Name ____ Date ______________________

1. Each of the illustrations on the next page shows in black a plane figure consisting of the letters F, R, E, and D evenly spaced and arranged in a row. In each illustration, an alteration of the black figure is shown in gray. In some of the illustrations, the gray figure is obtained from the black figure by a geometric transformation consisting of a single rotation. In others, this is not the case.

   a. Which illustrations show a single rotation?

   b. Some of the illustrations are not rotations or even a sequence of rigid transformations. Select one such illustration and use it to explain why it is not a sequence of rigid transformations.

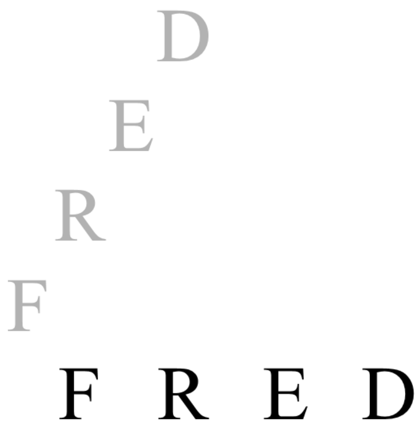


Illustration 1

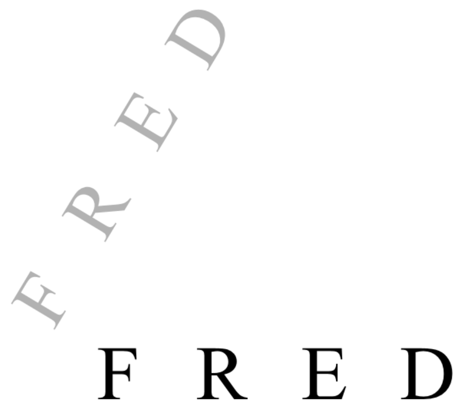


Illustration 2

Illustration 3

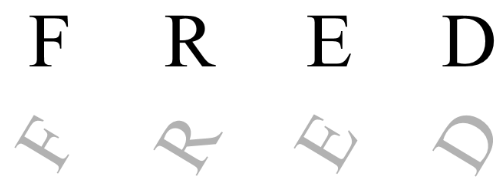


Illustration 4

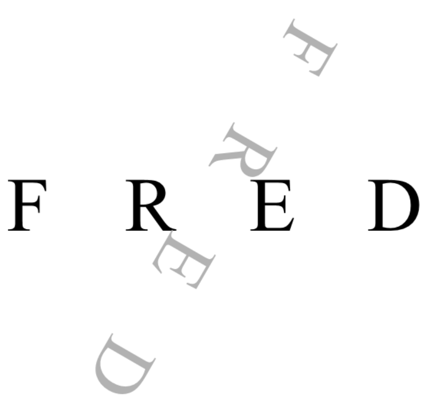


Illustration 5

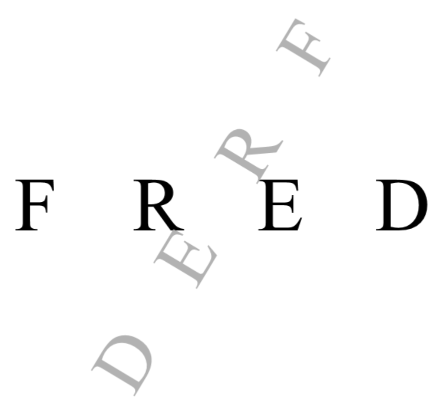
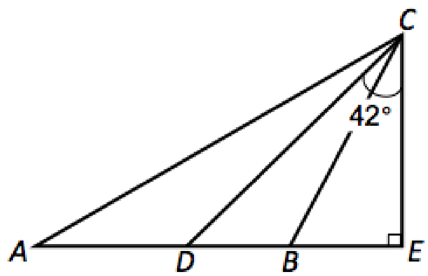


Illustration 6

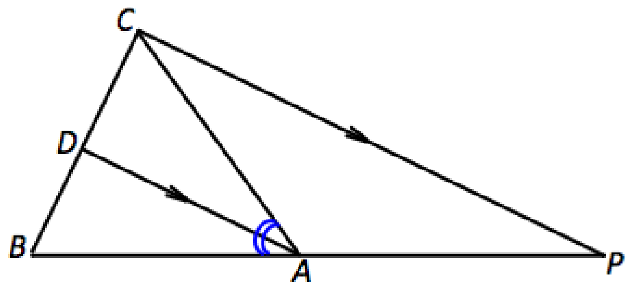
2. In the figure below, $\overline{CD}$ bisects $\angle ACB$, $AB = BC$, $\angle BEC = 90°$, and $\angle DCE = 42°$.

