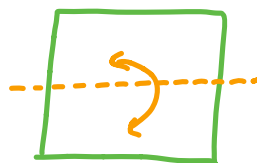# Symmetries of a Square

- **Reminder**: HW1 due Wednesday at 5pm, via iLearn

- **Video**: Symmetries of a square include

90° counter-clockwise rotation
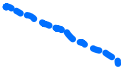
and

horizontal reflection

The equity manager for your group is the person whose first name comes alphabetically first, among all the group members. Write that person's name here:

Equity manager: _____

Get to know each other: Go around the group, and have each member introduce themselves with their name and answer the following question:

- What other classes are you taking this semester?

---

1. List as many symmetries of a square as you can collectively think of.

- Do nothing : $I = R_{360}$
- Rotate 90° counterclockwise: R_{90}
- " 180° " : $R_{180} = (R_{90})^2$
- " 270° " : R_{270}

- Reflect across ------ : H
- " " | : V
- " " $>$: D
- " " : D'

2. Don't go on to the next problem yet! If you're done before we come back together, you might think about the following follow-up questions:

- How do you know you've found all of the possible symmetries of a square?
- Could you do this for other shapes, like triangles or pentagons?

Composing Symmetries

$H \circ R_{90} = D$
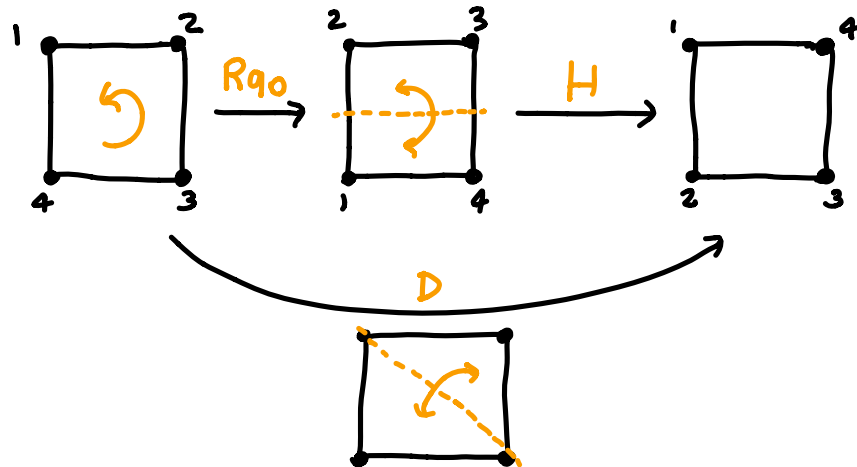
Fill in table:

	I	R_{90}	R_{180}	R_{270}	H	V	D	D'
I								
R_{90}								
R_{180}								
R_{270}								
H		D						
V								
D								
D'								

3. Fill in (at least part of) the following table, where the entry in row A and column B stands for $A \circ B$. For example, the fact that

$$H \circ R_{90} = D$$

has been filled in for you. You don't need to fill in the whole table, but fill in enough that you get the idea of how to do it, and maybe start noticing some patterns.

do this first

do this second

	I	R_{90}	R_{180}	R_{270}	H	V	D	D'
I	I	R_{90}	R_{180}	R_{270}	H	V	D	D'
R_{90}	R_{90}	R_{180}	R_{270}	I	D'	D	H	V
R_{180}	R_{180}	R_{270}	I	R_{90}	V	H	D'	D
R_{270}	R_{270}	I	R_{90}	R_{180}	D	D'	V	H
H	H	D	V	D'	I	R_{180}	R_{90}	R_{270}
V	V	D'	H	D	R_{180}	I	R_{270}	R_{90}
D	D	V	D'	H	R_{270}	R_{90}	I	R_{180}
D'	D'	H	D	V	R_{90}	R_{270}	R_{180}	I

4. What features of the table do you notice?

- First row & column are easiest to fill (composing with I does nothing)

- Each symmetry appears once in each row & column

- Rotations are self-contained (if you compose two rotations, get a rotation)