

- 1) $\angle AOB, \angle BOA$
- 2) O
- 3) \vec{OB}
- 4) 45°
- 5) \vec{OA}, \vec{OC}

Warm up

Pg 89, "Check Skills You'll Need", #1-5

Geometric proof tools

1. ✓ Definitions & undefined terms (points for instance)
2. ✓ Postulates \angle Add Post / Seg Add Post
3. Previously accepted or proven geometric conjectures (theorems)
4. Properties of algebra (equality & congruence)

$=$
#s

\cong
shapes, obj

You are a lawyer!

Your job is to convince the judge and jury

Must justify every point with facts and evidence

Properties of equality

Properties of equality *YOU MUST HAVE THESE DOWN PAT*****

POE

Properties of equality *YOU MUST HAVE THESE DOWN PAT*****

Add POE
Addition: If $a = b$, then $a + c = b + c$

Subt POE
Subtraction: If $a = b$, then $a - c = b - c$

Mult POE
Multiplication: If $a = b$, then $a \cdot c = b \cdot c$

Div POE
Division: If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$

Ref1 POE
Reflexive: $a = a$

Sym POE
Symmetric: If $a = b$, then $b = a$

Trans POE
Transitive: If $a = b$ and $b = c$, then $a = c$

Subst POE
Substitution: If $a = b$, then b can be replaced by a in any expression

general conditional

LOD
Add POE
 $a = 3, c = -5$

Properties of algebra

Any known property of algebra is true.

Dist Prop

Distributive Property: $a(b + c) = ab + ac$

$$\frac{3x-6}{3(x-2)} = \frac{3 \cdot x - 3 \cdot 2}{3(x-2)}$$

PEMDAS

$$3(x-2) = 3x - 6$$

$$(x-2)(x+5) = x^2 - 2x - 10$$

$$x-2 \quad (x+5) = x^2$$

$$x - 2x - 10 = x$$

How to justify a step in an algebra proof

Consider what changed from the prior step:

- If the changes are all on one side, you likely:
 - * Simplified *Combined like terms*
 - * or used Substitution Property of Equality *Subst PDE*
 - * or used Distributive Property of Algebra *Dist Prop*
- If the changes are on both sides:
 - * Identify the operation performed
 - * +, -, ×, ÷
 - * ...this will tell you what Property of Equality was used

$$2x - 3 = x + 1$$

$$x - 3 = 1$$

$$x = 3$$

$$y = 3(x)^2 + 2$$

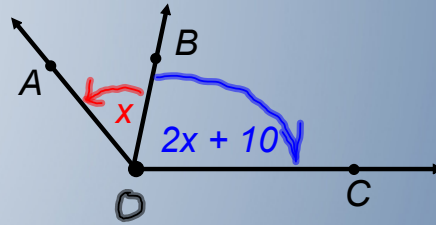
$$= 3(3)^2 + 2$$

*Add PDE
Subt PDE
Multi PDE
Div PDE*

Example – Pg 90, Example #1

Solve for x and justify each step.

Given: $m\angle AOC = 139$



Example – Pg 90, Example #1

Solve for x and justify each step.

Given: $m\angle AOC = 139$

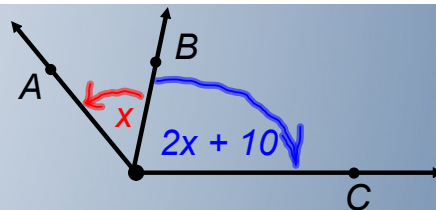
$$m\angle AOB + m\angle BOC = m\angle AOC \quad 1$$

$$x + 2x + 10 = 139 \quad 2$$

$$3x + 10 = 139 \quad 3$$

$$3x = 129 \quad 4$$

$$x = 43 \quad 5$$



Example – Pg 90, Example #1

Solve for x and justify each step.

Given: $m\angle AOC = 139$

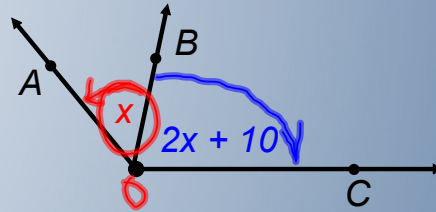
$$\textcircled{1} \quad m\angle AOB + m\angle BOC = m\angle AOC$$

$\textcircled{2} \quad x + 2x + 10 = 139$

$$3x + 10 = 139$$

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\angle Add Post
Angle Addition Postulate

Example – Pg 90, Example #1

Solve for x and justify each step.

