

## Lesson 25

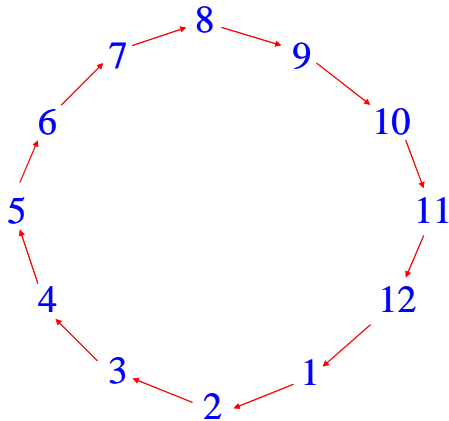
### CYCLIC GROUP OF ORDER 12

$$C_{12} \cong \mathbb{Z}_{12}$$

#### Generators:

(1,2,3,4,5,6,7,8,9,10,11,12)

#### Generator Diagram:



#### Order:

12

#### Elements:

{ (), (1,2,3,4,5,6,7,8,9,10,11,12), (1,3,5,7,9,11)(2,4,6,8,10,12),  
(1,4,7,10)(2,5,8,11)(3,6,9,12), (1,5,9)(2,6,10)(3,7,11)(4,8,12),  
(1,6,11,4,9,2,7,12,5,10,3,8), (1,7)(2,8)(3,9)(4,10)(5,11)(6,12),  
(1,8,3,10,5,12,7,2,9,4,11,6), (1,9,5)(2,10,6)(3,11,7)(4,12,8),  
(1,10,7,4)(2,11,8,5)(3,12,9,6), (1,11,9,7,5,3)(2,12,10,8,6,4),  
(1,12,11,10,9,8,7,6,5,4,3,2) }

#### Is Abelian?

Yes

## Lesson 25

Subgroups (conjugates for a given order shown in the same, non-blue color):

{  $()$ ,  $(1,2,3,4,5,6,7,8,9,10,11,12)$ ,  $(1,3,5,7,9,11)(2,4,6,8,10,12)$ ,  
 $(1,4,7,10)(2,5,8,11)(3,6,9,12)$ ,  $(1,5,9)(2,6,10)(3,7,11)(4,8,12)$ ,  
 $(1,6,11,4,9,2,7,12,5,10,3,8)$ ,  $(1,7)(2,8)(3,9)(4,10)(5,11)(6,12)$ ,  
 $(1,8,3,10,5,12,7,2,9,4,11,6)$ ,  $(1,9,5)(2,10,6)(3,11,7)(4,12,8)$ ,  
 $(1,10,7,4)(2,11,8,5)(3,12,9,6)$ ,  $(1,11,9,7,5,3)(2,12,10,8,6,4)$ ,  
 $(1,12,11,10,9,8,7,6,5,4,3,2)$  }

normal, center

$$\left\{ \begin{array}{c} () \\ (1,3,5,7,9,11)(2,4,6,8,10,12) \\ (1,5,9)(2,6,10)(3,7,11)(4,8,12) \\ (1,7)(2,8)(3,9)(4,10)(5,11)(6,12) \\ (1,9,5)(2,10,6)(3,11,7)(4,12,8) \\ (1,11,9,7,5,3)(2,12,10,8,6,4) \end{array} \right\}$$

normal, even

$$\left\{ \begin{array}{c} () \\ (1,4,7,10)(2,5,8,11)(3,6,9,12) \\ (1,7)(2,8)(3,9)(4,10)(5,11)(6,12) \\ (1,10,7,4)(2,11,8,5)(3,12,9,6) \end{array} \right\}$$

normal

$$\left\{ \begin{array}{c} () \\ (1,5,9)(2,6,10)(3,7,11)(4,8,12) \\ (1,9,5)(2,10,6)(3,11,7)(4,12,8) \end{array} \right\}$$

normal

$$\left\{ \begin{array}{c} () \\ (1,7)(2,8)(3,9)(4,10)(5,11)(6,12) \end{array} \right\}$$

normal

{ $()$ }

normal

commutator (derived)