EES 351: In-Class Exercise # 10

Instructions

1. Work alone or in a group of no more than three students.
2. Only one submission is needed for each group.
3. You have two choices for submission:
   (a) Online submission via Google Classroom
   - PDF only.
   - Only for those who can directly work on the posted files using devices with pen input.
   - Paper size should be the same as the posted file.
   - No scanned work, photos, or screen capture.
   - Your file name should start with the 10-digit student ID of one member. (You may add the IDs of other members, exercise #, or other information as well.)

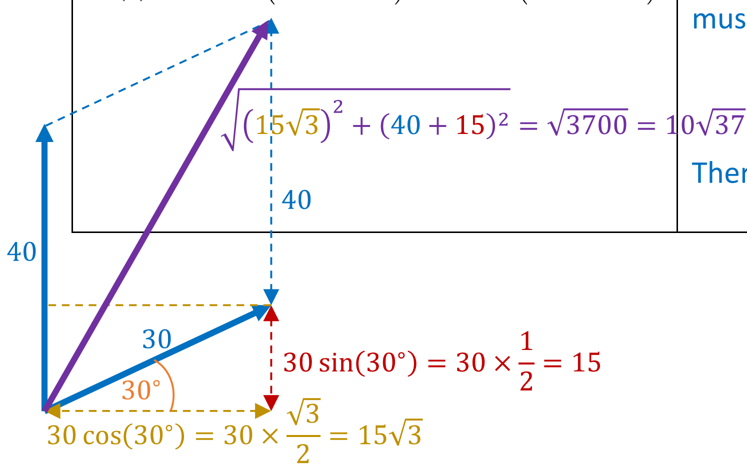
   (b) Hardcopy submission
4. **Do not panic.**

Date: 9 / 10 / 2020			
Name	ID (last 3 digits)		

1. For each of the following signal $g(t)$, find its (normalized) average power $P_g \equiv \langle |g(t)|^2 \rangle$.

$g(t)$	$P_g \equiv \langle \lvert g(t) \rvert^2 \rangle$
$g(t) = 30e^{j30\pi t}$	$P_g = 30^2 = 900.$
$g(t) = 30e^{j30\pi t} + 40e^{j40\pi t}$	First, we check that the freq. of the two terms are different which is the case here. Therefore, $P_g = 30^2 + 40^2 = 900 + 1600 = 2500.$
$g(t) = 30\cos(30t + 30^\circ)$	For sinusoidal signals, don't forget that we have an additional factor of $\frac{1}{2}$. $P_g = \frac{1}{2} \times 30^2 = 450.$
$g(t) = 30\cos(30t + 30^\circ) + 40\cos(40t + 40^\circ)$	First, we check that the freq. of the two terms are different and positive which is the case here. Therefore, $P_g = \frac{1}{2} \times 30^2 + \frac{1}{2} \times 40^2 = 1250.$
$g(t) = 30\cos(30t + 30^\circ) + 40\cos(30t + 90^\circ)$	The freq. of the two terms are the same. Therefore, we must combine them first: $g(t) \Leftrightarrow 30\angle 30^\circ + 40\angle 90^\circ \approx 10\sqrt{37}\angle 64.7^\circ \Leftrightarrow 10\sqrt{37}\cos(30t + 64.7^\circ).$ Therefore, $P_g = \frac{1}{2} \times \left(10\sqrt{37}\right)^2 = 1850.$

	$g(t)$	$P_g = \langle \lvert g(t) \rvert^2 \rangle$
Linear combination of complex exponential functions [4.23]	$\sum_k c_k e^{j2\pi f_k t}$ where the f_k are distinct	$\sum_k \lvert c_k \rvert^2$
Linear combination of sinusoids [4.28]	$\sum_k A_k \cos(2\pi f_k t + \phi_k)$ where the f_k are positive and distinct	$\frac{1}{2}\sum_k \lvert A_k \rvert^2$



Note that we don't need this angle. We only need the magnitude for our power calculation.