Geometry

Chapter 2 Handout 2.4
Reasoning in Algebra

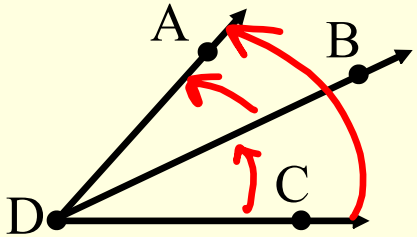
postulate - accepted rule or statement.

Postulates we already know:

Segment Addition Postulate

$AB + BC = AC$

Angle Addition Postulate



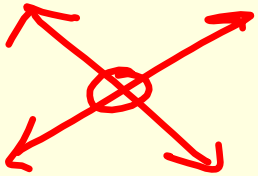
$m\angle ADB + m\angle BDC = m\angle ADC$

More postulate that we know

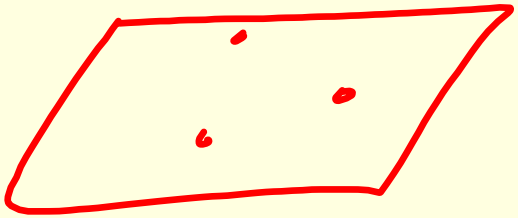
Through any two points there exists exactly one line.

A line contains at least two points.

If two lines intersect, then their intersection is exactly one point.



Through any 3 non collinear points there exists exactly one plane.



More postulate that we know

A plane contains at least three noncollinear points.

If two points lie in a plane, then the line containing them lies in the plane.

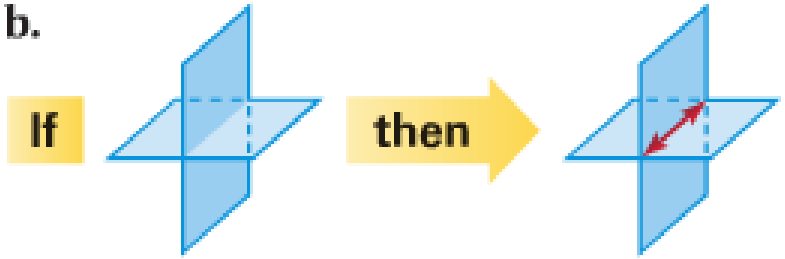
If two planes intersect, then their intersection is a line.

Example 1: State the postulate illustrated by the diagram.

a.

If 2 lines intersect then they intersect at exactly one point.

b.



If 2 planes intersect then their intersection is a line.

Example 2: Which of the following statements cannot be assumed from the diagram?

