

# Daily Class Slides

Geometry Fall 2021  
Chandru Narayan

Wednesday, Sep 8th

# Introductions!

Chandru  
Narayan



Role at Bush: CS and Math teacher

What you were like in High School: Outgoing

Your first day of school tradition/superstition: Bowtie!

Who inspires you: Friendly People

Your interests outside of Bush: Bicycling, Astronomy

Something you are doing: Bicycling 110 miles to raise money for the Child Abuse Prevention dept at Mary Bridge Children's Hospital - My 15th year

A song you know all the words to: Katrinile Varum Geetham - A Tamil song about music in a light breeze

A talent I cherish: South Indian Cooking

# Introductions!

State your name clearly pronouncing first and last names

How would you like to be addressed?

Your personal pronouns

Something interesting or special/peculiar about you?

What are your expectations from this class?

# My teaching & learning philosophy

Frequent Practice vs. Occasional Perfection

To value hard work more than excellence

Have fun! Be curious to try new things

Apply your learning in the Geometry classroom elsewhere!

Procrastination may become the biggest challenge

# What and how will we learn?

## Fall 2021

Algebra Review

Points, Lines, Planes

Angles, Vertices, Bisectors

Widgets, Types of Angles

Polygons

Triangles

Conjectures. Reasoning.

Investigations. Projects.

## Spring 2022

Trigonometry

Quadrilaterals

Special Quads

Circles Arcs

Cylinder, Cone, Prism

Pyramid, Sphere

Proofs.

Real-world Problems.

# Measure of the Earth! - Measure of Self!

How do we measure our learning?  
Understanding and Assessments

Standards of Learning Maths:

- Communication (clear, concise, method, visual)
- Collaboration (team work, online resources, teaching!)
- Curiosity (ask why? extend ideas, learn new skills)
- Organization (what is where, writing, sketching, toolbox)
- Problem-solving (solutions, accuracy, verification)

# Benchmarks and Assessments

Each of the 5 Standards are broken-down into Benchmarks or Skills

These Benchmarks are then associated with Assignment Rubrics

Each Benchmark is scored on a 1-4 scale

Four Scales of Assessment:

1. Not yet demonstrated exposure to skill
2. Exposed to skill and can apply at a basic level
3. Competent with skills & content apply its core concepts
4. Fluent with content and apply to multiple contexts

[See details of Benchmarks linked here](#)

# Textbook Geometry Resources etc.

1. Textbook - Discovering Geometry 4th Edition by Michael Serra
2. Online Class Text
  - a. username: firstname.lastname
  - b. password: 12345
  - c. pin: 98112
3. Geometry Instruments - Straight Edge, Ruler Compass, Protractor, Sharpened Pencils, Calculator - Pickup from me today!
4. Toolbox - A well-maintained notebook of sketches, definitions and formulas that you will create. Pickup from me today!
5. Geogebra Math App (we will return to this later)

# Online Sources and References

1. Conferences
  - a. *Conference Hours: 3:10-3:30 PM in WS 204A on days Class is held. No appointment needed*
  - b. *Please sign up for extra remote conference time using Zoom. [Schedule via Calendly here](#)*
2. [Google Classroom](#) - our class page where you will access many assignments and resources
3. [Bush Portal](#) - portal page where you will find the syllabus, grades, and calendar
4. [Syllabus](#) - Geometry Syllabus & Grading

# Where do I start each day!

1. [Bush Portal](#) - *portal page where you will find the syllabus, grades, and calendar*
2. [Google Classroom](#) - *our class page where you will access many assignments and resources*
3. Review [Daily Classwork slides](#) for previous and upcoming days
4. Attend Classes
5. Setup up conferences
6. Reach out to me by eMail

# Topics Outline for Fall Semester

## FIRST UNIT: LINES ANGLES TRIANGLES - Chapters 1 - 4

- Vocabulary: line, line segment, ray, point, different types of angles and triangles
- Notation: a common way of writing math so that you don't have to write sentences!
- Linear equations: mathematical relationships between variables which change linearly
- Slope relationships of parallel lines and perpendicular lines
- Inductive vs deductive reasoning
- Angle relationships in triangles (sum of all angles, isosceles/equilateral triangles, etc)
- Pythagorean Theorem
- Triangle inequalities (greater than, less than, not equal to)
- Proving triangles are congruent
- Solving algebra equations

## SECOND UNIT: POLYGONS - Chapter 5

## THIRD UNIT: CIRCLES - Chapter 6

We will first go into breakout into teams

Complete the first Classroom assignment!

“Turn-in” your assignment!

# of faces painted	$1 \times 1 \times 1$	$2 \times 2 \times 2$	$3 \times 3 \times 3$	$4 \times 4 \times 4$	$5 \times 5 \times 5$
0					
1					
2					
3					
4					
5					
6					
Total # of cubes:					



# Ready to break out?

1. We will breakout into teams
2. Talk amongst yourselves to help each other
3. I will walk by to see if you have any questions
4. Try to complete this during class time
5. It is OK if time runs out - make sure you decide how you will complete and submit it - one per team!
6. Complete this and your Reading assignment by Friday (it should be quick and fun!)

QUESTIONS?

Friday, Sep 10th

# Check-In

Kahoot! (Hint: Open up both of the “Hot Links” on the GEO Portal !)

# Overview for today

Review of last class period

Syllabus & Grading review

Investigation: Algebra and Linear Equations!

Building Blocks of Geometry - Book Chapter 1.1 (Page 28)

Assign Homework

# Review of last period

Did you upload your Painted Cube Investigation?

- Continue to ponder the formula part of the investigation (we will comeback to this at a later section)

Did you learn to use Camscanner?

- you need to submit as a SINGLE PDF
- Each of you will submit in our upcoming homework. So make sure you have Camscanner downloaded and working on your phone!

Did you watch the Induction/Deduction video?

- this will make even more sense as we cover additional topics

# Syllabus & Grading Review

Where to access ? [Syllabus & Grading review](#)

# Investigation - Algebra & Linear Equations

Classwork Investigation: [Linear Equations Algebra Investigation](#)

- We will start this in class as a team. This is not a graded assignment. You still need to submit to earn full points. This helps establish your level of algebra understanding to date so we can make adjustments as needed. Here are good online refreshers for [Fractions](#) and [Algebraic Equations](#).
- Do not use a calculator to solve problems unless when called for

# Homework & Reminders

## Homework:

1. [Watch Geo Vocabulary Video](#) and Write definitions in your Toolbox as you watch video - Complete by leaving comments/questions. No submission Needed
2. [Tools of Geometry Practice](#) - Submit completed constructions

## Reminders:

- Complete HW assigned from Portal. It is linked to assignments in Google Classroom.
- Submit as SINGLE Pdf using CamScanner.
- Turn-In your Google Classroom Assignment!
- Bring your notebook, toolbox, pencils, calculator, charged laptop (needed for textbook reference etc)

Tuesday, Sep 14th

# Overview for today

Check-in

Review of last class period

Midpoint formula investigation

Introduce 1st Quiz (Monday)

Homework - 1st reflection

# Review

Linear Equations Review (AK posted)

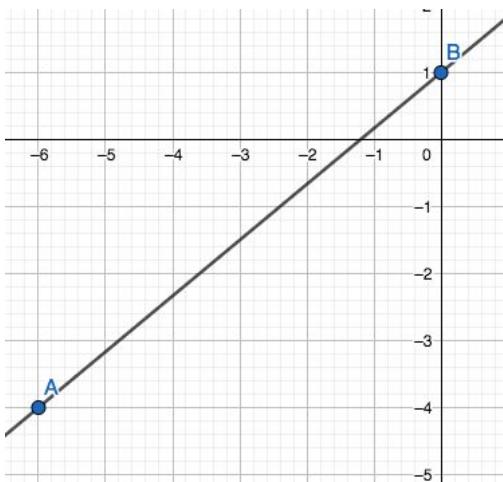
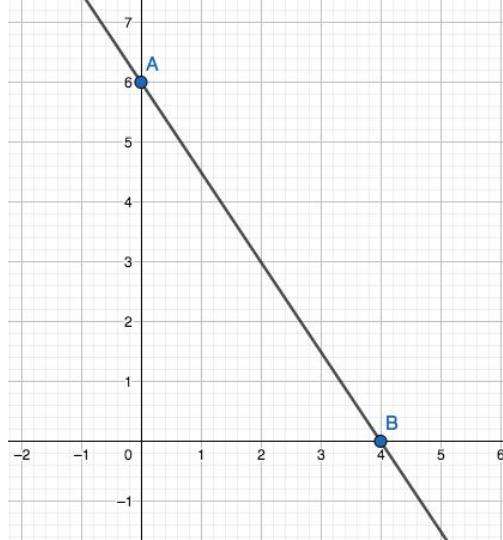
Slope = Rise/Run ([Visualize Slope Here!](#))

Eqn of Line:  $y = mx + b$  where  $m$  is slope and  $b$  is y-offset

$y = -\frac{1}{3}x + 4$  Graph this - What is the slope? What is the y-offset?

