5.2 Use Perpendicular Bisectors

Goal • Use perpendicular bisectors to solve problems.

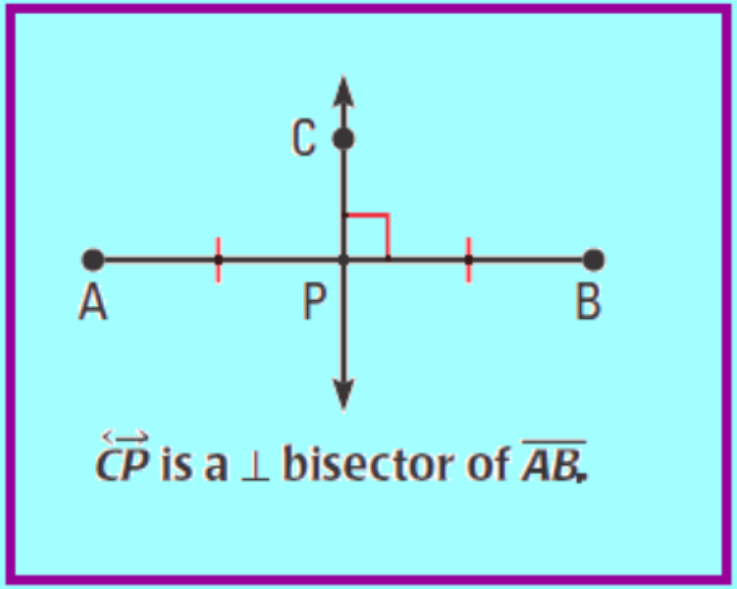
What do we know about segments that are PERPENDICULAR

What do we know about a BISECTOR?

So ... a perpendicular bisector is...

Perpendicular bisector- A segment, ray, line, or plane that is perpendicular to a segment at its midpoint

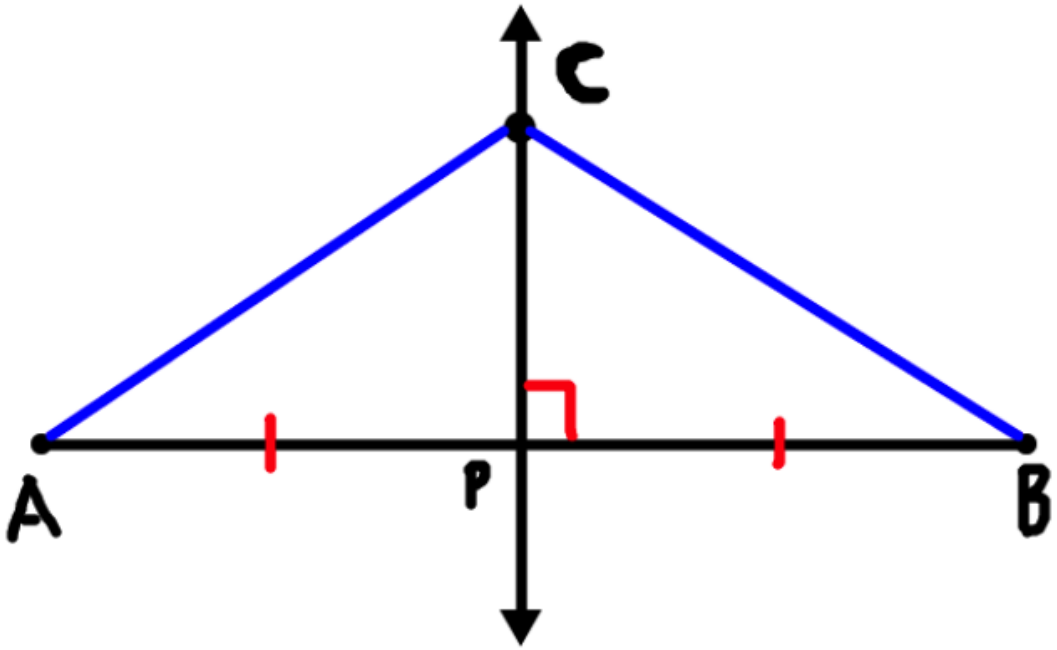
Equidistant- A point that is equal in distance from two or more figures



Points on the perpendicular bisector of a segment are equidistant from the segment's endpoints.

What do we know about AC and BC?

Why?



