PROOFS

TWO-COLUMN PROOFS FULL UNIT: PRESENTATION

Terms of Use

Thanks so much for downloading this file!

This resource is for personal use in your own classroom only. The copyright is owned by Math Giraffe and all rights are reserved. Permission is granted to copy pages for your own students.

Placing any part of this file anywhere online is a violation of the Digital Millennium Copyright Act.

You may:

- Print this file and distribute it to your students
- Use it in your own classroom

You may not:

- Upload it on the internet to another site in any form
- Sell it, sell any part of it, or sell anything based upon it
- Share it without permission

I hope that you and your students enjoy this!

© Copyright Math Giraffe

Note to Teacher:

This unit will guide you and your students through the entire concept of geometry proofs from beginning to end. The unit begins with the basic building blocks of proofs. Students learn the properties and postulates that will become the justifications for proofs. They begin with justifying algebra problems that they are familiar with and ease into the geometry proofs. The unit uses the two-column structure for proof writing.

This presentation set is accompanied by a set of printable resources that you can use as practice and assessment as you go through the unit.

Suggested Pacing Guide

	Regular Class Periods	Block Schedule
Day 1	Properties of Equality and Congruence (presentation p.5-18, printables p.2 -6)	Properties of Equality and Congruence, Postulates (presentation p. 5–24, printables 2-10)
Day 2	Properties Warm-Up (Printables p.7-8) Lesson on Postulates (presentation p.19-24, printables p.9-10)	The Two-Column Proof Structure, Algebraic Proofs (presentation p.25-34, printables p.11-16)
Day 3	The Two-Column Proof Structure, Algebraic Proofs (Presentation p.25-34, printables p.11-14)	Proofs Using Definitions and Postulates (presentation p. 35-51, printables p. 17-25), Review of Special Angle Pairs (presentation p. 52, 53)
Day 4	Algebra Proofs Warm-Up (printables p. 15-16) Lesson on Proofs Using Definitions and Postulates (presentation p. 35-51, printables p.17-25)	Quiz 1 (printables p.26-29), Proofs Using Special Angle Pairs (presentation p. 54-59, printables p.30-37)
Day 5	Quiz 1 (printables p.26-29) Review of Special Angle Pairs (presentation p. 52, 53)	Proofs Using Triangles (presentation p.60, printables p.38-41)
Day 6	Proofs Using Special Angle Pairs (presentation p. 54-59, printables p.30-31)	Quiz 2 (printables p.42-45)
Day 7	Warm-Up using Special Angle Pairs (printables p.32-33), More Proofs Using Special Angle Pairs (Transversals)(printables p. 34-37)	
Day 8	Proofs Using Triangles (presentation p.60, printables p.38-41)	
Day 9	Quiz 2 (printables p.42-45)	

Introduction to Proofs

When writing a proof, your job is to complete a puzzle. You start with the given information and have to reach the "goal" statement. You must show your logic to prove that you can get the desired result. To do this, you need to justify every statement that you make. Your statements and justifications link together to form the proof.

This unit will focus on a two-column style proof. Before we begin writing the formal proofs, we need a few building blocks of knowledge that will become our justifications. Justifications can be properties, postulates, and theorems that have already been proven or accepted as truth.

PROPERTIES OF EQUALITY

Addition Property of Equality

Adding the same number to both sides of an equation results in an equivalent equation.

If $a = b$ is true,
Then $a + m = b + m$ is also true.

Subtraction Property of Equality

Subtracting the same number from both sides of an equation results in an equivalent equation.

If $a = b$ is true,
Then $a - m = b - m$ is also true.

© Copyright 2014 Math Giraffe

PROPERTIES OF EQUALITY

Multiplication Property of Equality

Multiplying both sides of an equation by the same nonzero number results in an equivalent equation.

If $a = b$ is true,
Then $am = bm$ is also true.

Division Property of Equality

Dividing both sides of an equation by the same nonzero number results in an equivalent equation.

If $a = b$ is true,
Then $\frac{a}{m} = \frac{b}{m}$ is also true (for $m \neq 0$).

© Copyright 2014 Math Giraffe

Reflexive Property

REFLEXIVE PROPERTY OF EQUALITY

A number is equal to itself.

$x = x$

REFLEXIVE PROPERTY OF CONGRUENCE

A figure is congruent to itself.

$<A \cong <A$

© Copyright 2014 Math Giraffe

Symmetric Property

SYMMETRIC PROPERTY OF EQUALITY

The sides of an equation can be switched.

If $a = b$, then $b = a$

SYMMETRIC PROPERTY OF CONGRUENCE

The sides of a congruency statement can be switched.

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

© Copyright 2014 Math Giraffe

Transitive Property

Transitive Property of Equality

If two numbers are equal to the same number, then they are equal to each other.

If $a = b$ and $b = c$, then $a = c$

Transitive Property of Congruence

If two figures are congruent to the same figure, then they are congruent to each other.

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

© Copyright 2014 Math Giraffe

Identify which property was used to get from column 1 to column 2.

1	$6n + 9 = 15$	$6n + 9 - 9 = 15 - 9$ or $6n = 6$	
2	$\overline{JK} \cong \overline{GH}$	$\overline{GH} \cong \overline{JK}$	
3	$<QRS \cong <UVW$ and $<UVW \cong <XYZ$	$<QRS \cong <XYZ$	
4	$m<4 = m<9$	$m<4 + m<1 = m<9 + m<1$	

Write a new congruency statement using the transitive property.

5	$<DEF \cong <ABC$ and $<JKL \cong <DEF$	
6	$\overline{RS} \cong \overline{VW}$ and $\overline{RS} \cong \overline{XY}$	

© Copyright 2014 Math Giraffe

Identify which property was used to get from column 1 to column 2.

1	$6n + 9 = 15$	$6n + 9 - 9 = 15 - 9$ or $6n = 6$	Subtraction Property of Equality
2	$\overline{JK} \cong \overline{GH}$	$\overline{GH} \cong \overline{JK}$	Symmetric Property of Congruence
3	$<QRS \cong <UVW$ and $<UVW \cong <XYZ$	$<QRS \cong <XYZ$	Transitive Property of Congruence
4	$m<4 = m<9$	$m<4 + m<1 = m<9 + m<1$	Addition Property of Equality

Write a new congruency statement using the transitive property.

5	$<DEF \cong <ABC$ and $<JKL \cong <DEF$	$<ABC \cong <JKL$
6	$\overline{RS} \cong \overline{VW}$ and $\overline{RS} \cong \overline{XY}$	$\overline{VW} \cong \overline{XY}$

© Copyright 2014 Math Giraffe

Substitution Property

Substitution property of equality:
If two numbers are equal, one can replace the other in an equation.

Substitution property of congruence:
If two figures are congruent, one can replace the other in a congruency statement.

© Copyright 2014 Math Giraffe

Substitution Property

Example 1:

If m<G = m<H and we know that

m<G + m<A = m<B,

We can rewrite the statement as follows:

m<H + m<A = m<B.

Example 2:

If $\overline{TV} \cong \overline{WX}$ and we know that

$\overline{WX} \cong \overline{YU}$

We can rewrite the statement as follows:

$\overline{TV} \cong \overline{YU}$

© Copyright 2014 Math Giraffe

The Substitution and Transitive Properties can be used for full expressions as well.

Look at the following example.

The following information is GIVEN: $d = c$, $a = c$, $d + p = n$, $a + c = n$

Note: In order to use the Transitive Property, the equivalent parts must each be an ENTIRE SIDE of the equation!

Depending on our goal, we can write quite a few statements from the given equations.

Since two different expressions are equal to n, they are equal to each other. We can now write a new statement: $d + p = a + c$.

It can help to put boxes around the expressions to clearly see which expressions are equal.

Using the four given statements above, write as many new statements as you can. Use only Substitution and the Transitive Property.

© Copyright 2014 Math Giraffe

REMINDERS:

Angle measures are numbers, and can be equal.

$m<1 = m<4$

Angles are figures and can be congruent.

$<XYZ \cong <PQR$

Segment lengths are numbers and can be equal.

$MN = ST$

Segments are figures and can be congruent.

$\overline{GH} \cong \overline{CD}$

© Copyright 2014 Math Giraffe

Determine whether each statement is acceptable and explain.

1. <ABC = <STU
2. VW = VY
3. PR ≅ GH
4. m<5 = m<8
5. $\overline{AB} = \overline{CD}$

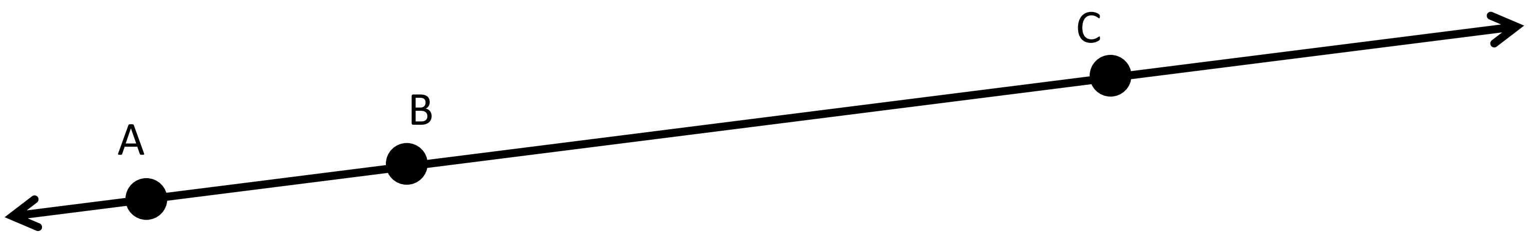
© Copyright 2014 Math Giraffe

Determine whether each statement is acceptable and explain.

