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Parallel and Perpendicular Lines

Content Standard
G.MG.3 Apply geometric methods to solve design problems.

Objective To relate parallel and perpendicular lines

Essential Understanding You can use the relationships of two lines to a third line to decide whether the two lines are parallel or perpendicular to each other.

Take note

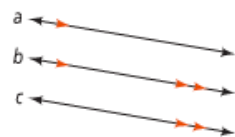
Theorem 3-8

Theorem

If two lines are parallel to the same line, then they are parallel to each other.

If ...

$$a \parallel b \text{ and } b \parallel c$$



Then ...

$$a \parallel c$$

You will prove Theorem 3-8 in Exercise 7.

Take note

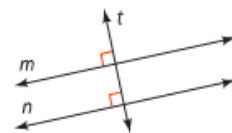
Theorem 3-9

Theorem

In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.

If ...

$$m \perp t \text{ and } n \perp t$$

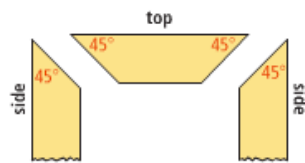


Then ...

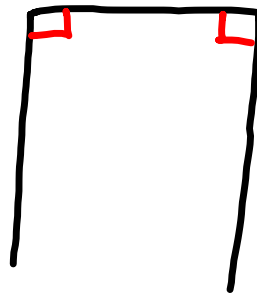
$$m \parallel n$$


Problem 1 Solving a Problem With Parallel Lines STEM

Carpentry A carpenter plans to install molding on the sides and the top of a doorway. The carpenter cuts the ends of the top piece and one end of each of the side pieces at 45° angles as shown. Will the side pieces of molding be parallel? Explain.



If 2 lines are \perp
to the same line,
then they are \parallel
to each other.



Take note

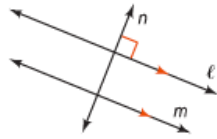
Theorem 3-10 ~~Perpendicular Transversal Theorem~~

Theorem

In a plane, if a line is perpendicular to one of two parallel lines, then it is also perpendicular to the other.

If ...

$n \perp \ell$ and $\ell \parallel m$



Then ...

$n \perp m$

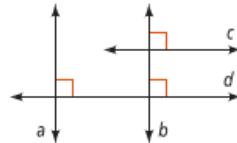


Problem 2 Proving a Relationship Between Two Lines

Given: In a plane, $c \perp b$, $b \perp d$, and $d \perp a$.

Prove: $c \perp a$

Proof: Lines c and d are both perpendicular to line b , so $c \parallel d$ because two lines perpendicular to the same line are parallel. It is given that $d \perp a$. Therefore, $c \perp a$ because a line that is perpendicular to one of two parallel lines is also perpendicular to the other (Perpendicular Transversal Theorem).



Got It? 2. In Problem 2, could you also conclude $a \parallel b$? Explain.

1. $c \perp b$ — 1. Given
 $b \perp d$ —
 $d \perp a$ —

2. $c \parallel d$ — 2. If 2 lines are \perp to the same line, then they are \parallel to each other.

3. $c \perp a$ 3. If a line is \perp to 1 of 2 \parallel lines, then it is \perp to the other.

$a \parallel b$

If 2 lines are \perp to the same line, then they are \parallel to each other.

Name

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