

MATH 122

(Day 2)

Frieze Patterns and Their Symmetries

Richard Hammack

<http://www.people.vcu.edu/~rhammack/Math122/>

Today's Goals

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- ▶ Survey frieze patterns in architecture and craft.

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- ▶ Examine the 5 basic symmetries that a frieze pattern may have.

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- ▶ Survey frieze patterns in architecture and craft.
- ▶ Examine the 5 basic symmetries that a frieze pattern may have.
- ▶ Analyze examples.
- ▶ First assignment



Roman Forum, Rome



Rome



Richmond

Richmond's Landmark Theater



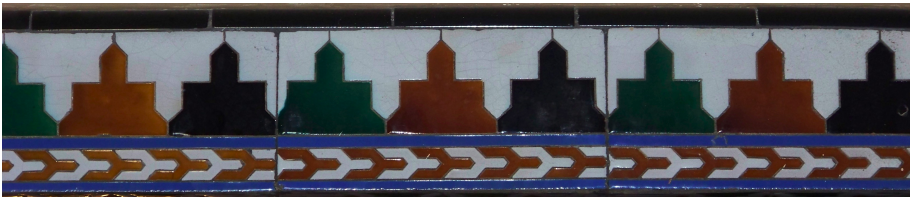
Richmond's Landmark Theater



Richmond's Landmark Theater



Richmond's Landmark Theater



Downtown Richmond



Downtown Richmond



Downtown Richmond



Downtown Richmond





Punjab region of India (date unknown)



Punjab region of India (date unknown)





India, c. 900 AD



India, c. 900 AD



Egyptian or Syrian, c. 1200 AD



India, c. 900 AD



Egyptian or Syrian, c. 1200 AD



George Elmsle (American) 1916

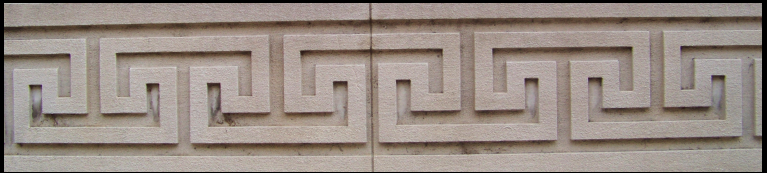
More Examples from Downtown Richmond



More Examples from Downtown Richmond



More Examples from Downtown Richmond





The Egyptian Building (MCV Campus)





Leone Battista Alberti

Frieze made from the emblem of the Rucellai family



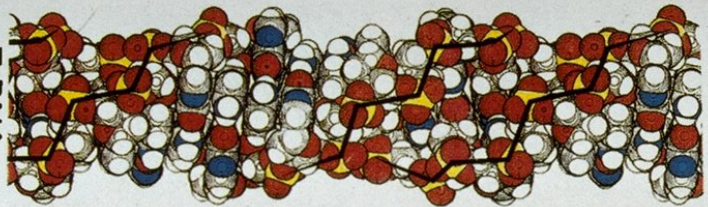
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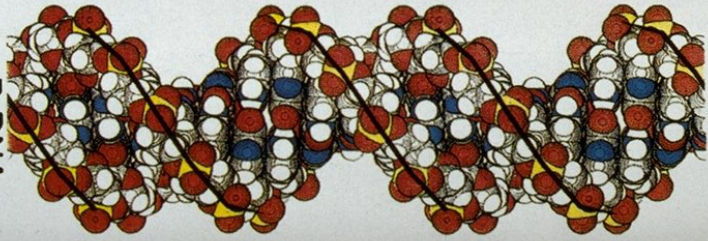