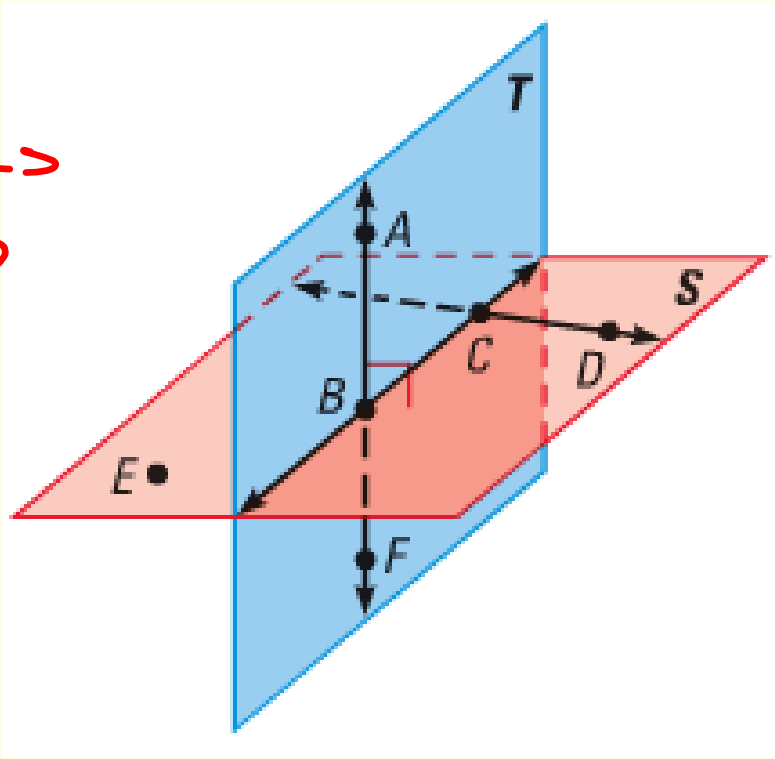
A, B, and F are collinear. yes

E, B, and C are collinear. NO

$\overline{AB} \perp plane\ S$ yes

$\overline{CD} \perp plane\ T$ NO

$\overleftrightarrow{AF}$ intersects $\overleftrightarrow{BC}$ at point B. yes



Properties of Equality

Addition Property: If a = b, then a + c = b + c

Ex: $x - 3 + 3 = 12 + 3$

add prop =

Subtraction Property: If a = b, then a - c = b - c

Ex: $x + 12 - 12 = 24 - 12$

subtr. prop =

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

Ex: 2. $\frac{1}{2}x = 14 \cdot 2$

mult. prop =

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

Ex: $\frac{12x}{12} = \frac{36}{12}$

Div. prop =

Reflexive Property: a = a

4 = 4
AB = AB

Symmetric Property: If a = b, then b = a

Ex: If 2x + 4 = 8 then 8 = 2x + 4.

Transitive Property: If a = b and b = c, then a = c

same

links 3 or more items together

Ex: If 2x + 5 = 12 and 12 = x + 10 then 2x + 5 = x + 10

trans prop =

Substitution Property: If a = b, then b can replace a in any expression

Ex: Let x = 6 and simplify the expression 3x + 12

3(6) + 12

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

Ex: 3(x - 14) = 3(x) − 3(14) = 3x − 42

Properties of Congruence

Reflexive Property

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

$\angle A \cong \angle A$

Symmetric Property

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 Property

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 $\angle A \cong \angle C$.

A proof is a logical argument that shows why a statement is true (or perhaps false).

We will be writing proofs in two-column format. This method allows you to see both the mathematical steps and their justifications side-by-side. Each statement in the proof must have a reason.

A two-column proof looks like this. Note that the statements are placed on the left and the reasons on the right. Number the statements/reasons to keep the proof neat and readable.

Given :

Prove :

Picture

Statements	Reasons
1.	1.
2.	2.
3.	3.
4.	4.

1. Justify each step used to solve $5x - 12 = 32 + x$

Statement	Reasons
1. $5x - 12 = 32 + x$	1. Given
2. $5x = 44 + x$	2. Add prop =
3. $4x = 44$	3. Subtr. prop =
4. $x = 11$	4. Div. prop =

Given: $-x-2(9-8x)=12$

Prove: x = 2

Statement	Reason
1. $-x-2(9-8x)=12$	1. Given
2. $-x-18+16x=12$	2. Dist. prop =
3. $15x-18=12$ $+18 \quad +18$	3. Simplify
4. $\frac{15x}{15}=\frac{30}{15}$	4. Add. prop =
5. $x=2$	5. Div. prop =

5. Name the property that justifies each statement:

a) If x = y and y + 4 = 3x, then x + 4 = 3x. subst. prop

b) If x + 4 = 3x, then 4 = 2x. Subtr. prop =

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

d) $\overline{XY} \cong \overline{XY}$ Reflexive prop $\cong$

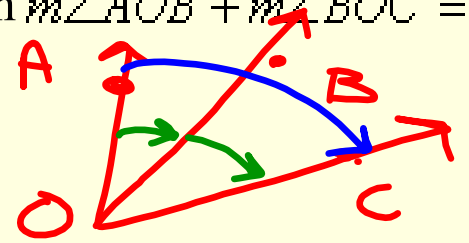
e) $m\angle A = 45$ and $45 = m\angle B$, then $m\angle A = m\angle B$. trans. prop =