1. <ABC = <STU
2. VW = VY
3. PR ≅ GH
4. m<5 = m<8
5. $\overline{AB} = \overline{CD}$

© Copyright 2014 Math Giraffe

Segment Addition Postulate:

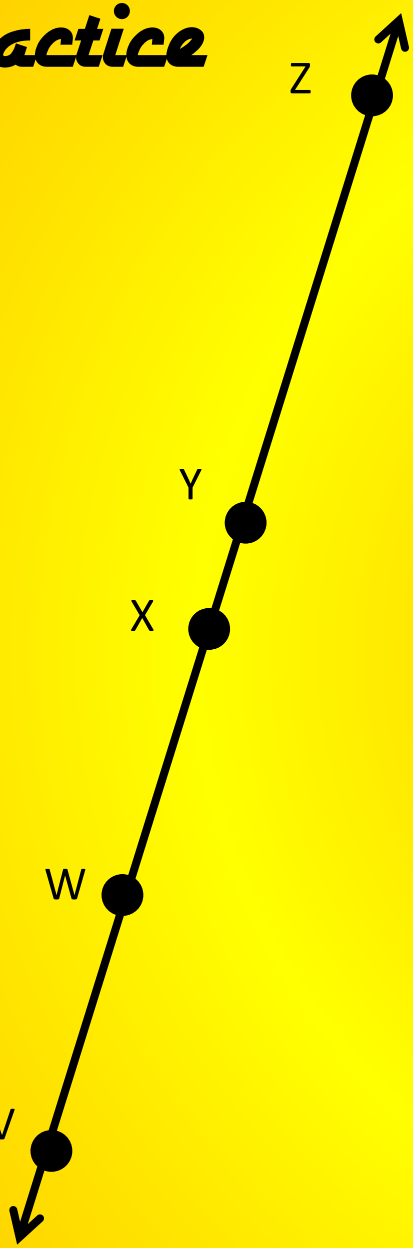


If B lies between A and C on segment AC, then the length of $\overline{AB}$ plus the length of $\overline{BC}$ is equal to the length of $\overline{AC}$.

$$AB + BC = AC$$

© Copyright 2014 Math Giraffe

Practice



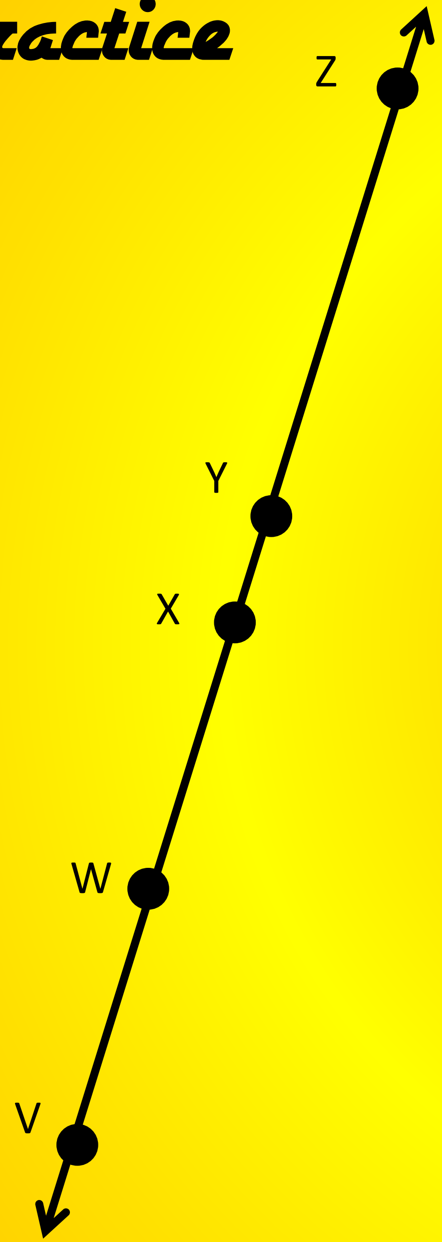
Given: X is the midpoint of $\overline{VZ}$,
VY = 16,
XY = 2
WX = 9

Find each length.

1	WY =	
2	VW =	
3	XZ =	
4	WZ =	
5	YZ =	
6	VZ =	

© Copyright 2014 Math Giraffe

Practice



Given: X is the midpoint of $\overline{VZ}$,
VY = 16,
XY = 2
WX = 9

Find each length.

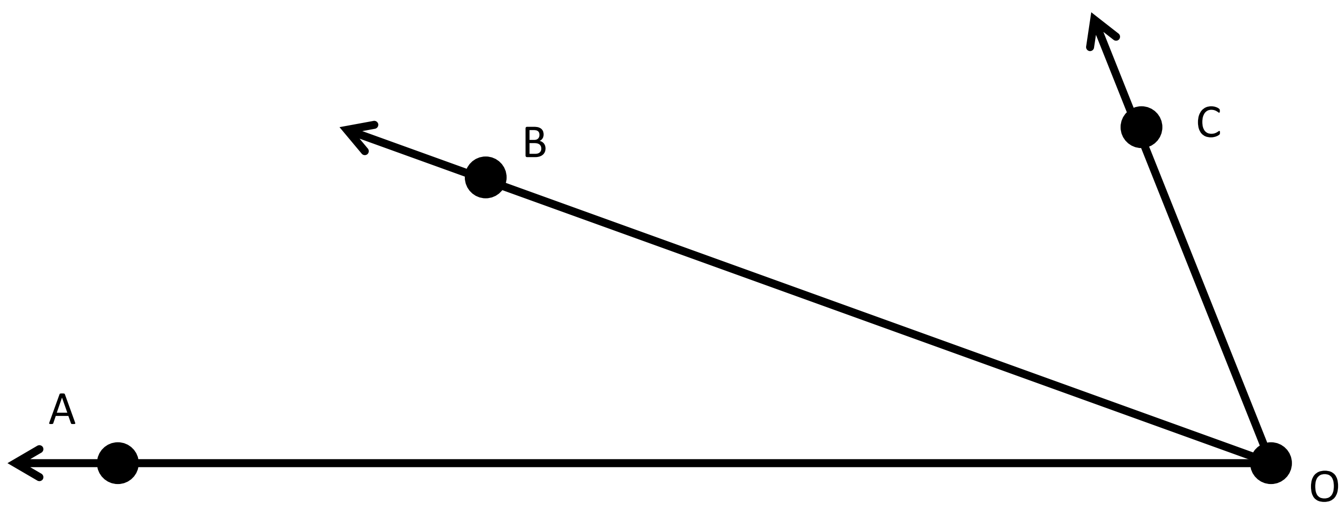
1	WY =	11
2	VW =	5
3	XZ =	14
4	WZ =	23
5	YZ =	12
6	VZ =	28

© Copyright 2014 Math Giraffe

Angle Addition Postulate:

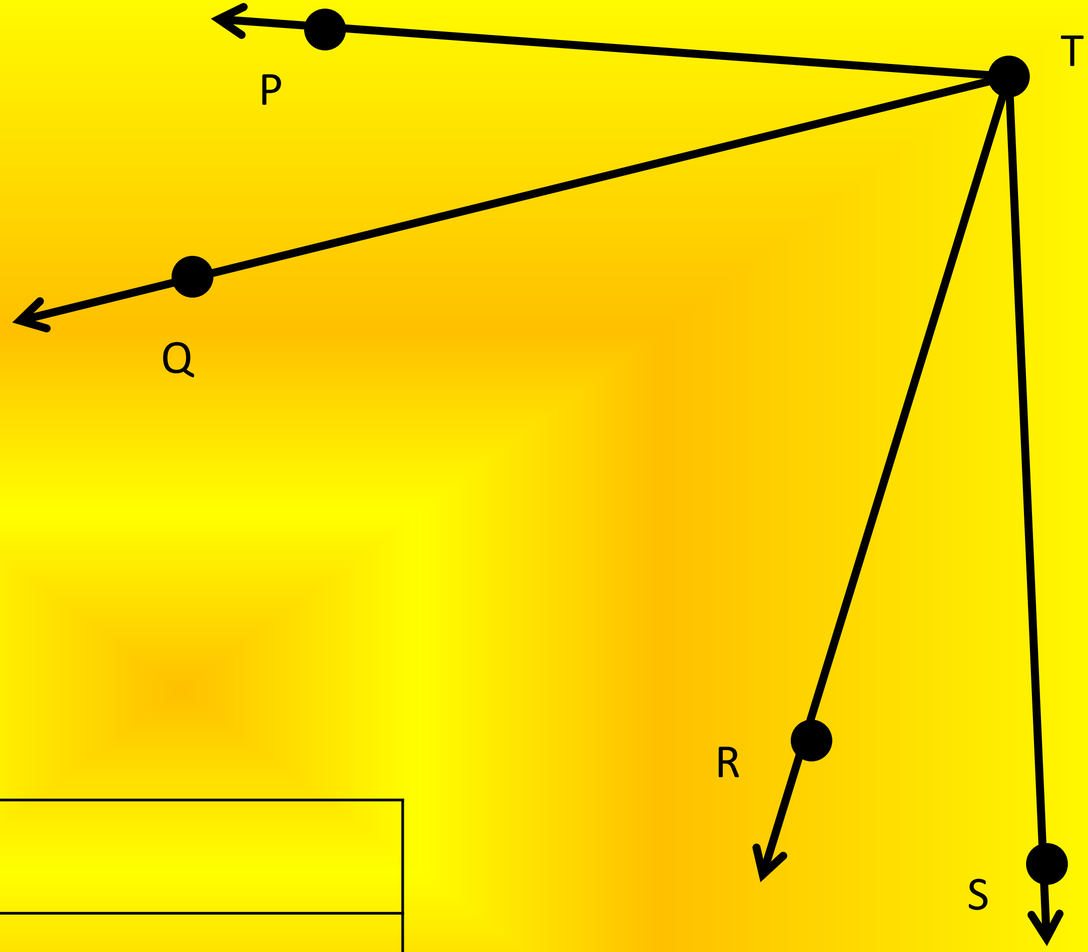
If B is in the interior of angle AOC, then the measure of angle AOB plus the measure of angle BOC is equal to the measure of angle AOC.

