Problem 1.

a, b and c are complex numbers. Show that the following inequalities are equivalent to each other

$$\operatorname{Re}\left((a-c)(\bar{c}-\bar{b})\right) \geq 0$$

and

$$\left| c - \frac{a+b}{2} \right| \leq \frac{1}{2} |a-b|$$

Problem 2.

Show that

$$\underbrace{x^{2n}-1} = (x^2-1)\left(x^2-2x\cos\frac{\pi}{n}+1\right)$$

$$\cdot\left(x^2-2x\cos\frac{2\pi}{n}+1\right)\ldots$$

$$\cdot\left(x^2-2x\cos\frac{(n-1)\pi}{n}+1\right)$$

$$x^{2n-1}-1 = (x^2-1)\left(x^2-2x\cos\frac{\pi}{n}+1\right)\left(x^2-2x\cos\frac{2\pi}{n}+1\right)\left(x^2-2x\cos\frac{3\pi}{n}+1\right)\cdot\ldots\cdot\left(x^2-2x\cos\frac{(n-1)\pi}{n}+1\right)$$