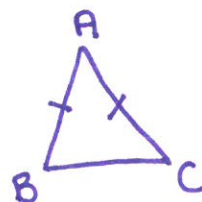


Isosceles and Equilateral Triangles

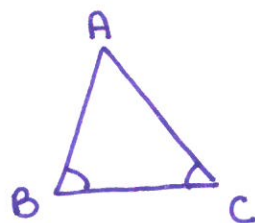
Base Angles Thm- If 2 sides of a triangle are \cong ,
then the angles opposite them are \cong .

If $\overline{AB} \cong \overline{AC}$, then $\angle B \cong \angle C$.



Converse of Base Angles Thm - If 2 angles of a triangle are \cong ,
then the sides opposite them are \cong .

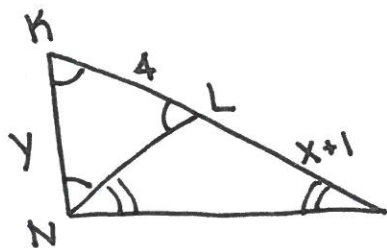
If $\angle B \cong \angle C$, then $\overline{AB} \cong \overline{AC}$



Isosceles Δ 's have at least 2 congruent sides.

Equilateral Δ 's are isosceles... (and equiangular)

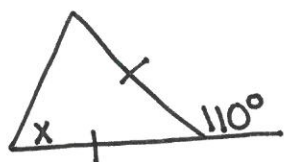
examples:



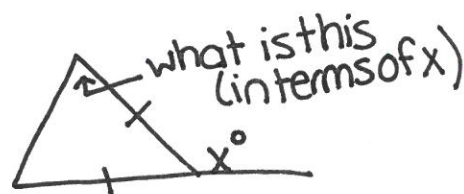
$$y=4$$

$$x=3$$

challenge:

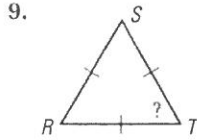
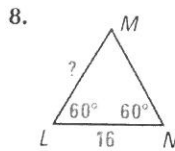
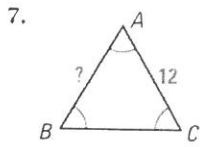


$$x=55$$

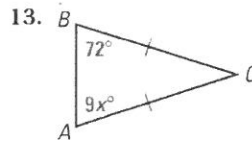
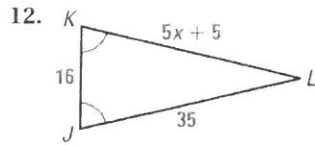
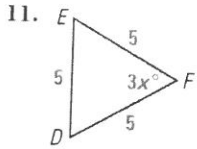


$$\frac{1}{2} \cdot x$$

REASONING Find the unknown measure.

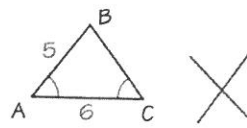


ALGEBRA Find the value of x .



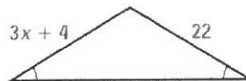
14. **ERROR ANALYSIS** Describe and correct the error made in finding BC in the diagram shown.

$\angle A \cong \angle C$, therefore
 $AC \cong BC$. So,
 $BC = 6$

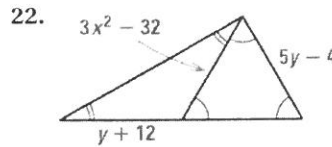
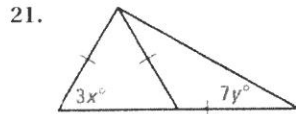
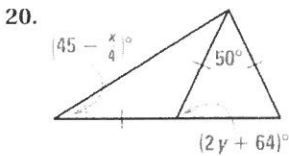


19. **MULTIPLE CHOICE** What is the value of x in the diagram?

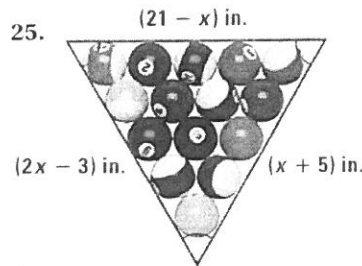
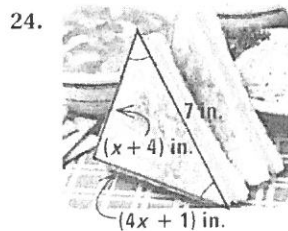
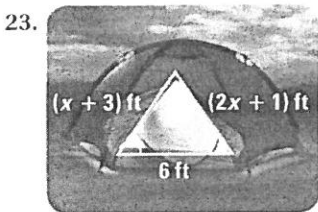
- (A) 5 (B) 6
 (C) 7 (D) 9



ALGEBRA Find the values of x and y , if possible. Explain your reasoning.

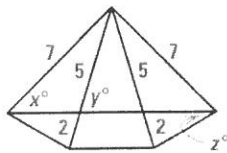


ALGEBRA Find the perimeter of the triangle.

