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**IDX G9 MATH S+ STUDY GUIDE ISSUE 6**

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**Contents:**

1. ***9-1 Translations***
2. ***9-2 Reflection***
3. ***9-3 Rotation***
4. ***9-6 Compositions of Reflections***
5. ***9-4 Symmetry***
6. ***9-6 Dilations***
7. ***9-1 Translations***

* **Definition of a Translation (Slide):**
  + A translation is an isometry (a transformation that preserves distances) that moves all points of a figure the same distance in the same direction.
* **Composition of Translations:**
  + A composition of translations is the result of applying two or more translations in sequence.
* A translation can be written as ((x, y) (x + a, y + b)).
* For a figure like (triangle ABC), the image after translation is denoted as (triangle A’B’C’), where (A’), (B’), and (C’) are the new positions of points (A), (B), and (C).

1. ***9-2 Reflection***
2. **New Term**

**·*Reflection***

**A reflection is an isometry in which a figure and its image have opposite orientation.**

**All reflection has its own reflection line.**

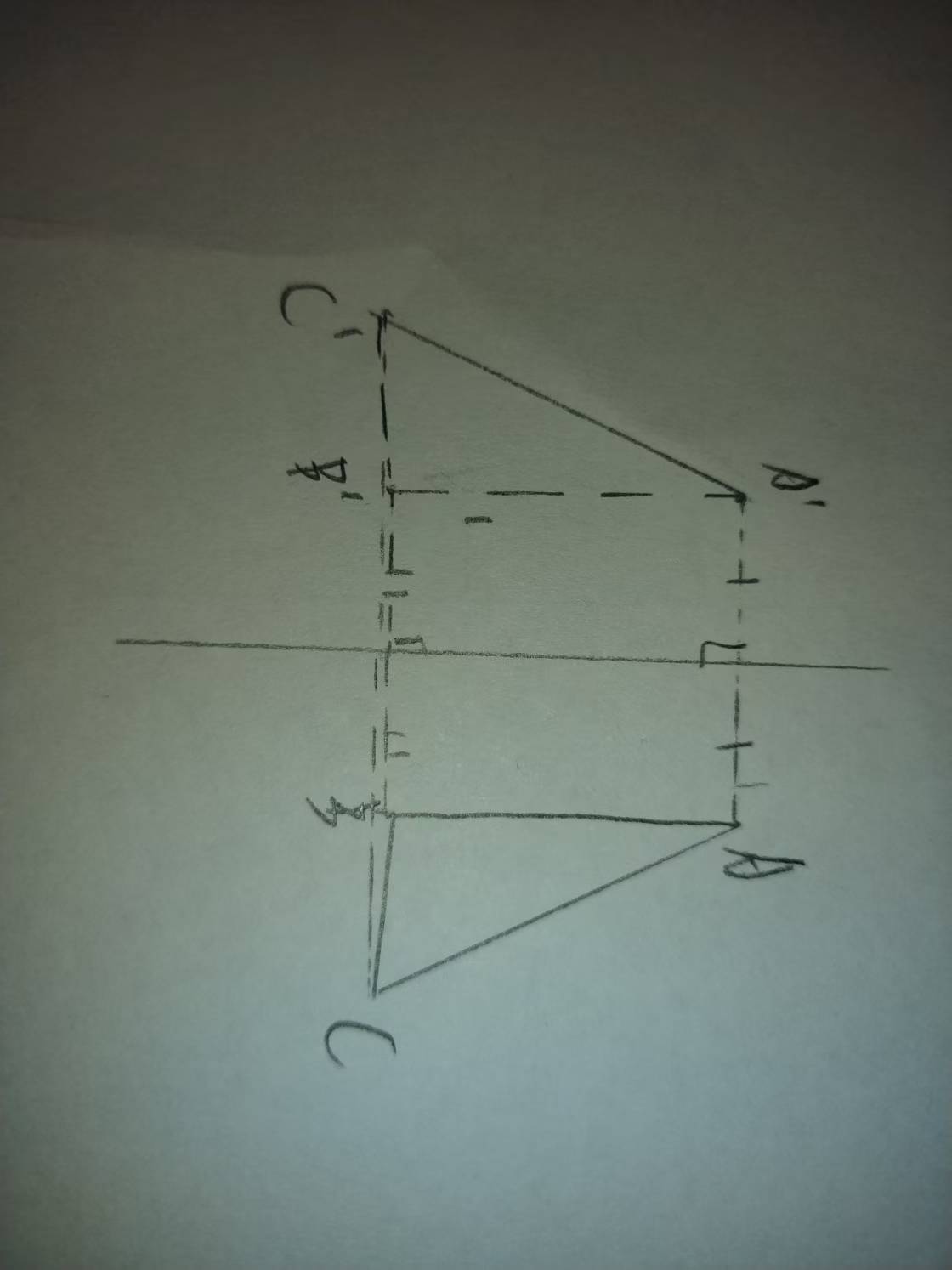
**·*how to draw reflection***

**1 .Draw lines perpendicular to the reflection line, passing through the points.**

**2 .Measure the distance from the points to the reflection line.**

**3 .Mark the reflected point on the opposite side of the line at the same distance.**

**4 .Connect the Reflected Points**

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**E.g.**

