Pattern, Patterns in Nature, Transformation & Fractals

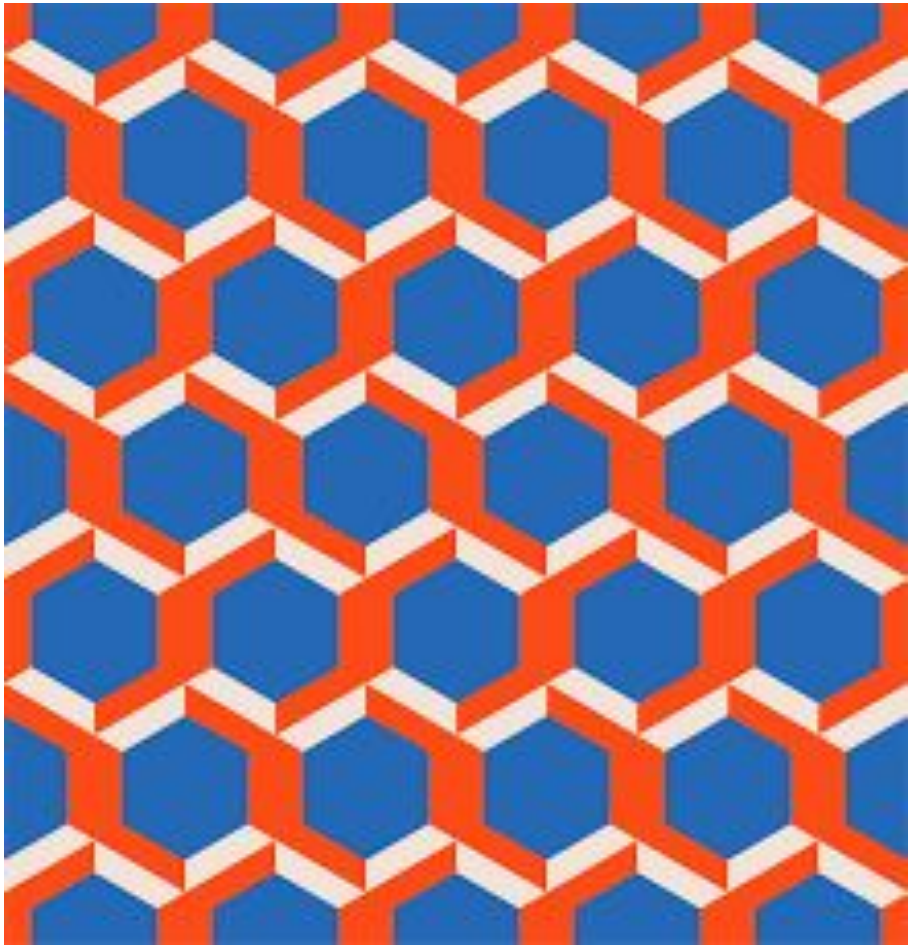
Mathematics in the Modern World
Module 1