   Find the measure of angle $\angle A$.

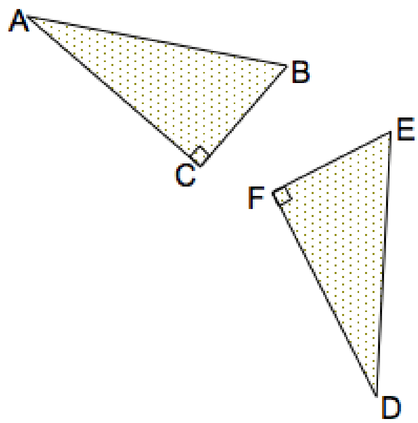


3. In the figure below, $\overline{AD}$ is the angle bisector of $\angle BAC$. $\overline{BAP}$ and $\overline{BDC}$ are straight lines, and $\overline{AD} \parallel \overline{PC}$.

   Prove that $AP = AC$.



4. The triangles ΔABC and ΔDEF in the figure below are such that $\overline{AB} \cong \overline{DE}$, $\overline{AC} \cong \overline{DF}$, and $\angle A \cong \angle D$.



a. Which criteria for triangle congruence (ASA, SAS, SSS) implies that $\Delta ABC \cong \Delta DEF$?

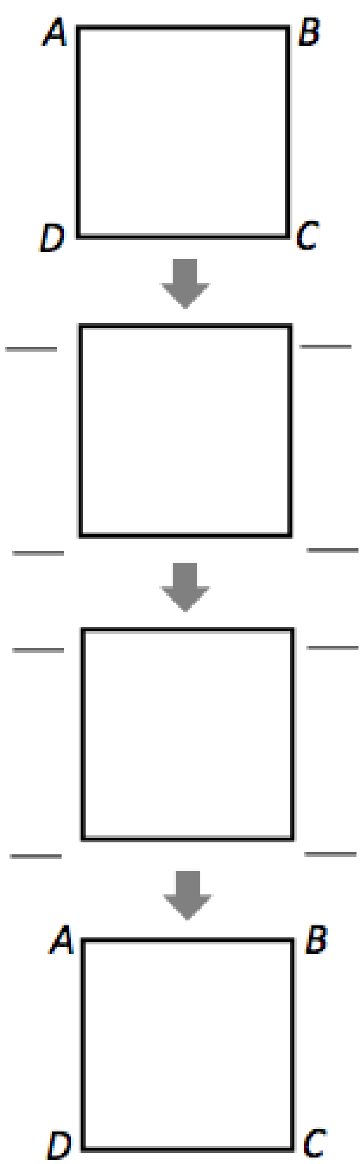
b. Describe a sequence of rigid transformations that shows $\Delta ABC \cong \Delta DEF$.

5.

a. Construct a square $ABCD$ with side $\overline{AB}$. List the steps of the construction.

b. Three rigid motions are to be performed on square $ABCD$. The first rigid motion is the reflection through line $\overline{BD}$. The second rigid motion is a $90°$ clockwise rotation around the center of the square.

Describe the third rigid motion that will ultimately map $ABCD$ back to its original position. Label the image of each rigid motion A, B, C, and D in the blanks provided.

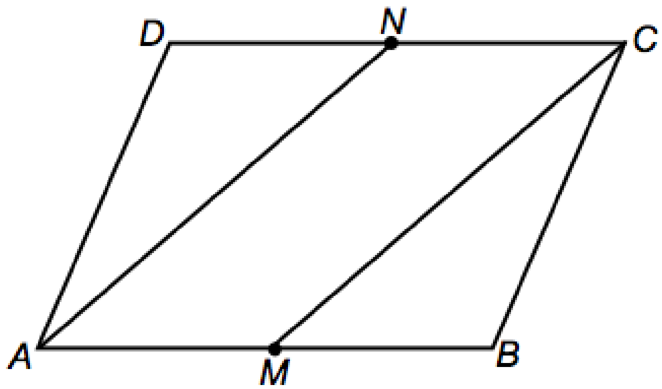


Rigid Motion 1 Description: Reflection through line $\overline{BD}$

Rigid Motion 2 Description: $90°$ clockwise rotation around the center of the square.