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



© Copyright 2014 Math Giraffe

Practice



Given: m<STQ = 78°

m<QTP = 31°

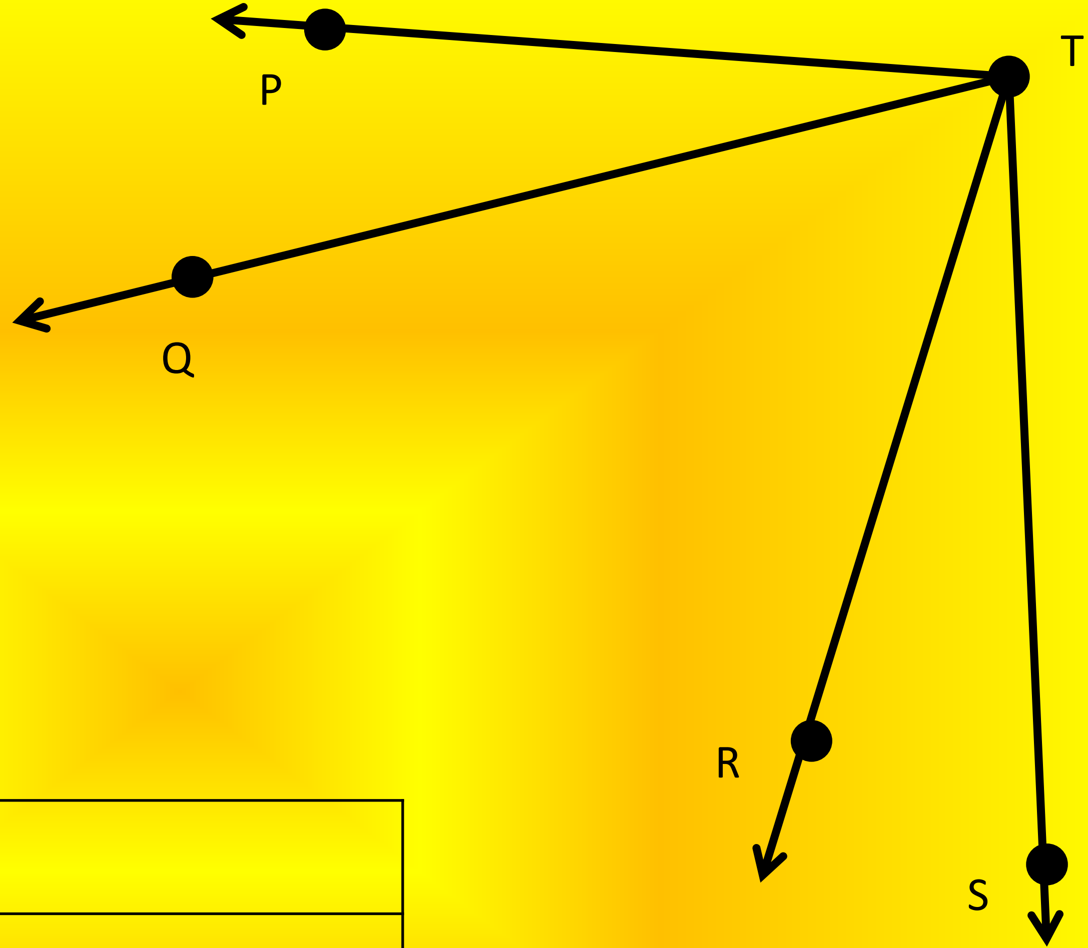
m<STR = m<QTP

Find each angle measure.

1	m<STP =	
2	m<STR =	
3	m<RTQ =	
4	m<RTP =	

© Copyright 2014 Math Giraffe

Practice



Given: m<STQ = 78°
m<QTP = 31°
m<STR = m<QTP

Find each angle measure.

1	m<STP =	109°
2	m<STR =	31°
3	m<RTQ =	47°
4	m<RTP =	78°

© Copyright 2014 Math Giraffe

We already know how to solve the following problem. Solve for x, and show every step of your work.

$$x + 3 = 5x - 8$$

Show all work!

Note that you use the Properties of Equality to solve for x.

Now, we will arrange these steps into a two-column proof to prove that the solution is $x = \frac{11}{4}$ and justify what we did in each step of the work.

© Copyright 2014 Math Giraffe

The Two-Column Structure for Proofs

LET'S REVIEW THIS SAMPLE PROOF TOGETHER. IT IS BASED ON THE SAME EQUATION WE JUST SOLVED.

The problem will contain at least one "Given" statement. Your end result must be the statement you are asked to "Prove."

The first column contains a series of statements that leads us logically from the given statement(s) to the fact that we are proving.

The second column contains the justifications for each statement.

Line one always contains the first given statement.

Justifications can include definitions, properties, postulates, and theorems that have already been accepted as true.

Sample Proof #1

Given: $x + 3 = 5x - 8$

Prove: $x = \frac{11}{4}$

	STATEMENT	JUSTIFICATION
1	$x + 3 = 5x - 8$	Given
2	$3 = 4x - 8$	Subtraction Prop. of Eq.
3	$11 = 4x$	Addition Prop. of Eq.
4	$\frac{11}{4} = x$	Division Prop. Of Eq.
5	$x = \frac{11}{4}$	Symmetric Prop. Of Eq.
6		

© Copyright 2014 Math Giraffe

Sample Proof #2

THE FIRST GIVEN STATEMENT WILL ALWAYS BE COPIED EXACTLY ONTO LINE ONE. IF THERE ARE MULTIPLE GIVEN STATEMENTS, THE ADDITIONAL STATEMENTS EACH WILL HAVE THEIR OWN LINE.

Given: <ABC ≅ <DEF
<DEF ≅ <JKL

Prove: <ABC ≅ <JKL

THE JUSTIFICATION FOR BOTH GIVEN STATEMENTS IS SIMPLY THAT WE WERE "GIVEN" THE STATEMENTS AND THUS MAY ASSUME THEY ARE TRUE.

	STATEMENT	JUSTIFICATION
1	<ABC ≅ <DEF	**Given**
2	<DEF ≅ <JKL	**Given**
3	<ABC ≅ <JKL	**Transitive Prop. Of Congruence (1, 2)**
4		
5		
6		

SINCE **SUBSTITUTION** AND THE **TRANSITIVE** PROPERTY ARE ALWAYS USED TO **COMBINE TWO PREVIOUS STATEMENTS**, WE MUST SPECIFY WHICH PREVIOUS LINES WE ARE USING.

WE DO NOT ALWAYS NEED ALL OF THE PROVIDED SPACE. THIS PROOF WAS SHORT.

© Copyright 2014 Math Giraffe

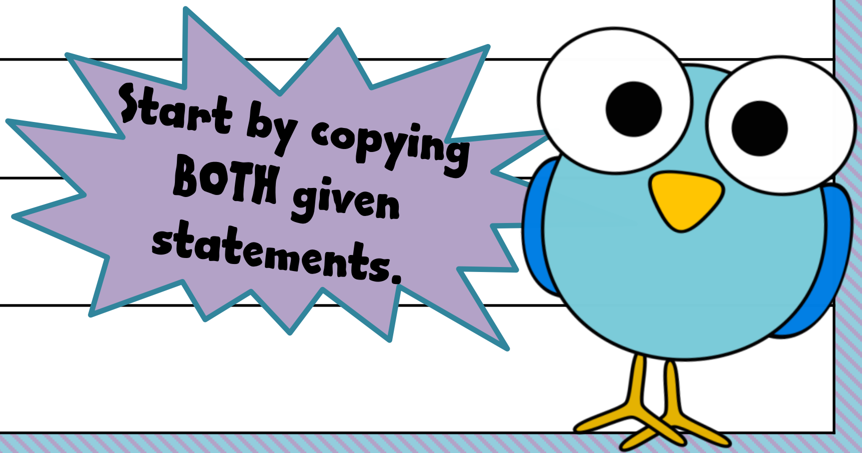
Let's complete the proof below together.

Given: $\frac{x}{10} = 3$, $y - 5 = 25$

Prove: $x = y$

Hint: You will need to use the properties of equality to solve the equations, then use the transitive property.

	STATEMENT	JUSTIFICATION
1		
2		
3		
4		
5		



(continued on next page)

© Copyright 2014 Math Giraffe

Let's complete the proof below together.

Given: $\frac{x}{10} = 3$, $y - 5 = 25$

Prove: $x = y$

Next, solve the first equation!

	STATEMENT	JUSTIFICATION
1	$\frac{x}{10} = 3$	Given
2	$y - 5 = 25$	Given
3		
4		
5		

(continued on next page)

Hint: You will need to use the properties of equality to solve the equations, then use the transitive property.

© Copyright 2014 Math Giraffe

Let's complete the proof below together.

Given: $\frac{x}{10} = 3$, $y - 5 = 25$

Prove: $x = y$

Now, solve the second equation.

	STATEMENT	JUSTIFICATION
1	$\frac{x}{10} = 3$	Given
2	$y - 5 = 25$	Given
3	$x = 30$	Multiplication Prop. of Equality
4		
5		

Hint: You will need to use the properties of equality to solve the equations, then use the transitive property.

(continued on next page)

© Copyright 2014 Math Giraffe

Let's complete the proof below together.

Given: $\frac{x}{10} = 3$,
$y - 5 = 25$

Prove: $x = y$

	STATEMENT	JUSTIFICATION
1	$\frac{x}{10} = 3$	Given
2	$y - 5 = 25$	Given
3	$x = 30$	Multiplication Prop. of Equality
4	$y = 30$	Addition Prop. of Equality
5		

Hint: You will need to use the properties of equality to solve the equations, then use the transitive property.