$y = 4x - 2$  Graph this - What is the slope? What is the y-offset?

What are the slopes of the lines in graphs on the right? What are the y-offsets?



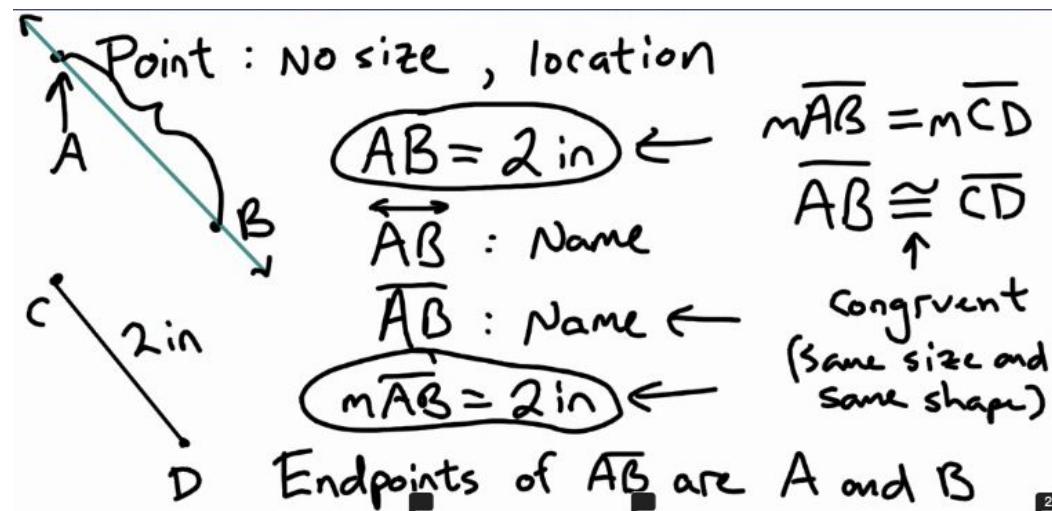
Review Building Blocks of Geometry (Vocab/Notation)

Did you watch video? We will cover in class

[Book Chapter 1.1](#) (Page 28)

# Building Blocks of Geometry - Vocabulary & Notations

Building Blocks of Geometry - [Book Chapter 1.1](#) (Starting Page 28)



# Building Blocks of Geometry - Vocabulary & Notations

Building Blocks of Geometry - [Book Chapter 1.1](#) (Starting Page 28)



G is the midpoint of  $\overline{EF}$ , because  $\overline{EG} \cong \overline{GF}$ .

G bisects  $\overline{EF}$ .



# Building Blocks of Geometry - Vocabulary & Notations

Building Blocks of Geometry - [Book Chapter 1.1](#) (Starting Page 28)

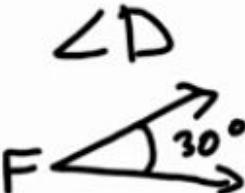
The diagram shows an angle  $\angle ABC$  with vertex  $B$ . The ray  $BA$  is labeled "Sides" and the point  $B$  is labeled "Vertex". A protractor is used to measure the angle, with the arc from  $B$  to  $C$  showing approximately 37 degrees. Below the angle, the text  $m\angle ABC \approx 37^\circ$  is written, with an arrow pointing to the measured value. To the right, it is noted that  $360^\circ = \text{a full circle}$ .

Below the angle, two other angles are shown:  $\angle D$  and  $\angle F$ . Both angles have a measure of  $30^\circ$  indicated by arcs. The text  $\angle D \cong \angle F$  is written, followed by the word "because". Below this, the equation  $m\angle D = m\angle F = 30^\circ$  is shown.

14:46 / 16:35      ⚙️ 🗑️ 🔍

# Building Blocks of Geometry - Vocabulary & Notations

Building Blocks of Geometry - [Book Chapter 1.1](#) (Starting Page 28)



$$\angle D \cong \angle F$$

because

$$m\angle D = m\angle F = 30^\circ$$



$\overrightarrow{NO}$  bisects  $\angle MNP$   
because  $\angle MNO \cong \angle ONP$ .

# What goes in your Toolbox?

Here is a checklist you might want to use!

## Reference Materials

⋮



Geometry Syllabus and Grading

Posted Sep 6



Geometry Online Textbook

Edited Sep 6



What goes in your Toolbox?

Posted 6:59 AM

⋮



Random Teams and Order

Posted Sep 6



Team Role Descriptions

Posted Sep 6



Using Geogebra to plot a quadrilateral

Posted Sep 6



Geometry Solutions Whiteboards for Specif...

Draft

## Vocabulary Words a

Point

Line

Line segment

Endpoints

Midpoint

Congruent line segments

Collinear

Bisects

Ray

Plane

Coplanar

Angle

Vertex

Side

Measure of an angle

Degrees

Protractor

Angle bisector

Congruent angles

Complementary Angles

Supplementary Angles

Linear Pair of Angles

Vertical Angles

Right Angle

Acute Angle

Obtuse Angle

# Midpoint formula Investigation

Get Investigation from Chandru

Complete in class - Upload as a single PDF

# Quiz 1 on Monday Sep 20th

You will take a 30 minute quiz at the end of class on Monday which will cover the following benchmarks. You can use a calculator, your tools of Geometry, and your toolbox.

COM01	Student communicates their thinking and justifies their solutions in a logical and precise manner, whether verbally, pictorially, in writing, or graphically.
COM02	Student uses common vocabulary to express mathematical ideas.
COM03	Student uses common notation to express mathematical ideas.
COM04	Student can mark, and interpret markings in, drawn diagrams.
GEN02	Student can solve linear algebraic equations.
GEN03	Student can use geometric tools such as rulers, protractors, and compasses.
LAT01	Student can calculate missing information related to a graphed line segment's endpoints and midpoint.
LAT02	Student can graph linear equations and write equations of graphed lines.

# Week 1 Reflections

Please complete this over the weekend so that I can help you as needed.

I appreciate your time in doing this.

Thursday, Sep 16th

# Check-In

Monitoring progress on submissions - good punctuality!

Completed the Midpoint formula Investigation?

Added STEM coaches to Portal

**STEM Center Coaches Contacts:**

Elise Lombardi: [elise.lombardi@bush.edu](mailto:elise.lombardi@bush.edu)  
and 206-316-6948

Harriet Simons: [harriet.simons@bush.edu](mailto:harriet.simons@bush.edu)  
and 206-890-1767

# What's happening today?

Review:

Midpoint Formula Investigation

Slope of Line, y-intercept, Equation of Line

What goes in your Toolbox?

New Chapter 2.5: Linear Pair of Angles & Vertical Angles

Investigation - Complete as Homework if we run out of time

Reminder for Quiz

# Review (all of these will be important for the quiz!)

Midpoint Formula Investigation - Did you complete ?

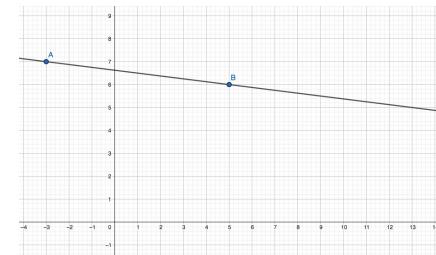
Slope of Line, y-intercept, Equation of Line

Find the equation of line which passes through  $(-3, 7)$  &  $(5, 6)$

Find it's midpoint using formula and verify visually!

Extend the line assuming  $(5, 6)$  as the new midpoint, find the other endpoint

What goes in your Toolbox - example



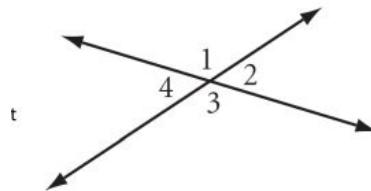
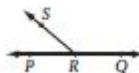
# Linear Pair & Vertical Angles

New Chapter 2.5 in textbook (Page 122) - Our first Conjectures!



## Investigation 1

### The Linear Pair Conjecture



### Linear Pair Conjecture

C-1

If two angles form a linear pair, then ?.

### Vertical Angles Conjecture

C-2

If two angles are vertical angles, then ?.