Given: $m\angle AOC = 139$

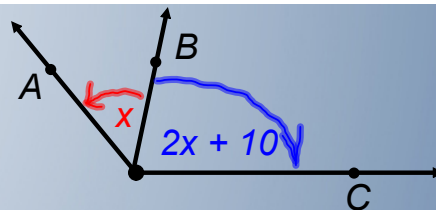
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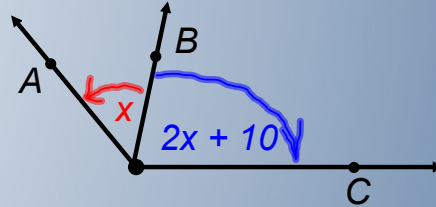


Angle Addition Postulate

(all on 1 side)

Example – Pg 90, Example #1

Solve for x and justify each step.



Given: $m\angle AOC = 139$

$$m\angle AOB + m\angle BOC = m\angle AOC$$

Angle Addition Postulate

$$x + 2x + 10 = 139$$

(all on 1 side) Substitution Prop

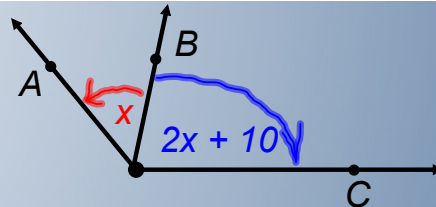
$$3x + 10 = 139$$

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(all on 1 side) Substitution Prop

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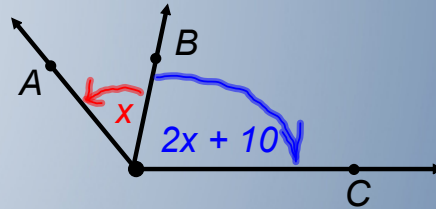
(all on 1 side)

$$3x = 129$$

$$x = 43$$

Example – Pg 90, Example #1

Solve for x and justify each step.



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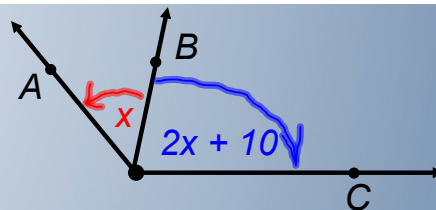
(all on 1 side) Simplify

$$3x = 129$$

$$x = 43$$

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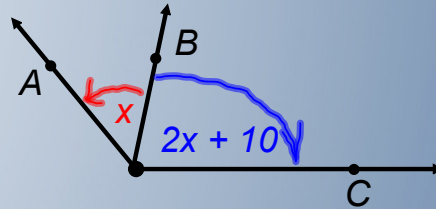
$$3x = 129$$

(-10 ea side)

$$x = 43$$

Example – Pg 90, Example #1

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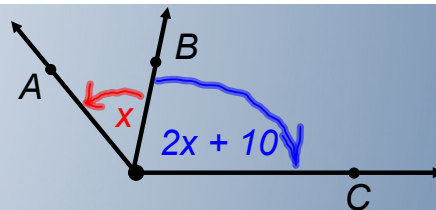
$$3x = 129$$

(-10 ea side) Subtraction Prop of Eq

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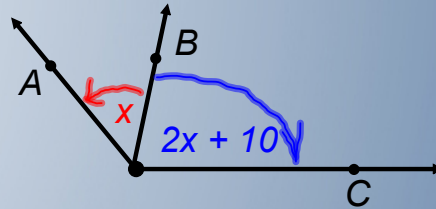
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($\div 3$ ea side)

Example – Pg 90, Example #1



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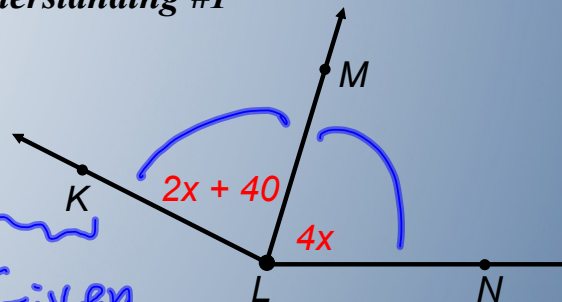
($\div 3$ ea side) Division Prop of Eq

QED!

Example – Pg 90, Check Understanding #1

Fill in each missing reason.