Santa Maria Novella, Florence, Italy

Z-DNA



B-DNA



More Examples of Frieze Patterns



More Examples of Frieze Patterns



More Examples of Frieze Patterns



More Examples of Frieze Patterns



More Examples of Frieze Patterns



More Examples of Frieze Patterns



More Examples of Frieze Patterns



More Examples of Frieze Patterns



Types of Symmetry in Frieze Patterns

Types of Frieze Symmetry

Types of Frieze Symmetry

1. Translation (T)

Types of Frieze Symmetry

1. Translation (T)



Types of Frieze Symmetry

1. Translation (T)



Types of Frieze Symmetry

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Types of Frieze Symmetry

1. Translation (T)



Types of Frieze Symmetry

1. Translation (T)



Types of Frieze Symmetry

2. Glide Reflection (G)

Types of Frieze Symmetry

2. Glide Reflection (G)



Types of Frieze Symmetry

2. Glide Reflection (G)



Types of Frieze Symmetry

2. Glide Reflection (G)



Types of Frieze Symmetry
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Types of Frieze Symmetry

2. **Glide Reflection (G)**



Types of Frieze Symmetry

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Types of Frieze Symmetry

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Types of Frieze Symmetry

2. Glide Reflection (G)



Types of Frieze Symmetry
3. Rotation by 180° (R)

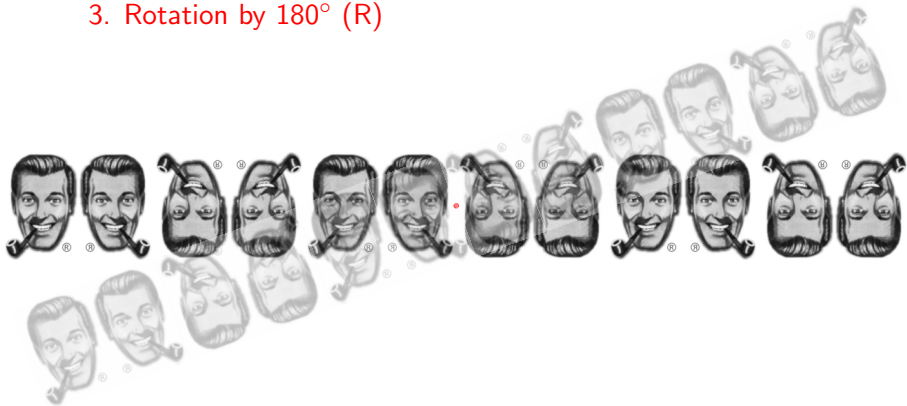


Types of Frieze Symmetry

3. Rotation by 180° (R)

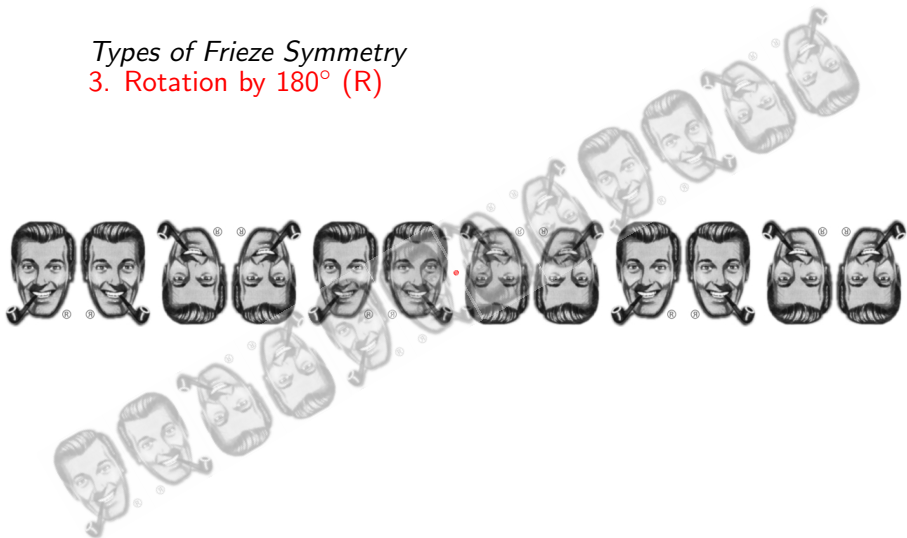


Types of Frieze Symmetry
3. Rotation by 180° (R)



