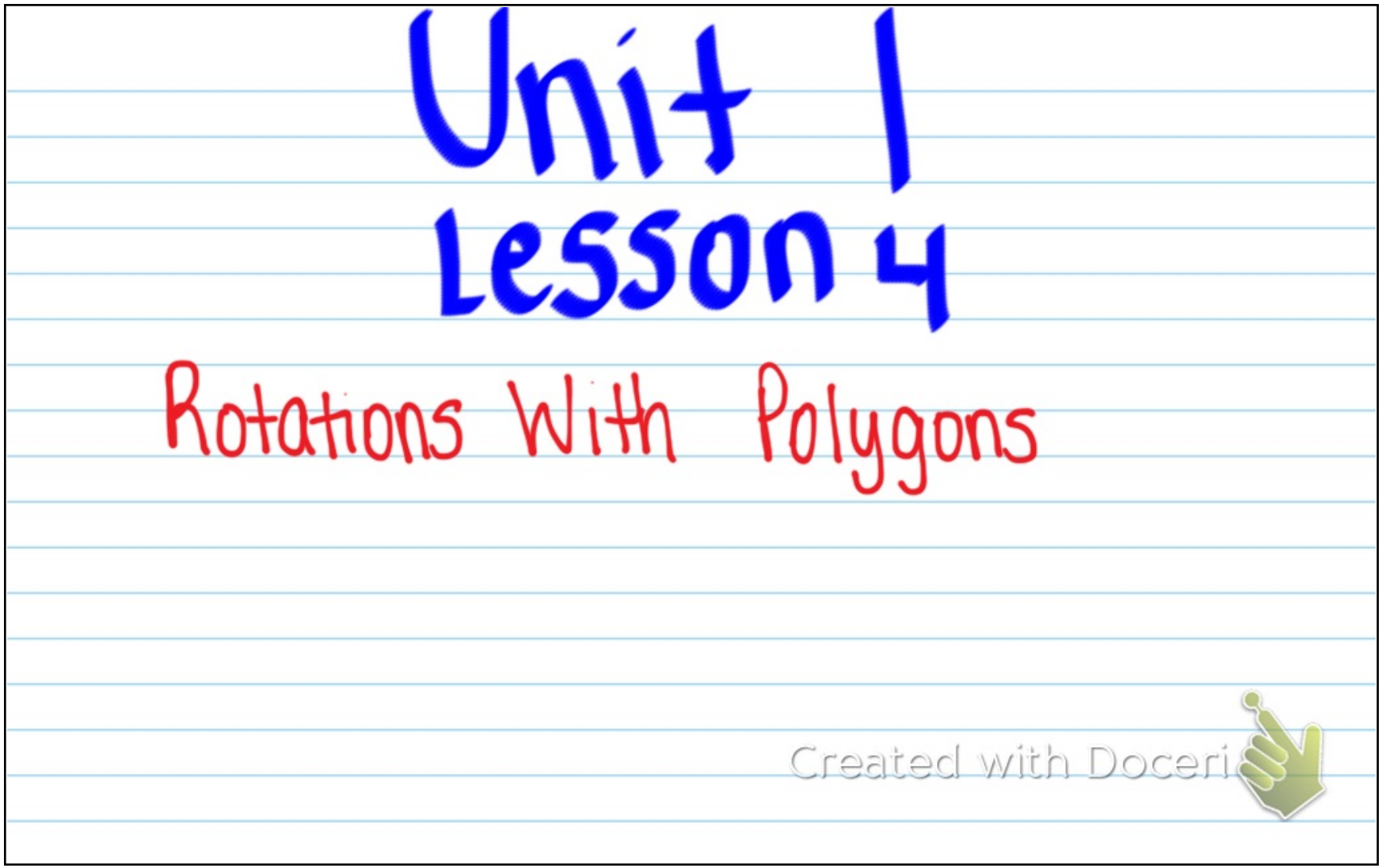
Unit 1
Lesson 4
Rotations With Polygons



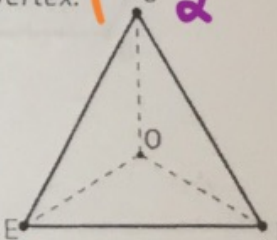
Unit 1 – Geometric Transformations Date_____ Pd_____