Given: \overrightarrow{LM} bisects $\angle KLN$



\overrightarrow{LM} bisects $\angle KLN$

$$m\angle MLN = m\angle KLM$$

Given
- defn of \angle bis

$$4x = 2x + 40$$

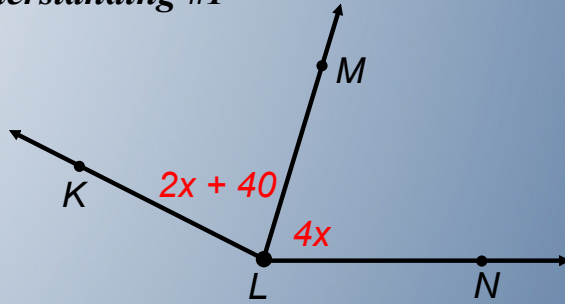
$$2x = 40$$

$$x = 20$$

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\overrightarrow{LM} bisects $\angle KLN$ Given

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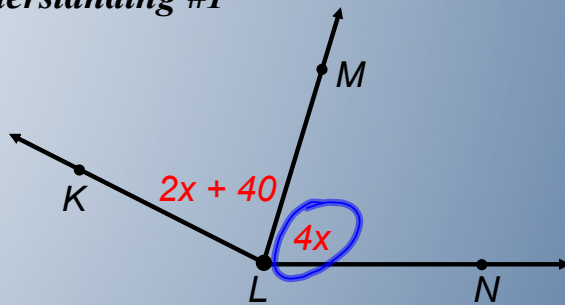
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Given: \overrightarrow{LM} bisects $\angle KLN$



\overrightarrow{LM} bisects $\angle KLN$ Given

$$m\angle MLN = m\angle KLM \quad \text{Definition of angle bisector}$$

defn \angle bis

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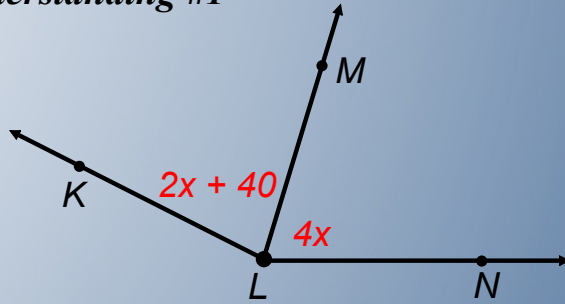
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Given: \overrightarrow{LM} bisects $\angle KLN$



\overrightarrow{LM} bisects $\angle KLN$ Given

$m\angle MLN = m\angle KLM$ Definition of angle bisector

$$4x = 2x + 40 \quad (\text{all on 1 side})$$

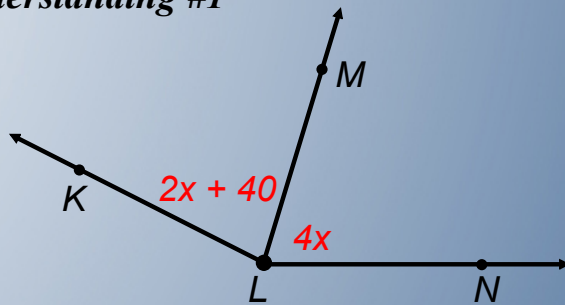
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$$4x = 2x + 40 \quad (\text{all on 1 side}) \text{ Substitution}$$

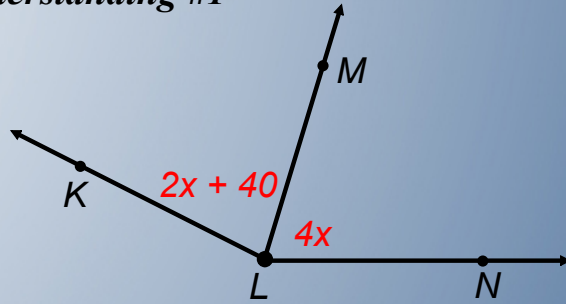
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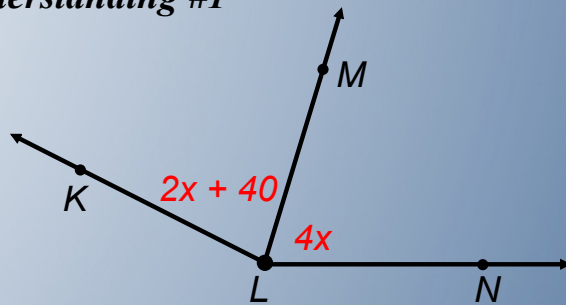
$$2x = 40 \quad (-2x \text{ ea side})$$

$$x = 20$$

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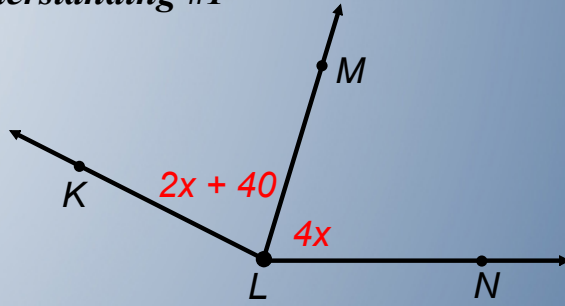
$$2x = 40 \quad (-2x \text{ ea side}) \text{ Subtraction Prop of Eq}$$

$$x = 20$$

Example – Pg 90, Check Understanding #1

Fill in each missing reason.

