Unit 8 · Coordinate Geometry & Transformations Cheat Sheet

Unit 8 focus: distance, midpoint, slope and translations

1 KEY VOCABULARY

pre-image / image	The figure before / after a transformation.	$A \to A'$
rigid motion	Keeps size and shape: translation, reflection, rotation.	congruent
dilation	Changes size by a scale factor k; keeps shape.	similar
quadrants	I $(+,+)$, II $(-,+)$, III $(-,-)$, IV $(+,-)$.	$(-2,3)$ in II

2 DISTANCE & MIDPOINT

Formula	Example
$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$	$(1,2),(5,5)$: $\sqrt{16+9}=5$
$M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$	$(2,1),(8,5)$: $(5,3)$

3 SLOPE, PARALLEL & PERPENDICULAR

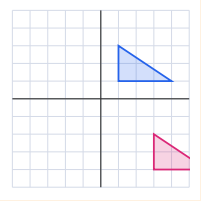
- $m = \dfrac{y_2-y_1}{x_2-x_1}$: $(1,2)$ to $(4,6)$ gives $\frac{4}{3}$.
- Parallel lines: equal slopes.
- Perpendicular lines: $m_1 m_2 = -1$ (opposite reciprocals).
- Use slopes to show a quadrilateral is a parallelogram or has right angles.

4 TRANSLATIONS

Slide every point the same way: $(x,y) \to (x+a, y+b)$.

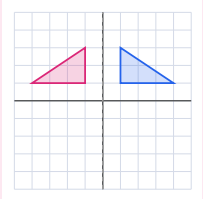
Example: Translate right 2, down 5.
Rule: $(x,y) \to (x+2, y-5)$
$(1,3)$**:** $\to (3,-2)$

Answer: blue → pink



5 REFLECTIONS

Over	Rule
x-axis	$(x,y) \to (x,-y)$
y-axis	$(x,y) \to (-x,y)$
$y=x$	$(x,y) \to (y,x)$
$y=-x$	$(x,y) \to (-y,-x)$



6 QUICK REMINDERS & COMMON MISTAKES

✓ Do remember

- Write points as (x,y): x first.
- Transform every vertex, then connect.
- Label images with primes: A', A''.

✘ Common mistakes

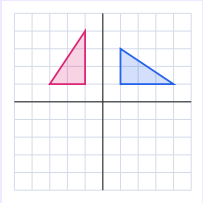
- Reflecting over the wrong axis: x-axis changes y
- Over $y=x$: keep the signs: swap the coordinates
- Mixing 90° and 270°: check the direction

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More practice: reflections, rotations, dilations and sequences of transformations

1 ROTATIONS ABOUT THE ORIGIN

Counterclockwise	Rule
$90°$	$(x, y) \to (-y, x)$
$180°$	$(x, y) \to (-x, -y)$
$270°$ **(= 90° clockwise)**	$(x, y) \to (y, -x)$



2 DILATIONS

From the origin: $(x, y) \to (kx, ky)$. $k > 1$ enlarges, $0 < k < 1$ shrinks.

Example: Dilate $A(2, 3)$ by $k = 2$.
Multiply: $(2 \cdot 2, 2 \cdot 3)$
Answer: $A'(4, 6)$

3 CONGRUENT OR SIMILAR?

Translation, reflection, rotation (rigid motions)	**congruent**
Dilation with $k \neq 1$	**similar**
Rigid motions followed by a dilation	**similar**

4 SEQUENCES OF TRANSFORMATIONS

Do them in order; each image is the next pre-image.

Example: $A(1, 2)$: right 3, then reflect over the x-axis.
Translate: $A_1(4, 2)$
Reflect: $A_2(4, -2)$
Answer: $A''(4, -2)$

5 COORDINATE PROOFS

- **Parallelogram**: both pairs of opposite sides have equal slopes.
- **Rectangle**: also adjacent slopes multiply to -1.
- **Rhombus**: all four side lengths equal (distance formula).
- **Right triangle**: two sides with perpendicular slopes.

6 CHECK YOURSELF

- Did I apply the rule to every vertex?
- Is my rotation counterclockwise unless told otherwise?
- For a sequence, did I use the first image as the next pre-image?
- Does my image have the right orientation?