PHGN462/507   Name:
In-class quiz 1

We will grade these, but on this quiz, you'll get full marks for effort.

1. Let $f = \exp[i\omega_1 t] + \exp[i\omega_2 t]$. Express $|f|^2$ as a real function.

$$|f|^2 = |\exp[i\omega_1 t] + \exp[i\omega_2 t]|^2$$
$$= (\exp[i\omega_1 t] + \exp[i\omega_2 t])(\exp[-i\omega_1 t] + \exp[-i\omega_2 t])$$
$$= 1 + 1 + \exp[i(\omega_1 - \omega_2)t] + \exp[-i(\omega_1 - \omega_2)t]$$
$$= 2 + 2\cos[(\omega_1 - \omega_2)t]$$

2. Let x <<1. Expand the quantity $\dfrac{1}{1+e^{-x}}$ to first order in x, with x in the numerator.

$$\frac{1}{1+e^{-x}} \approx \frac{1}{1+(1-x)}$$
$$= \frac{1}{2}\left(\frac{1}{1-\frac{1}{2}x}\right)$$
$$\approx \frac{1}{2}\left(1+\tfrac{1}{2}x\right)$$