**·*some universal law of reflection***

|  |  |  |  |
| --- | --- | --- | --- |
| **The form of reflection line** | **Transformation formula** | **Example** | **Orientation change** |
| **X=a** | (*x*,*y*)→(2*a*−*x*,*y*) | (3,4)→(5,4) (if *a*=4) | Left-right flipped |
| *y*=*b* | (*x*,*y*)→(*x*,2*b*−*y*) | (2,5)→(2,−1) (if *b*=2) | Up-down flipped |
| *y*=*x* | (*x*,*y*)→(*y*,*x*) | (4,7)→(7,4) | Swapped coordinates |
| *y*=−*x* | (*x*,*y*)→(−*y*,−*x*) | |  | | --- | | (2,3)→(−3,−2) | | Swapped & negated coordinates |

1. ***9-3 Rotation***
2. **New terms**

**·*Rotation***

**Rotation is a transformation that turns a figure around a fixed point by a specified angle and direction.**

**·*the center of rotation***

The **center of rotation** is the fixed point about which a figure is rotated. Every point on the figure moves along a circular path around this point during rotation.

**·*the angle of rotation***

The **angle of rotation** is the measure (in degrees or radians) by which a figure is turned around the center of rotation. It determines how "far" the figure rotates.

**·*clockwise & counterclockwise***

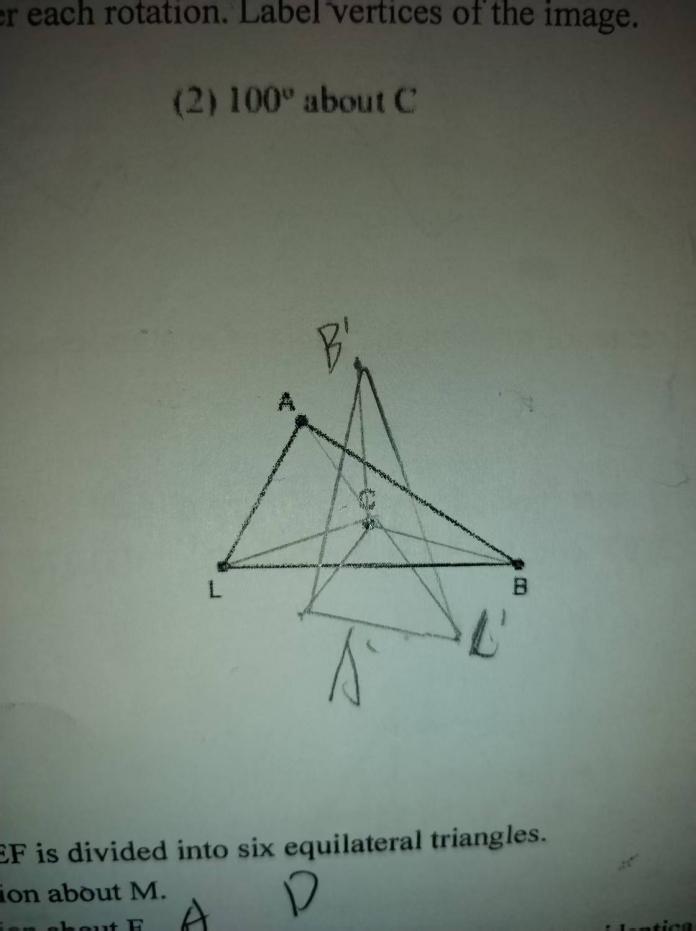
Rotation in the **same direction/opposite** as the movement of a clock’s hands (↷/↶). Mathematically, this is a negative/positive angle.