Lesson 4 – Rotations with Polygons

360/3 = 120°

Part 1 – Regular Polygons and Rotational Symmetry

*A **regular polygon** is a **polygon** that is equiangular (all angles are equal in measure) and equilateral (all sides have the same length). In the case of **regular polygons** the **center** is the point that is equidistant from each vertex.* 1 2



1. Given *Regular Triangle EFG* with center O.
   a. F is rotated about O. If the image of F is G, what is the angle of rotation?

1 turn x 120° = 120°

   b. $\overline{FG}$ is rotated 120° about O. What is the image of $\overline{FG}$?

1 2 $\overline{GE}$

2 1 2

General Rule: The regular triangle has rotation symmetry with respect to the center of the polygon and angles of rotation that measure 120°, 240° and 360°.

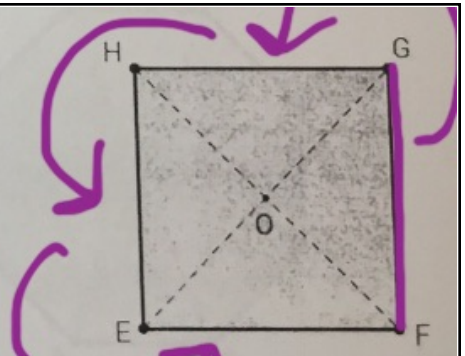
Side note: A regular triangle is also called an equilateral triangle or an equiangular triangle

2. Given *Regular Quadrilateral EFGH* with center O. 360/4 = 90

a. F is rotated about O. If the image of F is G, what is the angle of rotation? 90°

b. F is rotated about O. If the image of F is H, what is the angle of rotation? 2 x 90° = 180°

c. $\overline{FG}$ is rotated 270° about O. What is the image of $\overline{FG}$? $\overline{EF}$ 270/90 = 3 turns



General Rule: The regular quadrilateral has rotation symmetry with respect to the center of the polygon and angles of rotation that measure 90°, 180°, 270° and 360°

Side note: A regular quadrilateral is often called a Square.

3. Given *Regular Pentagon ABCDE* with center O. 360/5 = 72

a. C is rotated about O. If the image of C is D, what is the angle of rotation? 1 turn x 72° = 72°

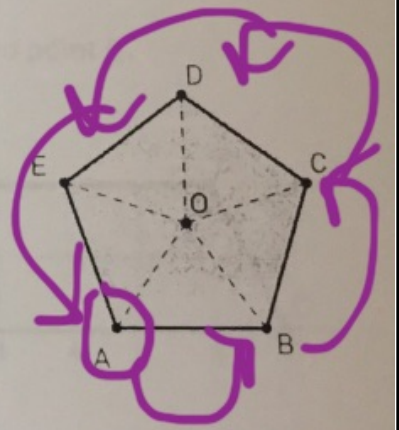
b. C is rotated about O. If the image of C is E, what is the angle of rotation? 2 turns x 72° = 144°

c. C is rotated about O. If the image of C is A, what is the angle of rotation? 3 turns x 72° = 216°

d. $\overline{DC}$ is rotated 288° about O, what is the image of $\overline{DC}$? 288/72 = 4 turns $\overline{CB}$

e. *Pentagon ABCDE* is rotated 72° about O, what is the image of *pentagon ABCDE* (in terms of the original points' labels – do not use $A'B'C'D'E'$)? BCDEA

f. Explain the significance of the multiples of 72°. # of degrees per turn



General Rule: The regular pentagon has rotation symmetry with respect to the center of the polygon and angles of rotation that measure 72°, 144°, 216°, 288° and 360°.

