ECS 332: In-Class Exercise # 2 - Sol

Instructions

1. Separate into groups of no more than three students each. **The group cannot be the same as your group** for the previous exercise.
2. [ENRE] = Explanation is not required for this exercise.
3. **Do not panic.**

Date: 23/08/2019			
Name	ID (last 3 digits)		
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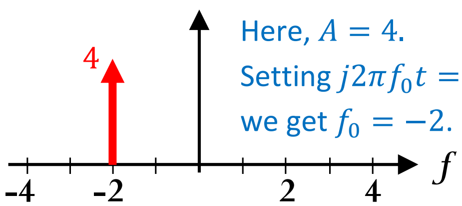
1. [ENRPr] Consider each $g(t)$ defined below.

   Let $G(f)$ be its Fourier transform. Plot $G(f)$ from $f=-4$ to $f=4$ Hz.

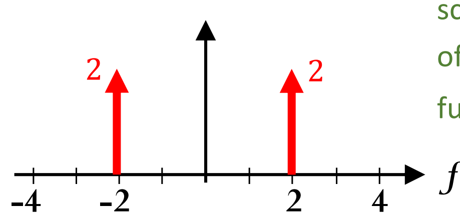
   a. $g(t)=4e^{-j4\pi t}$

   $$Ae^{j2\pi f_0 t} \xrightleftharpoons{\mathcal{F}} A\delta(f-f_0)$$

   Here, $A = 4$.
   Setting $j2\pi f_0 t = -j4\pi t$,
   we get $f_0 = -2$.



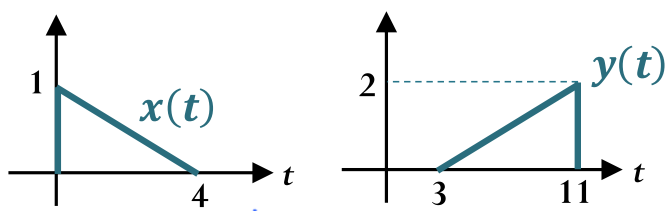
   b. $g(t)=4\cos(4\pi t)$



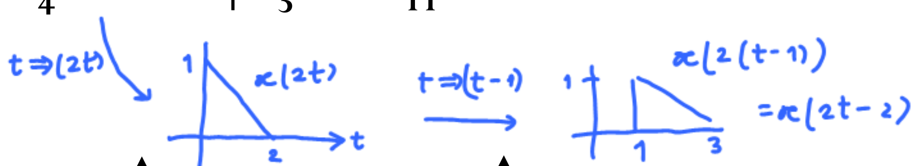
   Don't forget to scale the size of each δ-function by $\frac{1}{2}$.

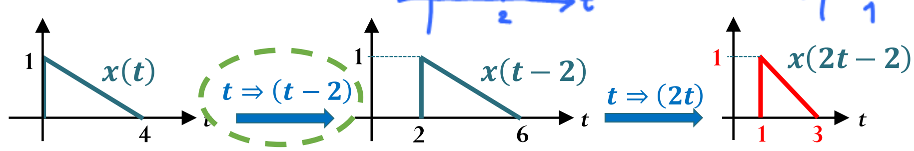
   $$A\cos(2\pi f_0 t) \xrightleftharpoons{\mathcal{F}} \frac{A}{2}\delta(f-(-f_0))+\frac{A}{2}\delta(f-f_0)$$

2. [ENRPr] Signals $x(t)$ and $y(t)$ are plotted below.



   a) Plot the signal $w(t)=x(2t-2)$.

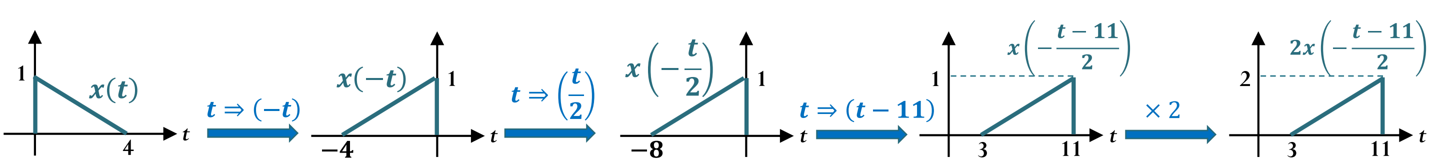




This notation means we replace t by $t-2$.

   b) Suppose $y(t)=c_1x(c_2t+c_3)$. Find the values of the constants c_1, c_2, and c_3.

   $c_1 =$ 2 $, c_2 =$ -0.5 $, c_3 =$ 5.5 .

