\right) \qquad a = \frac{1}{2}$$

$$m\left(\frac{t}{2}\right) \xrightarrow{\ \mathscr{F}\ } 2M(2f)$$

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c. Let $z(t) = m\left(\dfrac{2-t}{2}\right)$. Carefully sketch $|Z(f)|$.

Scale-change theorem

Let $h(t) = m\left(-\frac{t}{2}\right)$.

$$x(at) \xrightarrow{\ \mathscr{F}\ } \frac{1}{|a|}X\left(\frac{f}{a}\right) \qquad a = -\frac{1}{2} \quad \text{extra flip}$$

Then $H(f) = 2M(-2f)$.

Let $z(t) = h(t-2) \left(= m\left(-\frac{(t-2)}{2}\right) = m\left(\frac{2-t}{2}\right)\right)$
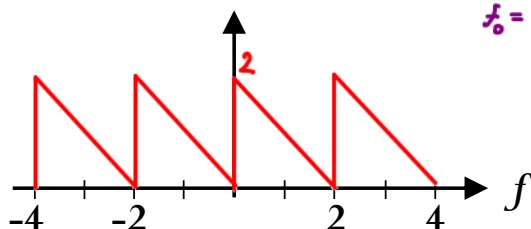
Then $|Z(f)| = |H(f)| = 2|H(-2f)|$

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d. Let $x(t) = m(t) \times 4\cos(4\pi t)$.

Carefully sketch $X(f)$. $\quad 4 \times \frac{1}{2} = 2$

$f_0 = 2$

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e. Let $g(t) = m(t) \times 2\cos(2\pi t)$.

Carefully sketch $G(f)$. $\quad 2 \times \frac{1}{2} = 1$

$f_0 = 1$