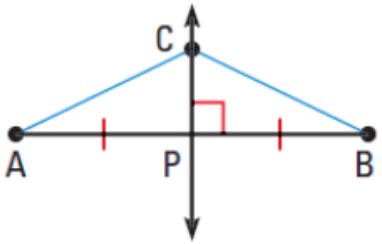
THEOREMS *For Your Notebook*

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

Proof: Ex. 26, p. 308

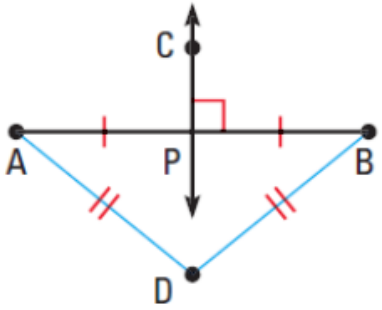


THEOREM 5.3 Converse of the Perpendicular Bisector Theorem

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

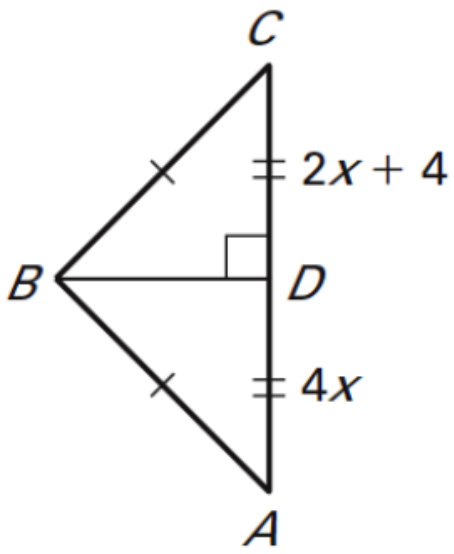


EXAMPLE 1 Use the Perpendicular Bisector Theorem

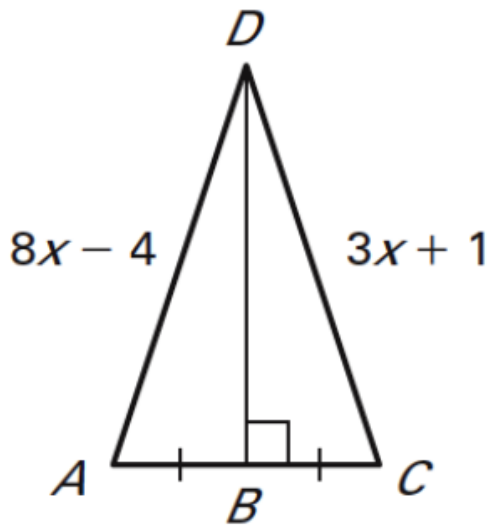
xy ALGEBRA $\overleftrightarrow{BD}$ **is the perpendicular bisector of** $\overline{AC}$**. Find** AD**.**

Find the length of $\overline{CD}$.

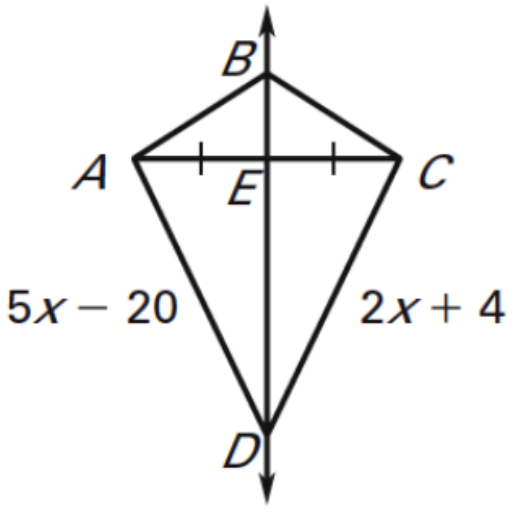
1.



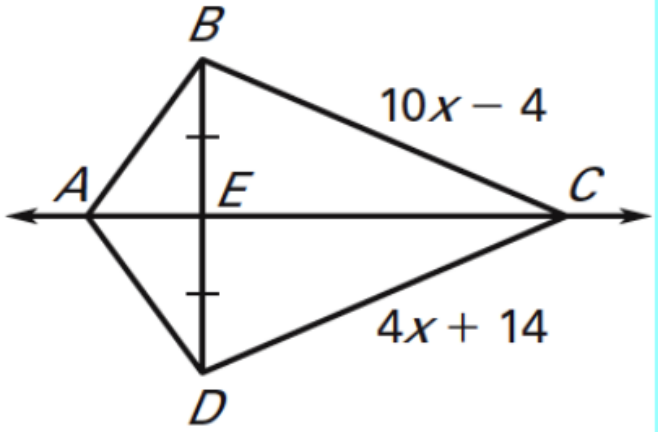
2.



3.



4.