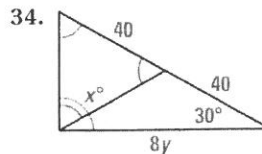
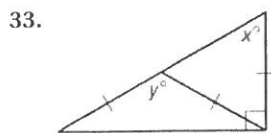
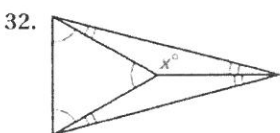


REASONING In Exercises 26–29, use the diagram. State whether the given values for x , y , and z are possible or not. If not, explain.

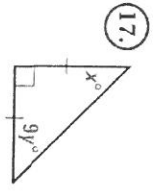
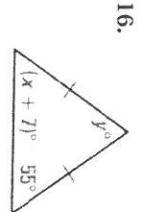
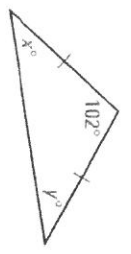
26. $x = 90$, $y = 68$, $z = 42$
 27. $x = 40$, $y = 72$, $z = 36$
 28. $x = 25$, $y = 25$, $z = 15$
 29. $x = 42$, $y = 72$, $z = 33$



ALGEBRA Find the value(s) of the variable(s). Explain your reasoning.



ALGEBRA Find the values of x and y .



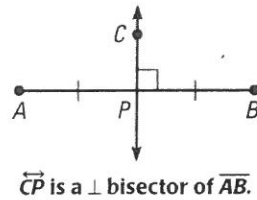
18. **SHORT RESPONSE** Are isosceles triangles always acute triangles? Explain your reasoning.

30. **SHORT RESPONSE** In $\triangle DEF$, $m\angle D = (4x + 2)^\circ$, $m\angle E = (6x - 30)^\circ$, and $m\angle F = 3x^\circ$. What type of triangle is $\triangle DEF$? Explain your reasoning.
 31. **SHORT RESPONSE** In $\triangle ABC$, D is the midpoint of \overline{AC} , and \overline{BD} is perpendicular to \overline{AC} . Explain why $\triangle ABC$ is isosceles.

Perpendicular Bisectors

In Lesson 1.3, you learned that a segment bisector intersects a segment at its midpoint. A segment, ray, line, or plane that is perpendicular to a segment at its midpoint is called a **perpendicular bisector**.

A point is **equidistant** from two figures if the point is the *same distance* from each figure. Points on the perpendicular bisector of a segment are equidistant from the segment's endpoints.



THEOREMS

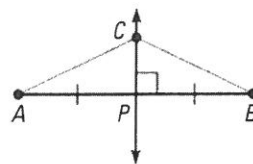
For Your Notebook

THEOREM 5.2 Perpendicular Bisector Theorem

In a plane, if a point is on the perpendicular bisector of a segment, then it is equidistant from the endpoints of the segment.

If \vec{CP} is the \perp bisector of \overline{AB} , then $CA = CB$.

Proof: Ex. 26, p. 308

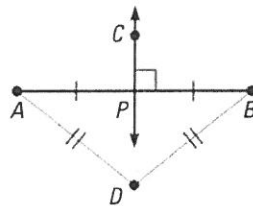


THEOREM 5.3 Converse of the Perpendicular Bisector Theorem

In a plane, if a point is equidistant from the endpoints of a segment, then it is on the perpendicular bisector of the segment.

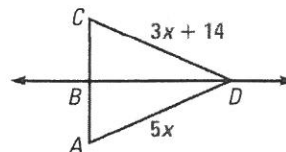
If $DA = DB$, then D lies on the \perp bisector of \overline{AB} .

Proof: Ex. 27, p. 308



EXAMPLE 1 Use the Perpendicular Bisector Theorem

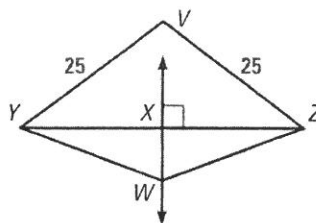
xy ALGEBRA \vec{BD} is the perpendicular bisector of \overline{AC} . Find AD .



EXAMPLE 2 Use perpendicular bisectors

In the diagram, \vec{WX} is the perpendicular bisector of \overline{YZ} .

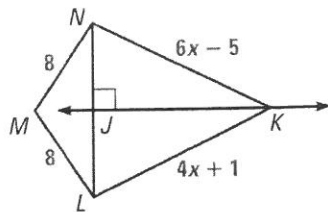
- What segment lengths in the diagram are equal?
- Is V on \vec{WX} ?



GUIDED PRACTICE for Examples 1 and 2

In the diagram, \overleftrightarrow{JK} is the perpendicular bisector of \overline{NL} .

1. What segment lengths are equal? Explain your reasoning.
2. Find NK .
3. Explain why M is on \overleftrightarrow{JK} .



ACTIVITY FOLD THE PERPENDICULAR BISECTORS OF A TRIANGLE

QUESTION Where do the perpendicular bisectors of a triangle meet?

Materials:

Follow the steps below and answer the questions about perpendicular bisectors of triangles.

