

12/1 Aim: Unknown Angle PROOFS  
 —Proofs with Constructions  
 Take out your homework

Do now: Do the opening exercise

Homework: Last page exit ticket  
 Quiz tomorrow or Friday  
 Simple construction

*Test Wed/Thurs*

Nov 30-9:07 AM

In the diagram to the right, prove that the sum of the labeled angles is  $180^\circ$ .  
 $x + z + y = 180^\circ$

Statements	Reason
1. $z + a + y = 180^\circ$	1. Angles in a line sum to $180^\circ$
2. $x = a$	2. intersecting lines form $\cong$ vertical $\angle$ 's.
3. $z + x + y = 180^\circ$	3. Substitution

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#4. Weekly Review

Dec 5-10:52 AM

4. In the diagram to the right, prove that  $m\angle y + m\angle z = m\angle w + m\angle x$ .  
 $y + z = w + x$   
 (You need to write a label in the diagram that is not labeled yet for this proof.)

Statements	Reasons
1. $x + w + a = 180^\circ$	1. Angles in a $\triangle$ sum to $180^\circ$
2. $z + y + a = 180^\circ$	2. $\triangle$ sum to $180^\circ$
3. $x + w + a = z + y + a$	3. Substitution
4. $x + w = z + y$	4. Subtraction

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5. In the figure to the right,  $AB \parallel CD$  and  $BC \parallel DE$ .  
 Prove that  $m\angle ABC = m\angle CDE$ .  
 $\angle 1 = \angle 2$

Statements	Reasons
1. $\angle 1 \cong \angle 3$	1. $\parallel$ lines cut by a transversal form $\cong$ alt. int. $\angle$ 's
2. $\angle 2 \cong \angle 3$	2. "
3. $\angle 1 \cong \angle 2$	3. Substitution

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7. In the figure to the right, prove that DC perpendicular to EF.  
 Draw in label Z.

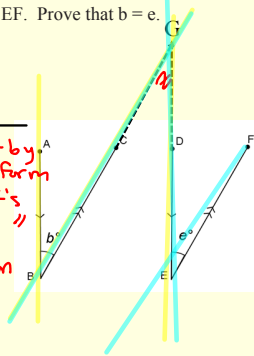
Statements	Reason
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**Opening Exercise**

In the figure on the right,  $AB \parallel DE$  and  $BC \parallel EF$ . Prove that  $b = e$ .  
(Hint: Extend BC and ED.)

Statements	Reasons
1. $\angle b \cong \angle z$	1. $\parallel$ lines cut by a transversal form $\cong$ alt. int. $\angle$ 's
2. $\angle e \cong \angle z$	2. " " "
3. $\angle b \cong \angle e$	3. substitution



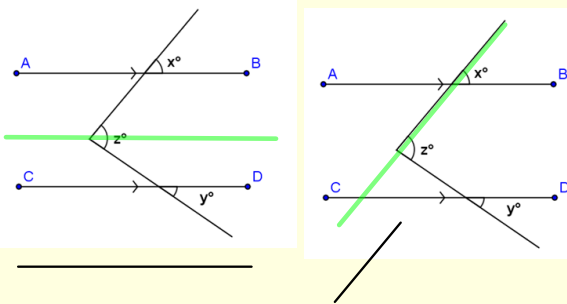
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In the previous lesson, you used deductive reasoning with labeled diagrams to prove specific conjectures. What is different about the proof above?

Drawing or extending segments, lines, or rays (referred to as *auxiliary lines*) is frequently useful in demonstrating steps in the deductive reasoning process. Once BC and ED were extended, it was relatively simple to prove the two angles congruent based on our knowledge of alternate interior angles. Sometimes there are several possible extensions or additional lines that would work equally well.

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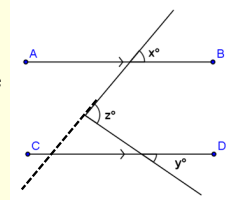
For example, in this diagram, there are at least two possibilities for auxiliary lines. Can you spot them both?



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Given:  $\overline{AB} \parallel \overline{CD}$   
Prove  $z = x + y$

Extend the transversal as shown by the dotted line in the diagram. Label the angle measures  $v$  and  $w$ , as shown.  
What do you know about  $v$  and  $x$ ?



What do you know about  $v$  and  $x$ ?  
About  $w$  and  $y$ ? How does this help you?

Write the proof.

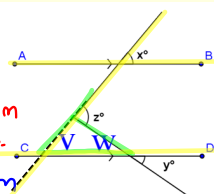
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Given:  $AB \parallel CD$   
Prove  $z = x + y$

**Statement**

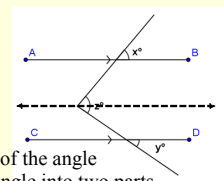
**Reasons**

- |                              |   |
|------------------------------|---|
| 1. $z = v + w$               | 1. ext. $\angle \cong$ sum of opp. int. $\angle$ 's                 |
| 2. $\angle w \cong \angle y$ | 2. int. lines form $\cong$ vertical $\angle$ 's                     |
| 3. $\angle x = \angle v$     | 3. $\parallel$ lines cut by a trans. form $\cong$ corr. $\angle$ 's |
| 4. $z = x + y$               | 4. substitution   |



Given:  $\overline{AB} \parallel \overline{CD}$   
Prove  $z = x + y$

Draw a segment AB through the vertex of the angle measuring  $z$  degrees. This divides the angle into two parts as shown.