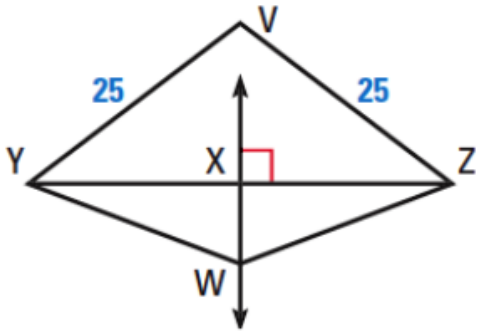


EXAMPLE 2 Use perpendicular bisectors

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

a. What segment lengths in the diagram are equal?

b. Is V on $\overleftrightarrow{WX}$?



Concurrent- Three or more lines, rays, or segments that intersect at the same point._

Point of Concurrency- The point where the three or more lines, rays, or segments intersect._

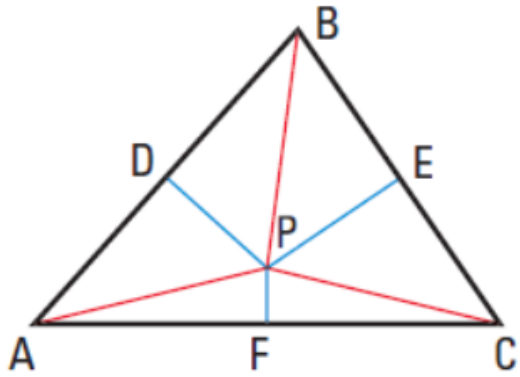
THEOREM *For Your Notebook*

THEOREM 5.4 Concurrency of Perpendicular Bisectors of a Triangle

The perpendicular bisectors of a triangle intersect at a point that is equidistant from the vertices of the triangle.

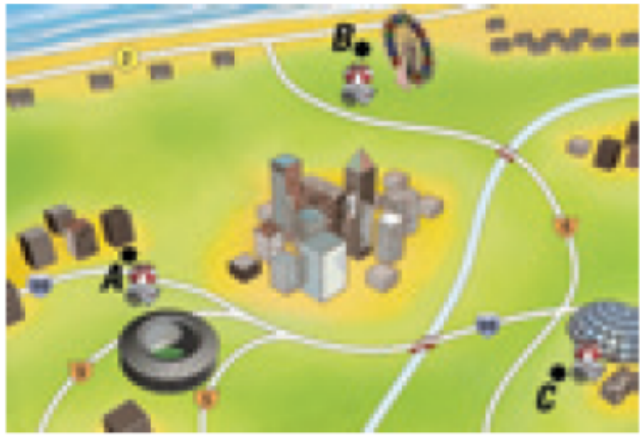
If $\overline{PD}$, $\overline{PE}$, and $\overline{PF}$ are perpendicular bisectors, then $PA = PB = PC$.

Proof: p. 933



EXAMPLE 3 Use the concurrency of perpendicular bisectors

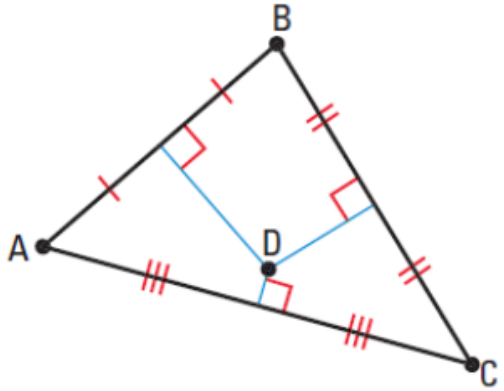
FROZEN YOGURT Three snack carts sell frozen yogurt from points A, B, and C outside a city. Each of the three carts is the same distance from the frozen yogurt distributor.



Find a location for the distributor that is equidistant from the three carts.

Solution

Theorem 5.4 shows you that you can find a point equidistant from three points by using the perpendicular bisectors of the triangle formed by those points.



Copy the positions of points A, B, and C and connect those points to draw $\triangle ABC$. Then use a ruler and protractor to draw the three perpendicular bisectors of $\triangle ABC$. The point of concurrency D is the location of the distributor.

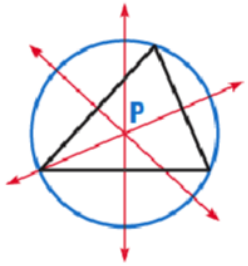
circumcenter- the point of concurrency of three perpendicular bisectors of a triangle

*The circumcenter is equidistant from the three vertices.

