MATH 171 SPRING 2018

DYLAN KARP

CLASS 1

I COURSE OVERVIEW.

A. INTROS

1. NAMES

2. NOTE CARDS

a. NAME + NICKNAME

b. WHERE HOMETOWN/HIGH SCHOOL

c. PRONOUNS (HE/HIM/HIS)

d. HOBBIES/INTERESTS

B. COURSE GOALS

1. ALGEBRA IS A BEAUTIFUL AND AMAZING SUBJECT DESCRIBING SYMMETRY AND UNDERPINNING HUGE SWATHS OF MATHEMATICS AND THE SCIENCES.

2. GOALS OF THE COURSE INCLUDE HELPING PEOPLE IN THE CLASS

LEARN ALGEBRA FOR THEIR OWN ENJOYMENT AND TO HELP THEM IN THEIR JOURNEY TOWARD LEADERSHIP POSITIONS IN STEM W/ A POSITIVE IMPACT IN SOCIETY.

C. COURSE STRUCTURE

1. TEXT: ABSTRACT ALGEBRA, THEORY AND APPLICATIONS BY THOMAS JUDSON. FREE ONLINE.
2. HW ONCE PER WEEK ON THURSDAYS IN CLASS.
3. 2 TAKE-HOME EXAMS.

   EXAM 1: OUT 2/20
   DUE 2/27

   EXAM 2: OUT 4/26
   DUE 5/8

4. GRADES:

A. HW 25%

B EXAM 1 25%

C EXAM 2 25%

D = MAX{A, B, C} 25%

5. OFFICE HOURS

TUE/WED/THU 3-4 PM

SHAN 3414

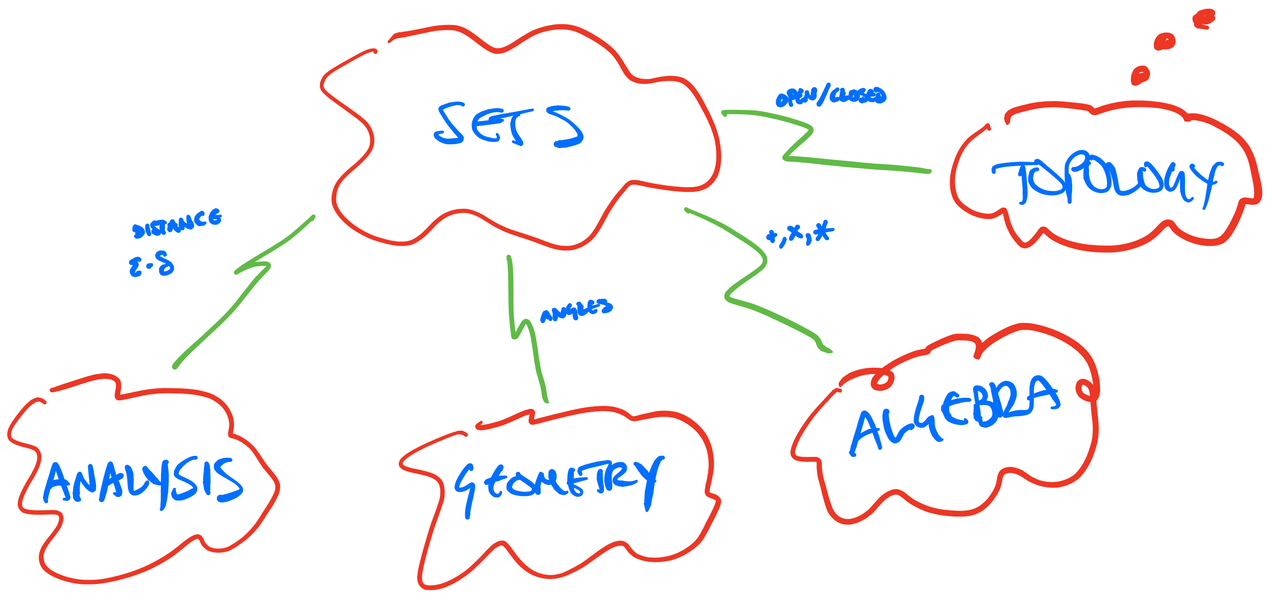
6. WEBSITE: math.hmc.edu/~dk

7. TUTORS:

? WED 7-9 PLATT

II INTRO TO ALGEBRA.

A.



B. $S_3 \cong D_3$ GAME.

Q: HOW MANY WAYS ARE THERE
TO REARRANGE THE NUMBERS
1,2,3?