Complete Investigation handed out in class

Problems of the Day (POD): Chapter 2.5: 5, 6, 9, 10, 11, 13, 19

## Vocabulary Words a

Point
Line
Line segment
Endpoints
Midpoint
Congruent line segments
Collinear
Bisects
Ray
Plane
Coplanar
Angle
Vertex
Side
Measure of an angle
Degrees
Protractor
Angle bisector
Congruent angles
Complementary Angles
Supplementary Angles
<u>Linear Pair of Angles</u>
<u>Vertical Angles</u>
Right Angle
Acute Angle
Obtuse Angle

# Reminder for Quiz

Complete your Toolbox notebook so that can use in Quiz

Cannot use your regular notebook

Bring your Geometry instruments, sharpened pencils, calculator

Quiz will last about 45 minutes

Will include everything except Linear Pair and Vertical Angles

First practice problems on your own from Daily class Slides and from Homework, verify your own answer by sight and by plugging answers back into your equations

Also check the Answer Keys I posted in GC (Look for AK ....)

You can email me if you are really confused, we can schedule a Zoom to discuss

Monday, Sep 20th

# Check-In

Welcome back!!

Did you look at the [Answer Keys for the Linear Equations & Midpoint Formula Investigations?](#)

When walking to Schuchart for MMM - walk on Republican! (avoid MS or LS)

What POD?

What is PON?

# American Mathematics Competition!

**What?**: The American Mathematics Competition is exactly that. Kids from around the country take this timed math exam at the same time. Studying for this exam builds problem-solving skills and mathematical knowledge in middle and high school students. The AMC 10 and AMC 12 are both 25-question, 75-minute, multiple-choice examinations in high school mathematics designed to promote the development and enhancement of problem-solving skills.

The AMC 10 is for students in 10th grade and below, and covers the high school curriculum up to 10th grade. Students in grade 10 or below and under 17.5 years of age on the day of the contest can take the AMC 10. The AMC 12 covers the entire high school curriculum including trigonometry, advanced algebra, and advanced geometry, but excluding calculus. Students in grade 12 or below and under 19.5 years of age on the day of the contest can take the AMC 12.

**Why?**: Some students do it just for fun and some to compete with kids from around the country. If a student performs well, they may be invited to take the AIME (the American Invitational Mathematics Exam) and it may look good for colleges.

**When?**: The exam is Wednesday November 10<sup>th</sup> but we need to know about your interest by NEXT FRIDAY SEPTEMBER 24<sup>th</sup>. Tom will send an e-mail.

**How?**: Respond to Tom's e-mail!

**Practice questions (that showed up on last year's AMC 10 exam):**[https://artofproblemsolving.com/wiki/index.php/2021\\_AMC\\_10A\\_Problems](https://artofproblemsolving.com/wiki/index.php/2021_AMC_10A_Problems)

## Vocabulary Words a

Point
Line
Line segment
Endpoints
Midpoint
Congruent line segments
Collinear
Bisects
Ray
Plane
Coplanar
Angle
Vertex
Side
Measure of an angle
Degrees
Protractor
Angle bisector
Congruent angles
<del>Complementary Angles</del>
<del>Supplementary Angles</del>
<del>Linear Pair of Angles</del>
<del>Vertical Angles</del>
Right Angle
Acute Angle
Obtuse Angle

# What's happening today?

## Review Last Week:

We covered Geo Notation last week.

We will add 2 more Complementary and Supplementary angles

Started Chapter 2.5: Linear Pair of Angles & Vertical Angles

Completed LP and VA investigation

## Today:

Prove LP & VA Conjectures

After a break Take Quiz 1

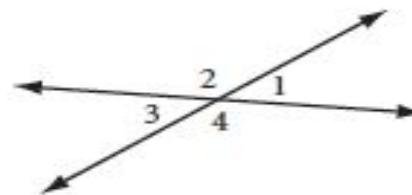
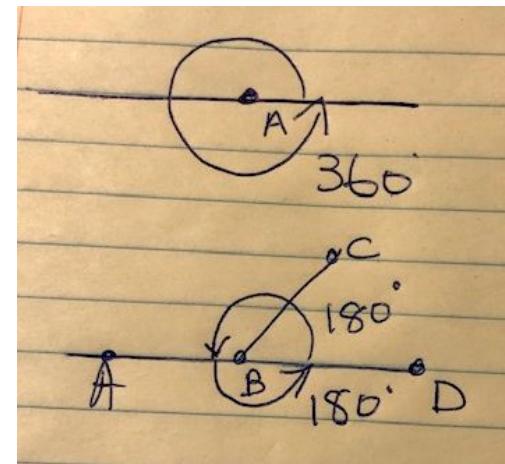
# Prove LP & VA Conjectures Chap 2.5 Page 122

By definition the angle measure around a point is 360 degrees

Can you now deductively prove that the Linear Pair Conjecture?

How about proving the Vertical Angles Conjecture?

Use the Linear Pair Conjecture and the diagram at right to write a deductive argument explaining why  $\angle 1$  must be congruent to  $\angle 3$ .



# Quiz

You have 45 minutes to complete the quiz (hard stop by 3:10)

You will need:

Sharpened Pencils, Eraser

Calculator

Geometry Set

Toolbox (notebook of notations & formulas)

Extra paper and graph sheets (I will provide)

Earn 100% back in test corrections!

YOU GOT THIS! Good luck!

Wednesday, Sep 22nd

# Check-In

Welcome back!!

We are going to switch our seats! (Appoint Recorder and Facilitator!)

Quiz 1 grading and corrections

Did you complete the LP and VA Investigation?

All investigations need to be uploaded by each student even if you completed it as a team!

What is a PON & POD?

Are you working on the LP VA PON?

# What's happening today?

REVIEW:

Introduce Complementary & Supplementary Angles

TODAY:

Introduce Complementary & Supplementary Angles

Do some Chapter 2.5 LP & VA POD (from 1:40 to 2:10)

Introduce Parallel Lines

[Do the Parallel Lines Investigation](#)

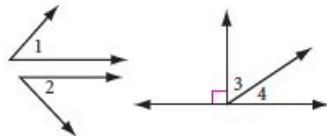
Special Angles on Parallel Lines

Do some Parallel Lines POD

# Complementary & Supplementary Angles

**Complementary Angles** | A pair of complementary angles has a sum of  $90^\circ$ .

$$m\angle 1 + m\angle 2 = 90^\circ$$

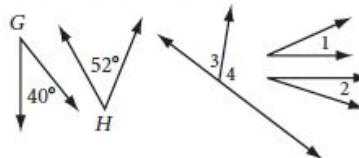


Pairs of complementary angles:

$$\angle 1 \text{ and } \angle 2$$

$$\angle 3 \text{ and } \angle 4$$

$$m\angle 1 + m\angle 2 \neq 90^\circ$$



Not pairs of complementary angles:

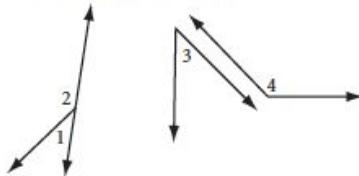
$$\angle G \text{ and } \angle H$$

$$\angle 1 \text{ and } \angle 2$$

$$\angle 3 \text{ and } \angle 4$$

**Supplementary Angles** | A pair of supplementary angles has a sum of  $180^\circ$ .

$$m\angle 3 + m\angle 4 = 180^\circ$$

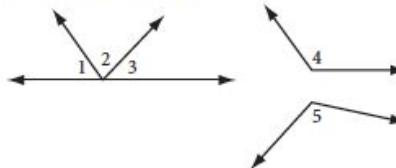


Pairs of supplementary angles:

$$\angle 1 \text{ and } \angle 2$$

$$\angle 3 \text{ and } \angle 4$$

$$m\angle 4 + m\angle 5 > 180^\circ$$



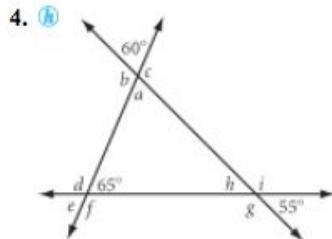
Not pairs of supplementary angles:

$$\angle 1, \angle 2, \text{ and } \angle 3$$

$$\angle 4 \text{ and } \angle 5$$

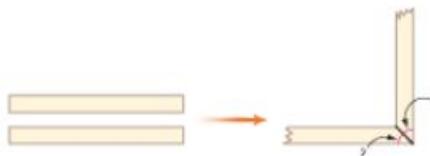
# LP & VA POD

Chapter 2.5: 5, 6,  
9, 10, 11, 13, 19

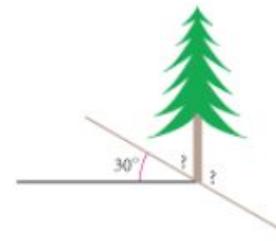


6. **Developing Proof** Points  $A$ ,  $B$ , and  $C$  are collinear. What's wrong with this picture?