(continued on next page)

© Copyright 2014 Math Giraffe

Given: $\frac{x}{10} = 3$, $y - 5 = 25$

Prove: $x = y$

	STATEMENT	JUSTIFICATION
1	$\frac{x}{10} = 3$	Given
2	$y - 5 = 25$	Given
3	$x = 30$	Multiplication Prop. of Equality
4	$y = 30$	Addition Prop. of Equality
5	$x = y$	Transitive Prop. (3, 4)

© Copyright 2014 Math Giraffe

Given: $m = n$,
$n + p = 2t$,
$t = m$

Prove: $p = t$

Complete the proof.

	STATEMENT	JUSTIFICATION
1		
2		
3		
4		
5		
6		
7		

© Copyright 2014 Math Giraffe

Complete the proof.

Given: $m = n$,
$n + p = 2t$,
$t = m$

Prove: $p = t$

	STATEMENT	JUSTIFICATION
1	$m = n$	Given
2	$n + p = 2t$	Given
3	$t = m$	Given
4	$n = t$	Transitive Prop. (1, 3)
5	$n + p = 2n$	Subst. (2, 4)
6	$p = n$	Subtraction Prop. of Equal. (Subtract n from both sides.)
7	$p = t$	Transitive Prop. (4, 6)

© Copyright 2014 Math Giraffe

© Copyright 2014 Math Giraffe

Some proofs require additional justifications. We will now focus on proofs that use **definitions** and **postulates**.

Here are a few justifications that will be used frequently in proofs.

ANGLE ADDITION POSTULATE

CONGRUENT

MIDPOINT

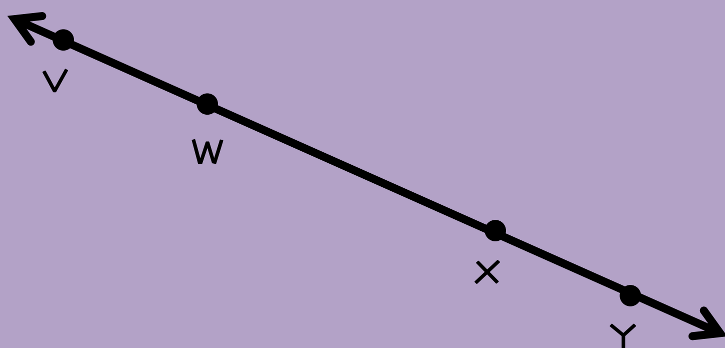
SEGMENT ADDITION POSTULATE

BISECTOR

EXAMPLE 1

Given: W is the midpoint of $\overline{VX}$.
XY = VW

Prove: $\overline{WX} \cong \overline{XY}$



Before beginning a geometry proof, take a minute to look and think. Figure out what you know and what you are trying to prove! Use the diagram.

	STATEMENT	JUSTIFICATION
1		
2		
3		
4		
5		
6		
7		
8		

(continued on next page)

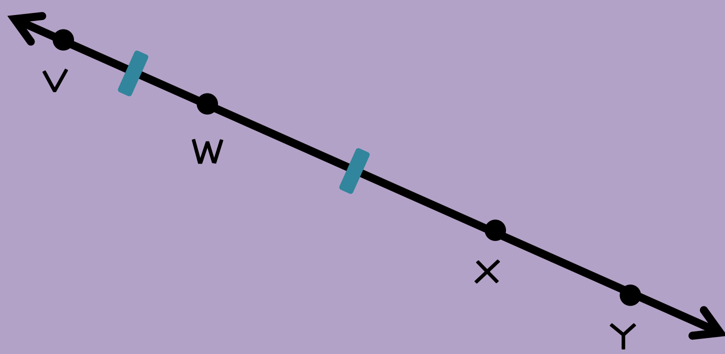
Start by copying the given information and marking it on the diagram.

© Copyright 2014 Math Giraffe

EXAMPLE 1

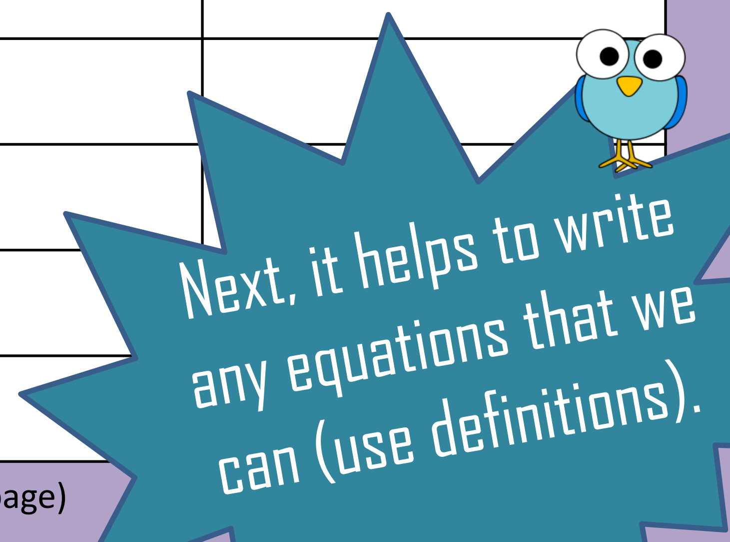
Given: W is the midpoint of $\overline{VX}$.
$XY = VW$

Prove: $\overline{WX} \cong \overline{XY}$



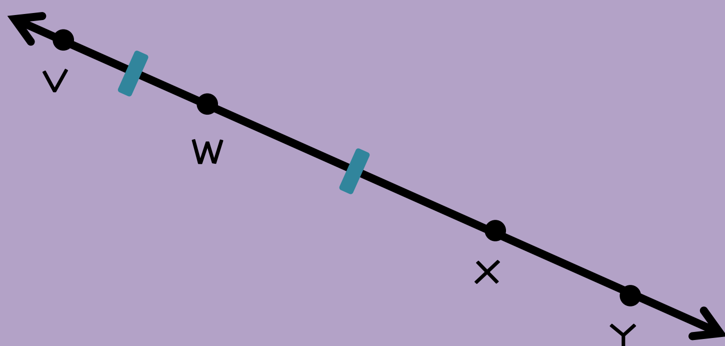
	STATEMENT	JUSTIFICATION
1	W is the midpoint of $\overline{VX}$.	Given
2	$XY = VW$	Given
3		
4		
5		
6		
7		
8		

(continued on next page)



© Copyright 2014 Math Giraffe

EXAMPLE 1



Given: W is the midpoint of $\overline{VX}$.
XY = VW

Prove: $\overline{WX} \cong \overline{XY}$

	STATEMENT	JUSTIFICATION
1	W is the midpoint of $\overline{VX}$.	Given
2	XY = VW	Given
3	VW = WX	Definition of midpoint
4		
5		
6		
7		
8		

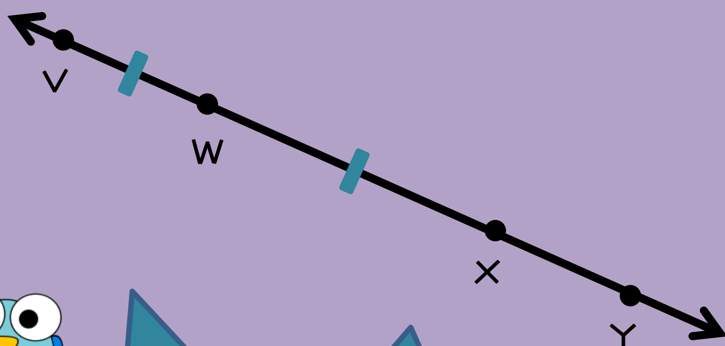
(continued on next page)

© Copyright 2014 Math Giraffe

EXAMPLE 1

Given: W is the midpoint of $\overline{VX}$.
XY = VW

Prove: $\overline{WX} \cong \overline{XY}$



	STATEMENT	JUSTIFICATION
1	**W is the midpoint of $\overline{VX}$.**	**Given**
2	**XY = VW**	**Given**
3	**VW = WX**	**Definition of midpoint**
4	**WX = XY**	**Transitive Prop. (2, 3)**
5		
6		
7		
8		

We are almost there! Our final line does not look QUITE like the goal, so we use one more definition.

(continued on next page)

© Copyright 2014 Math Giraffe

EXAMPLE 1

Given: W is the midpoint of $\overline{VX}$.
XY = VW

Prove: $\overline{WX} \cong \overline{XY}$

	STATEMENT	JUSTIFICATION
1	W is the midpoint of $\overline{VX}$.	Given
2	XY = VW	Given
3	VW = WX	Definition of midpoint
4	WX = XY	Transitive Prop. (2, 3)
5	$\overline{WX} \cong \overline{XY}$	Definition of Congruent
6		
7		
8		

The definition of congruent helps us convert between EQUALITY statements (equations) and CONGRUENCE statements.