What do you know about  $v$  and  $x$ ?  
About  $w$  and  $y$ ? How does this help you?

Write the proof.

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Given:  $\overline{AB} \parallel \overline{CD}$   
 Prove  $z = x + y$

Statement	Reason
1. $\angle x = \angle v$	1+2. $\parallel$ lines cut by a transversal form $\cong$ corresponding $\angle$ 's
2. $\angle w = \angle y$	3. addition
3. $z = v + w$	4. substitution
4. $z = x + y$	

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2. In the figure to the right,  $AB \parallel CD$  and  $BC \parallel DE$ .  
 Prove that  $b + d = 180$ .

Statement	Reason
① $c = b$	① Parallel lines cut by a transversal form $\cong$ alt. int. $\angle$ 's
② $c + d = 180$	② Same side int. add to $180^\circ$
③ $b + d = 180$	③ Substitution

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3. In the figure to the right, prove that  $d = a + b + c$

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In the figure to the right,  $AB \parallel DE$  and  $BC \parallel EF$ .  
 Prove that  $m\angle ABC = m\angle DEF$

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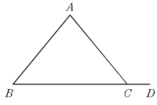
3. In the figure to the right,  $AB \parallel CD$ .  
 Prove that  $m\angle AEC = a + c$

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1. In the accompanying diagram, parallel lines  $\overline{AB}$  and  $\overline{CD}$  are cut by transversal  $\overline{GH}$  at E and F, respectively. If  $m\angle BEF = (3x + 60)$ , find the value of x.

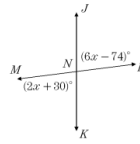
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2. In the accompanying diagram,  $\triangle ABC$  is isosceles,  $\overline{BC}$  is extended to  $D$ ,  $\overline{AB} \cong \overline{AC}$ , and  $m\angle A = 80$ . Find  $m\angle ACD$ .



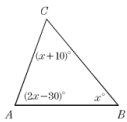
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3. In the accompanying diagram, lines  $\overleftrightarrow{JK}$  and  $\overleftrightarrow{LM}$  intersect at  $N$ ,  $m\angle JNL = 6x - 74$ , and  $m\angle MNK = 2x + 30$ . What is the value of  $x$ ? What is the  $m\angle LNK$ ?



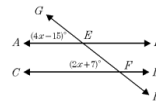
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4. In the accompanying diagram,  $m\angle A = 2x - 30$ ,  $m\angle B = x$ , and  $m\angle C = x + 10$ . Find the number of degrees in  $\angle A$ .



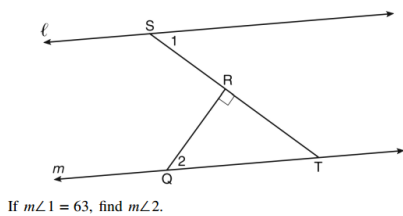
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5. In the accompanying diagram, parallel lines  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CD}$  intersect transversal  $\overleftrightarrow{GH}$  at points  $E$  and  $F$ , respectively. If  $m\angle AEG = 4x - 15$  and  $m\angle CFE = 2x + 7$ , find the value of  $x$ . What is the  $m\angle BEF$ ?



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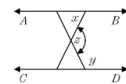
6. In the diagram below,  $\ell \parallel m$  and  $\overline{QR} \perp \overline{ST}$  at  $R$ .



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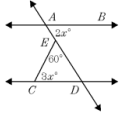
7. In the diagram shown,  $\overline{AB} \parallel \overline{CD}$ ,  $m\angle x = 68$ , and  $m\angle y = 117$ . What is  $m\angle z$ ?

- A. 131 B. 117 C. 112 D. 49



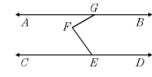
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8. In the accompanying diagram,  $\overleftrightarrow{AB}$  is parallel to  $\overleftrightarrow{CD}$ ,  $\overleftrightarrow{AE}$  is a transversal, and  $\overleftrightarrow{CE}$  is drawn. If  $m\angle CED = 60$ ,  $m\angle DAB = 2x$ , and  $m\angle DCE = 3x$ , find  $x$ .



9. In the accompanying diagram,  $\overleftrightarrow{AGB} \parallel \overleftrightarrow{CED}$ ,  $m\angle AGF = 30$ , and  $m\angle CEF = 45$ . What is  $m\angle GFE$ ?

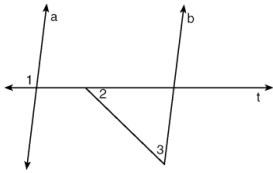
- A. 45 B. 52 C. 60 D. 75



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10. In the accompanying diagram, line  $a$  is parallel to line  $b$ , and line  $t$  is a transversal. If  $m\angle 1 = 97$  and  $m\angle 2 = 44$ , find  $m\angle 3$ .



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