f) ab =ab Reflexive prop =

g) If $m\angle ABC + 40 = 85$, then $m\angle ABC = 45$. Subtr. prop =

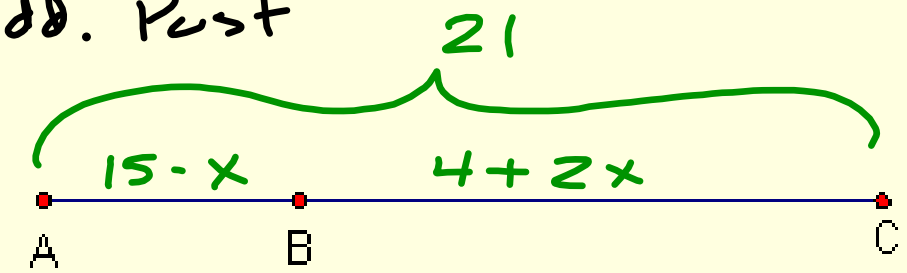
h) If k = m and k + w = 12, then m + w = 12. Subst. prop =

i) If B is a point in the interior of $\angle AOC$, then $m\angle AOB + m\angle BOC = m\angle AOC$. ✗ add post.



2. Suppose that points A, B, and C are collinear with points B between points A and C. Solve for x if AC = 21, AB = 15 - x, and BC = 4 + 2x

"Seg. Add. Post"



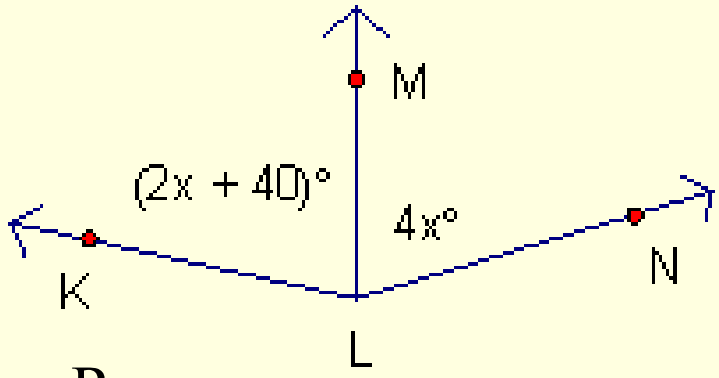
$15 - x + 4 + 2x = 21$

$x + 19 = 21$

$-19 \quad -19$

$x = 2$

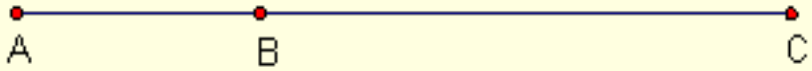
3. Fill in each missing reason.



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

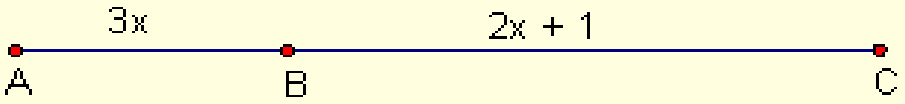
Statements	Reasons
1. $\overline{LM}$ bisects $\angle KLN$	1.
2. $m\angle MLN = m\angle KLM$	2.
3. $4x = 2x + 40$	3.
4. $2x = 40$	4.
5. $x = 20$	5.

4. AB = 15 + 6x, BC = 4 + 2x, and AC = 51. Find x and then find the lengths of AB and BC.



6. Fill in the missing information.

Given: AC = 36



Statements	Reasons
1. AC = 36	1.
2. AB + BC = AC	2.
3. 3x + 2x + 1 = 36	3.
4.	4. Simplify
5. 5x = 35	5.
6. x = 7	6.

Assignment:

Day 1: Pgs 105-108 1-4,16,17,18,21,22,24 27,28,29,30(omit a)