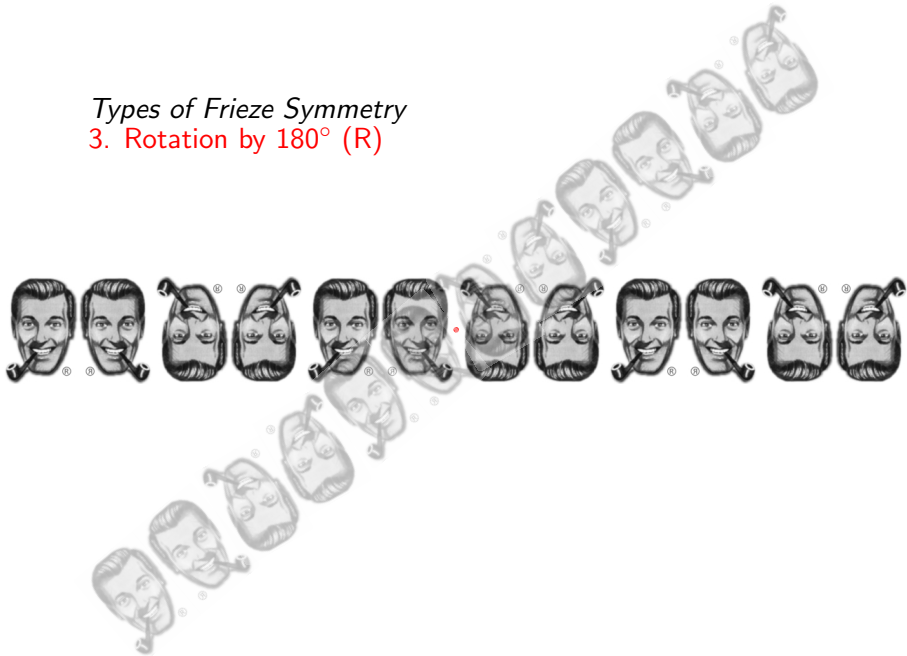
Types of Frieze Symmetry

3. Rotation by 180° (R)



Types of Frieze Symmetry

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Types of Frieze Symmetry
3. Rotation by 180° (R)



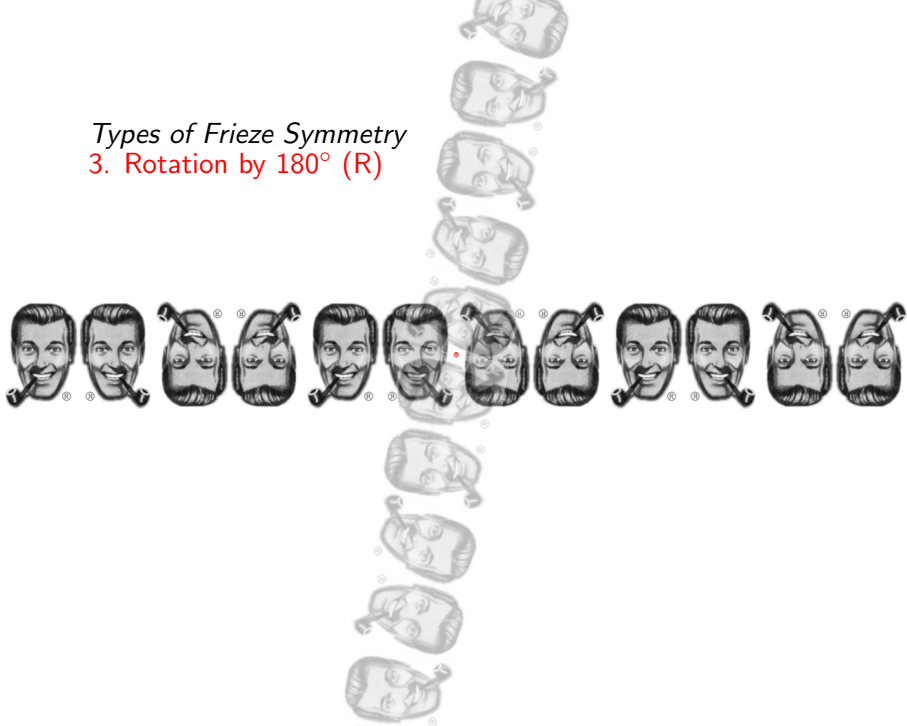
Types of Frieze Symmetry
3. Rotation by 180° (R)