123, 231, 312, 132, 321, 213

PERMUTATIONS

PERMUTATION ARRAY NOTATION:

$$\sigma_0 = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \end{pmatrix}^{\rho_0} \quad \sigma_1 = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{pmatrix}^{\rho_1}$$

$$\sigma_2 = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{pmatrix}^{\rho_2} \quad \sigma_5 = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \end{pmatrix}^{\mu_3}$$

$$\sigma_4 = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{pmatrix}^{\mu_2} \quad \sigma_3 = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \end{pmatrix}^{\mu_1}$$

PERMUTATION MULTIPLICATION

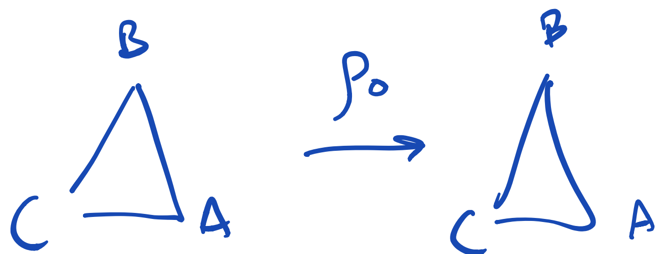
$$\sigma_5 * \sigma_2 = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \end{pmatrix} * \begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \end{pmatrix} = \sigma_3$$

GROUP WORK: COMPLETE THE TABLE

$*$	σ_0	σ_1	σ_2	σ_3	σ_4	σ_5
σ_0						
σ_1						
σ_2						
σ_3						
σ_4						
σ_5			σ_3			

NEW GAME: SYMMETRIES OF THE TRIANGLE



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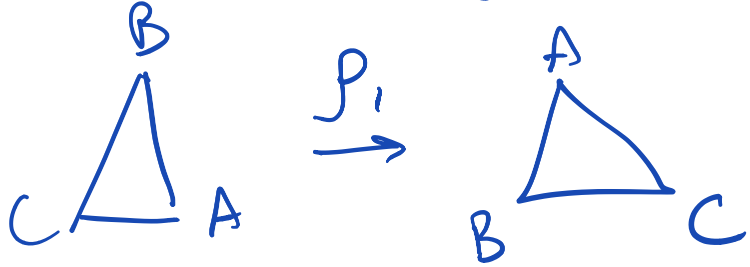

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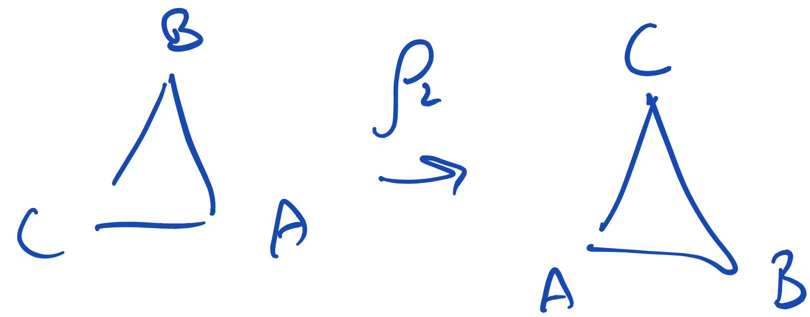
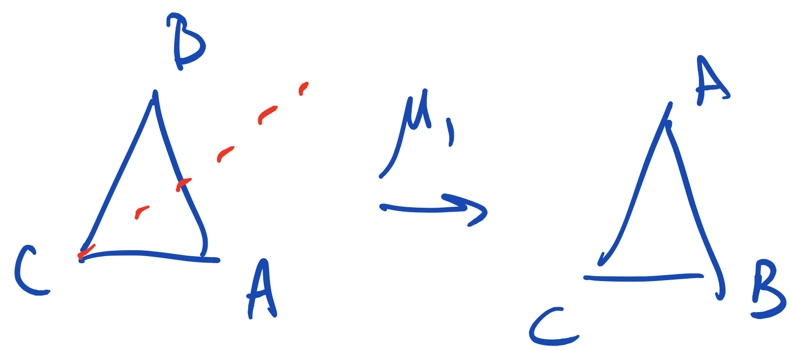
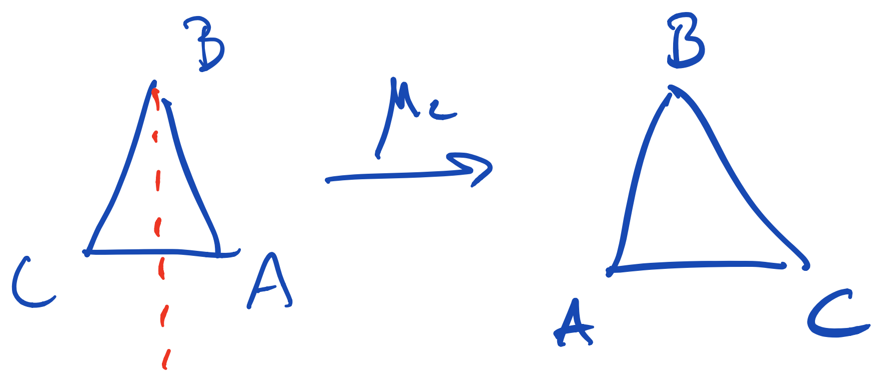
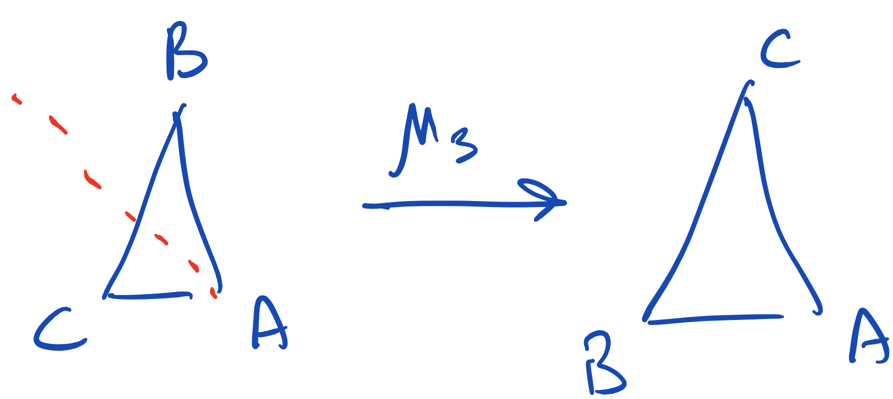