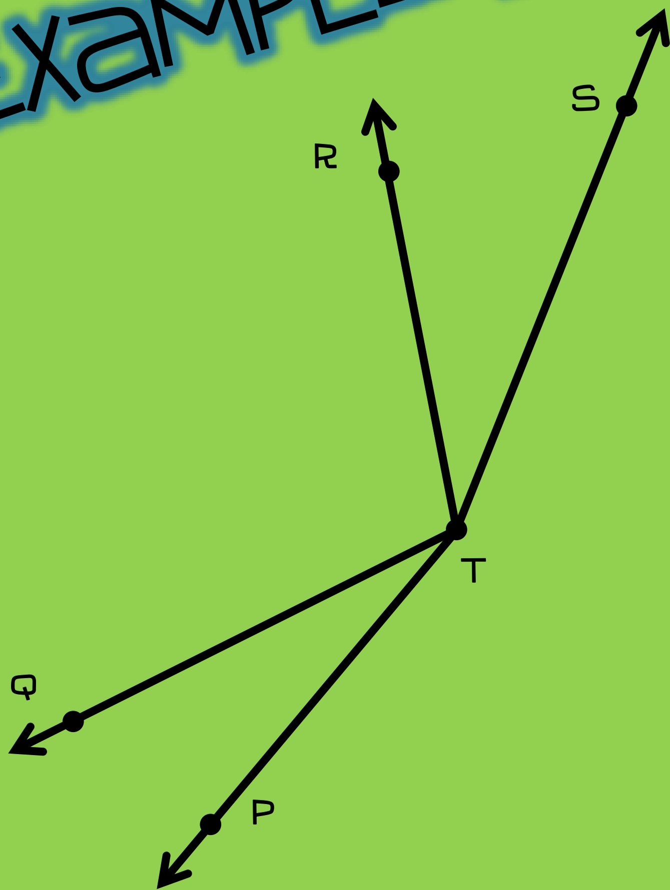
When segments have equal lengths, they are congruent.

© Copyright 2014 Math Giraffe

Example 2

Given: $\angle PTR \cong \angle QTS$

Prove: $\angle PTQ \cong \angle RTS$



	Statement	Justification
1		
2		
3		
4		
5		
6		
7		
8		

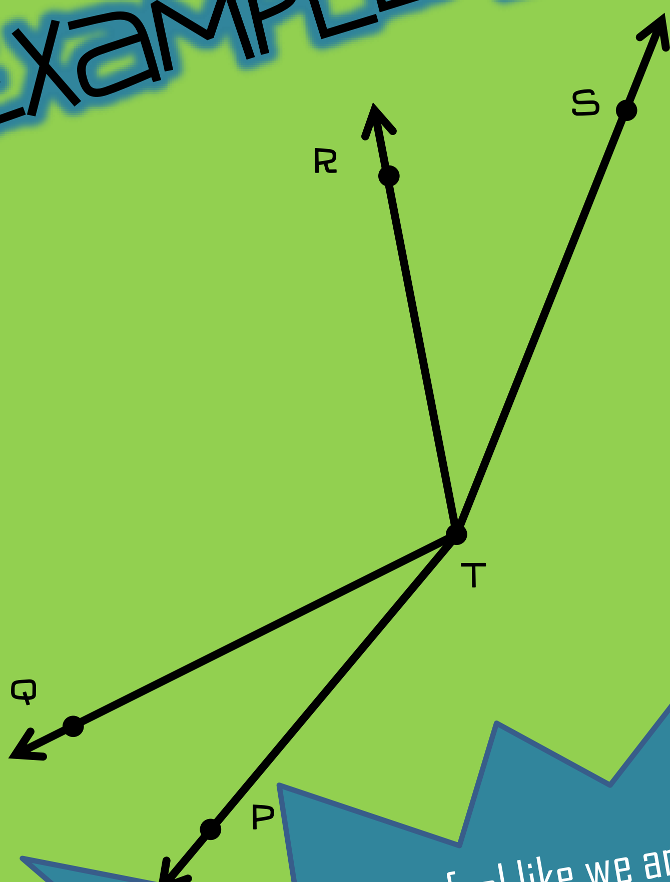
Before beginning a geometry proof, take a minute to look and think. Figure out what you know and what you are trying to prove! Use the diagram.

As always, start by filling in any given information. Then, let's see if we can convert it to an equation that we can work with a little more easily.

(continued on next page)

© Copyright 2014 Math Giraffe

EXAMPLE 2



Given: $\angle PTR \cong \angle QTS$

Prove: $\angle PTQ \cong \angle RTS$

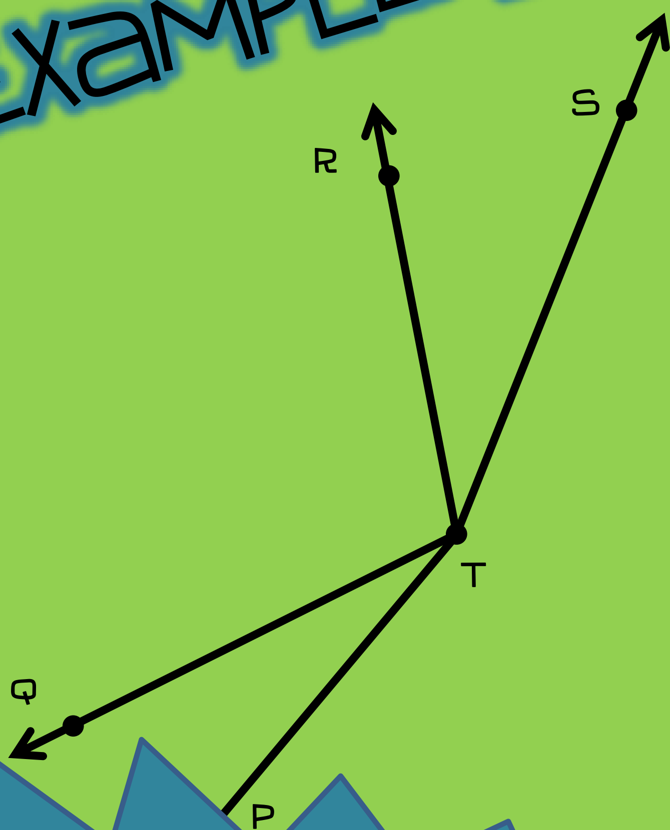
	STATEMENT	JUSTIFICATION
1	$\angle PTR \cong \angle QTS$	Given
2	$m\angle PTR = m\angle QTS$	Defn. congruent
3		
4		

Now, we may feel like we are stuck. This is when we use the diagram and think "Do I know anything else?" Sometimes, we can get additional information from the diagram. In this case, we can write some equations of our own using Angle Addition Postulate.

(continued on next page)

© Copyright 2014 Math Giraffe

EXAMPLE 2



Given: <PTR ≅ <QTS

Prove: <PTQ ≅ <RTS

	STATEMENT	JUSTIFICATION
1	<PTR ≅ <QTS	Given
2	m<PTR = m<QTS	Defn. congruent
3	m<PTQ + m<QTR = m<PTR	Angle Addition Post.
4	m<RTS + m<QTR = m<QTS	Angle Addition Post.
5		
6		
7		
8		

The Angle Addition Postulate gives us two new equations to work with. Now that we have a few lines of equations, let's try to combine some to get new statements that will lead us to our goal. Copy line 3, but replace m<PTR with m<QTS.

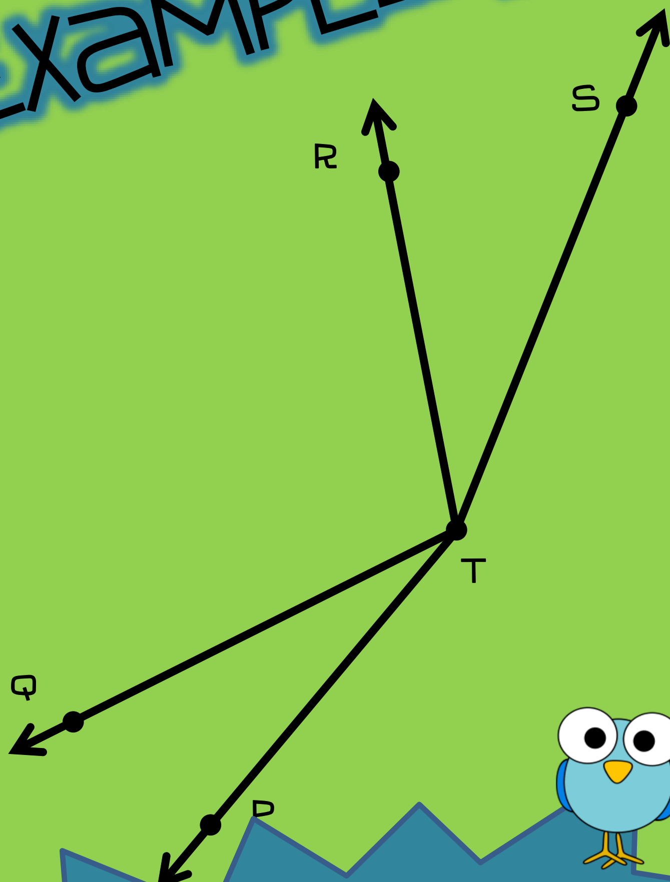
(continued on next page)

© Copyright 2014 Math Giraffe

EXAMPLE 2

Given: $<PTR \cong <QTS$

Prove: $<PTQ \cong <RTS$



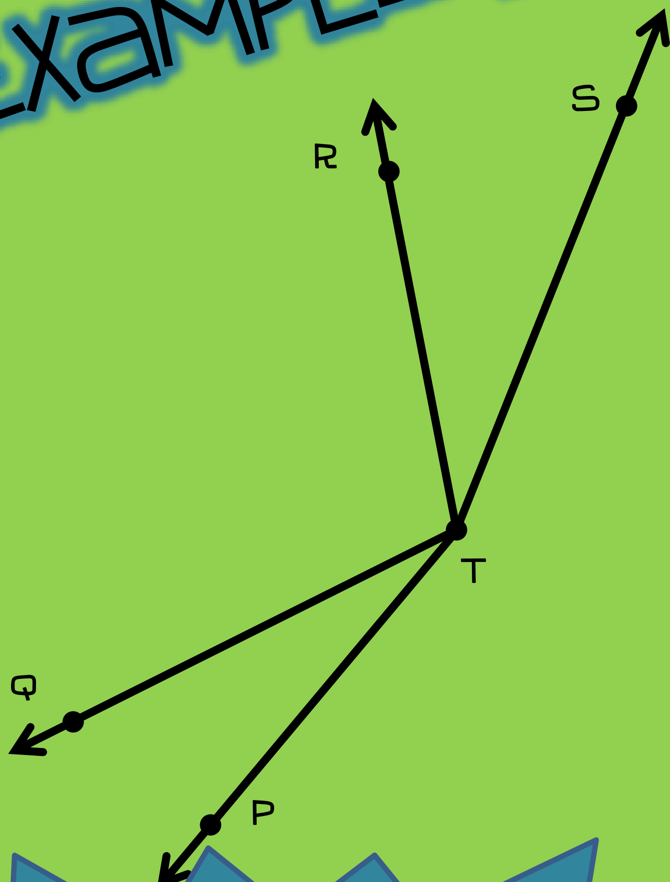
	STATEMENT	JUSTIFICATION
1	$<PTR \cong <QTS$	Given
2	$m<PTR = m<QTS$	Defn. congruent
3	$m<PTQ + m<QTR = m<PTR$	Angle Addition Post.
4	$m<RTS + m<QTR = m<QTS$	Angle Addition Post.
5	$m<PTQ + m<QTR = m<QTS$	Substitution (2, 3)
6		
7		
8		

Now, look at lines 4 and 5. When you notice that one entire side of the equation matches, that can be a signal to use the Transitive Property.

