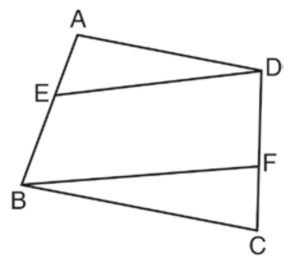
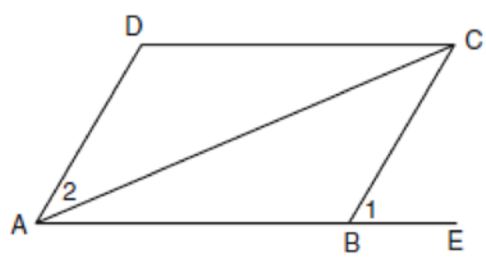
G.CO.C.11: Quadrilateral Proofs

1 In the diagram below of quadrilateral $ABCD$, E and F are points on $\overline{AB}$ and $\overline{CD}$, respectively, $\overline{BE} \cong \overline{DF}$, and $\overline{AE} \cong \overline{CF}$.



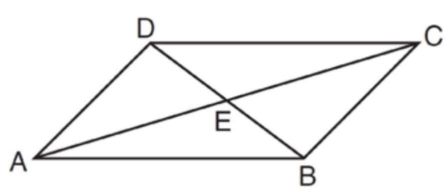
Which conclusion can be proven?
1) $\overline{ED} \cong \overline{FB}$
2) $\overline{AB} \cong \overline{CD}$
3) $\angle A \cong \angle C$
4) $\angle AED \cong \angle CFB$

2 Given: parallelogram $ABCD$, diagonal $\overline{AC}$, and $\overline{ABE}$



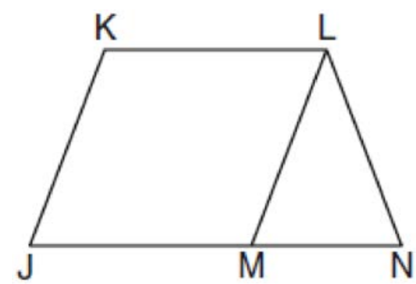
Prove: $m\angle 1 > m\angle 2$

3 In parallelogram $ABCD$ shown below, diagonals $\overline{AC}$ and $\overline{BD}$ intersect at E.

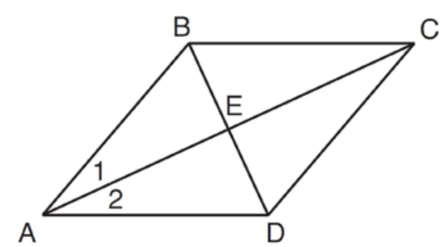


Prove: $\angle ACD \cong \angle CAB$

4 Given: $JKLM$ is a parallelogram.
$\overline{JM} \cong \overline{LN}$
$\angle LMN \cong \angle LNM$
Prove: $JKLM$ is a rhombus.

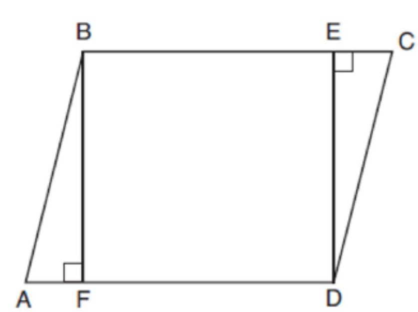


5 Given: Quadrilateral $ABCD$ with diagonals $\overline{AC}$ and $\overline{BD}$ that bisect each other, and $\angle 1 \cong \angle 2$



Prove: $\triangle ACD$ is an isosceles triangle and $\triangle AEB$ is a right triangle

6 Given: Parallelogram $ABCD$, $\overline{BF} \perp \overline{AFD}$, and $\overline{DE} \perp \overline{BEC}$



Prove: $BEDF$ is a rectangle

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Answer Section

1 ANS: 2 REF: 011411ge

2 ANS:
Because $ABCD$ is a parallelogram, $\overline{AD} \parallel \overline{CB}$ and since $\overline{ABE}$ is a transversal, $\angle BAD$ and $\angle 1$ are corresponding angles and congruent. If $m\angle BAD > m\angle 2$, then $m\angle 1 > m\angle 2$, using substitution.

REF: 060533b

3 ANS:
Parallelogram $ABCD$, diagonals $\overline{AC}$ and $\overline{BD}$ intersect at E (given). $\overline{DC} \parallel \overline{AB}$; $\overline{DA} \parallel \overline{CB}$ (opposite sides of a parallelogram are parallel). $\angle ACD \cong \angle CAB$ (alternate interior angles formed by parallel lines and a transversal are congruent).

REF: 081528geo

4 ANS:
$\overline{JK} \cong \overline{LM}$ because opposite sides of a parallelogram are congruent. $\overline{LM} \cong \overline{LN}$ because of the Isosceles Triangle Theorem. $\overline{LM} \cong \overline{JM}$ because of the transitive property. $JKLM$ is a rhombus because all sides are congruent.

REF: 011036ge

5 ANS:
Quadrilateral $ABCD$ with diagonals $\overline{AC}$ and $\overline{BD}$ that bisect each other, and $\angle 1 \cong \angle 2$ (given); quadrilateral $ABCD$ is a parallelogram (the diagonals of a parallelogram bisect each other); $\overline{AB} \parallel \overline{CD}$ (opposite sides of a parallelogram are parallel); $\angle 1 \cong \angle 3$ and $\angle 2 \cong \angle 4$ (alternate interior angles are congruent); $\angle 2 \cong \angle 3$ and $\angle 3 \cong \angle 4$ (substitution); $\triangle ACD$ is an isosceles triangle (the base angles of an isosceles triangle are congruent); $\overline{AD} \cong \overline{DC}$ (the sides of an isosceles triangle are congruent); quadrilateral $ABCD$ is a rhombus (a rhombus has consecutive congruent sides); $\overline{AE} \perp \overline{BE}$ (the diagonals of a rhombus are perpendicular); $\angle BEA$ is a right angle (perpendicular lines form a right angle); $\triangle AEB$ is a right triangle (a right triangle has a right angle).

REF: 061635geo

6 ANS:
Parallelogram $ABCD$, $\overline{BF} \perp \overline{AFD}$, and $\overline{DE} \perp \overline{BEC}$ (given); $\overline{BC} \parallel \overline{AD}$ (opposite sides of a ▱ are $\parallel$); $\overline{BE} \parallel \overline{FD}$ (parts of $\parallel$ lines are $\parallel$); $\overline{BF} \parallel \overline{DE}$ (two lines $\perp$ to the same line are $\parallel$); $BEDF$ is ▱ (a quadrilateral with both pairs of opposite sides $\parallel$ is a ▱); $\angle DEB$ is a right $\angle$ ($\perp$ lines form right $\angle$s); $BEDF$ is a rectangle (a ▱ with one right $\angle$ is a rectangle).

REF: 061835geo