Rigid Motion 3 Description: ______________________________

6. Suppose that $ABCD$ is a parallelogram and that M and N are the midpoints of $\overline{AB}$ and $\overline{CD}$, respectively. Prove that $AMCN$ is a parallelogram.



A Progression Toward Mastery					
Assessment Task Item		**STEP 1** Missing or incorrect answer and little evidence of reasoning or application of mathematics to solve the problem.	**STEP 2** Missing or incorrect answer but evidence of some reasoning or application of mathematics to solve the problem.	**STEP 3** A correct answer with some evidence of reasoning or application of mathematics to solve the problem, or an incorrect answer with substantial evidence of solid reasoning or application of mathematics to solve the problem.	**STEP 4** A correct answer supported by substantial evidence of solid reasoning or application of mathematics to solve the problem.
1	**a–b** **G-CO.A.2**	Student identifies illustration 2 OR 5 for part (a) and provides a response that shows no understanding of what a sequence of rigid transformations entails in part (b).	Student correctly identifies illustrations 2 AND 5 for part (a) and provides a response that shows little understanding of what a sequence of rigid transformations entails in part (b).	Student correctly identifies illustrations 2 AND 5 for part (a) and provides a response that shows an understanding of what a sequence of rigid transformations entails but states a less than perfect solution.	Student correctly identifies illustrations 2 AND 5 for part (a) and provides a response that correctly reasons why any one of illustrations 1, 3, 4, or 6 is not a sequence of rigid transformations.
2	**G-CO.C.10**	Student provides a response that shows little or no understanding of angle sum properties and no correct answer. OR Student states the correct answer without providing any evidence of the steps to get there.	Student provides a response that shows the appropriate work needed to correctly calculate the measure of angle A but makes one conceptual error and one computational error, two conceptual errors, or two computational errors.	Student provides a response that shows the appropriate work needed to correctly calculate the measure of angle A but makes one conceptual error, such as labeling $\angle CDE = 132°$ or one computational error, such as finding $\angle CDE \neq 48°$.	Student provides a response that shows all the appropriate work needed to correctly calculate the measure of angle A.
3	**G-CO.C.10**	Student writes a proof that demonstrates little or no understanding of the method needed to achieve the conclusion.	Student writes a proof that demonstrates an understanding of the method needed to reach the conclusion but two steps are missing or incorrect.	Student writes a proof that demonstrates an understanding of the method needed to reach the conclusion but one step is missing or incorrect.	Student writes a complete and correct proof that clearly leads to the conclusion that $AP = AC$.

4	**a–b** **G-CO.B.7** **G-CO.B.8**	Student provides a response that shows little or no evidence of understanding for parts (a) or (b).	Student provides a response that shows the correct triangle congruence criteria in part (a) and provides a sequence that contains more than one error in part (b).	Student provides a response that shows the correct triangle congruence criteria in part (a) and provides a sequence that contains an error in part (b).	Student provides a response that shows the correct triangle congruence criteria in part (a) and provides any valid sequence of transformations in part (b).
5	**a–b** **G-CO.A.3** **G-CO.D.13**	Student draws a construction that is not appropriate and provides an underdeveloped list of steps. Student provides a response that contains errors with the vertex labels and the description for Rigid Motion 3 in part (b).	Student draws a construction but two steps are either missing or incorrect in the construction or list of steps. Student correctly provides vertex labels in the diagram for part (b) but gives an incorrect Rigid Motion 3 description. OR Student correctly describes the Rigid Motion 3 but provides incorrect vertex labels.	Student draws a construction but one step is missing or incorrect in the construction or in list of steps, such as the marks to indicate the length of side $\overline{AD}$. Student correctly provides vertex labels in the diagram for part (b) but gives an incorrect Rigid Motion 3 description. OR Student correctly describes the Rigid Motion 3 but provides incorrect vertex labels.	Student draws a correct construction showing all appropriate marks, and correctly writes out the steps of the construction. Student correctly provides vertex labels in the diagram for part (b) and gives a correct Rigid Motion 3 description.
6	**G-CO.C.11**	Student writes a proof that demonstrates little or no understanding of the method needed to achieve the conclusion.	Student writes a proof that demonstrates an understanding of the method needed to reach the conclusion but two steps are missing or incorrect.	Student writes a proof that demonstrates an understanding of the method needed to reach the conclusion but one step is missing or incorrect.	Student writes a complete and correct proof that clearly leads to the conclusion that $AMCN$ is a parallelogram.

