2) b) A small simplification to 2b)

$$\operatorname{corr}(a_n, b_n) = \frac{\sum_{k=0}^{N-1} \cos(2\pi f_n k) \sin(2\pi f_n k)}{\sqrt{\left(\sum_{k=0}^{N-1} \cos^2(2\pi f_n k)\right)\left(\sum_{k=0}^{N-1} \sin^2(2\pi f_n k)\right)}}$$

$$= \frac{\frac{1}{2} \sum_{k=0}^{N-1} \sin(4\pi f_n k)}{\sqrt{\left(\sum_{k=0}^{N-1} \cos^2 2\pi f_n k\right)\left(\sum_{k=0}^{N-1} \sin^2(2\pi f_n k)\right)}}$$

$$N^r = \operatorname{Im}\left(\sum_{k=0}^{N-1} e^{j\left(\frac{4\pi n}{N} k\right)}\right) = \operatorname{Im}\left(\frac{1 - e^{j\frac{4\pi n}{N} \times N}}{1 - e^{j\frac{4\pi n}{N}}}\right)$$

$$= \operatorname{Im}\left(\frac{0 + 0j}{1 - e^{j\frac{4\pi n}{N}}}\right) = 0$$

$$\therefore \quad \boxed{\operatorname{corr}(a_n, b_n) = 0}$$