$\circlearrowleft 4\pi/3$



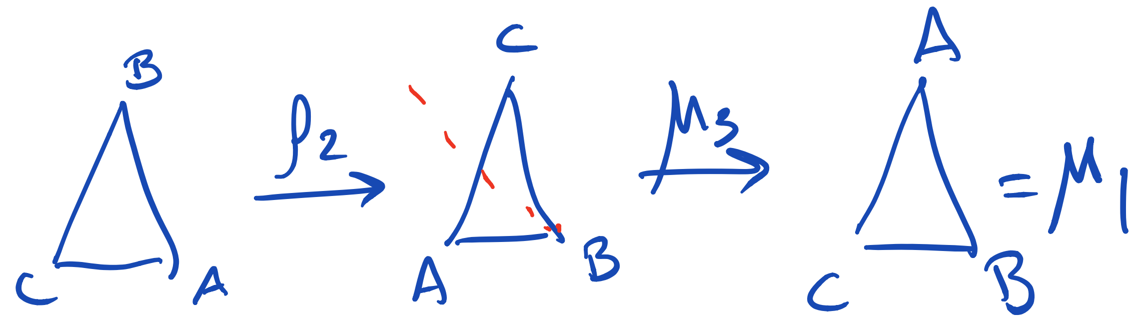
REFLECTION





MULTIPLICATION: $\star$

$\mu_3 \star \rho_2 =$



GROUPWORK:

$\star$	ρ_0	ρ_1	ρ_2	μ_1	μ_2	μ_3
ρ_0						
ρ_1						
ρ_2						
μ_1						
μ_2						
μ_3			μ_1			

NOTE: THESE ARE THE SAME GAME:

S_3 = SET OF PERMUTATIONS OF $\{1,2,3\}$

D_3 = SYMMETRIES OF TRIANGLE

$$\varphi : S_3 \longrightarrow D_3$$

$$\varphi(\sigma_0) = \rho_0 \quad \varphi(\sigma_1) = \rho_1 \quad \varphi(\sigma_2) = \rho_2$$

$$\varphi(\sigma_3) = \mu_3 \quad \varphi(\sigma_4) = \mu_2 \quad \varphi(\sigma_5) = \mu_1$$

$$\varphi(\mu_3 \star \rho_2) = \varphi(\mu_1) = \sigma_3$$

NOTE: $\varphi(\mu_3) \ast \varphi(\rho_2) = \sigma_5 \ast \sigma_2 = \sigma_3$

$$\varphi(\mu_3 \star \rho_2) = \varphi(\mu_3) \ast \varphi(\rho_2)$$

WE WILL LEARN: D_3 & S_3 ARE GROUPS. THE SYMMETRIC GROUP S_3 IS ISOMORPHIC TO THE DIHEDRAL GROUP D_3.

HW 1: 3.4: 2, 5, 10, 33, 48, 54

* NO CLASS THURSDAY (FUNERAL).