Name ______________________________ Date ________________

1. Each of the illustrations on the next page shows in black a plane figure consisting of the letters F, R, E, and D evenly spaced and arranged in a row. In each illustration, an alteration of the black figure is shown in gray. In some of the illustrations, the gray figure is obtained from the black figure by a geometric transformation consisting of a single rotation. In others, this is not the case.

   a. Which illustrations show a single rotation?

   Illustrations 2 and 5

   b. Some of the illustrations are not rotations or even a sequence of rigid transformations. Select one such illustration and use it to explain why it is not a sequence of rigid transformations.

   Illustration 1 shows translations of individual letters F, R, E, and D; but each letter is translated a different distance. Since translation requires a shift of the entire plane by the same distance, Illustration 1 does not qualify.

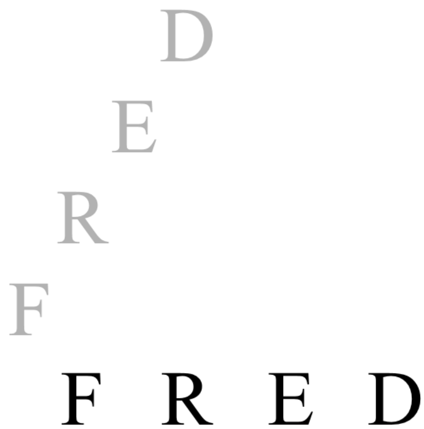


Illustration 1

Illustration 2

Illustration 3

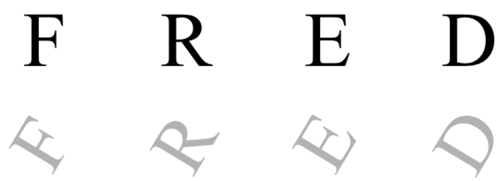


Illustration 4

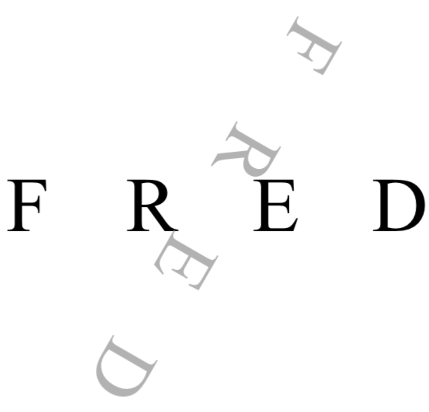


Illustration 5

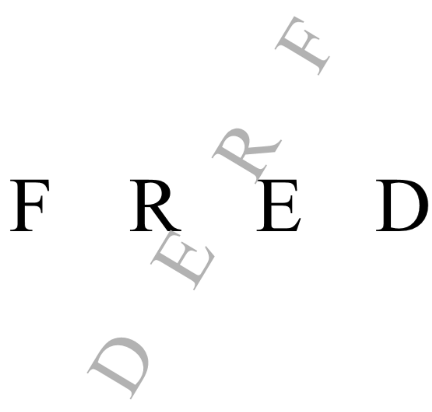
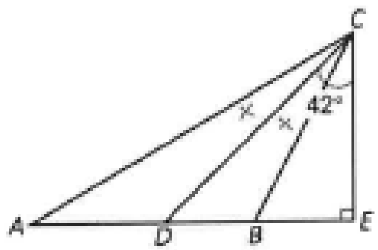


Illustration 6

2. In the figure below, $\overline{CD}$ bisects $\angle ACB$, $AB = BC$, $\angle BEC = 90°$, and $\angle DCE = 42°$.

   Find the measure of angle $\angle A$.



Label the angles as shown.
($\angle ACD \cong \angle DCB$ since $\overline{CD}$ bisects $\angle ACB$)
Since $AB = BC$, ΔABC is isosceles, therefore $2x = a$.

$m\angle A + m\angle ACE + m\angle E = 180°$

$a + (x + 42) + 90 = 180$

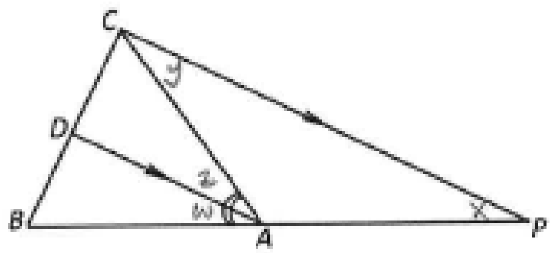
$2x + x + 132 = 180$

$x = 16$

Since $a = 2x$, $m\angle A = 32°$

3. In the figure below, $\overline{AD}$ is the angle bisector of $\angle BAC$. $\overline{BAP}$ and $\overline{BDC}$ are straight lines, and $\overline{AD} \parallel \overline{PC}$.