(continued on next page)

© Copyright 2014 Math Giraffe

EXAMPLE 2



Given: $\angle PTR \cong \angle QTS$

Prove: $\angle PTQ \cong \angle RTS$

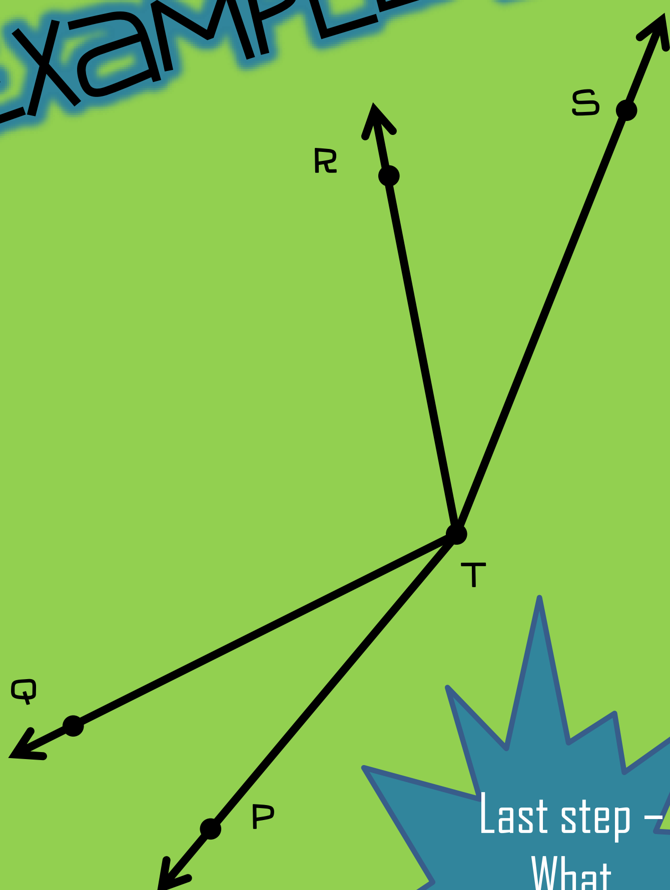
	STATEMENT	JUSTIFICATION
1	$\angle PTR \cong \angle QTS$	Given
2	$m\angle PTR = m\angle QTS$	Defn. congruent
3	$m\angle PTQ + m\angle QTR = m\angle PTR$	Angle Addition Post.
4	$m\angle RTS + m\angle QTR = m\angle QTS$	Angle Addition Post.
5	$m\angle PTQ + m\angle QTR = m\angle QTS$	Substitution (2, 3)
6	$m\angle RTS + m\angle QTR = m\angle PTQ + m\angle QTR$	Transitive Property (4, 5)
7		

We are almost there! Note that if we can get the m<QTR to drop away from both sides, we pretty much have the result we want. What property can make m<QTR "disappear?"

(continued on next page)

© Copyright 2014 Math Giraffe

Example 2



Given:	$<PTR \cong <QTS$
Prove:	$<PTQ \cong <RTS$

	Statement	Justification
1	$<PTR \cong <QTS$	Given
2	$m<PTR = m<QTS$	Defn. congruent
3	$m<PTQ + m<QTR = m<PTR$	Angle Addition Post.
4	$m<RTS + m<QTR = m<QTS$	Angle Addition Post.
5	$m<PTQ + m<QTR = m<QTS$	Substitution (2, 3)
6	$m<PTQ + m<QTR = m<RTS + m<QTR$	Transitive Property (4, 5)
7	$m<PTQ = m<RTS$	Subtraction Prop. of Equal.
8		

(continued on next page)

© Copyright 2014 Math Giraffe

EXAMPLE 2

Don't worry – It is normal if you are thinking "I would have no idea how to come up with the sequence of those steps myself!" – It takes practice. Take time to look if over and see how each step led to the next.

Given: <PTR ≅ <QTS

Prove: <PTQ ≅ <RTS

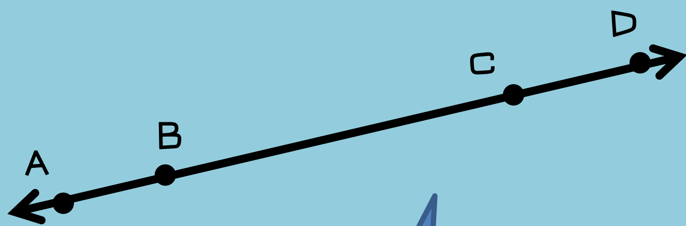
	STATEMENT	JUSTIFICATION
1	<PTR ≅ <QTS	Given
2	m<PTR = m<QTS	Defn. congruent
3	m<PTQ + m<QTR = m<PTR	Angle Addition Post.
4	m<RTS + m<QTR = m<QTS	Angle Addition Post.
5	m<PTQ + m<QTR = m<QTS	Substitution (2, 3)
6	m<PTQ + m<QTR = m<RTS + m<QTR	Transitive Property (4, 5)
7	m<PTQ = m<RTS	Subtraction Prop. of Equal.
8	<PTQ ≅ <RTS	Defn. congruent

© Copyright 2014 Math Giraffe

Example 3

Given: $AB = CD$

Prove: $AC = BD$



	Statement	Justification
1		
2		
3		
4		
5		
6		
7		
8		

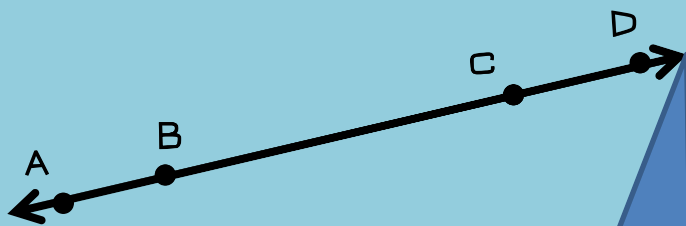
Start this one off. You should have a good idea how to begin. Once you've got the given statement, then start writing some equations using Segment Addition Postulate. See if you can then combine your equations to write new ones.

© Copyright 2014 Math Giraffe

EXAMPLE 3

Given: AB = CD

Prove: AC = BD



	STATEMENT	JUSTIFICATION
1	AB = CD	Given
2	AB + BC = AC	Segment Add. Post.
3	CD + BC = BD	Segment Add. Post.
4	AB + BC = BD	Substitution (1, 3)
5		
6		
7		
8		

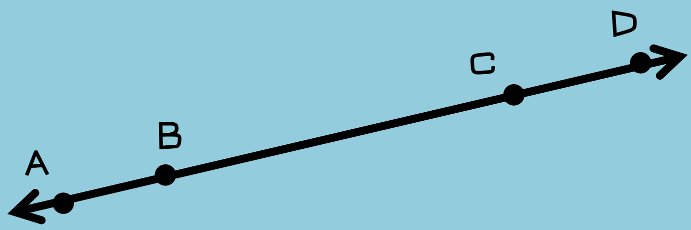
How far were you able to get on your own? We have to use substitution to get one side of the equation to match. We have a few options – there can be more than one correct proof. Here is one substitution you can do.