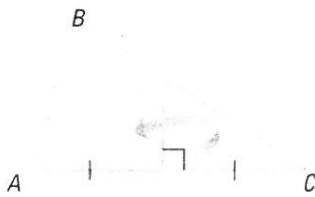
- paper
- scissors
- ruler

STEP 1 Cut four large acute scalene triangles out of paper. Make each one different.

STEP 2 Choose one triangle. Fold it to form the perpendicular bisectors of the sides. Do the three bisectors intersect at the same point?

STEP 3 Repeat the process for the other three triangles. Make a conjecture about the perpendicular bisectors of a triangle.

STEP 4 Choose one triangle. Label the vertices A , B , and C . Label the point of intersection of the perpendicular bisectors as P . Measure \overline{AP} , \overline{BP} , and \overline{CP} . What do you observe?

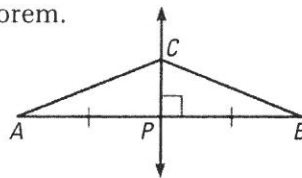


PROVING THEOREM 5.2 Prove the Perpendicular Bisector Theorem.

GIVEN \overleftrightarrow{CP} is the perpendicular bisector of \overline{AB} .

PROVE $CA = CB$

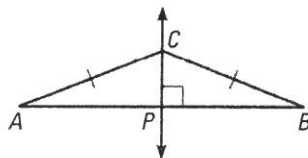
Plan for Proof Show that right triangles $\triangle APC$ and $\triangle BPC$ are congruent. Then show that $\overline{CA} \cong \overline{CB}$.



PROVING THEOREM 5.3 Prove the converse of Theorem 5.2. (Hint: Construct a line through C perpendicular to \overline{AB} .)

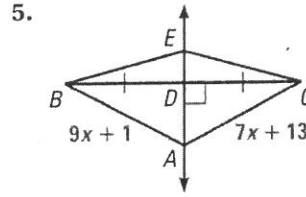
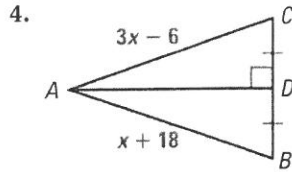
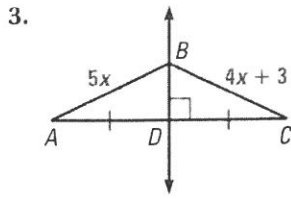
GIVEN $CA = CB$

PROVE C is on the perpendicular bisector of \overline{AB} .

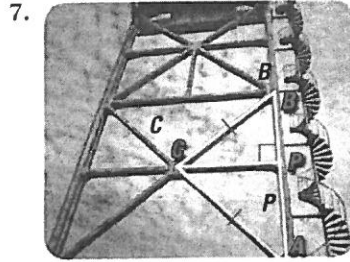
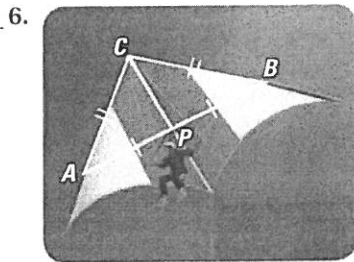


2. ★ **WRITING** Consider \overline{AB} . How can you describe the set of all points in a plane that are equidistant from A and B ?

xy **ALGEBRA** Find the length of \overline{AB} .



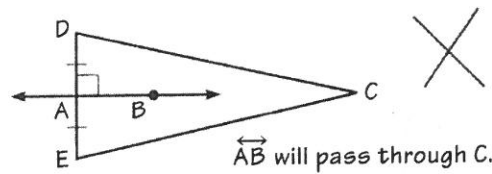
REASONING Tell whether the information in the diagram allows you to conclude that C is on the perpendicular bisector of \overline{AB} .



9. ★ **MULTIPLE CHOICE** Point P is inside $\triangle ABC$ and is equidistant from points A and B . On which of the following segments must P be located?

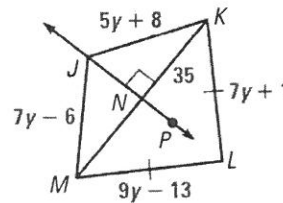
- (A) \overline{AB} (B) The perpendicular bisector of \overline{AB}
 (C) The midsegment opposite \overline{AB} (D) The perpendicular bisector of \overline{AC}

10. **ERROR ANALYSIS** Explain why the conclusion is not correct given the information in the diagram.



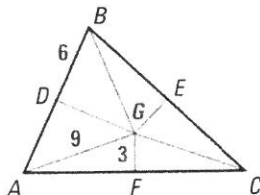
PERPENDICULAR BISECTORS In Exercises 11–15, use the diagram. \overleftrightarrow{JN} is the perpendicular bisector of \overline{MK} .

11. Find NM . 12. Find JK .
 13. Find KL . 14. Find ML .
 (15.) Is L on \overleftrightarrow{JP} ? Explain your reasoning.



USING CONCURRENCY In the diagram, the perpendicular bisectors of $\triangle ABC$ meet at point G and are shown in blue. Find the indicated measure.

16. Find BG .



- (17.) Find GA .