7. Yoshi is building a cold frame for his plants. He wants to cut two wood strips so that they'll fit together to make a right-angled corner. At what angle should he cut ends of the strips?



8. A tree on a  $30^\circ$  slope grows straight up. What are the measures of the greatest and smallest angles the tree makes with the hill? Explain.



9. You discovered that if a pair of angles is a linear pair, then the angles are supplementary. Does that mean that all supplementary angles form a linear pair of angles? Is the converse true? If not, sketch a counterexample.

10. If two congruent angles are supplementary, what must be true of the two angles? Make a sketch, then complete the following conjecture: If two angles are both congruent and supplementary, then ?

11. **Developing Proof** Using algebra, write a paragraph proof that explains why the conjecture from Exercise 10 is true.

# Special Angles on Parallel Lines

## New Chapter 2.6: Special Angles on Parallel Lines

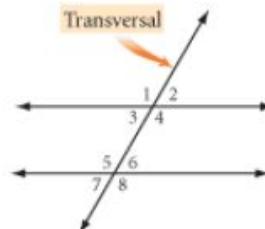
A line intersecting two or more other lines in the plane is called a **transversal**. A transversal creates different types of angle pairs. Three types are listed below.

One pair of **corresponding angles** is  $\angle 1$  and  $\angle 5$ . Can you find three more pairs of corresponding angles?

One pair of **alternate interior angles** is  $\angle 3$  and  $\angle 6$ . Do you see another pair of alternate interior angles?

One pair of **alternate exterior angles** is  $\angle 2$  and  $\angle 7$ . Do you see the other pair of alternate exterior angles?

When parallel lines are cut by a transversal, there is a special relationship among the angles. Let's investigate.



# Complete Parallel Lines Investigation

Read Chapter 2.6

Complete Parallel Lines Investigation

**\*\* All investigations need to be uploaded by each student even if you completed it as a team!\_\*\***

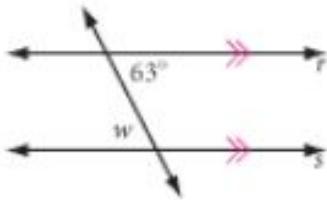
# Do Parallel Lines Problems

Section 2.6: 1-3, 6, 14-16, 20

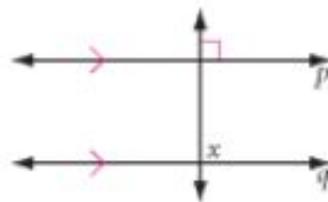
# Do Parallel Lines Problems

Section 2.6: 1-3, 6, 14-16, 20

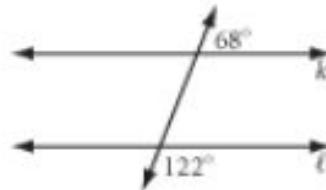
1.  $w = \underline{\hspace{1cm}}$



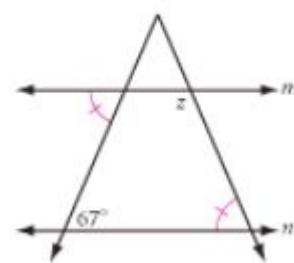
2.  $x = \underline{\hspace{1cm}}$



3. Is line  $k$  parallel to line  $\ell$ ?



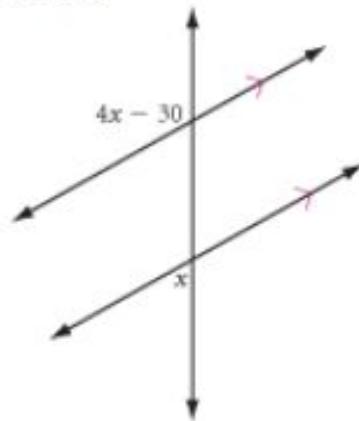
6.  $m \parallel n$   
 $z = \underline{\hspace{1cm}} \text{ } \textcolor{blue}{\textcircled{h}}$



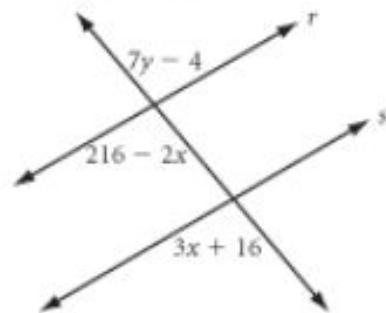
# Do Parallel Lines Problems

Section 2.6: 1-3, 6, 14-16, 20

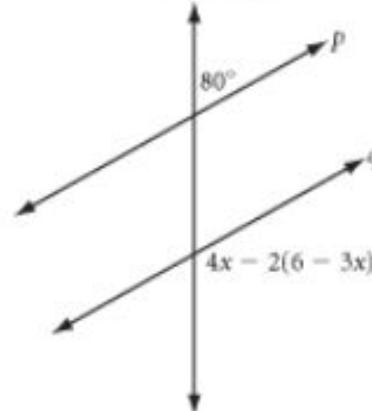
14. Find  $x$ .



15. If  $r \parallel s$ , find  $y$ .



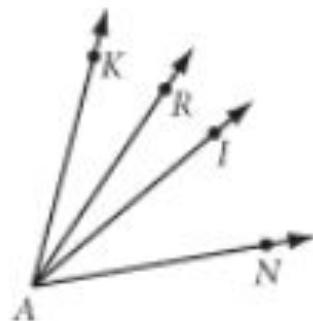
16. If  $x = 12^\circ$ , is  $p \parallel q$ ?



# Do Parallel Lines Problems

Section 2.6: 1-3, 6, 14-16, 20

17. What type (or types) of triangle has one or more lines of symmetry?
18. What type (or types) of quadrilateral has only rotational symmetry? [h](#)
19. If  $D$  is the midpoint of  $\overline{AC}$  and  $C$  is the midpoint of  $\overline{BD}$ , what is the length of  $\overline{AB}$  if  $BD = 12 \text{ cm}$ ?
20. If  $\overline{AI}$  is the angle bisector of  $\angle KAN$  and  $\overline{AR}$  is the angle bisector of  $\angle KAI$ , what is  $m\angle RAN$  if  $m\angle RAK = 13^\circ$ ?



# Reminders

Complete & Submit:

[Quiz 1 grading and corrections](#)

[LP and VA Investigation](#)

[LP VA PON](#)

All investigations need to be uploaded by each student even if you completed it as a team!

Friday, Sep 24th

# Check-In

Welcome back!!

Returned Intro to Geo Quiz 1 with grades.

[Submit Quiz 1 Corrections to Google Classroom](#)

Meet me in conference \*\* very important \*\*

Did you complete the Parallel Lines Investigations and submit to classroom?

Did you start on the Parallel Lines 2.6 problems?

# What's happening today?

Do some more Parallel Lines Problems

Parallel & Perpendicular Lines & Slopes Investigation

Introduce Triangles - New Chapter 4! (vertex, sides, acute, right, obtuse, isosceles, equilateral)

Triangle Sum Investigation, Paper Folding - deductive argument

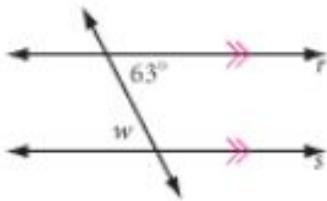
Isosceles & Equilateral Triangle problems

Review Quiz 1

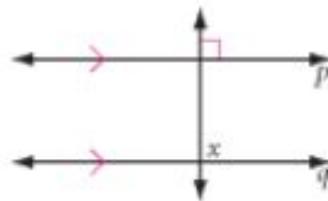
# Do Parallel Lines Problems

Section 2.6: 1-3, 6, 14-16, 20

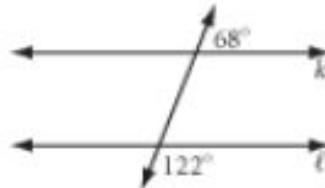
1.  $w = \underline{\hspace{1cm}}$



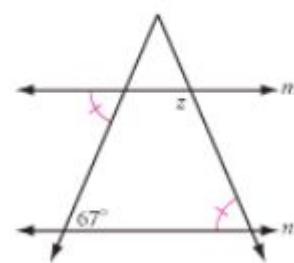
2.  $x = \underline{\hspace{1cm}}$



3. Is line  $k$  parallel to line  $\ell$ ?



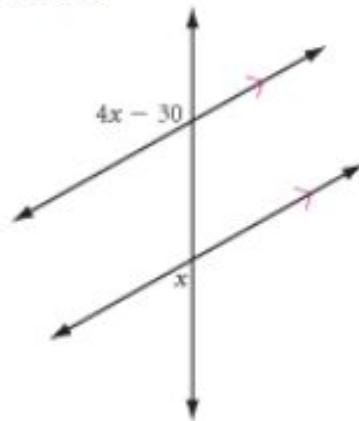
6.  $m \parallel n$   
 $z = \underline{\hspace{1cm}} \text{ } \textcolor{blue}{\textcircled{h}}$



