5-2 Perpendicular and Angle Bisectors

Content Standards

G.CO.9 Prove theorems about lines and angles . . . points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

G.SRT.5 Use congruence . . . criteria to solve problems and prove relationships in geometric figures.

Objective To use properties of perpendicular bisectors and angle bisectors

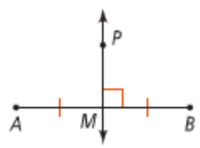
A point is **equidistant** from two objects if it is the same distance from the objects.

take note

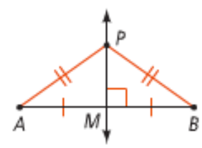
Theorem 5-2 Perpendicular Bisector Theorem

Theorem
If a point is on the perpendicular bisector of a segment, then it is equidistant from the endpoints of the segment.

If . . .
$\overleftrightarrow{PM} \perp \overline{AB}$ and $MA = MB$



Then . . .
$PA = PB$

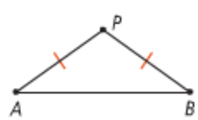


You will prove Theorem 5-2 in Exercise 32.

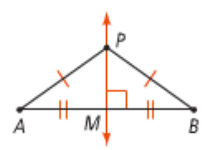
Theorem 5-3 Converse of the Perpendicular Bisector Theorem

Theorem
If a point is equidistant from the endpoints of a segment, then it is on the perpendicular bisector of the segment.

If . . .
$PA = PB$

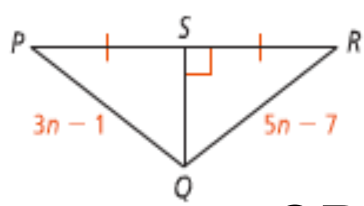


Then . . .
$\overleftrightarrow{PM} \perp \overline{AB}$ and $MA = MB$



You will prove Theorem 5-3 in Exercise 33.

Got It? **1.** What is the length of $\overline{QR}$?



$3n - 1 = 5n - 7$

$-1 = 2n - 7$

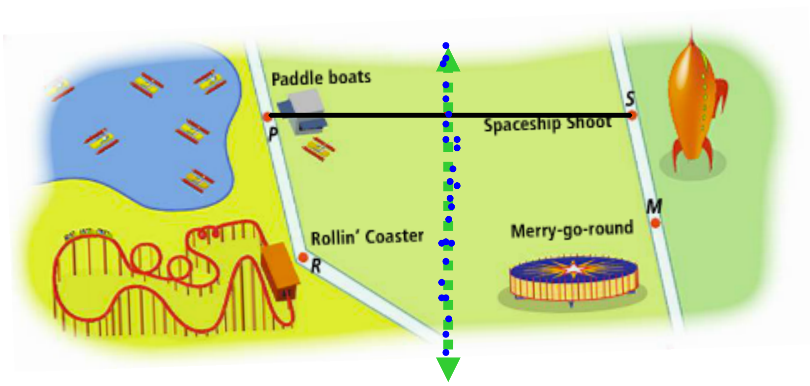
$6 = 2n$

$3 = n$

$QR = 5(3) - 7$

$QR = 8$

Got It? **2. a.** Suppose the director wants the T-shirt stand to be equidistant from the paddle boats and the Spaceship Shoot. What are the possible locations?



The t-shirt stand should be placed somewhere on the perpendicular bisector of the segment between the paddle boats and the spaceship shoot.

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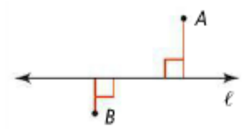
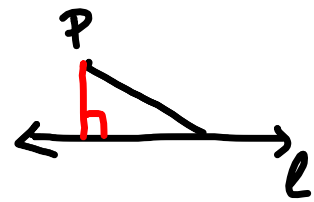
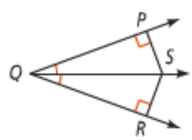
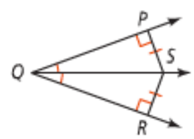
The **distance from a point to a line** is the length of the perpendicular segment from the point to the line. This distance is also the length of the shortest segment from the point to the





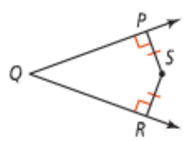
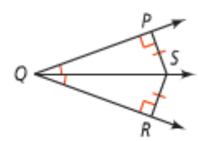
take note

Theorem 5-4 Angle Bisector Theorem

Theorem	If . . .	Then . . .
If a point is on the bisector of an angle, then the point is equidistant from the sides of the angle.	$\overrightarrow{QS}$ bisects $\angle PQR$, $\overline{SP} \perp \overrightarrow{QP}$, and $\overline{SR} \perp \overrightarrow{QR}$ 	$SP = SR$ 

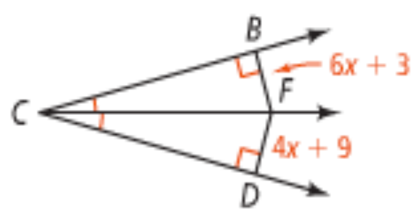
You will prove Theorem 5-4 in Exercise 34.

Theorem 5-5 Converse of the Angle Bisector Theorem

Theorem	If . . .	Then . . .
If a point in the interior of an angle is equidistant from the sides of the angle, then the point is on the angle bisector.	$\overline{SP} \perp \overrightarrow{QP}$, $\overline{SR} \perp \overrightarrow{QR}$, and $SP = SR$ 	$\overrightarrow{QS}$ bisects $\angle PQR$ 

You will prove Theorem 5-5 in Exercise 35.

Got It? 3. What is the length of $\overline{FB}$?



$6x + 3 = 4x + 9$

$2x + 3 = 9$

$2x = 6$

$x = 3$

$FB = 6(3) + 3$

$FB = 21$

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