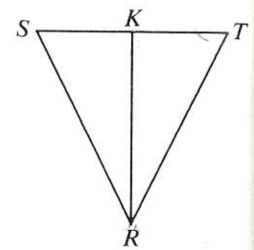
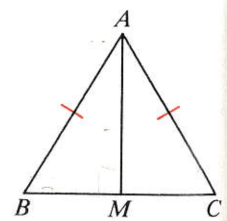
Classroom Exercises

Complete.



Exs. 1–6

1. If K is the midpoint of $\overline{ST}$, then $\overline{RK}$ is called a(n) __?__ of $\triangle RST$.
2. If $\overline{RK} \perp \overline{ST}$, then $\overline{RK}$ is called a(n) __?__ of $\triangle RST$.
3. If K is the midpoint of $\overline{ST}$ and $\overline{RK} \perp \overline{ST}$, then $\overline{RK}$ is called a(n) __?__ of $\overline{ST}$.
4. If $\overline{RK}$ is both an altitude and a median of $\triangle RST$, then:
   a. $\triangle RSK \cong \triangle RTK$ by __?__
   b. $\triangle RST$ is a(n) __?__ triangle.
5. If R is on the perpendicular bisector of $\overline{ST}$, then R is equidistant from __?__ and __?__. Thus __?__ = __?__.
6. If K is on the angle bisector of $\angle SRT$, then K is equidistant from __?__ and __?__.



Exs. 7–9

7. Given: Isosceles $\triangle ABC$; $\overrightarrow{AM}$ bisects $\angle BAC$.
   What postulate, theorem, or corollary leads to the conclusion that $\overrightarrow{AM}$ is the perpendicular bisector of $\overline{BC}$?
8. Given: Isosceles $\triangle ABC$; $\overline{AM}$ is the median to base $\overline{BC}$.
   Explain why:
   a. $\triangle AMB \cong \triangle AMC$
   b. $\overline{AM}$ is an altitude.
   c. $\overline{AM}$ is a perpendicular bisector of $\overline{BC}$.
   d. $\overrightarrow{AM}$ bisects vertex angle A.
9. Given: Isosceles $\triangle ABC$; $\overline{AM}$ is the altitude to base $\overline{BC}$.
   Explain why:
   a. $\triangle AMB \cong \triangle AMC$ **b.** $\overline{AM}$ is a median.
10. Do you think it is ever possible for a triangle to have
   a. two congruent medians?   **b.** three congruent medians?
   c. two congruent altitudes?   **d.** three congruent altitudes?

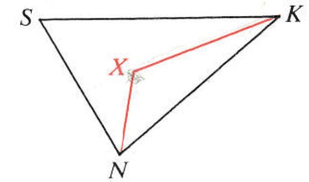
Written Exercises

A

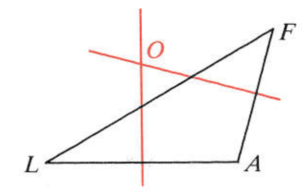
1. **a.** Draw a large scalene triangle ABC. Carefully draw the bisector of $\angle A$, the altitude from A, and the median from A. These three should all be different.
   b. Draw a large isosceles triangle ABC with vertex angle A. Carefully draw the bisector of $\angle A$, the altitude from A, and the median from A. Are these three different?
2. Draw a large obtuse triangle. Then draw its three altitudes in color.
3. Draw a right triangle. Then draw its three altitudes in color.
4. Draw a large acute scalene triangle. Then draw the perpendicular bisectors of its three sides.

5. Draw a large scalene right triangle. Then draw the perpendicular bisectors of its three sides and tell whether they appear to meet in a point. If so, where is this point?

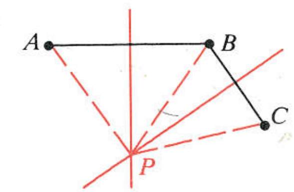
Complete each statement.



6. If X is on the bisector of $\angle K$, then X is equidistant from __?__ and __?__.
7. If X is on the bisector of $\angle N$, then X is equidistant from __?__ and __?__.
8. If X is equidistant from $\overline{SK}$ and $\overline{SN}$, then X lies on the __?__.



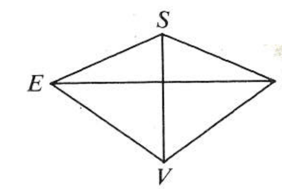
9. If O is on the perpendicular bisector of $\overline{LA}$, then O is equidistant from __?__ and __?__.
10. If O is on the perpendicular bisector of $\overline{AF}$, then O is equidistant from __?__ and __?__.
11. If O is equidistant from L and F, then O lies on the __?__.