© Copyright 2014 Math Giraffe

EXAMPLE 3

Given: AB = CD

Prove: AC = BD



	STATEMENT	JUSTIFICATION
1	AB = CD	Given
2	AB + BC = AC	Segment Add. Post.
3	CD + BC = BD	Segment Add. Post.
4	AB + BC = BD	Substitution (1, 3)
5	AC = BD	Transitive Prop. (2, 4)
6		
7		
8		

© Copyright 2014 Math Giraffe

Review of steps

In general, when writing a two- column proof, we must:

1. Copy all given information
2. Pause to get an understanding of what you know and what you are trying to prove. Make marks on the diagram.
3. Write and work with equations based on the given statements if possible. (Sometimes you can convert statements into equations using definitions)
4. Develop new equations from the diagram if possible.
5. Manipulate and combine your equations, always keeping your goal in mind. (You can sometimes use the transitive property or substitution to combine two lines)

© Copyright 2014 Math Giraffe

Special Angle Pairs

REVIEW THESE ANGLE PAIRS:

COMPLEMENTARY ANGLES (2 & 3)

SUPPLEMENTARY ANGLES (4 & 5)

ADJACENT ANGLES (1 & 2)

VERTICAL ANGLES (6 & 8)

LINEAR PAIR (6 & 7)

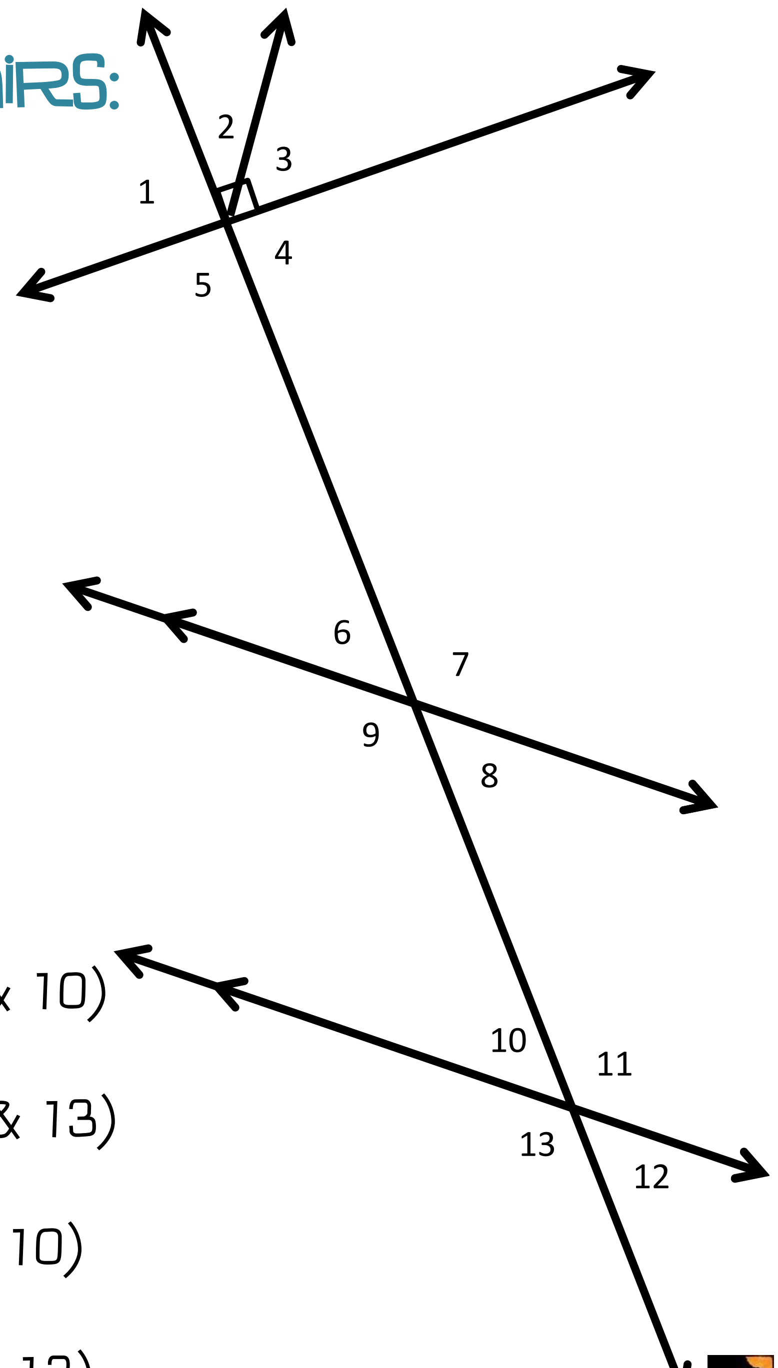
CORRESPONDING ANGLES (6 & 10)

ALTERNATE INTERIOR ANGLES (8 & 10)

ALTERNATE EXTERIOR ANGLES (7 & 13)

SAME-SIDE INTERIOR ANGLES (9 & 10)

SAME-SIDE EXTERIOR ANGLES (7 & 12)



© Copyright 2014 Math Giraffe

THEOREMS THAT YOU CAN USE AS JUSTIFICATIONS:

Vertical Angles Theorem: Vertical angles are congruent.

Right angles Theorem: All right angles are congruent.

Linear Pair Theorem: Angles in a linear pair are supplementary.

YOU MIGHT ALSO USE SOME NEW DEFINITIONS.
(SUCH AS THE FOLLOWING SAMPLES):

Definition of perpendicular

Definition of right angle

For Angles Along a Transversal:

Corresponding Angles Postulate: If lines are parallel, then corresponding angles are congruent.

Alternate Interior / Alternate Exterior Angles Theorems: If lines are parallel, then alternate interior / alternate exterior angles are congruent.

Same- Side Interior / Same- Side Exterior Angles Theorems: If lines are parallel, then same-side interior / same-side exterior angles are supplementary.

(We also often use the CONVERSES of the theorems regarding angles along a transversal.)

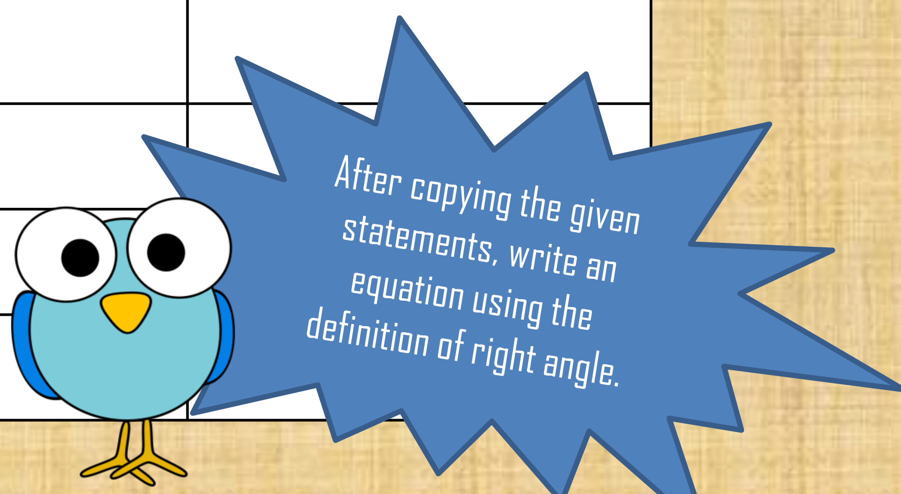
© Copyright 2014 Math Giraffe

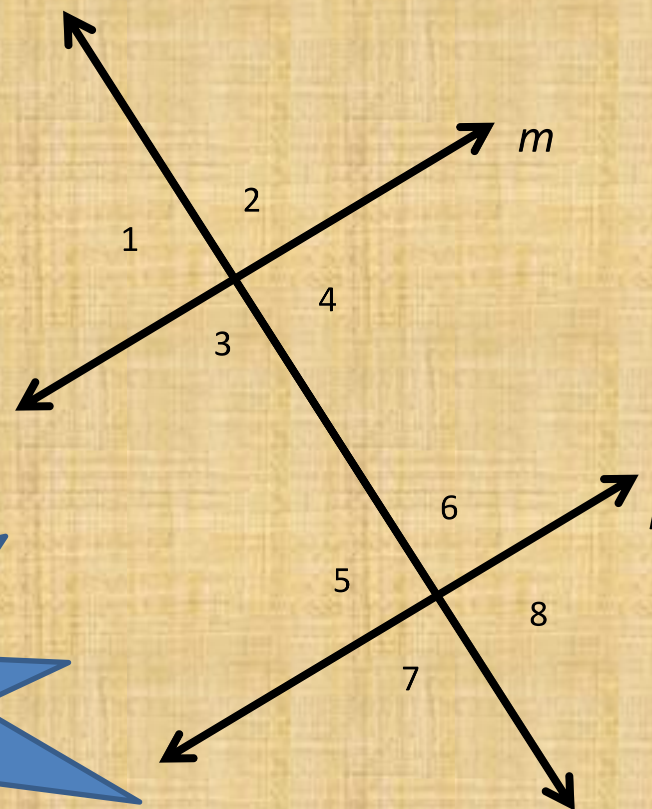
Given: Angle 2 is a right angle.
Lines m and n are parallel.

Prove: $m\angle 7 = 90^\circ$

LET'S TRY THIS PROOF

	STATEMENT	JUSTIFICATION
1		
2		
3		
4		
5		
6		
7		
8		



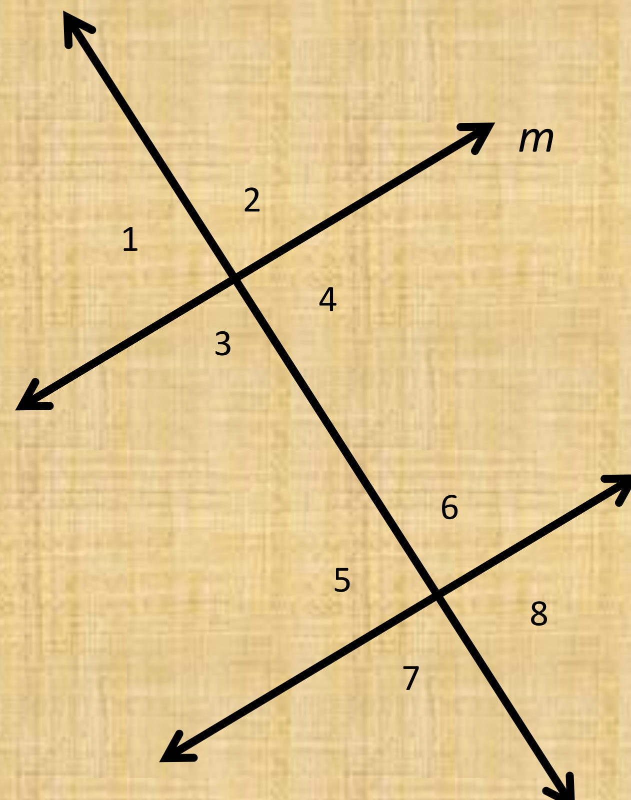


© Copyright 2014 Math Giraffe

Given:	**Angle 2 is a right angle.** **Lines m and n are parallel.**
Prove:	**m<7 = 90˚**

Choose the correct theorem for angles along a transversal. Remember our goal is to incorporate angle 7.