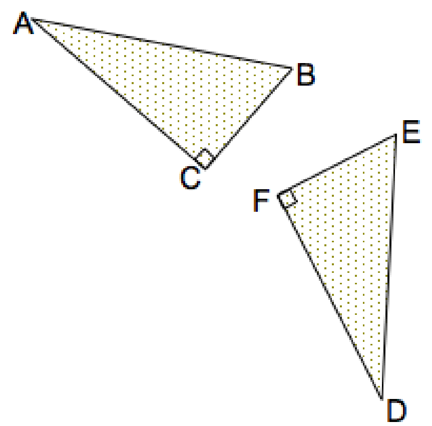
   Prove that $AP = AC$.



Label w, x, y, and z as shown.

Statements	Reasons
1. $\overline{AD}$ is the angle bisector of $\angle BAC$	Given
2. $\overline{AD} \parallel \overline{PC}$	Given
3. $z = w$	Definition of angle bisector
4. $z = y$	If two parallel lines are cut by a transversal, alt. int. angles are equal in measure.
5. $w = x$	If two parallel lines are cut by a transversal, corr. angles are equal in measure.
6. $x = y$	Transitive property
7. $\triangle ACP$ is isosceles	Base angles are congruent
8. $AC = AP$	Definition of isosceles triangle

4. The triangles ΔABC and ΔDEF in the figure below are such that $\overline{AB} \cong \overline{DE}$, $\overline{AC} \cong \overline{DF}$, and $\angle A \cong \angle D$.



a. Which criteria for triangle congruence (ASA, SAS, SSS) implies that $\Delta ABC \cong \Delta DEF$?

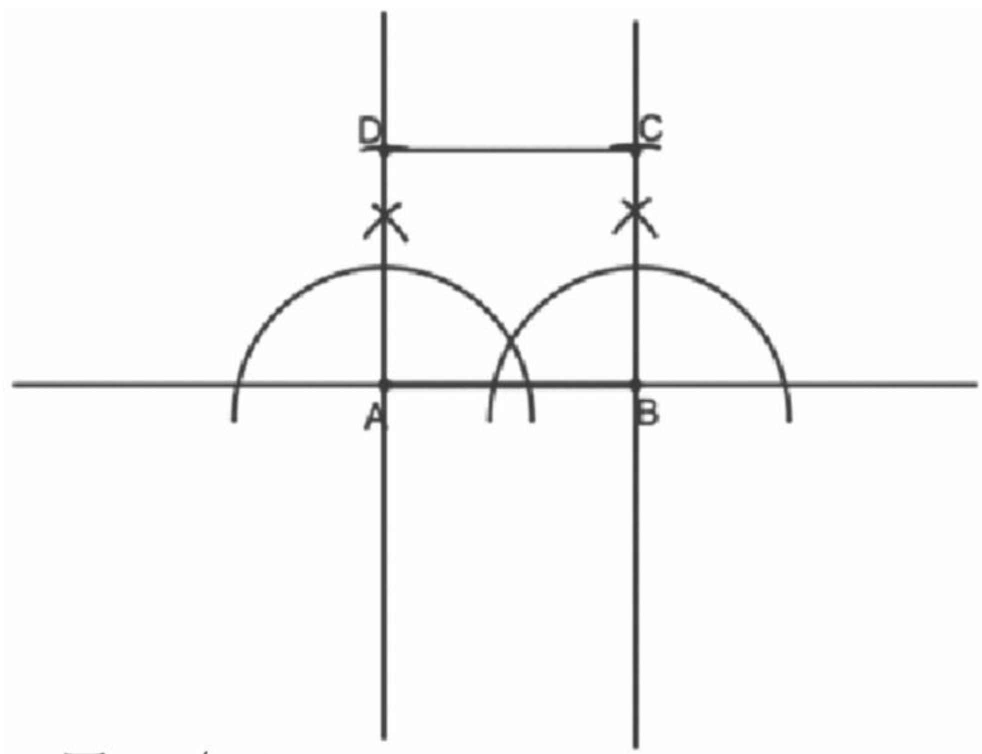
Side-Angle-Side

b. Describe a sequence of rigid transformations that shows $\Delta ABC \cong \Delta DEF$.

