1. Fill out the operation table for the permutation group S_3

$f \circ g$ do first $(g) \rightarrow$ do second $(f) \downarrow$	$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \end{pmatrix}$	$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \end{pmatrix}$	$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \end{pmatrix}$	$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{pmatrix}$	$\begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{pmatrix}$	$\begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{pmatrix}$
$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \end{pmatrix}$						
$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \end{pmatrix}$						
$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \end{pmatrix}$						
$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{pmatrix}$						
$\begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{pmatrix}$						
$\begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{pmatrix}$						

a. Is S_3 abelian? Give an example of this from your table.

b. What is the identity element for S_3?

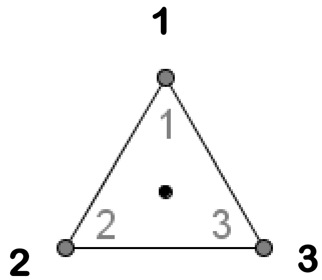
c. List the inverses of each of these elements:

i. $\begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \end{pmatrix}^{-1} = \begin{pmatrix} 1 & 2 & 3 \\ & & \end{pmatrix}$ ii. $\begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{pmatrix}^{-1} = \begin{pmatrix} 1 & 2 & 3 \\ & & \end{pmatrix}$

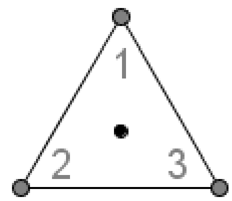
iii. $\begin{pmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \end{pmatrix}^{-1} = \begin{pmatrix} 1 & 2 & 3 \\ & & \end{pmatrix}$ iv. $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \end{pmatrix}^{-1} = \begin{pmatrix} 1 & 2 & 3 \\ & & \end{pmatrix}$

2. Write in where each vertex ends after the transformation shown

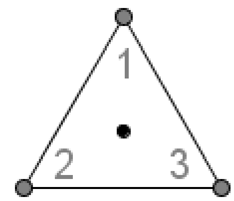
$e =$ identity map rotate 0°



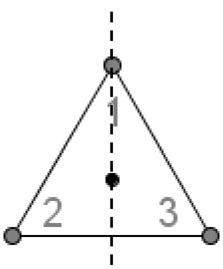
$r_1 =$ rotate 120° counterclockwise



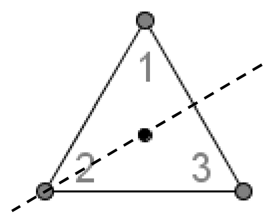
$r_2 =$ rotate 240° counterclockwise



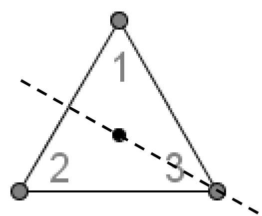
$v =$ reflect in the vertical line



$u =$ reflect in the line shown



$w =$ reflect in the line shown



Fill out the operation table for the dihedral group D_3 of rigid transformations of the equilateral triangle

$f \circ g$ do first $(g) \rightarrow$ do second $(f) \downarrow$	e	r_1	r_2	v	u	w
e						
r_1						
r_2						
v						
u						
w						

Is D_3 abelian? How do you know?

What is the inverse of each element?

$e^{-1} =$ $v^{-1} =$

$r_1^{-1} =$ $u^{-1} =$

$r_2^{-1} =$ $w^{-1} =$

Each of the elements can be written as a composition of r_1 and v. For example $r_2 = r_1 \circ r_1$. Find a way to get u and w using r_1 and v.

$u =$ $w =$