	STATEMENT	JUSTIFICATION
1	**Angle 2 is a right angle.**	**Given**
2	**Lines m and n are parallel.**	**Given**
3	**m<2 = 90**	**Defn. right angle**
4		
5		
6		
7		
8		

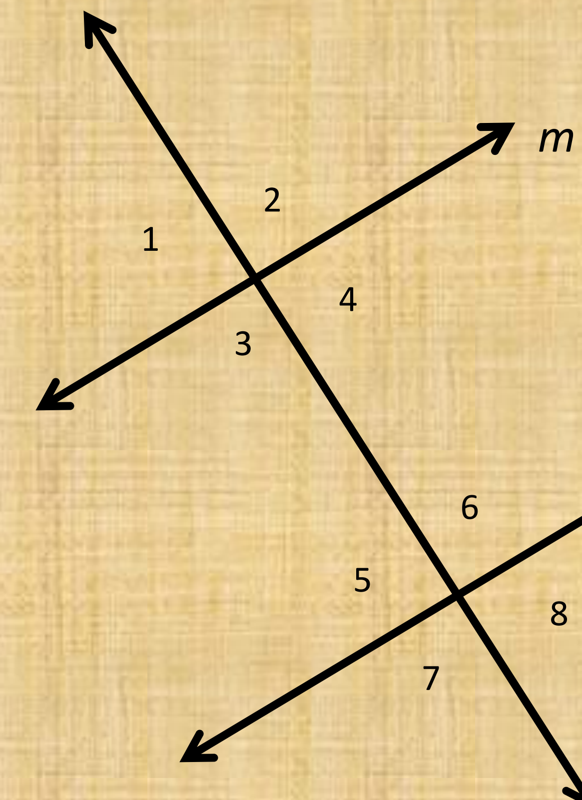


© Copyright 2014 Math Giraffe

Given: Angle 2 is a right angle.
Lines m and n are parallel.

Prove: $m\angle 7 = 90^\circ$

	STATEMENT	JUSTIFICATION
1	Angle 2 is a right angle.	Given
2	Lines m and n are parallel.	Given
3	m<2 = 90	Defn. right angle
4	m<2 = m<7	Alternate Exterior Angles Theorem
5		
6		
7		
8		

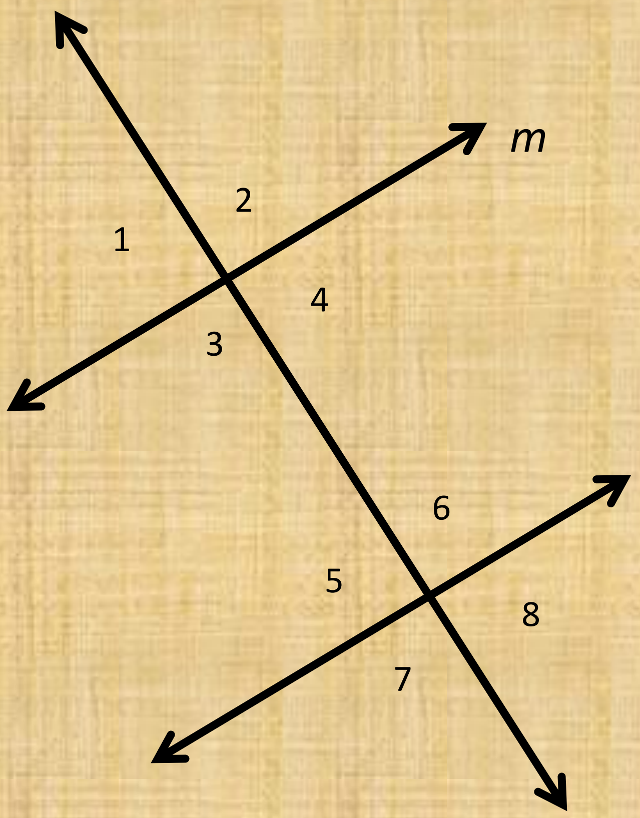


© Copyright 2014 Math Giraffe

Given: Angle 2 is a right angle.
Lines m and n are parallel.

Prove: $m\angle 7 = 90^\circ$

	STATEMENT	JUSTIFICATION
1	Angle 2 is a right angle.	Given
2	Lines m and n are parallel.	Given
3	m<2 = 90	Defn. right angle
4	m<2 = m<7	Alternate Exterior Angles Theorem
5	m<7 = 90	Substitution (3, 4)
6		
7		
8		

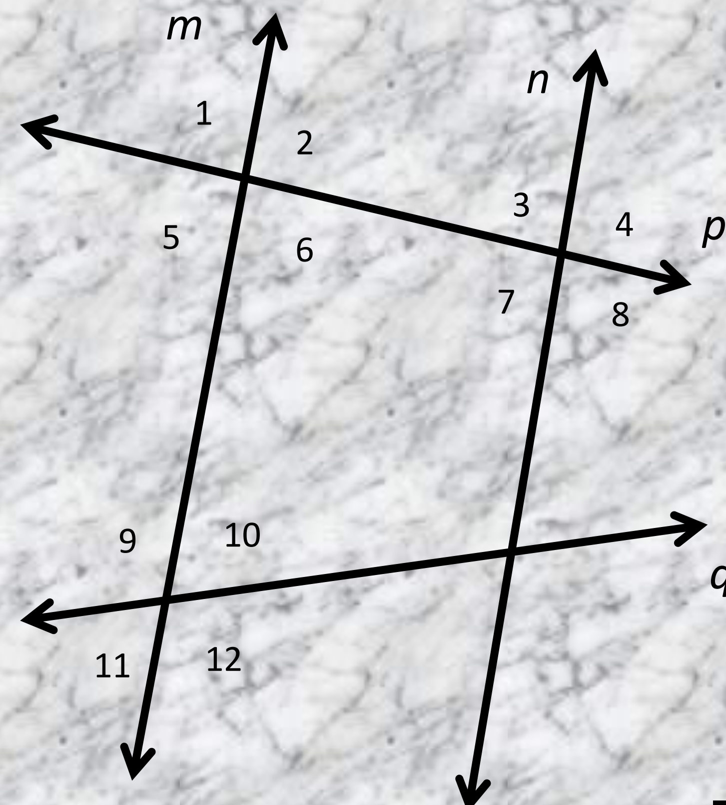


© Copyright 2014 Math Giraffe

Given:	$<9 \cong <3$
	m ll n
Prove:	**p ll q**

One more practice proof – try the whole thing!

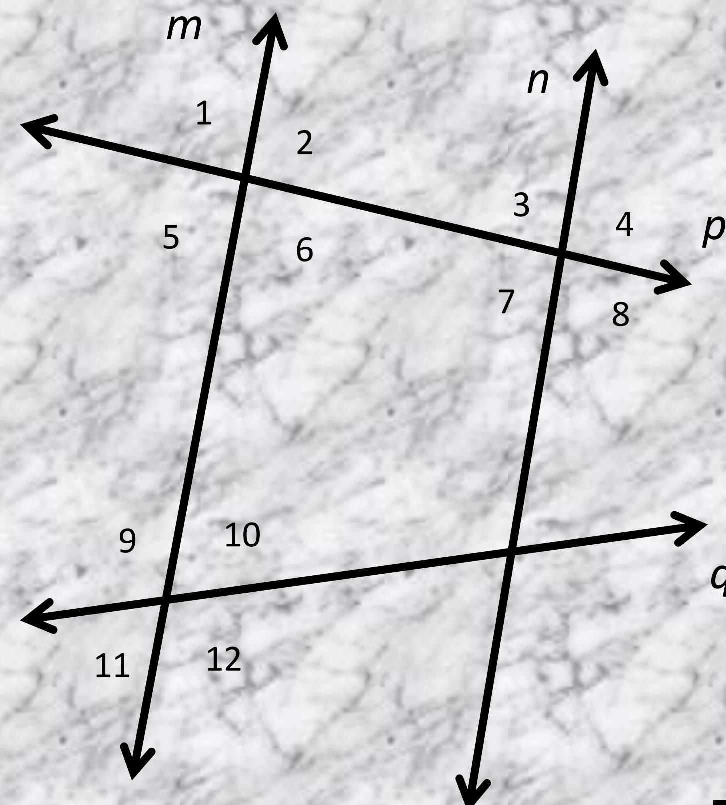
	Statement	Justification
1		
2		
3		
4		
5		
6		
7		
8		



© Copyright 2014 Math Giraffe

Given:	**<9 ≅ <3**
	m ll n
Prove:	**p ll q**

	STATEMENT	JUSTIFICATION
1	**<9 ≅ <3**	**Given**
2	**m ll n**	**Given**
3	**<1 ≅ <3**	**Corresp. Angles Post.**
4	**<1 ≅ <9**	**Transitive Prop. (1, 3)**
5	**p ll q**	**Converse of Corresp. Angles Post.**
6		
7		
8		



© Copyright 2014 Math Giraffe

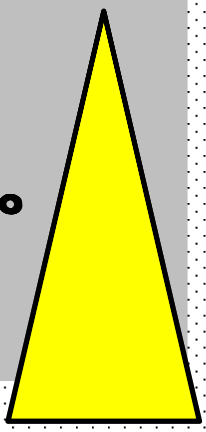
PROOFS WITH TRIANGLES

A few more theorems to use as justifications

TRIANGLE SUM THEOREM: The sum of the interior angles of a triangle is 180 degrees.

BASE ANGLE THEOREM FOR ISOSCELES TRIANGLES: If two sides of a triangle are congruent, then the two angles opposite them are congruent.

CONVERSE OF BASE ANGLE THEOREM: If two angles of a triangle are congruent, then the two sides opposite them are congruent.



© Copyright 2014 Math Giraffe