Increasing, decreasing and periodic sequences

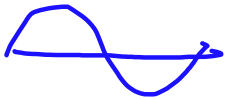
A sequence is **strictly increasing** if the terms are always increasing, i.e. $u_{n+1} > u_n$ for all $n \in \mathbb{N}$.
e.g. $1, 2, 4, 8, 16, \ldots$

increasing
1, 1, 2, 2, 3, 8, 12, 12

Similarly a sequence is **strictly decreasing** if $u_{n+1} < u_n$ for all $n \in \mathbb{N}$

10, 8, 6, 4, 2, 0

A sequence is **periodic** if the terms repeat in a cycle. The **order** k of a sequence is **how often it repeats**, i.e. $u_{n+k} = u_n$ for all n.
e.g. 2, 3, 0, 2, 3, 0, 2, 3, 0, 2, ... *is periodic and has order 3.*



$u_1 = u_4$ $k = 3$

For each sequence:
i) State whether the sequence is increasing, decreasing or periodic.
ii) If the sequence is periodic, write down its order.

a) $u_{n+1} = u_n + 3,\ u_1 = 7$ — 7, 10, 13, 16 — strictly increasing

b) $u_{n+1} = (u_n)^2,\ u_1 = \frac{1}{2}$ — $\frac{1}{2}, \frac{1}{4}, \frac{1}{16}, \frac{1}{256}$ — strictly decreasing

c) $u_{n+1} = \sin(90n°)$ — $n=0$ $u_1 = 0$ $u_2 = 1$ $u_3 = 0$ $u_4 = -1$ $u_5 = 0$ — 0, 1, 0, −1, 0, 1, 0, −1 — periodic, order 4

Ex 3H