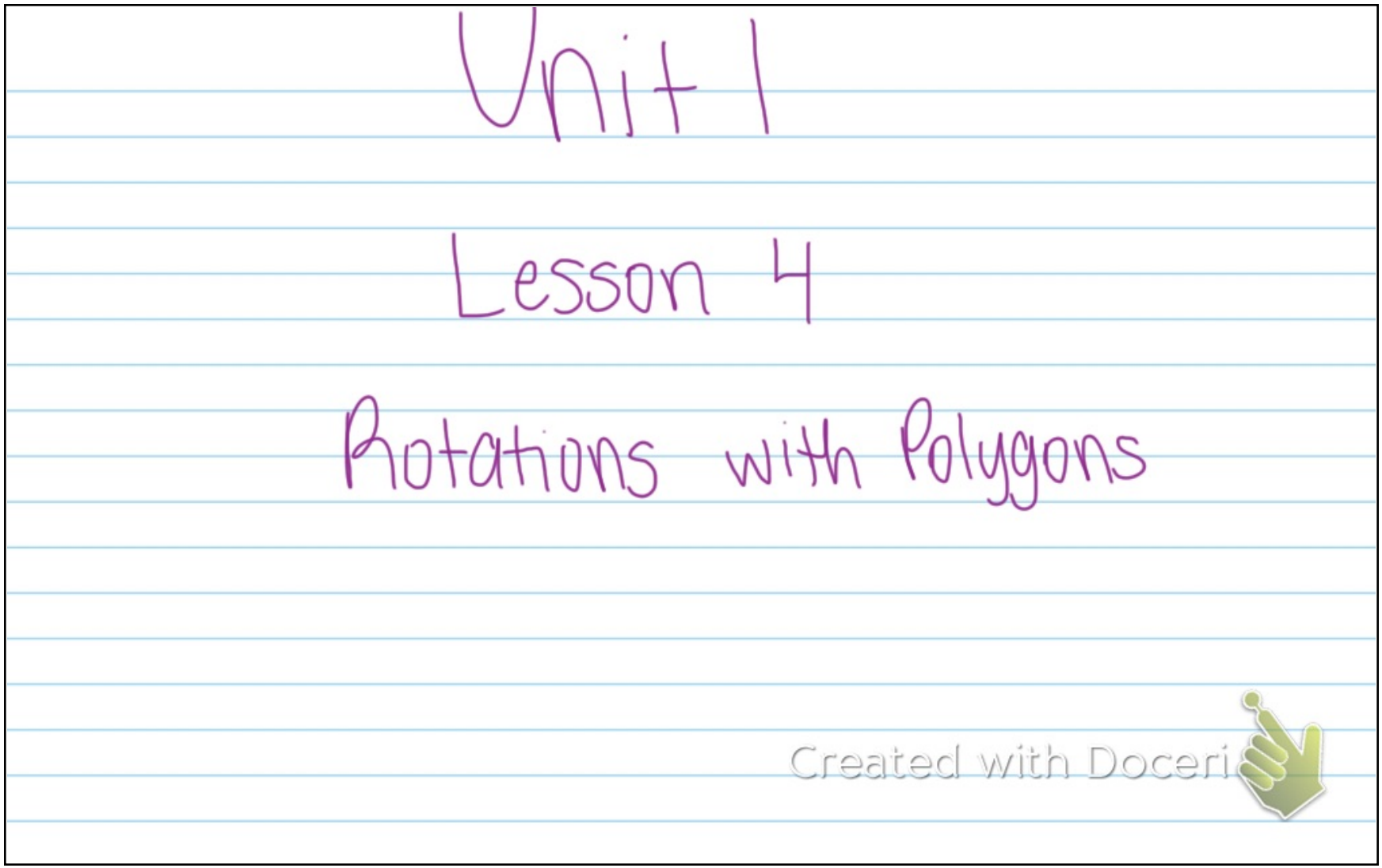
Unit 1

Lesson 4

Rotations with Polygons

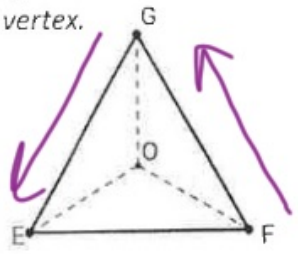


Unit 1 – Geometric Transformations
Lesson 4 – Rotations with Polygons

Date_____ Pd_____

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

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.*

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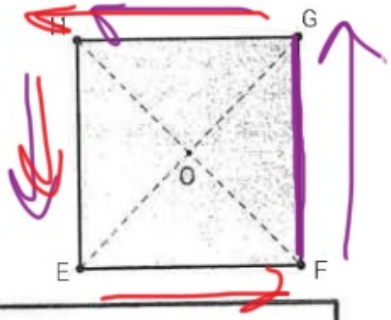
2. Given *Regular Quadrilateral EFGH* with center O.