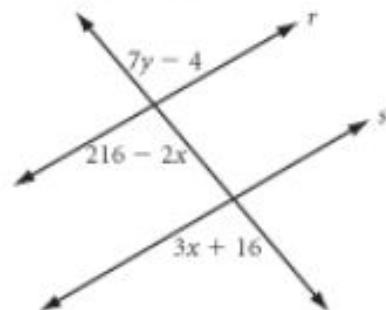
# Do Parallel Lines Problems

Section 2.6: 1-3, 6, 14-16, 20

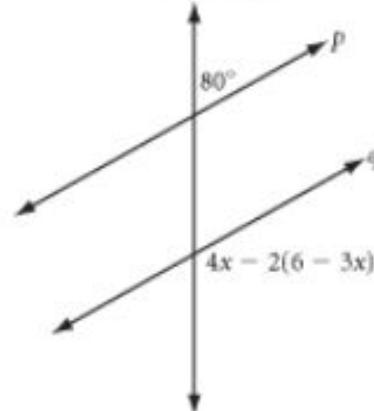
14. Find  $x$ .



15. If  $r \parallel s$ , find  $y$ .



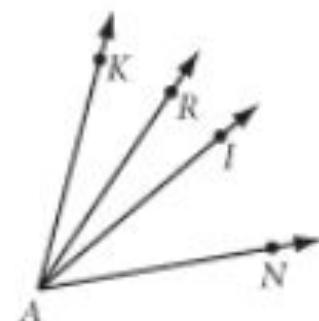
16. If  $x = 12^\circ$ , is  $p \parallel q$ ?



# Do Parallel Lines Problems

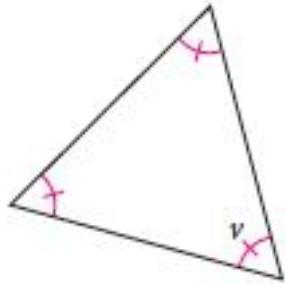
Section 2.6: 1-3, 6, 14-16, 20

17. What type (or types) of triangle has one or more lines of symmetry?
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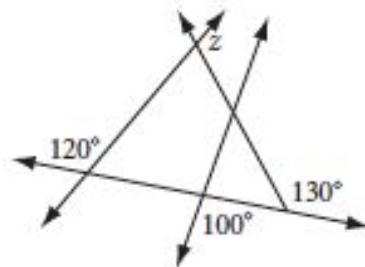


# Do some Triangle Problems!

Find v



Find z



# Review Quiz 1

Clues for Quiz 1

# Reminders

Meet me in conference!

Complete & Submit:

[Quiz 1 grading and corrections](#)

[Parallel & Perpendicular Lines Investigation](#)

[Triangles Investigation](#)

Tuesday, Sep 28th

# Check-In

Welcome back!!

## My conference times & Zoom - Also STEM center!

### **Conference Hours:**

- 3:10-3:30 PM in WS 204A on days Class is held. No appointment needed
- After Lunch in GR Faculty Room (Sun Room). No appointment needed
- Please sign up for extra remote conference time using Zoom. [Schedule via Calendly here](#)

### **STEM Center Coaches Contact:**

Elise Lombardi: [elise.lombardi@bush.edu](mailto:elise.lombardi@bush.edu) and 206-316-6948

Harriet Simons: [harriet.simons@bush.edu](mailto:harriet.simons@bush.edu) and 206-890-1767

Did you complete the Parallel Lines Investigation & Problems?

Did you complete the Triangles Investigation?

# Review & Geogebra

## Assignments & Google Classroom

- Submit your missing/overdue assignments. Read my comments and speed notes
- React to my classroom comments by making appropriate modifications to your submissions and resubmit
- Submit all work as a Single PDF (not jpg images). Use CamScanner or similar app (it is free if used carefully!). I can show you how.
- Read clues and Answer Keys

What can you say about slopes and y-intercepts of Parallel and Perpendicular lines?

## Geogebra

[Access Geogebra](#)

Let's practice!

# What's happening today?

Chapter 4!

- Sum of Angles in a Triangle - Deductive Proof
- Triangle Legitimacy
- Inequalities
- Isosceles Triangle Conjecture & POD
- Triangles Worksheet - Individual/Team Investigation
- Triangle Exterior Angle Conjecture

Back to School Night for your Parents tonight

Painted Cubes Investigation! OR

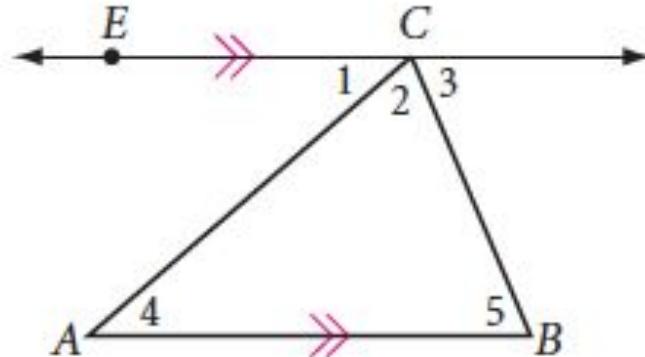
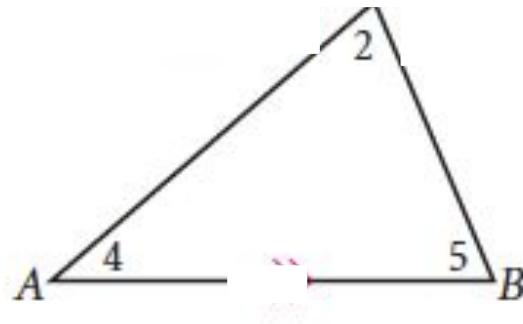
Prove Vertical Angles are Congruent give Linear Pair Conjecture

They may need your help!!

# Triangle Sum Deductive Argument!

Section 4.1: Page 201

Hint: Apply Parallel Lines Conjectures!



# Triangle Legitimacy



## Investigation 1

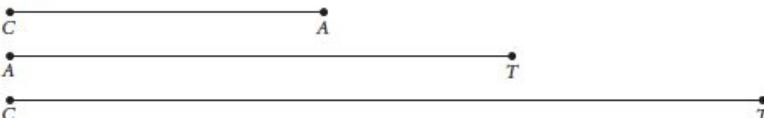
### What Is the Shortest Path from A to B?

Each person in your group should do each construction. Compare results when you finish.

#### Step 1

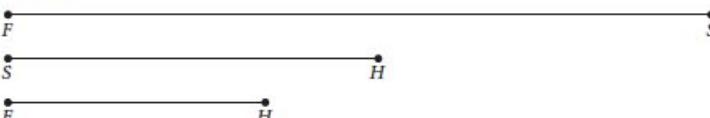
Construct a triangle with each set of segments as sides.

Given:



Construct:  $\triangle CAT$

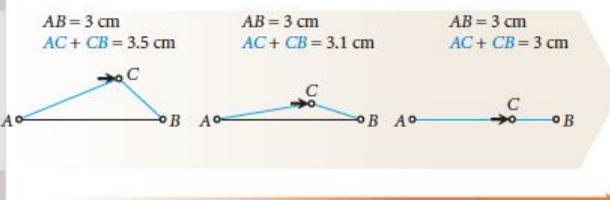
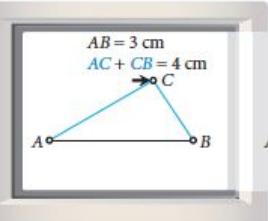
Given:



Construct:  $\triangle FSH$

#### Step 2 tie

You should have been able to construct  $\triangle CAT$ , but not  $\triangle FSH$ . Why? Discuss your results with others. State your observations as your next conjecture.



#### Triangle Inequality Conjecture

The sum of the lengths of any two sides of a triangle is ? the length of the third side.

