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OKay

H.W 14

$$1a. \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 4 & 5 & 7 & 6 & 8 & 1 & 9 & 3 & 2 \end{pmatrix} \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 5 & 4 & 8 & 7 & 1 & 6 & 2 & 9 & 3 \end{pmatrix} \\ = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 7 & 1 & 2 & 6 & 9 & 5 & 3 & 8 & 4 \end{pmatrix}$$

$$1b. \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 5 & 7 & 4 & 1 & 8 & 6 & 2 & 3 & 9 \end{pmatrix} \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 5 & 7 & 4 & 1 & 8 & 2 & 6 & 3 & 9 \end{pmatrix} \\ = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 8 & 6 & 1 & 5 & 3 & 2 & 7 & 4 & 9 \end{pmatrix}$$

$$2. \pi = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 2 & 1 \end{pmatrix}$$

$$\pi^2 = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 5 & 2 & 1 & 4 & 3 \end{pmatrix}$$

$$\pi^3 = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 1 & 4 & 3 & 2 & 5 \end{pmatrix}$$

$$\pi^4 = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 2 & 5 & 4 & 1 \end{pmatrix}$$

$$\pi^5 = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 5 & 4 & 1 & 2 & 3 \end{pmatrix}$$

$$\pi^6 = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 1 & 2 & 3 & 4 & 5 \end{pmatrix} = I$$

had to do 6 powers

$$3. \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 4 & 5 & 7 & 6 & 8 & 1 & 9 & 3 & 2 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 4 & 6 \\ 4 & 6 & 1 \end{pmatrix} \begin{pmatrix} 2 & 5 & 8 & 3 & 7 & 9 \\ 5 & 8 & 3 & 7 & 9 & 2 \end{pmatrix}$$

Cycle lengths are 3 and 6 so smallest i such that π^i is identity permutation is $\text{lcm}(3, 6) = 6$

$$4. \pi = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ 9 & 4 & 5 & 7 & 6 & 8 & 2 & 10 & 1 & 3 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 9 \\ 9 & 1 \end{pmatrix} \begin{pmatrix} 2 & 4 & 7 \\ 4 & 7 & 2 \end{pmatrix} \begin{pmatrix} 3 & 5 & 6 & 9 & 10 \\ 5 & 6 & 8 & 10 & 3 \end{pmatrix}$$

$$\text{lcm}(2, 3, 5) = 30$$

So π^{30} is going to give us identity permutation

$$5. \pi = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ 4 & 9 & 5 & 8 & 6 & 7 & 2 & 1 & 10 & 3 \end{pmatrix}$$

flipping we get $\begin{pmatrix} 4 & 9 & 5 & 8 & 6 & 7 & 2 & 1 & 10 & 3 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \end{pmatrix}$

$$\pi^{-1} = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ 8 & 7 & 10 & 1 & 3 & 5 & 6 & 4 & 2 & 9 \end{pmatrix}$$