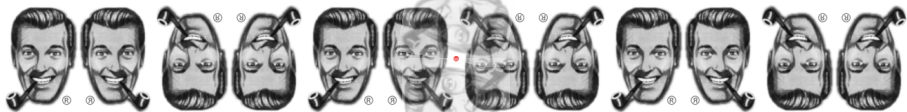
Types of Frieze Symmetry
3. Rotation by 180° (R)



Types of Frieze Symmetry
3. Rotation by 180° (R)



Types of Frieze Symmetry
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Types of Frieze Symmetry
3. Rotation by 180° (R)



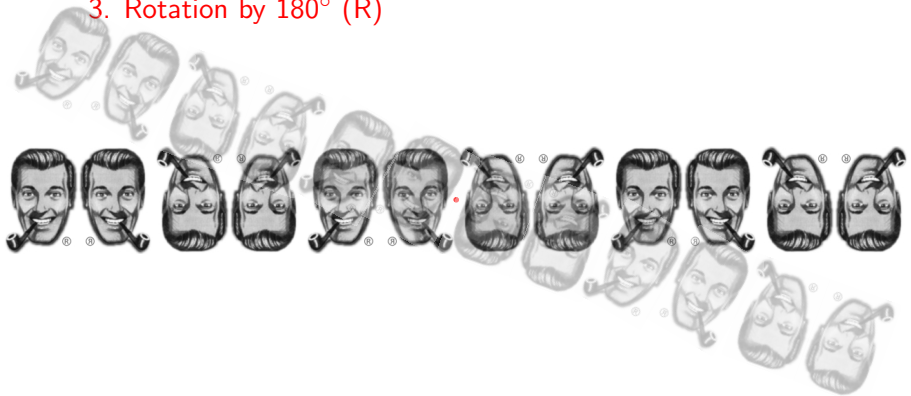
Types of Frieze Symmetry

3. Rotation by 180° (R)



Types of Frieze Symmetry

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Types of Frieze Symmetry
3. Rotation by 180° (R)



Types of Frieze Symmetry
3. Rotation by 180° (R)



Types of Frieze Symmetry

3. Rotation by 180° (R)



There are many centers of rotation

Types of Frieze Symmetry
4. Vertical reflection (V)



Types of Frieze Symmetry
4. Vertical reflection (V)



Types of Frieze Symmetry
4. Vertical reflection (V)



There are many different axes of reflection

Types of Frieze Symmetry

5. Horizontal Reflection (H)

Types of Frieze Symmetry
5. Horizontal Reflection (H)



Types of Frieze Symmetry
5. Horizontal Reflection (H)



Example:

What symmetries does this frieze pattern have?



Example:

What symmetries does this frieze pattern have?



Translation?

Example:

What symmetries does this frieze pattern have?



Translation?

YES

Example:

What symmetries does this frieze pattern have?



Translation?

YES

Glide Reflection?

Example:

What symmetries does this frieze pattern have?



Translation?	YES
Glide Reflection?	NO

Example:

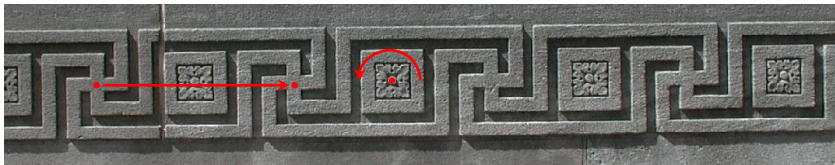
What symmetries does this frieze pattern have?



