

Transformations

Short-answer problems about transformations.

Question 1 What is your name?

Free Response:

Question 2 To specify a translation, we need a vector. Equivalently, we need a magnitude (or length) and a direction.

Question 3 To specify a rotation, we need a center and an angle (assuming an agreement about the direction of rotation).

Question 4 To specify a reflection, we need a line.

Question 5 A transformation that does nothing is call the identitytransformation.
(Hint: Two words.)

Sometimes a sequence of transformations can be described as a single translation, rotation, or reflection.

Question 6 What kind of transformation is a translation followed by a translation? Explain. Be sure to consider any special cases.

Free Response: **Hint:** Usually a translation. If the vectors are opposites of each other, the result is the identity transformation (which can be thought of as a translation by a vector of magnitude 0).

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Question 7 What kind of transformation is a rotation followed by a rotation? Explain. Be sure to consider any special cases.

Free Response: **Hint:** Usually a rotation. If the angles sum to a multiple of 360° , then the result is a translation. If the centers of rotation are also the same, the result is the identity transformation (which can be thought of as a rotation of 0°).

Question 8 What kind of transformation is a reflection followed by another reflection? Explain. Be sure to consider any special cases.

Free Response: **Hint:** You are doing this for homework.

Question 9 Will the letter *F* look like an *F* after a reflection? What about after a sequence of two reflections? What about after a sequence of 73 or 124 reflections? Explain your reasoning.

Free Response: **Hint:** Ignoring which side is up, after a reflection the *F* will look like a “backwards *F*”. More generally, after an odd number of reflections, the *F* will look like a backwards *F*. After an even number of reflections, the *F* will look like a typical *F*.

Question 10 How will your answer to the previous problem change if you use a capital *D*? Explain.

Free Response: **Hint:** Ignoring which side is up, the *D* will always look like a *D*. Because of its line symmetry, a reflection doesn’t appear to reverse its “orientation.”

Question 11 Given a figure and its image after a translation, how do find the direction and distance of the translation? How many points and images do you need?

Free Response: **Hint:** Draw a vector from any point to its image. The vector provides both the direction and the distance. Any point and its image will do.

Question 12 Given a figure and its image after a reflection, how do you find the line of reflection? How many points and images do you need?

Free Response: **Hint:** Draw a segment from a point to its image. The perpendicular bisector of that segment is the line of reflection. Any point and its image will do.

Question 13 Given a figure and its image after a rotation, how do you find the center and the angle of the rotation? How many points and images do you need?

Free Response: **Hint:** Draw a segment from a point P to its image P' . The center of rotation is somewhere on the perpendicular bisector of that segment. Draw a segment from a second point Q to its image Q' . The center of rotation is also somewhere on the perpendicular bisector of that segment. As long as the segments $\overline{PP'}$ and $\overline{QQ'}$ are not parallel, the two perpendicular bisectors will intersect at a point C , which is the unique center of the rotation.

To find the angle of rotation, measure $\angle PCP'$ or $\angle QCQ'$.

Two points and their images are enough, (as long as the segments $\overline{PP'}$ and $\overline{QQ'}$ are not parallel).