C-20

# Triangle Legitimacy



## Investigation 2

### Where Are the Largest and Smallest Angles?

d

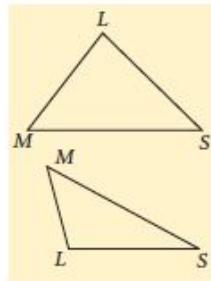
Each person should draw a different scalene triangle for this investigation. Some group members should draw acute triangles, and some should draw obtuse triangles.

Step 1 Measure the angles in your triangle. Label the angle with greatest measure  $\angle L$ , the angle with second greatest measure  $\angle M$ , and the smallest angle  $\angle S$ .

Step 2 Measure the three sides. Label the longest side  $l$ , the second longest side  $m$ , and the shortest side  $s$ .

Conjecture Step 3  
opposite the  
and so on.

Which side is opposite  $\angle L$ ?  $\angle M$ ?  $\angle S$ ?  
Discuss your results with others. Write a conjecture that states where the largest and smallest angles are in a triangle, in relation to the longest and shortest sides.



#### Side-Angle Inequality Conjecture

C-21

In a triangle, if one side is longer than another side, then the angle opposite the longer side is           . **larger than the angle opposite the shorter side**

# Isosceles Triangle Conjecture & Converse

## Chapter 4.2

Base Angles of a Isosceles Triangles Conjecture (Page 207)

**Isosceles Triangle Conjecture**

C-18

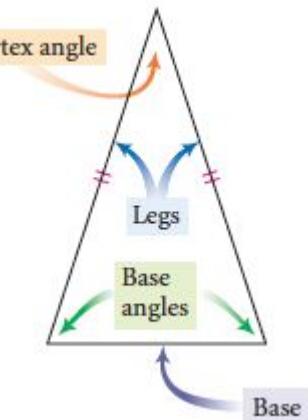
If a triangle is isosceles, then ?.

Converse of the Isosceles Triangles Conjecture (Page 208)

**Converse of the Isosceles Triangle Conjecture**

C-19

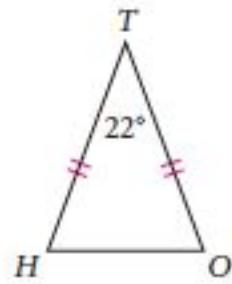
If a triangle has two congruent angles, then ?.



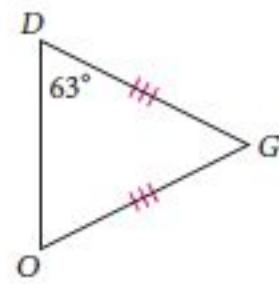
# POD: Isosceles Triangle Problems

Chapter 4.2 Questions 1-3

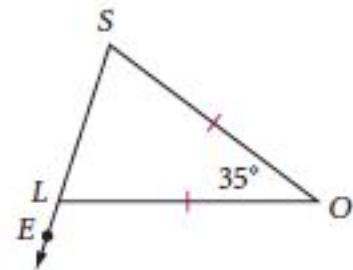
1.  $m\angle H = \underline{\hspace{2cm}} \text{ (h) } \boxed{\hspace{1cm}}$



2.  $m\angle G = \underline{\hspace{2cm}} \boxed{\hspace{1cm}}$



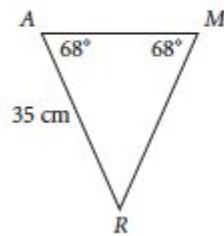
3.  $m\angle OLE = \underline{\hspace{2cm}} \boxed{\hspace{1cm}}$



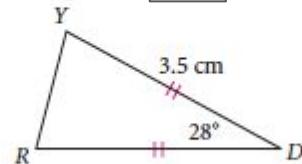
# POD: Isosceles Triangle Problems

## Chapter 4.2 Questions 4-6

4.  $m\angle R = ?$    
 $RM = ?$

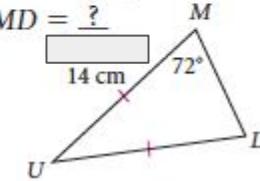


5.  $m\angle Y = ?$    
 $RD = ?$



6. The perimeter of  $\triangle MUD$

is 36.6 cm.  
 $m\angle D = ?$    
 $m\angle U = ?$



# Back to School Night - mini lesson!

Classwork: Prove the  
Vertical Angles Conjecture  
(daily slide #43 - scroll back)

Homework: Complete the  
Painted Cubes investigation  
and submit your answer via  
your student (see right)



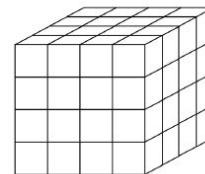
Case 1



Case 2



Case 3



Case 4

## Task Instructions

Imagine that we paint a  $4 \times 4 \times 4$  cube blue on every side.

How many of the small cubes have no paint on them?

How many have 1 blue face?

How many have 2 blue faces?

How many have 3 blue faces?

How many unit cubes have no faces painted, 1, 2, or 3 faces painted in a cube of any size?  
Think visually.

Thursday, Sep 30th

# Check-In

Welcome back!!

Did you complete the PON: LP, VA, Parallel Lines, Special Angles?  
Have you finished Quiz 1 correction (including the bonus problem)?

[Added Practice Your Skills Worksheet with Answer Key \(AK\)](#)

Please Note & Respond to my Missing Assignments emails  
(important for Quiz 2!)!

# What's happening today?

New Today (Complete in class!)

Be ready with Compass, Ruler, sharpened pencils and sheets of paper

Get your textbooks - 2 per table!

Select Recorder/Facilitator - Be ready!

[Triangle Legitimacy Investigation](#) (triangle side inequalities!) (10 min)

Constructing a perpendicular bisector (textbook Ch 3.2 page 150 Investigation 2) (10 min)

This is how we construct Isosceles triangles as well!

[Isosceles Triangle Worksheet](#) (plotting triangles and perpendicular bisector) (30 min)

Concluding discussions

Triangles Exterior Angles Conjecture & Observations

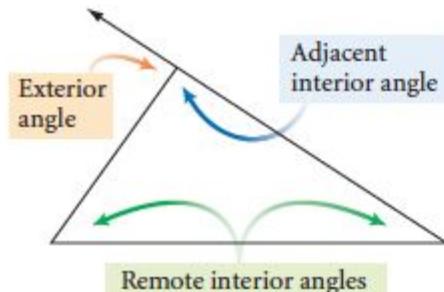
Review & Practice (40 min)

Complete your Conjectures!

Do some Parallel Lines Problems

Do some Triangles Problems

# Triangle Exterior Angles Conjecture



So far in this chapter, you have studied interior angles of triangles. Triangles also have exterior angles. If you extend one side of a triangle beyond its vertex, then you have constructed an **exterior angle** at that vertex.

Each exterior angle of a triangle has an **adjacent interior angle** and a pair of **remote interior angles**. The remote interior angles are the two angles in the triangle that do not share a vertex with the exterior angle.

## Triangle Exterior Angle Conjecture

The measure of an exterior angle of a triangle ?.

is equal to the sum of  
the measures of the remote  
interior angles

C-22

Can you prove the above conjecture? (deductive argument)

# Isosceles Triangles Individual/Team Worksheet

Get Worksheet from Chandru

Complete part 'a' Individually

Complete part 'b' as a team

[Verify using Geogebra link in Worksheet](#)

Make sure everyone understands

[Individually upload completed worksheet to Google Assignment](#)

# Slopes Perpendicular Conjectures

## Perpendicular Bisector Conjecture

C-5

If a point is on the perpendicular bisector of a segment, then it is ? from the endpoints.

## Converse of the Perpendicular Bisector Conjecture

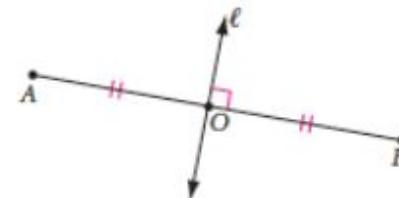
C-6

If a point is equidistant from the endpoints of a segment, then it is on the ? of the segment.

## Shortest Distance Conjecture

C-7

The shortest distance from a point to a line is measured along the ? from the point to the line.



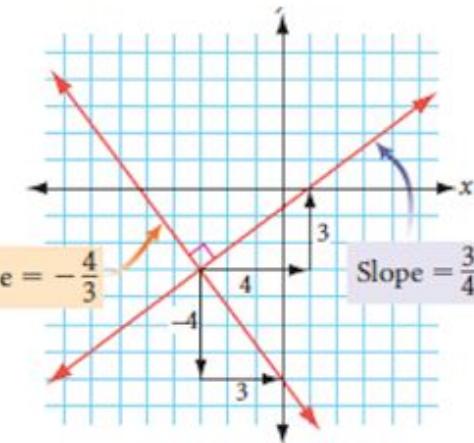
Line  $\ell$  is the perpendicular bisector of  $\overline{AB}$ .