   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? 180°

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



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.

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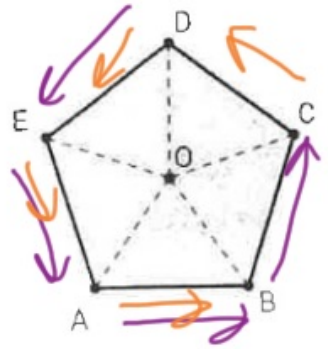
3. Given *Regular Pentagon ABCDE* with center O.



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

b. C is rotated about O. If the image of C is E, what is the angle of rotation? 144°

c. C is rotated about O. If the image of C is A, what is the angle of rotation? 216°

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

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°. "Central Angle"

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°. 16

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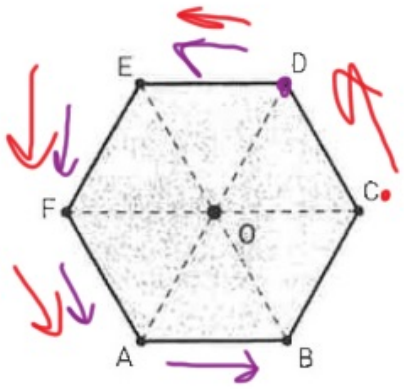
4. Given *Regular Hexagon ABCDEF* with center O.



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 $\overline{DC}$? BA

e. Explain the significance of the multiples of 60°. "central angle"

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°.

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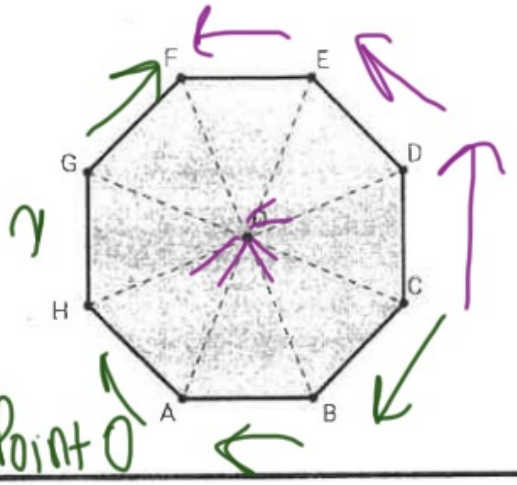
5. Given *Regular Octagon ABCDEFGH* with center O.



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

R 45° about Point O

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

R 135° about Point O / R 225° CW About Point O

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 _____

$$\frac{360^\circ}{\text{n of sides}} = \text{central angle}$$

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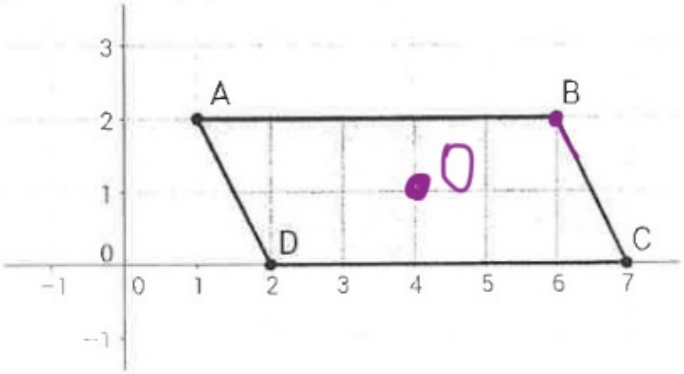
Part 2 – Parallelograms and Rotational Symmetry

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? R180°about O

R180°CW about O

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

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

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

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Pg 18 #5

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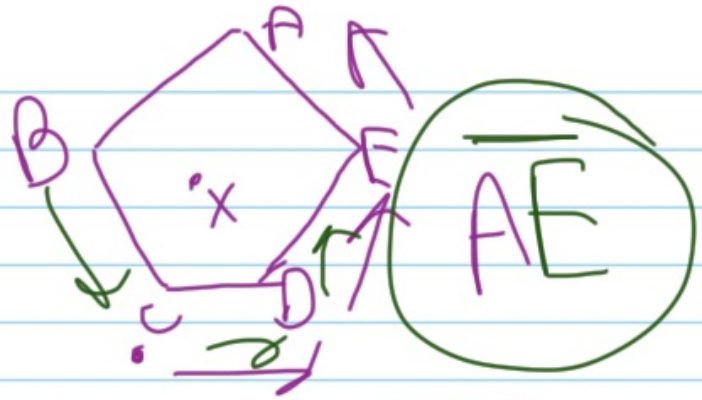
a) A