12. Given: P is on the perpendicular bisector of $\overline{AB}$;
    P is on the perpendicular bisector of $\overline{BC}$.
    Prove: $PA = PC$

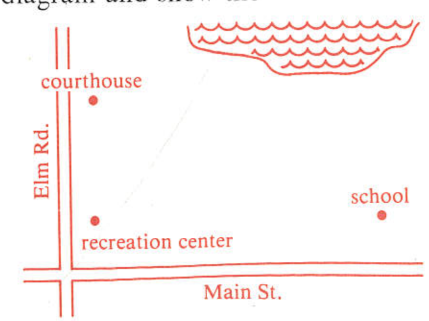
B

13. Prove Theorem 3-5. Use the diagram on page 138.



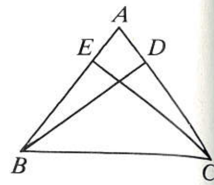
14. Given: S is equidistant from E and D;
    V is equidistant from E and D.
    Prove: $\overleftrightarrow{SV}$ is the perpendicular bisector of $\overline{ED}$.

15. **a.** A town wants to build a beach house on the lake front equidistant from the recreation center and the school. Copy the diagram and show the point B where the beach house should be located.



   b. The town also wants to build a boat-launching site that is equidistant from Elm Road and Main Street. Find the point L where it should be built.
   c. On your diagram, locate the spot F for a flagpole that is to be the same distance from the recreation center, the school, and the courthouse.
16. Prove Theorem 3-6. Use the diagram on page 138.
17. Prove **(a)** Theorem 3-7 and **(b)** Theorem 3-8. Use the diagrams on page 139.

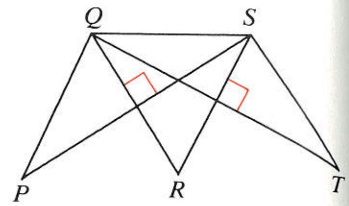
18. Given: $\overline{BE} \cong \overline{CD}$; $\overline{BD} \cong \overline{CE}$
Prove: $\triangle ABC$ is isosceles.



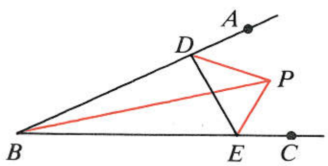
19. a. Given: $\overline{AB} \cong \overline{AC}$; $\overline{BD} \perp \overline{AC}$; $\overline{CE} \perp \overline{AB}$
Prove: $\overline{BD} \cong \overline{CE}$
b. You have just proved a theorem about altitudes. State this theorem in your own words.

20. Prove that the medians drawn to the legs of an isosceles triangle are congruent.

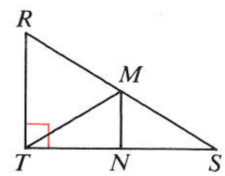
21. Given: $\overleftrightarrow{SR}$ is the perpendicular bisector of $\overline{QT}$;
$\overleftrightarrow{QR}$ is the perpendicular bisector of $\overline{SP}$.
Prove: $PQ = ST$
(*Hint:* One theorem will make your proof short.)



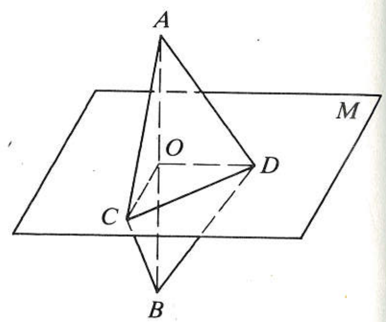
C 22. Given: $\overrightarrow{DP}$ bisects $\angle ADE$;
$\overrightarrow{EP}$ bisects $\angle DEC$.
Prove: $\overrightarrow{BP}$ bisects $\angle ABC$.
(*Hint:* There are two theorems that will make your proof short.)



23. Given: $m\angle RTS = 90$;
$\overleftrightarrow{MN}$ is the $\perp$ bisector of $\overline{TS}$.
Prove: $\overline{TM}$ is a median.



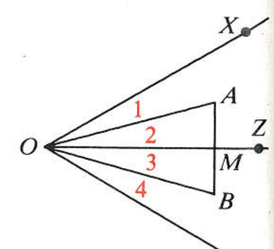
24. Given: $\overline{AB} \perp$ plane M;
O is the midpoint of $\overline{AB}$.
Prove: a. $\overline{AD} \cong \overline{BD}$ (*Hint:* In the plane determined by $\overleftrightarrow{AB}$ and D, $\overleftrightarrow{OD}$ is the $\perp$ bisector of $\overline{AB}$.)
b. $\overline{AC} \cong \overline{BC}$
c. $\angle CAD \cong \angle CBD$



For Exercises 25 and 26, give a detailed plan for proof instead of a two-column proof.

25. Given: $\overline{QM}$ and $\overline{RN}$ are altitudes to the legs of isosceles $\triangle PQR$; $\overline{QM}$ and $\overline{RN}$ intersect at O.
Prove: $\triangle MNO$ is isosceles.

26. Given: $\overleftrightarrow{OZ}$ is the $\perp$ bisector of $\overline{AB}$;
$\angle 1 \cong \angle 3$; $\angle 2 \cong \angle 4$
Prove: The distance from A to $\overrightarrow{OX}$ equals the distance from B to $\overrightarrow{OY}$.



Ex. 26