

NAME: _____

1. Prove that:

$$\sum_{i=1}^n (6i^2 - 2i) = 2(n^3 + n^2)$$

2. Prove that:

$$\sum_{i=0}^n \frac{1}{2^i} = 2 - \frac{1}{2^n}$$

3. Multiply the following matrices.

$$\begin{pmatrix} 1 & 1 & 2 \\ 0 & 2 & 1 \end{pmatrix} \begin{pmatrix} 0 & 1 & 1 & 2 \\ 2 & 1 & 2 & 0 \\ 1 & 1 & 0 & 2 \end{pmatrix}$$

4. Multiply the following matrices.

$$\begin{pmatrix} 0 & 1 \\ 2 & 1 \\ 3 & 2 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 3 & 0 \end{pmatrix}$$

5. There are six permutations on a set of 3 elements. One has been given for you. List the other five.

$$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \end{pmatrix} \quad \begin{pmatrix} 1 & 2 & 3 \\ & & \end{pmatrix} \quad \begin{pmatrix} 1 & 2 & 3 \\ & & \end{pmatrix}$$

$$\begin{pmatrix} 1 & 2 & 3 \\ & & \end{pmatrix} \quad \begin{pmatrix} 1 & 2 & 3 \\ & & \end{pmatrix} \quad \begin{pmatrix} 1 & 2 & 3 \\ & & \end{pmatrix}$$

6. Combine the following permutations as indicated. Remember that $(f \circ g)(x) = f(g(x))$.

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 2 & 4 & 1 \end{pmatrix} \circ \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 1 \end{pmatrix}$$

7. Combine the following permutations as indicated.

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 4 & 1 & 5 \end{pmatrix} \circ \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 1 & 2 & 5 & 4 \end{pmatrix}$$

8. What does it mean to say that a function is recursive?

9. How fast are the following algorithms?

a. Repeated Minimum Sort

b. Merge Sort

c. Radix Sort

10. Convert from binary to decimal:

a. 1000101

b. 1101

c. 1101101101