b) $\overline{AE}$ $\overline{ED}$ $\overline{EA}$ $\overline{BA}$



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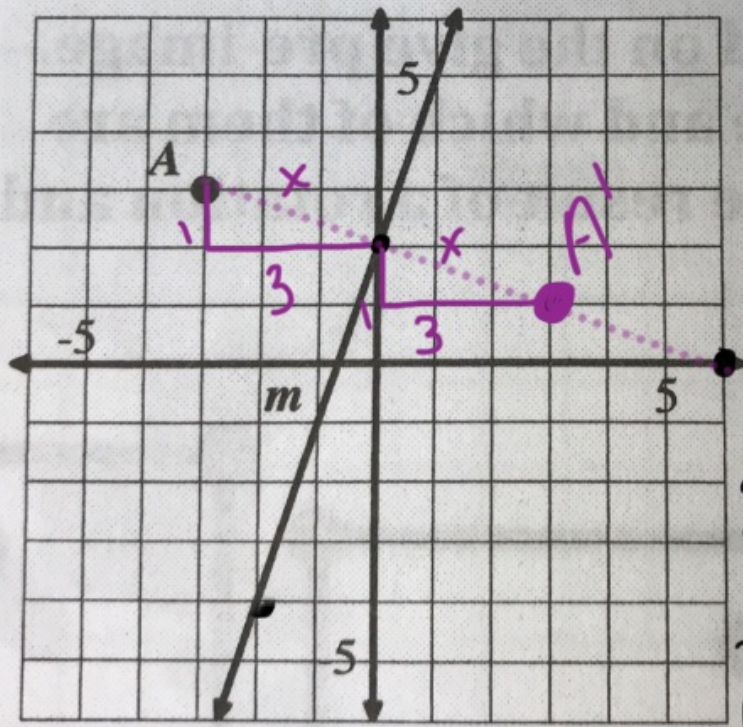
3.



4.

Slope of Reflection

$m = \frac{\text{rise}}{\text{run}} \quad \frac{3}{1} = 3$

$\perp$ opp. rec slope $-\frac{1}{3}$

Start at given point and use opp. reciprocal slope to get line where reflected point lies.

Draw right Δ's to be equidistant

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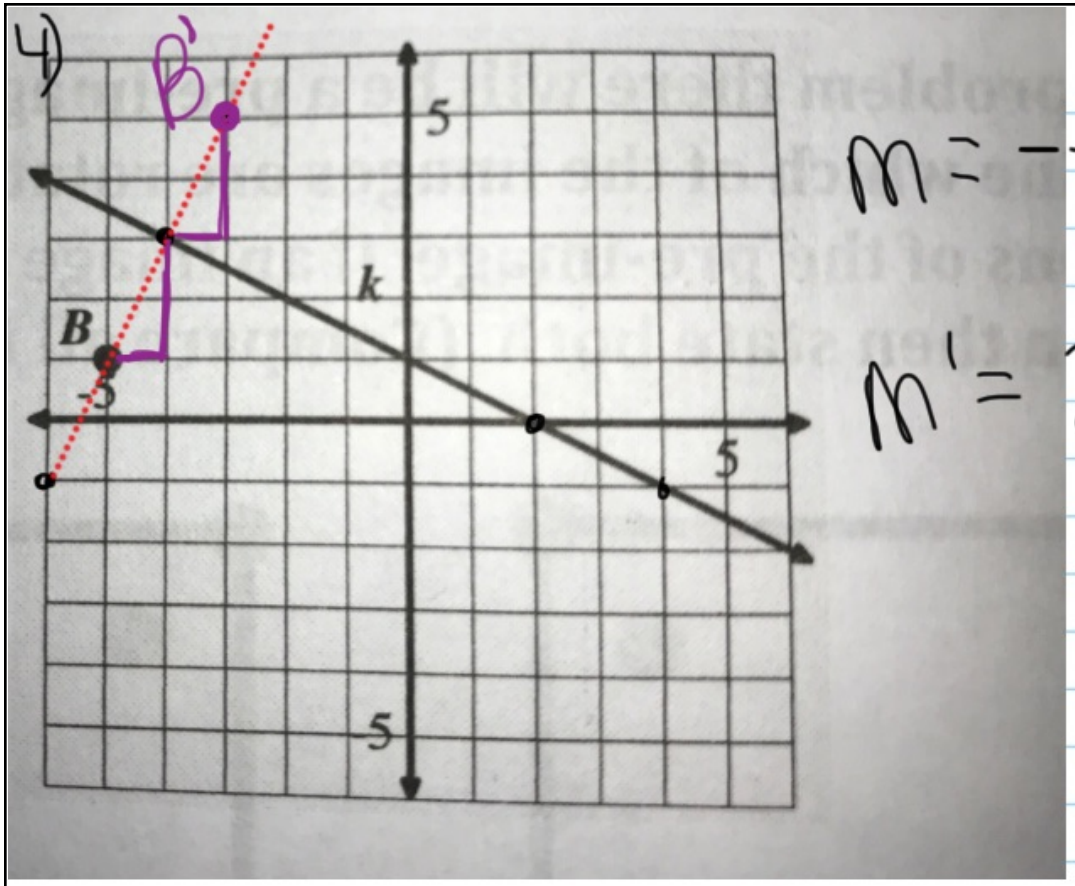