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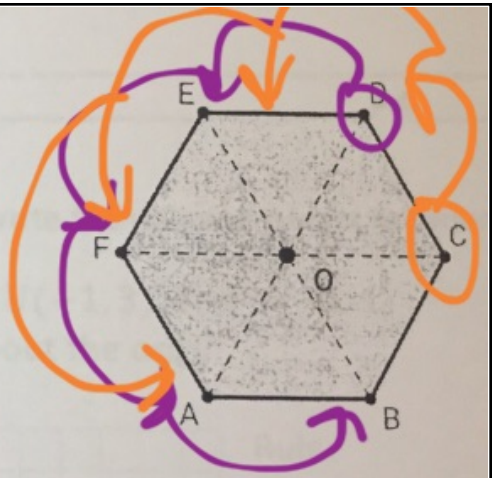
4. Given *Regular Hexagon ABCDEF* with center O.



a. C is rotated 60° about O, what is the image of C? D

b. C is rotated 120° about O, what is the image of C? E

c. C is rotated 180° about O, what is the image of C? F

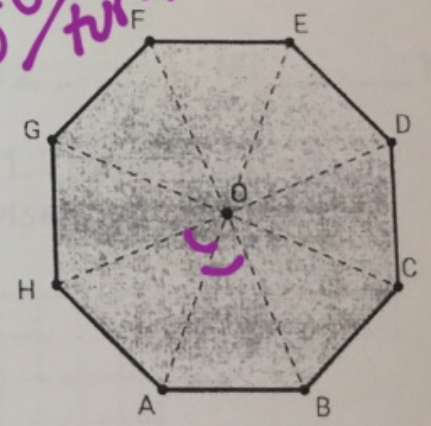
d. $\overline{DC}$ is rotated 240° about O, what is the image of $\overline{DC}$? $\overline{BA}$

240°/60° = 4

e. Explain the significance of the multiples of 60°: # degrees per turn

General Rule: The regular hexagon has rotation symmetry with respect to the center of the polygon and angles of rotation that measure 60°, 120°, 180°, 240°, 300° and 360°.

5. Given *Regular Octagon ABCDEFGH* with center O. 360/8 = 45°/turn



a. When point C is rotated about O, the image of point C is point D. Describe the rotation (be sure to include degree).

45° CCW

b. When point C is rotated about O, the image of point C is point F. Describe the rotation (be sure to include degree).

3 × 45 = 135°

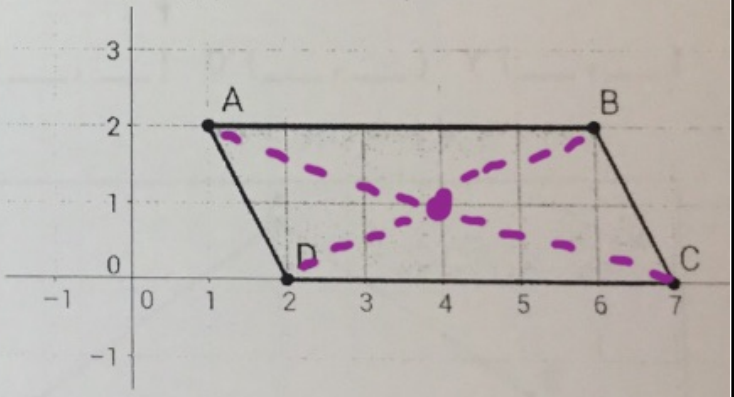
A regular polygon can be mapped onto itself if we rotate in multiples of the central angle measure.

The central angle of a regular polygon is found by 360/n

n = # of sides/Angles

Part 2 – Parallelograms and Rotational Symmetry

6. Given *Parallelogram ABCD*, there is a center of rotation, O, that will map point A onto point C.



a. What are the coordinates of O? (4,1)

b. What degree of rotation mapped C onto A using the center O? 180°

c. If we rotate the parallelogram around center O using the degree measure found in part b, $\angle D$ maps to $\angle B$.

d. If $\angle A$ maps to $\angle C$, then $\angle A$ and $\angle C$ are $\cong$.

e. If $\angle D$ maps to $\angle B$, then $\angle D$ and $\angle B$ are $\cong$.

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