ECE113, Winter 2023 **Quiz #9**
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Wednesday, 8 Feb 2023
10 points total.

Name: _____
UID: _____

1. (10 points) Determine the **IDTFT** of

$$X(\Omega) = \frac{2e^{-j\Omega}}{1 - \frac{1}{4}e^{-j2\Omega}}$$

(Hint: $y[n] = 0.5^n u[n] \xrightarrow{\text{DTFT}} Y(\Omega) = \frac{1}{1-0.5e^{-j\Omega}}$)

Solution:

$$X\left(\Omega\right) = \frac{2e^{-j\Omega}}{1-\frac{1}{4}e^{-j2\Omega}} = \frac{A}{1-\frac{1}{2}e^{-j\Omega}} + \frac{B}{1+\frac{1}{2}e^{-j\Omega}},$$

with $2 = 0.5\ \mathrm{A} - 0.5\ \mathrm{B}$ and $0 = \mathrm{A} + \mathrm{B}$, so

$$X\left(\Omega\right) = \frac{2}{1-\frac{1}{2}e^{-j\Omega}} - \frac{2}{1+\frac{1}{2}e^{-j\Omega}}.$$

Now by taking the inverse DTFT by inspection we obtain

$$x[n] = 2\left((0.5)^n - (-0.5)^n\right)u[n].$$