Translation?	YES
Glide Reflection?	NO
Rotation?	

Example:

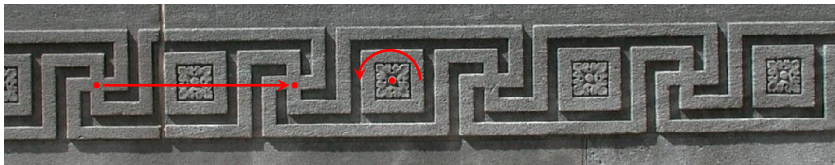
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Translation?	YES
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Rotation?	YES

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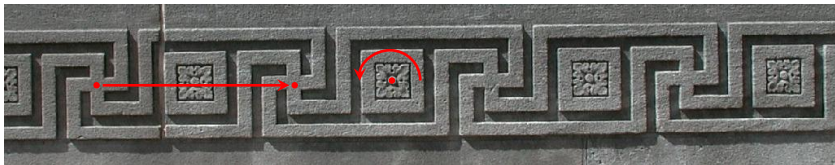
What symmetries does this frieze pattern have?



- | | |
|----------------------|-----|
| Translation? | YES |
| Glide Reflection? | NO |
| Rotation? | YES |
| Vertical Reflection? | |

Example:

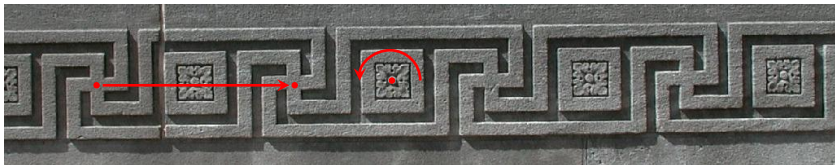
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Rotation?	YES
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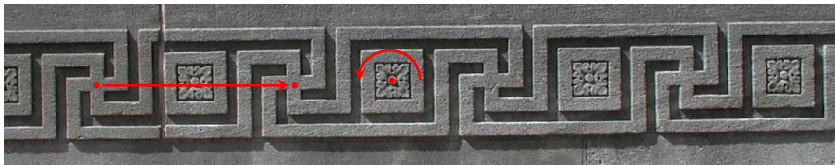
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Translation?	YES
Glide Reflection?	NO
Rotation?	YES
Vertical Reflection?	NO
Horizontal Reflection?	

Example:

What symmetries does this frieze pattern have?



Translation?	YES
Glide Reflection?	NO
Rotation?	YES
Vertical Reflection?	NO
Horizontal Reflection?	NO

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Rotation?

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What symmetries does this frieze pattern have?



Translation?	YES
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What symmetries does this frieze pattern have?



Translation? YES

Glide Reflection? NO

Rotation? NO

Vertical Reflection?

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What symmetries does this frieze pattern have?



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Rotation?	NO
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Translation?

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What symmetries does this frieze pattern have?



Translation?

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Glide Reflection?

Example:

What symmetries does this frieze pattern have?



Translation? YES

Glide Reflection? YES

Example:

What symmetries does this frieze pattern have?



Translation? **YES**

Glide Reflection? **YES**

Rotation?

Example:

What symmetries does this frieze pattern have?



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|-------------------|-----|
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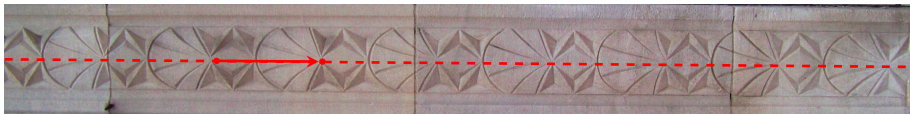
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Glide Reflection?

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What symmetries does this frieze pattern have?



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Rotation? NO

Vertical Reflection?

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Horizontal Reflection? NO



Assignment #1



<http://www.people.vcu.edu/~rhammack/Math122/index.html>