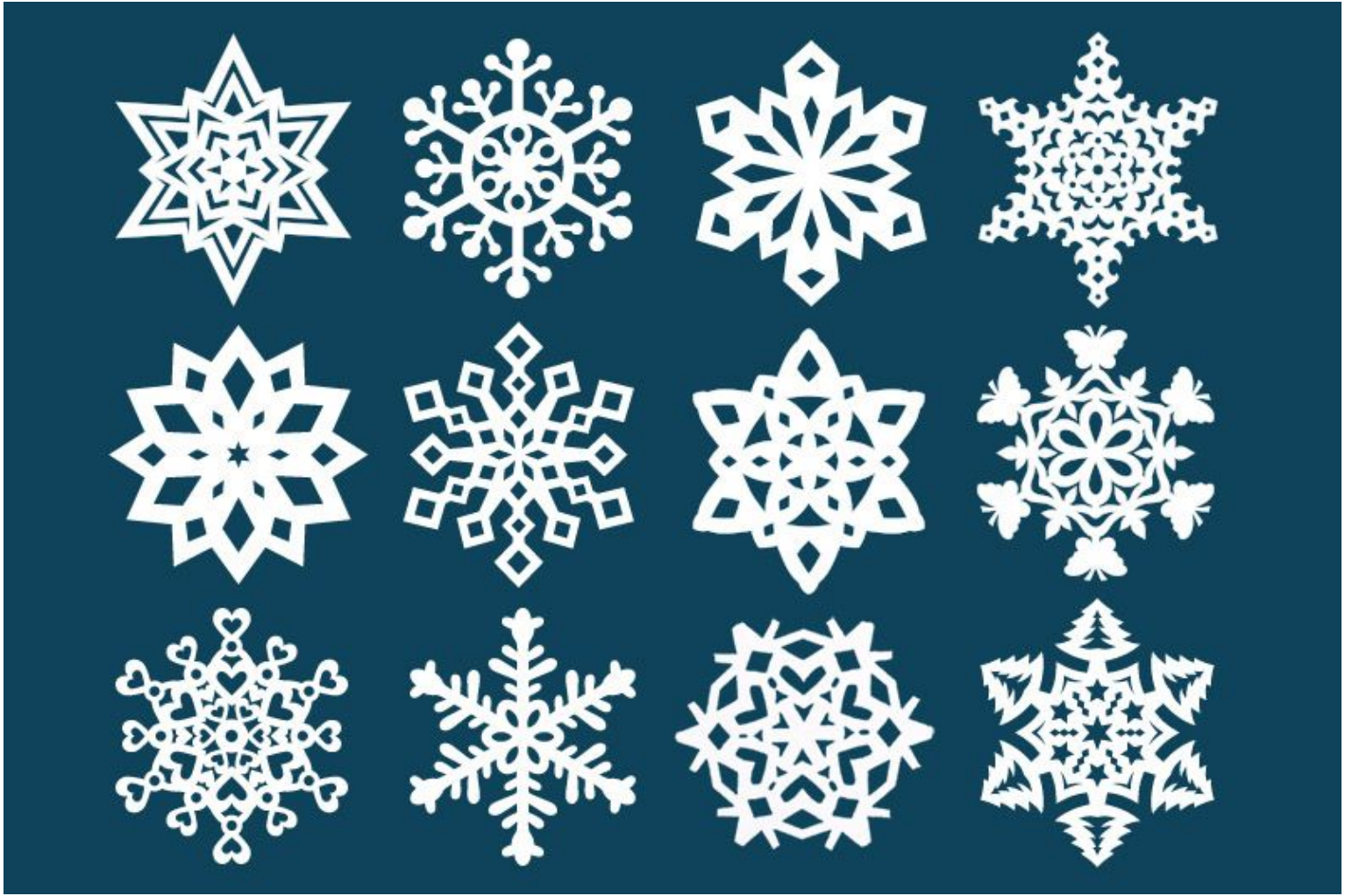
Objectives

1. Familiarization of patterns
2. Discuss patterns in nature
3. Identify different types of patterns
4. Enumerate & discuss different types of transformations

Patterns

- Exist in different types of forms
- Nature is bounded by different colors and shapes
- Some patterns are molded with strict regularity





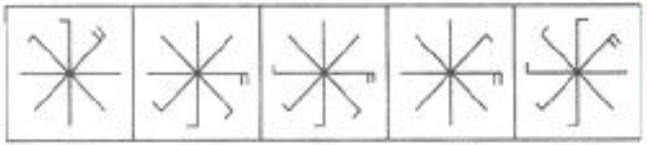
Patterns

- Helps us anticipate what we might see or expect to happen next
- Helps us to see what may have come before or what we are currently seeing
- Four types of patterns: Logic, Numbers, Geometric, Word

Logic Patterns

- Ability to discover meaningful patterns in strange and unpredictable situations

1.



(a) (b) (c) (d) (e)

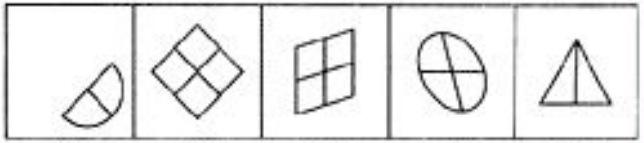
2.

(a) (b) (c) (d) (e)

3.

(a) (b) (c) (d) (e)

4.



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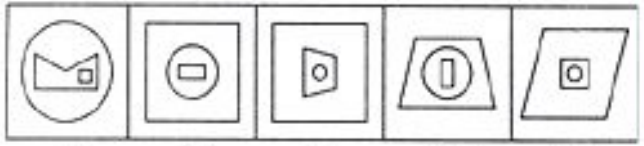

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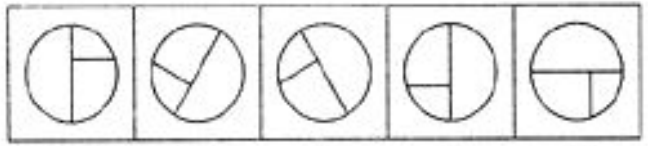

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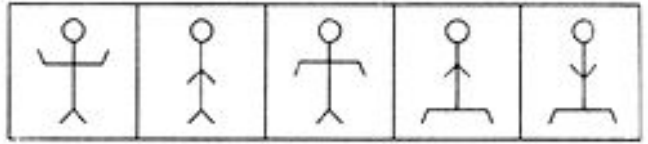