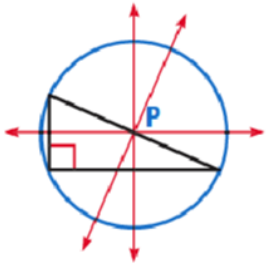
... so it is the center of a circle that passes through all three vertices.

READ VOCABULARY

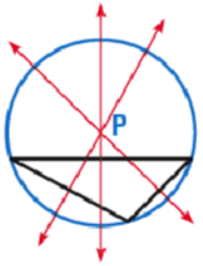
The prefix *circum-* means "around" or "about" as in *circumference* (distance around a circle).



Acute triangle
P is inside triangle.



Right triangle
P is on triangle.



Obtuse triangle
P is outside triangle.

Day 1

Assignment:

5.2 ws

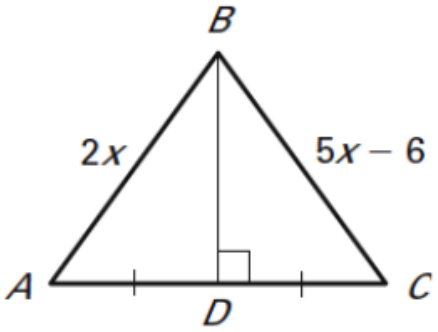
LESSON 5.2

Practice B

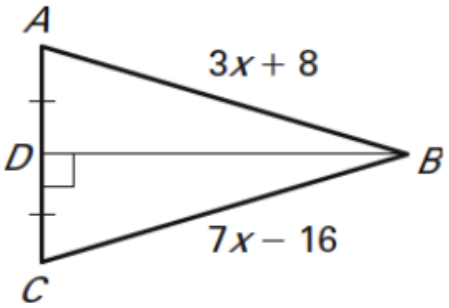
For use with pages 303–309

Find the length of $\overline{AB}$.

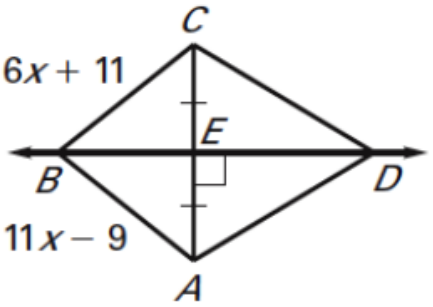
1.



2.

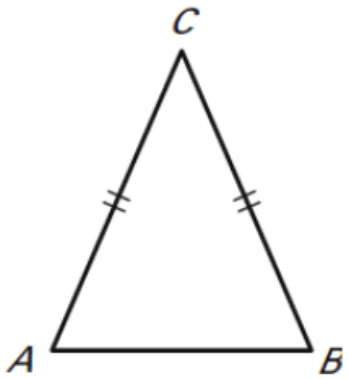


3.

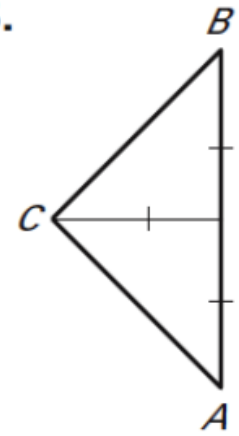


Tell whether the information in the diagram allows you to conclude that *C* is on the perpendicular bisector of $\overline{AB}$.

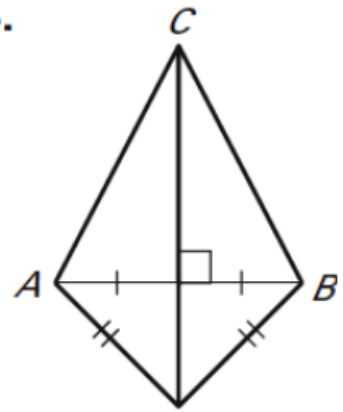
4.



5.



6.



Use the diagram. $\overline{EH}$ is the perpendicular bisector of $\overline{DF}$. Find the indicated measure.

7. Find EF.

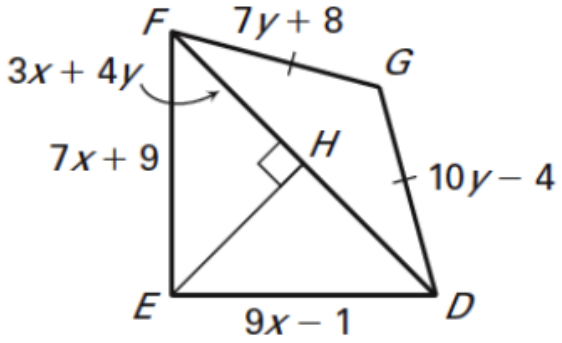
8. Find DE.

