

$$ag^{-1}g^{-1}KKddfa^{-1}f^{-1}=1$$

compose with  $a^{-1}$  on LHS

$$g^{-1}g^{-1}KKddfa^{-1}f^{-1}=a^{-1}$$

and call  $a$  on RHS

$$g^{-1}g^{-1}KKddfa^{-1}f^{-1}a=1$$

Using a crosscap as a catalyst  
turn handles into crosscaps.

Move  $fa^{-1}$  from behind the 2nd  $d$   
to behind the 1st  $d$ .

$$g^{-1}g^{-1}KKda f^{-1}d f^{-1}a=1$$

Use Lemma 1 to move  $f^{-1}d f^{-1}$  from  
in front of the 2nd  $a$  to in front  
of the first  $a$ .

$$g^{-1}g^{-1}KKda f d^{-1}faa=1$$

Use Lemma 1 to move  $d^{-1}$  from in  
front of 2nd  $f$  to in front of 1st  $f$

$$g^{-1}g^{-1}KKddffaa=1 \text{ [Canonical form]}$$

We can

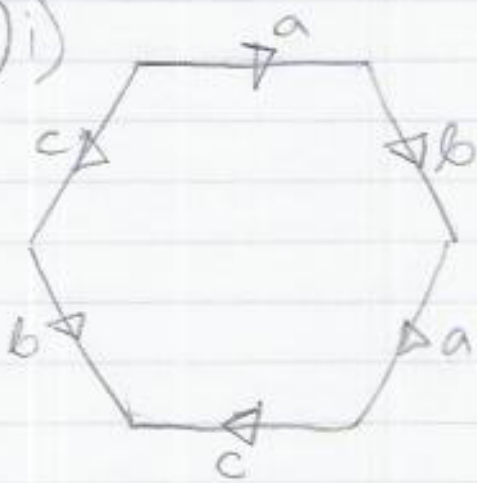
append the front with  $cc^{-1}$  to

$$\text{give } cc^{-1}g^{-1}g^{-1}KKddffaa=1$$

which is the equation of a  
sphere with five crosscaps.

✓

6)i)



The edge eqn is  
 $abac b^{-1}c^{-1}=1$

Using Lemma 1  
to move  $b$  from  
behind the 1st  $a$   
to behind the 2nd  
 $a$ . gives

$$aab^{-1}cb^{-1}c^{-1}=1$$

✓ Use Lemma 1 again to move  $c$   
from behind the 1st  $b^{-1}$  to