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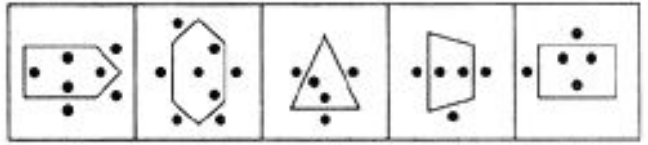
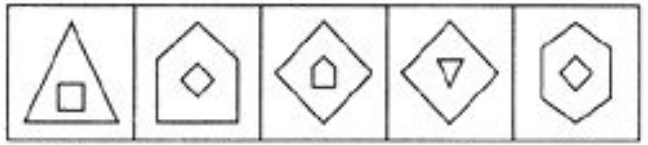


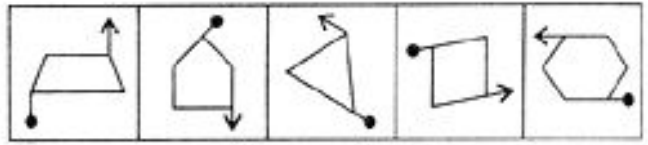
(a) (b) (c) (d) (e)

9.



(a) (b) (c) (d) (e)

10.



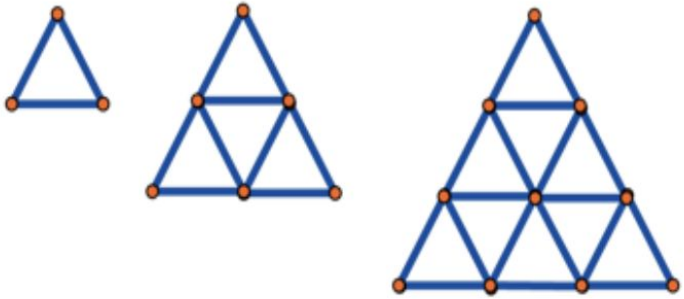
(a) (b) (c) (d) (e)

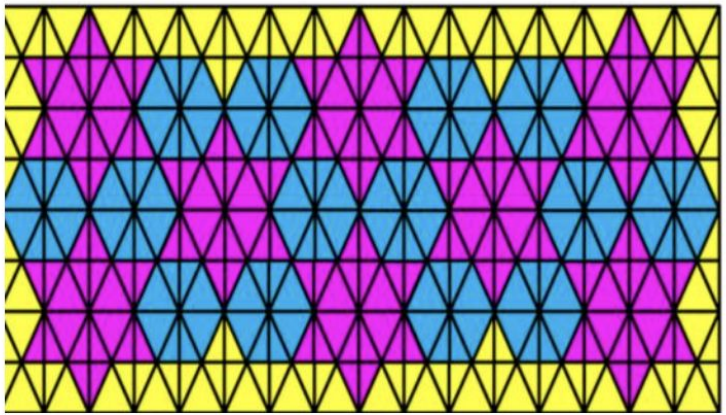
Number Patterns

- Sequence of numbers that are formed in accordance with a definite rule
- 1, 3, 5, 7, 9, ...
- 2, 4, 6, 8, 10, ...

Geometric Patterns

- Patterns represented by geometric figures such as polygons and isometric shapes





Word Patterns

- Represented by jumbled words and analyzed the hidden logic in it

Rearrange the jumbled words.

I R A C H _____ 

L C P I E N _____ 

E O R S H _____ 

U N E Q E _____ 

Y D R A I _____ 

N T O T C O _____ 

O M N A G _____ 

Y D I A S _____ 

E L P T A _____ 

S L S G A _____ 

Patterns

- Has symmetry
- Isometry preserves the symmetry
- Isometry - transformation of plane that preserves geometrical properties

Transformations

- Process which shifts points of a plane to possibly new locations on a plane
- Four types: Translation, Reflection, Rotation, Dilation

Translation

- Also known as “Slide”
- Moves a shape in a given direction by sliding it up, down, sideways, or diagonally

Reflection

- Also known as “Flip”
- Getting a mirror image
- Has a line of reflection or mirror line where the distance between the image and mirror line is the same as that between the original figure and the mirror line

Rotation

- Also known as “Turn”
- Has a point about which the rotation is made and an angle that says how far to rotate

Dilation

- Transformation which changes the size of an object

Rigid Transformation

- Combination of reflection, translation, and rotation
- Leaves the dimensions of the object and its image unchanged

Pattern

- Observing patterns makes an individual develop their ability to predict future behavior of organisms and phenomena
- Patterns are useful in different areas of science

Fractals

- An object or quantity that displays self-similarity, in a somewhat technical sense, on all scales
- Need not exhibit exactly the same structure at all scales, but the same type of structures must appear on all scales

Self-Similarity

- An object is said to be self-similar if it can be formed from smaller versions of itself (with no gaps and overlaps)

Topology

- Study of objects that can be stretched, bent, or otherwise distorted without tearing or scattering
- Also known as “Rubber sheet geometry”
- Investigates basic structure such as number of holes or how many components

Orientability and Genus

- A topological surface is orientable if you can determine its outside and inside
- Any orientable, compact (finite size) surface is determined by its number of holes
- Number of holes - Genus