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\overrightarrow{LM} bisects $\angle KLN$ Given

$m\angle MLN = m\angle KLM$ Definition of angle bisector

$4x = 2x + 40$ (**all on 1 side**) Substitution

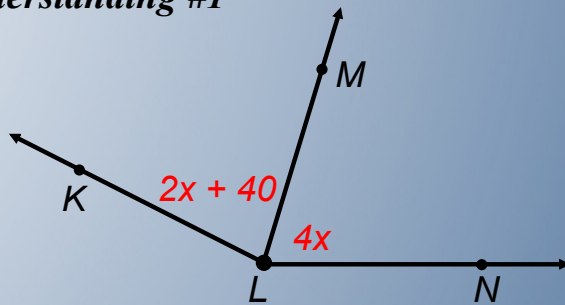
$2x = 40$ (**-2x ea side**) Subtraction Prop of Eq

$x = 20$ (**$\div 2$ ea side**)

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\overrightarrow{LM} bisects $\angle KLN$ Given

$m\angle MLN = m\angle KLM$ Definition of angle bisector

$4x = 2x + 40$ (**all on 1 side**) Substitution

$2x = 40$ (**-2x ea side**) Subtraction Prop of Eq

$x = 20$ (**$\div 2$ ea side**) Division Prop of Eq

Example – not in the book

Solve for x and justify each step.

Given: $5x - 12 = 32 + x$

$5x - 12 = 32 + x$

$5x = 44 + x$

$4x = 44$

$x = 11$

Example – not in the book

Solve for x and justify each step.

Given: $5x - 12 = 32 + x$

$5x - 12 = 32 + x$ Given

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Example – not in the book

Solve for x and justify each step.

Given: $5x - 12 = 32 + x$

$5x - 12 = 32 + x$ Given

$5x = 44 + x$ **(+12 ea side)**

$4x = 44$

$x = 11$

Example – not in the book

Solve for x and justify each step.

Given: $5x - 12 = 32 + x$

$5x - 12 = 32 + x$ Given

$5x = 44 + x$ **(+12 ea side)** Addition Prop of Eq

$4x = 44$

$x = 11$

Example – not in the book

Solve for x and justify each step.

Given: $5x - 12 = 32 + x$

$5x - 12 = 32 + x$ Given

$5x = 44 + x$ (+12 ea side) Addition Prop of Eq

$4x = 44$ (-x ea side)

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Sub Prop

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Solve for x and justify each step.

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$x = 11$ ($\div 4$ ea side)

Example – not in the book

Solve for x and justify each step.

Given: $5x - 12 = 32 + x$

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$4x = 44$ (-x ea side) Subtraction Prop of Eq

$x = 11$ ($\div 4$ ea side) Division Prop of Eq

QED

POC = #'s
Properties of Congruence

Shape \cong POC

Reflexive:

$\overline{AB} \cong \overline{AB}$

$\angle A \cong \angle A$

segs
 L's

Shapes

Symmetric:

If $\overline{AB} \cong \overline{CD}$, then $\overline{CD} \cong \overline{AB}$

If $\angle A \cong \angle B$, then $\angle B \cong \angle A$

Transitive:

If $\overline{AB} \cong \overline{CD}$ and $\overline{CD} \cong \overline{EF}$, then $\overline{AB} \cong \overline{EF}$

If $\angle A \cong \angle B$ and $\angle B \cong \angle C$, then $\angle A \cong \angle C$

Example – Pg 91, Check Understanding #3

analysis

Name the property of equality or congruence illustrated.

a) $\overline{XY} \cong \overline{XY}$

REFL POC

Reflexive Property of Congruence

b) If $m\angle A = 45$ and $45 = m\angle B$, then $m\angle A = m\angle B$

$a = b$ $b = c$ $a = c$
 Trans POC
 Subst POC

Transitive Property of Congruence Equal

or Substitution Prop of Congruence Equal

Example – not in the book

Name the property that justifies each statement.

a) If $x = y$ and $y + 4 = 3x$, then $x + 4 = 3x$

Substitution Prop of Equality

b) If $x + 4 = 3x$, then $4 = 2x$

Subtraction Prop of Equality

c) If $\angle P \cong \angle Q$ and $\angle Q \cong \angle R$ and $\angle R \cong \angle S$, then $\angle P \cong \angle S$

Transitive Prop of Congruence

$x = y$, $y + 4 = 3x$
 $x + 4 = 3x$

Subst POE

$x + 4 = 3x$
 $4 = 2x$

Assignment

Pg 91 #1-23
27
29
38-41
45-48