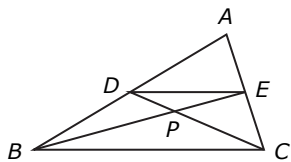


## LESSON 54 Proofs with Triangles

When proving statements involving segments and centers of triangles, remember their definitions. Complete each proof.

1. Given:  $P$  is the centroid.

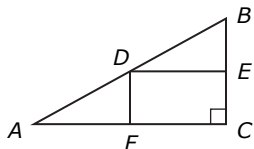
Prove:  $DE = \frac{1}{2} BC$



STATEMENTS	REASONS
1. $P$ is the centroid.	1. Given
2. $\overline{BE}$ and $\overline{CD}$ are medians.	2.
3. $D$ and $E$ are midpoints.	3. Def. of median
4. $\overline{DE}$ is a midsegment.	4. Def. of midsegment
5. $DE = BC/2$	5.

2. Given:  $\overline{AC} \perp \overline{BC}$ ,  
 $D$ ,  $E$ , and  $F$  are midpoints.

Prove:  $D$  is the circumcenter.



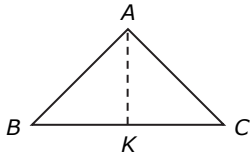
STATEMENTS	REASONS
1. $\overline{AC} \perp \overline{BC}$ ; midpoints $D$ , $E$ , $F$	1. Given
2. $\overline{DE}$ and $\overline{DF}$ are midsegments.	2.
3. $\overline{DE} \parallel \overline{AC}$ , $\overline{DF} \parallel \overline{BC}$	3.
4. $\overline{DE} \perp \overline{BC}$ , $\overline{DF} \perp \overline{AC}$	4.
5. $\overline{DE}$ is the $\perp$ bisector of $\overline{BC}$ . $\overline{DF}$ is the $\perp$ bisector of $\overline{AC}$ .	5. Def. of perpendicular bisector (1 & 4)
6. $D$ is the circumcenter.	6.

(Continued on the next page.)

## LESSON 54 Proofs with Triangles

Complete the proof that an angle bisector of an isosceles triangle is also a median.

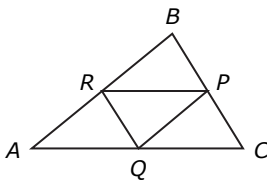
3. Given:  $\overline{AB} \cong \overline{AC}$ ,  
 $\overline{AK}$  bisects  $\angle A$ .  
Prove:  $\overline{AK}$  is a median.



STATEMENTS	REASONS
1. $\overline{AB} \cong \overline{AC}$ , $\overline{AK}$ bisects $\angle A$ .	1. Given
2. $\angle BAK \cong \angle CAK$	2.
3. $\overline{AK} \cong \overline{AK}$	3.
4. $\triangle ABK \cong \triangle ACK$	4.
5. $\overline{BK} \cong \overline{CK}$	5.
6. $K$ is the midpoint of $\overline{BC}$ .	6.
7. $\overline{AK}$ is a median.	7.

Complete the proof that the perimeter of the triangle formed by the midsegments of a triangle is *half* the perimeter of the original triangle.

4. Given:  $\overline{PQ}$ ,  $\overline{QR}$ , and  $\overline{PR}$   
are midsegments.  
Prove: perimeter of  $\triangle PQR$   
 $= \frac{1}{2}$  perimeter of  $\triangle ABC$



STATEMENTS	REASONS
1. midsegments $\overline{PQ}$ , $\overline{QR}$ , $\overline{PR}$	1. Given
2. $PQ = \frac{1}{2}AB$ , $QR = \frac{1}{2}BC$ , $PR = \frac{1}{2}AC$	2.
3. P. of $\triangle PQR = PQ + QR + PR$ P. of $\triangle ABC = AB + BC + AC$	3. Def. of perimeter
4. P. of $\triangle PQR = \frac{1}{2}AB + \frac{1}{2}BC + \frac{1}{2}AC$	4.
5. P. of $\triangle PQR = \frac{1}{2}(AB + BC + AC)$	5. Distributive Property
6. P. of $\triangle PQR = \frac{1}{2}$ P. of $\triangle ABC$	6.