## Perpendicular Slope Property

In a coordinate plane, two nonvertical lines are perpendicular if and only if their slopes are opposite reciprocals of each other.

## Parallel Slope Property

In a coordinate plane, two distinct lines are parallel if and only if their slopes are equal, or they are both vertical lines.



$$\text{Slope} = -\frac{4}{3}$$

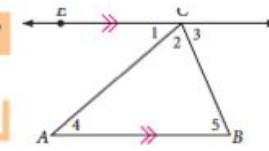
$$\text{Slope} = \frac{3}{4}$$

# Triangle Conjectures!

## Triangle Sum Conjecture

The sum of the measures of the angles in every triangle is ?.

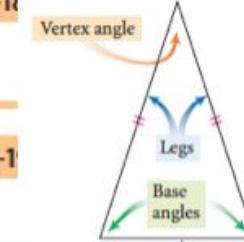
C-17



## Isosceles Triangle Conjecture

If a triangle is isosceles, then ?.

C-18



## Converse of the Isosceles Triangle Conjecture

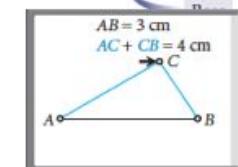
If a triangle has two congruent angles, then ?.

C-19

## Triangle Inequality Conjecture

The sum of the lengths of any two sides of a triangle is ? the length of the third side.

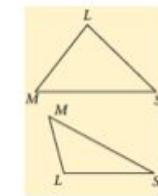
C-20



## Side-Angle Inequality Conjecture

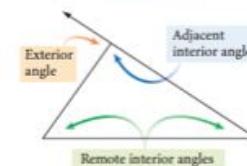
In a triangle, if one side is longer than another side, then the angle opposite the longer side is ?.

C-21



## Triangle Exterior Angle Conjecture

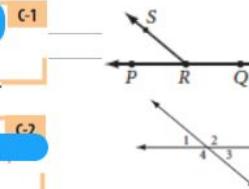
The measure of an exterior angle of a triangle ?.



# Lines & Angles Conjectures

## Linear Pair Conjecture

If two angles form a linear pair, then ?.

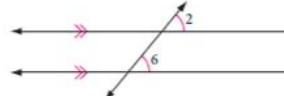


## Vertical Angles Conjecture

If two angles are vertical angles, then ?.

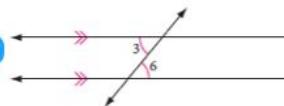
## Corresponding Angles Conjecture, or CA Conjecture

If two parallel lines are cut by a transversal, then corresponding angles are ?.



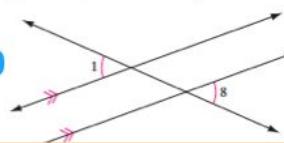
## Alternate Interior Angles Conjecture, or AIA Conjecture

If two parallel lines are cut by a transversal, then alternate interior angles are ?.



## Alternate Exterior Angles Conjecture, or AEA Conjecture

If two parallel lines are cut by a transversal, then alternate exterior angles are ?.



## Parallel Lines Conjecture

If two parallel lines are cut by a transversal, then corresponding angles are ?, alternate interior angles are ?, and alternate exterior angles are ?.

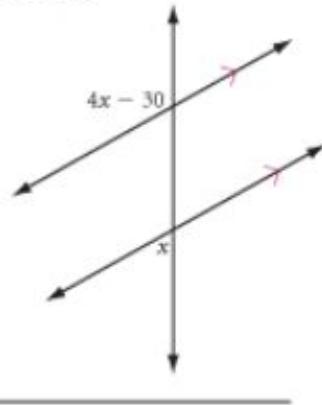
## Converse of the Parallel Lines Conjecture

If two lines are cut by a transversal to form pairs of congruent corresponding angles, congruent alternate interior angles, or congruent alternate exterior angles, then the lines are ?.

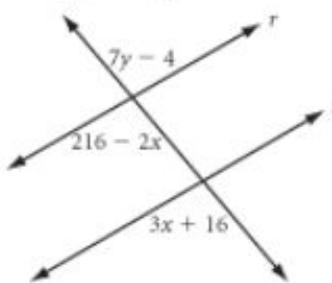
# Practice Parallel Lines Problems (also a Homework)

Section 2.6: 14, 15, 16, 20 (How can you verify these?)

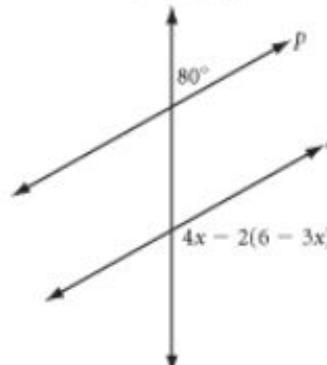
14. Find  $x$ .



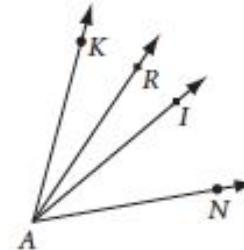
15. If  $r \parallel s$ , find  $y$ .



16. If  $x = 12^\circ$ , is  $p \parallel q$ ?



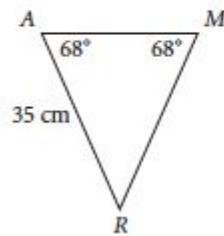
20. If  $\overrightarrow{AI}$  is the angle bisector of  $\angle KAN$  and  $\overrightarrow{AR}$  is the angle bisector of  $\angle KAI$ , what is  $m\angle RAN$  if  $m\angle RAK = 13^\circ$ ?



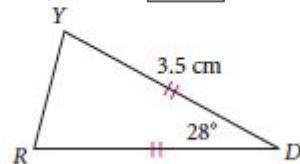
# Practice Isosceles Triangle Problems(also a Homework)

## Chapter 4.2 Questions 4-6

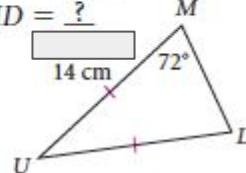
4.  $m\angle R = ?$    
 $RM = ?$



5.  $m\angle Y = ?$    
 $RD = ?$



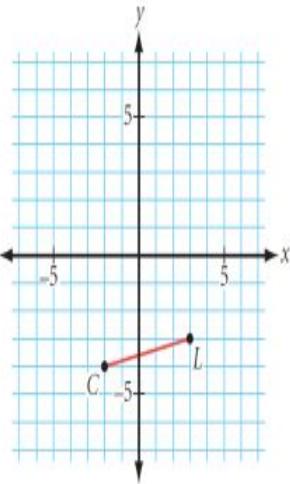
6. The perimeter of  $\triangle MUD$  is 36.6 cm.  
 $m\angle D = ?$    
 $m\angle U = ?$    
 $MD = ?$



# Practice Triangle Problems (also a Worksheet)

Use the graph at right:

- a. What are the coordinates of a point  $A$  that makes  $\triangle CAL$  an isosceles triangle? Which two sides are congruent? How do you know?



- b. Is there more than one answer? If so, find at least two more. Remember  $\overline{CL}$  can be the base of the triangle or one of its legs.

- i. What is the slope of  $\overline{CL}$ ? Use the slope formula, not the graph to calculate this number.
- ii. What is the slope of a line that is perpendicular to  $\overline{CL}$ ? Which conjecture supports this answer?
- iii. What is the midpoint of  $\overline{CL}$ ? Use the Midpoint Formula and show your work.
- iv. What is the equation of the perpendicular bisector of  $\overline{CL}$ ? Why is this helpful in finding a point  $A$  that makes  $\triangle CAL$  an isosceles triangle?

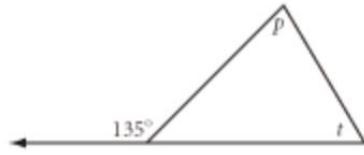
# Practice Triangle Problems (also a Homework)

Section 4-3: 11, 14, 15, 16, 17

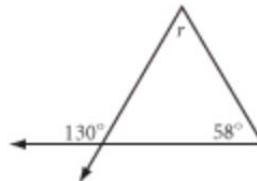
11. If 54 and 48 are the lengths of two sides of a triangle, what is the range of possible values for the length of the third side? h

In Exercises 14–16, use one of your new conjectures to find the missing measures.

