Transformations on the Coordinate Plane

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

Translation adds a fixed coordinate change. Reflections use $(x, y) \to (x, -y)$ across the x-axis or $(-x, y)$ across the y-axis. About the origin, a $90°$ counterclockwise rotation uses $(-y, x)$ and $180°$ uses $(-x, -y)$. For $(2, 3)$ these images are $(-3, 2)$ and $(-2, -3)$. Rigid motions preserve length.

Worked example

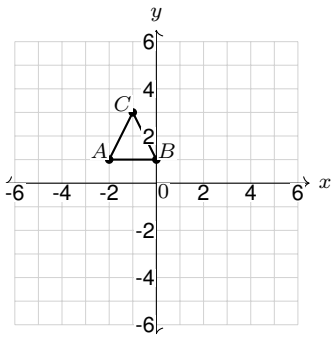
Translate $(1, -2)$ by $(3, 1)$.

1. New $x = 1 + 3 = 4$.
2. New $y = -2 + 1 = -1$.
3. The image is $(4, -1)$; reverse change $(4 - 3, -1 - 1) = (1, -2)$.
Answer: $(4, -1)$.

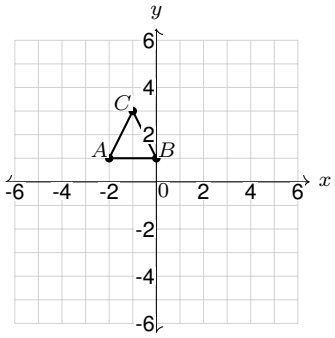
Practice Problems

Show your thinking.

1. Given $A = (-2, 1), B = (0, 1), C = (-1, 3)$, translate $(3, -2)$. Give all three image coordinates. Plot the image triangle and label the vertices.

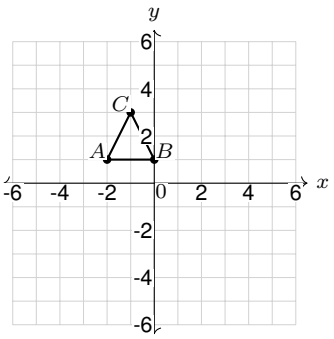


2. Given $A = (-2, 1), B = (0, 1), C = (-1, 3)$, reflect across the x-axis. Give all three image coordinates. Plot the image triangle and label the vertices.



3. Given $A = (-2, 1), B = (0, 1), C = (-1, 3)$, reflect across the y-axis. Give all three image coordinates.

4. Given $A = (-2, 1), B = (0, 1), C = (-1, 3)$, rotate $90°$ counterclockwise about the origin. Give all three image coordinates. Plot the image triangle and label the vertices.



5. Given $A = (-2, 1), B = (0, 1), C = (-1, 3)$, rotate $180°$ about the origin. Give all three image coordinates.

6. Given $A = (-2, 1), B = (0, 1), C = (-1, 3)$, translate $(-1, 2)$. Give all three image coordinates.

Answer Key

1. $A\prime = (1, -1), B\prime = (3, -1), C\prime = (2, 1)$.
2. $A\prime = (-2, -1), B\prime = (0, -1), C\prime = (-1, -3)$.
3. $A\prime = (2, 1), B\prime = (0, 1), C\prime = (1, 3)$.
4. $A\prime = (-1, -2), B\prime = (-1, 0), C\prime = (-3, -1)$.
5. $A\prime = (2, -1), B\prime = (0, -1), C\prime = (1, -3)$.
6. $A\prime = (-3, 3), B\prime = (-1, 3), C\prime = (-2, 5)$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. For $(-2, 1)$: $x\prime = -2 + 3 = 1$; $y\prime = 1 - 2 = -1$. Image $(1, -1)$.
2. For $(0, 1)$: $x\prime = 0 + 3 = 3$; $y\prime = 1 - 2 = -1$. Image $(3, -1)$.
3. For $(-1, 3)$: $x\prime = -1 + 3 = 2$; $y\prime = 3 - 2 = 1$. Image $(2, 1)$.
4. Plot the three result points and connect them in order to close the triangle.

Problem 2

1. For $(-2, 1)$: $x\prime = -2$; $y\prime = -(1) = -1$. Image $(-2, -1)$.
2. For $(0, 1)$: $x\prime = 0$; $y\prime = -(1) = -1$. Image $(0, -1)$.
3. For $(-1, 3)$: $x\prime = -1$; $y\prime = -(3) = -3$. Image $(-1, -3)$.
4. Plot the three result points and connect them in order to close the triangle.

Problem 3

1. For $(-2, 1)$: $x\prime = -(-2) = 2$; $y\prime = 1$. Image $(2, 1)$.
2. For $(0, 1)$: $x\prime = -(0) = 0$; $y\prime = 1$. Image $(0, 1)$.
3. For $(-1, 3)$: $x\prime = -(-1) = 1$; $y\prime = 3$. Image $(1, 3)$.

Problem 4

1. For $(-2, 1)$: $x\prime = -(1) = -1$; $y\prime = -2 = -2$. Image $(-1, -2)$.
2. For $(0, 1)$: $x\prime = -(1) = -1$; $y\prime = 0 = 0$. Image $(-1, 0)$.
3. For $(-1, 3)$: $x\prime = -(3) = -3$; $y\prime = -1 = -1$. Image $(-3, -1)$.
4. Plot the three result points and connect them in order to close the triangle.

Problem 5

1. For $(-2, 1)$: $x\prime = -(-2) = 2$; $y\prime = -(1) = -1$. Image $(2, -1)$.
2. For $(0, 1)$: $x\prime = -(0) = 0$; $y\prime = -(1) = -1$. Image $(0, -1)$.
3. For $(-1, 3)$: $x\prime = -(-1) = 1$; $y\prime = -(3) = -3$. Image $(1, -3)$.

Problem 6

1. For $(-2, 1)$: $x\prime = -2 - 1 = -3$; $y\prime = 1 + 2 = 3$. Image $(-3, 3)$.
2. For $(0, 1)$: $x\prime = 0 - 1 = -1$; $y\prime = 1 + 2 = 3$. Image $(-1, 3)$.
3. For $(-1, 3)$: $x\prime = -1 - 1 = -2$; $y\prime = 3 + 2 = 5$. Image $(-2, 5)$.

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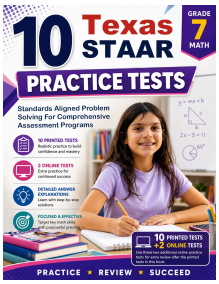

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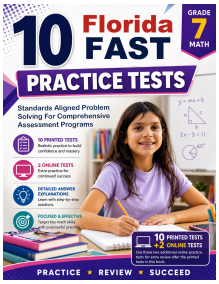

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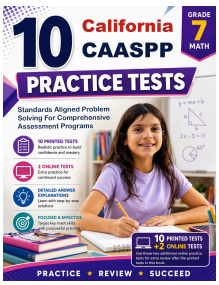

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