1. **How to draw rotation**

**1 .Locate the center of rotation**

**2 .Turn each point by the angle of rotation in clockwise/counterclockwise(as counterclockwise if not mentioned)**

**3 .Connect the points to complete image**

****

**E.g.**

1. **How to find the center of rotation**

**1 .Select two pairs of points (original and rotated).**

**2 .Draw two segments connecting original and rotated points**

**3 .Construct a perpendicular bisector of each segment**

**4 .The connected point of two perpendicular bisectors is the center of rotation**

**9.4 Symmetry**

Symmetry refers to a figure that can be mapped onto itself by a transformation (reflection or rotation).

Review Questions

1. Types of Symmetry:
   * Line/Reflectional Symmetry: A figure can be reflected over a line to map onto itself.
   * Rotational Symmetry: A figure can be rotated around a point (less than360) to map onto itself.
   * Point Symmetry: A 180 rotation maps the figure onto itself.
2. Draw Lines of Symmetry:
   * (1) Isosceles Trapezoid: 1 line of symmetry.
   * (2) Square: 4 lines of symmetry.
   * (3) Regular Pentagon: 5 lines of symmetry.
   * (4) Parallelogram: 0 lines (unless it’s a square or rhombus).
3. Rotational Symmetry:
   * Regular ( n )-gon: ( n ) lines of symmetry, rotational symmetry of 360
   * Example: Pentagon (( n = 5 )) has 72 rotational symmetry.
4. Identify Symmetry in Objects:
   * (1) Ping Pong Paddle: Rotational symmetry (yes).
   * (2) Mug: No symmetry.
   * (3) Umbrella: Rotational symmetry (yes).
   * (4) Eagle: No symmetry.

Symmetry Examples

* Letter Symmetry:
  + Letter ( V ): 1 line of symmetry, no rotational symmetry.
  + Letter ( H ): 2 lines of symmetry
  + Letter ( A ): 1 line of symmetry, no rotational symmetry.
  + Letter ( I ): 2 lines of symmetry

**9.5 Dilations**

A dilation is a transformation that changes the size of a figure (enlargement or reduction) with a center and a scale factor.

Review Questions

1. Enlargement Dimensions:
2. Similarity and Scale Factor:
3. Dilation Coordinates:

* Dilation Rules:
  + For center ( O(0, 0) ), scale factor ( s ):
    - ( (x, y) to (sx, sy) ).

Key Formulas and Rules

* Rotation:
  + ( 90 ) counterclockwise: ( (x, y) to (-y, x) ).
  + ( 180): ( (x, y) to (-x, -y) ).
* Reflection:
  + Across ( y = x ): ( (x, y) \to (y, x) ).
  + Across ( y = -x ): ( (x, y) \to (-y, -x) ).
* Dilation:
  + With center ( (h, k) ), scale factor ( s ): ( (x, y) to (h + s(x - h), k + s(y - k)) ).
* Symmetry:
  + Regular ( n )-gon: ( n ) lines of symmetry, rotational symmetry of 360/n