Transformations

Short-answer problems about transformations.

Question 1 *What is your name?*

Free Response:

Question 2 *To specify a translation, we need a* $\boxed{vector}$. *Equivalently, we need a magnitude (or length) and a* $\boxed{direction}$.

Question 3 *To specify a rotation, we need a* $\boxed{center}$ *and an* $\boxed{angle}$ *(assuming an agreement about the direction of rotation).*

Question 4 *To specify a reflection, we need a* $\boxed{line}$.

Question 5 *A transformation that does nothing is call the* $\boxed{identitytransformation}$. *(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 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).