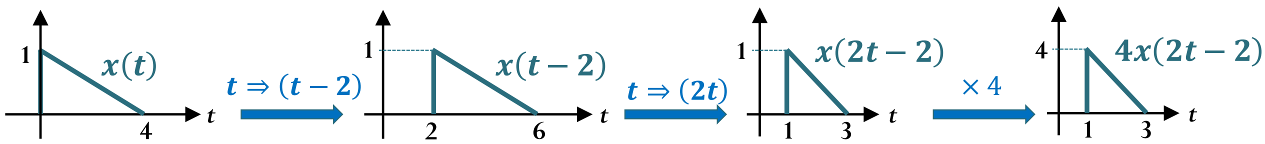


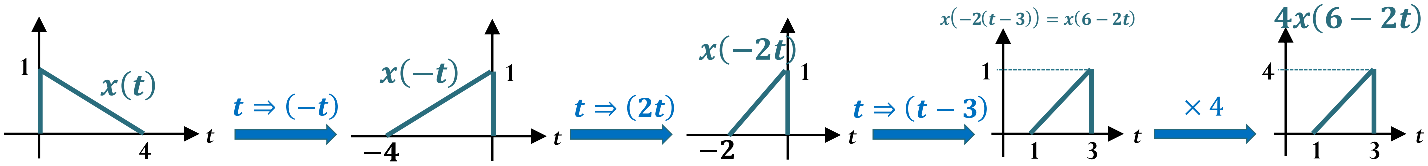
$$y(t) = 2x\left(-\frac{t-11}{2}\right) = 2x(-0.5t+5.5).$$

Caution: One common mistake is that, in the third step, when we shift the graph to the right by 11 units, we can't just put "-11" blindly into the expression and get $x\left(-\frac{t}{2}-11\right)$; we need to replace t by $t-11$.

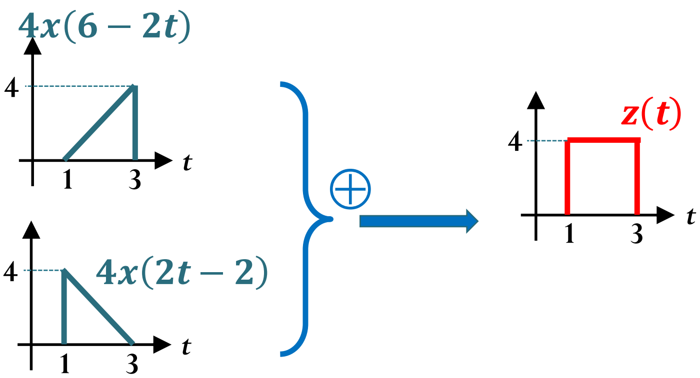
c) Suppose $z(t) = 4x(2t-2) + 4x(6-2t)$. Plot $z(t)$.

First, we plot $4x(2t-2)$ and $4x(6-2t)$.





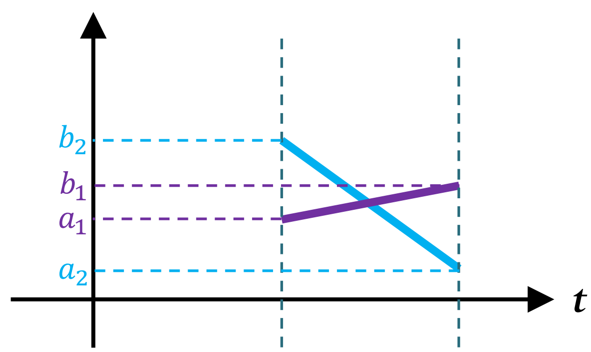
Next, we combine (add) the two plots.



Remark: Adding two straight lines.

Given the graphs of two straight lines over an interval, it is easy to find their sum.

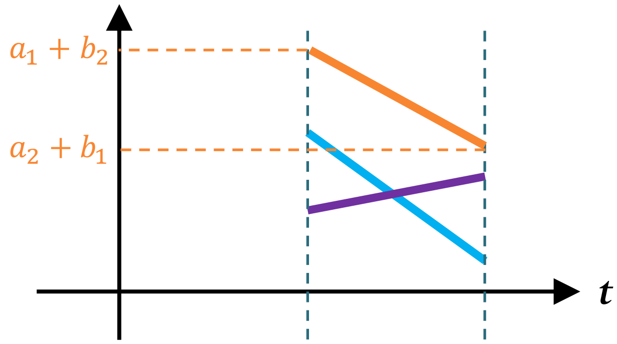
For example, suppose we want to find the sum of the two straight lines below:



First, note that the sum is still a straight line.

To see this, let's assume that the two original straight lines are given by $m_1 t + c_1$ and $m_2 t + c_2$. Then, their sum is $(m_1 + m_2)t + (c_1 + c_2)$ which is still a straight line.

To draw a straight line, it is enough to find two points that it passes. In the example above, this can be done easily at the two boundaries of the interval.


$a_1 + b_2$
$a_2 + b_1$
t