1. Translate ΔDEF so that F is mapped onto C
2. Rotate the image of ΔDEF about C so that E is mapped onto B
3. Reflect the image of the rotation across $\overleftrightarrow{BC}$

5.

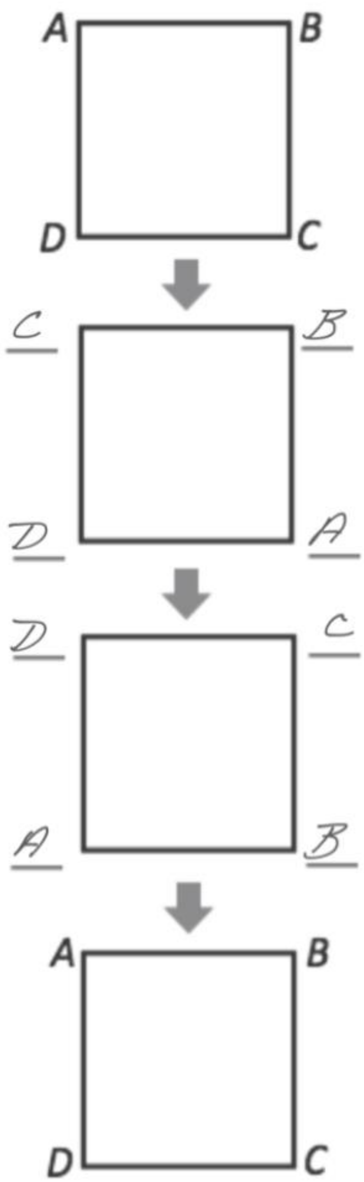
a. Construct a square $ABCD$ with side $\overline{AB}$. List the steps of the construction.



1. Extend $\overline{AB}$ in both directions.
2. Construct a perpendicular bisector to AB through A; construct a perpendicular bisector to AB through B.
3. Construct a circle with center A and radius AB; construct a circle with center B and radius AB.
4. Select a point where circle A meets the perpendicular through A and call that point D. On the same side of AB as D, select the point where circle B meets the perpendicular through B and call that point C.
5. Draw segment CD.

b. Three rigid motions are to be performed on square $ABCD$. The first rigid motion is the reflection through line $\overline{BD}$. The second rigid motion is a $90°$ clockwise rotation around the center of the square.

Describe the third rigid motion that will ultimately map $ABCD$ back to its original position. Label the image of each rigid motion A, B, C, and D in the blanks provided.

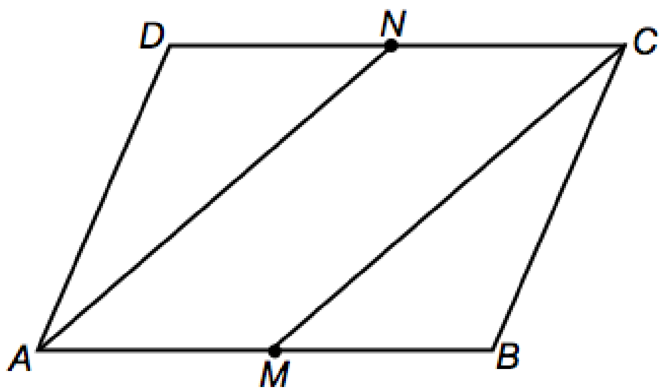


Rigid Motion 1 Description: Reflection through line $\overline{BD}$

Rigid Motion 2 Description: 90° clockwise rotation around the center of the square.

Rigid Motion 3 Description: Reflection through the line connecting the midpoint of AD and the midpoint of BC.

6. Suppose that $ABCD$ is a parallelogram and that M and N are the midpoints of $\overline{AB}$ and $\overline{CD}$, respectively. Prove that $AMCN$ is a parallelogram.



Statements	Reasons
1. M and N are the midpoints of $\overline{AB}$ and $\overline{CD}$	Given
2. ABCD is a parallelogram	Given
3. $AB = DC$	Opposite sides of a parallelogram are congruent
4. $NC = \frac{1}{2}DC$	N is the midpoint of DC
5. $AM = \frac{1}{2}AB$	M is the midpoint of AB
6. $AM = \frac{1}{2}DC$	Substitution
7. $AM = NC$	Transitive Property
8. $\overline{AB} \parallel \overline{DC}$	Definition of a parallelogram
9. $\overline{AM} \parallel \overline{NC}$	M is on line AB, N is on line DC
10. AMCN is a parallelogram	opposite sides are equal in length and parallel