$m = -\frac{1}{2}$

$m' = 2$

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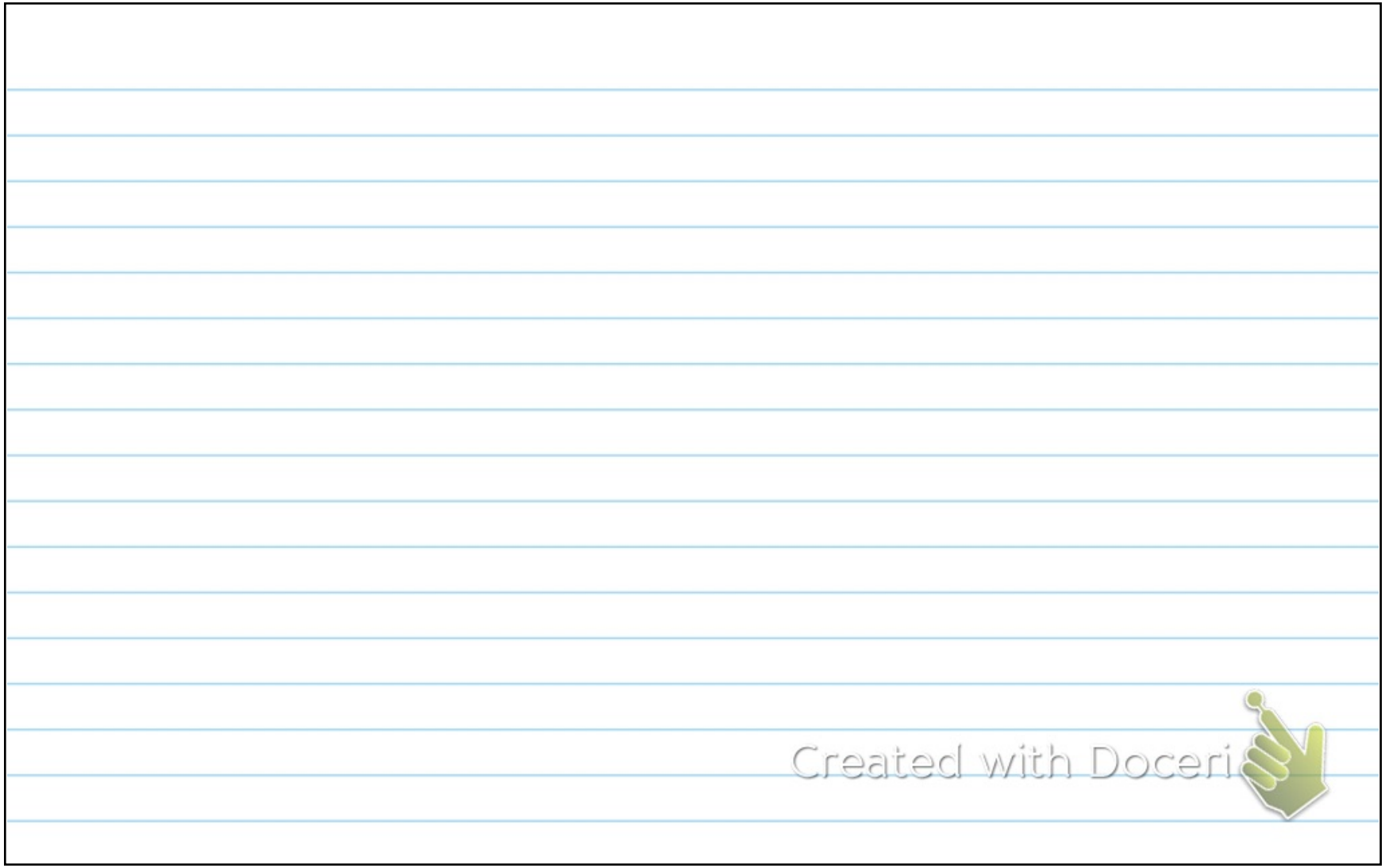
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