9. Find FG.

10. Find DG.

11. Find FH.

12. Find DF.



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

13. Find AG.

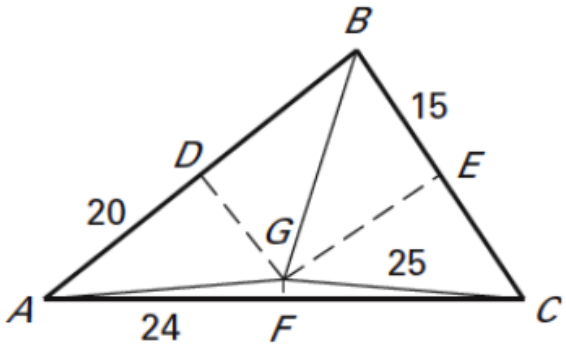
14. Find BD.

15. Find CF.

16. Find BG.

17. Find CE.

18. Find AC.



LESSON 5.2

Practice B *continued*

For use with pages 303–309

Draw $\overline{AB}$ with the given length. Construct the perpendicular bisector and choose point C on the perpendicular bisector so that the distance between C and $\overline{AB}$ is 1 inch. Measure $\overline{AC}$ and $\overline{BC}$.

19. $AB = 0.5$ inch

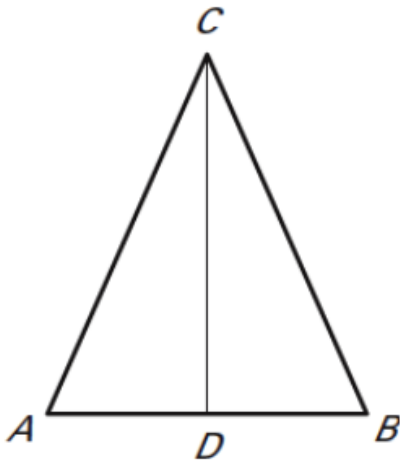
20. $AB = 1$ inch

21. $AB = 2$ inches

24. Early Aircraft Set On many of the earliest airplanes, wires connected vertical

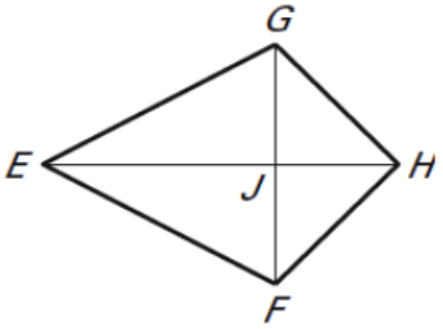
22. **GIVEN:** C is on the perpendicular bisector of $\overline{AB}$.

PROVE: $\triangle ACD \cong \triangle BCD$



23. **GIVEN:** $\triangle GHJ \cong \triangle FHJ$

PROVE: $\overline{EF} \cong \overline{EG}$



Lesson 5.2

Practice Level B

1. 4 **2.** 26 **3.** 35 **4.** yes **5.** no **6.** yes **7.** 44

8. 44 **9.** 36 **10.** 36 **11.** 31 **12.** 62 **13.** 25

14. 20 **15.** 24 **16.** 25 **17.** 15 **18.** 48

19. Check student's drawing; $AC = BC = 1$ in.

20. Check student's drawing; $AC = BC = 1.125$ in.

21. Check student's drawing; $AC = BC = 1.4375$ in.

22. Because a point on the $\perp$ bisector is equidistant to the endpoints, $\overline{AC} \cong \overline{BC}$. By the Reflexive Property of $\cong$, $\overline{CD} \cong \overline{CD}$. By the definition of bisector, $\overline{AD} \cong \overline{BD}$. By the SSS Congruence Postulate, $\triangle ACD \cong \triangle BCD$.

23. Because corresponding parts of $\cong \triangle$'s are $\cong$, $\overline{GJ} \cong \overline{FJ}$ and $\angle GJH \cong \angle FJH$. By the Vertical $\angle$'s Theorem, $\angle GJH \cong \angle EJF$ and $\angle FJH \cong \angle EJG$. By the Transitive Property, $\angle EJF \cong \angle EJG$. By the Reflexive Property, $\overline{EJ} \cong \overline{EJ}$. By the SAS $\cong$ Postulate, $\triangle EJG \cong \triangle EJF$. Because corresponding parts of $\cong \triangle$'s are $\cong$, $\overline{EF} \cong \overline{EG}$.

24. The post is the $\perp$ bisector of the segment between the ends of the wires.

Day 2 Assignment:

p. 306 (3-17, 20-26, 34-41 all)