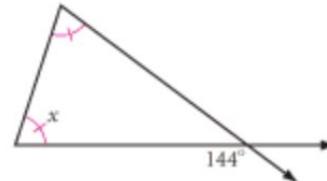
14.  $t + p = \underline{\hspace{1cm}}$



15.  $r = \underline{\hspace{1cm}}$

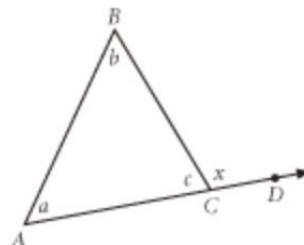


16.  $x = \underline{\hspace{1cm}}$



17. **Developing Proof** Use the Triangle Sum Conjecture to explain why the Triangle Exterior Angle Conjecture is true. Use the figure at right.

18. Read the Recreation Connection below. If you want to know the perpendicular distance from a landmark to the path of your boat, what should be the measurement of your bow angle when you begin recording?



Monday, Oct 4th

# Check-In

Welcome back!!

Best way to Prep for quiz 2 is to:

1. Know your conjectures really well - know what it means and how to apply them, not just what it says!
2. Learn constructions - triangles, perpendicular bisectors
3. Catch up on assignments. Verify that you can do them again from scratch
4. Do problems from the [Practice Worksheet for Chapters 2.6, 4.1, 4.2, 4.3](#)
5. See if you can do problems we did in class from THIS presentation!

Posted solution for [Perpendicular Bisector Equation problem](#)

# What's happening today?

Review & Practice for Quiz 2

Complete your Conjectures!

Do some Parallel Lines Problems

Do some Triangles Problems

Triangle Congruence Chapter 4.4 (time permitting)

# Slopes Perpendicular Conjectures

## Perpendicular Bisector Conjecture

C-5

If a point is on the perpendicular bisector of a segment, then it is ? from the endpoints.

## Converse of the Perpendicular Bisector Conjecture

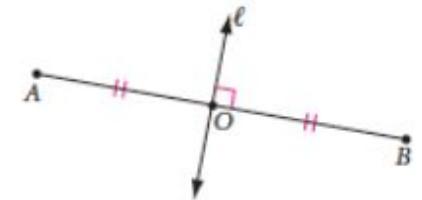
C-6

If a point is equidistant from the endpoints of a segment, then it is on the ? of the segment.

## Shortest Distance Conjecture

C-7

The shortest distance from a point to a line is measured along the ? from the point to the line.



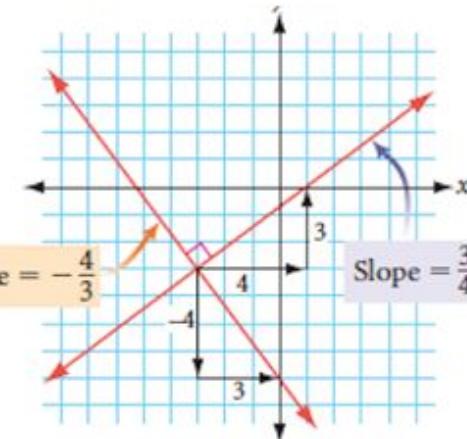
Line  $\ell$  is the perpendicular bisector of  $\overline{AB}$ .

## Perpendicular Slope Property

In a coordinate plane, two nonvertical lines are perpendicular if and only if their slopes are opposite reciprocals of each other.

## Parallel Slope Property

In a coordinate plane, two distinct lines are parallel if and only if their slopes are equal, or they are both vertical lines.



$$\text{Slope} = -\frac{4}{3}$$

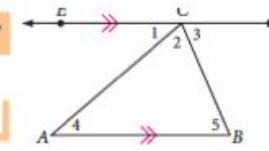
$$\text{Slope} = \frac{3}{4}$$

# Triangle Conjectures!

## Triangle Sum Conjecture

The sum of the measures of the angles in every triangle is ?.

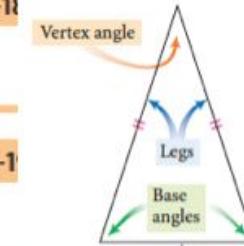
C-17



## Isosceles Triangle Conjecture

If a triangle is isosceles, then ?.

C-18



## Converse of the Isosceles Triangle Conjecture

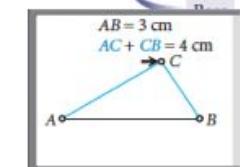
If a triangle has two congruent angles, then ?.

C-19

## Triangle Inequality Conjecture

The sum of the lengths of any two sides of a triangle is ? the length of the third side.

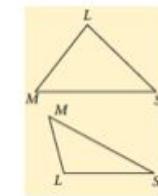
C-20



## Side-Angle Inequality Conjecture

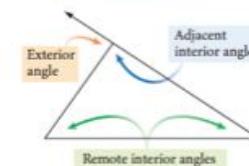
In a triangle, if one side is longer than another side, then the angle opposite the longer side is ?.

C-21



## Triangle Exterior Angle Conjecture

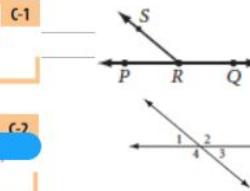
The measure of an exterior angle of a triangle ?.



# Lines & Angles Conjectures

## Linear Pair Conjecture

If two angles form a linear pair, then ?.

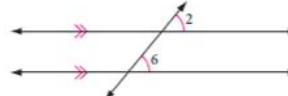


## Vertical Angles Conjecture

If two angles are vertical angles, then ?.

## Corresponding Angles Conjecture, or CA Conjecture

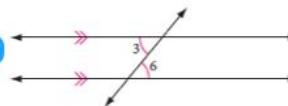
If two parallel lines are cut by a transversal, then corresponding angles are ?.



C-3a

## Alternate Interior Angles Conjecture, or AIA Conjecture

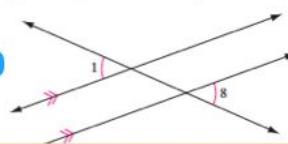
If two parallel lines are cut by a transversal, then alternate interior angles are ?.



C-3b

## Alternate Exterior Angles Conjecture, or AEA Conjecture

If two parallel lines are cut by a transversal, then alternate exterior angles are ?.



C-3c

## Parallel Lines Conjecture

If two parallel lines are cut by a transversal, then corresponding angles are ?, alternate interior angles are ?, and alternate exterior angles are ?.

C-3

## Converse of the Parallel Lines Conjecture

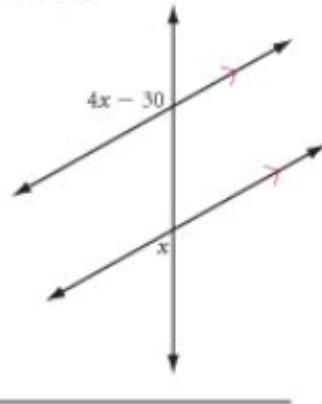
If two lines are cut by a transversal to form pairs of congruent corresponding angles, congruent alternate interior angles, or congruent alternate exterior angles, then the lines are ?.

C-4

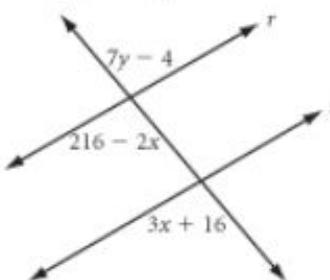
# Practice Parallel Lines Problems (also a Homework)

Section 2.6: 14, 15, 16, 20 (How can you verify these?)

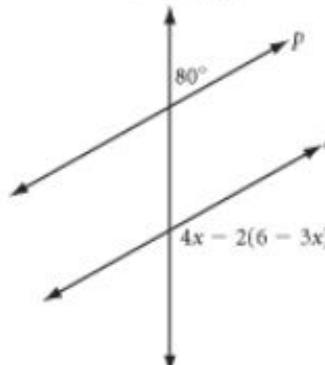
14. Find  $x$ .



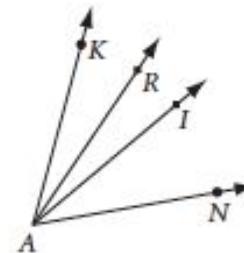
15. If  $r \parallel s$ , find  $y$ .



16. If  $x = 12^\circ$ , is  $p \parallel q$ ?



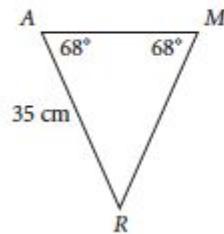
20. If  $\overrightarrow{AI}$  is the angle bisector of  $\angle KAN$  and  $\overrightarrow{AR}$  is the angle bisector of  $\angle KAI$ , what is  $m\angle RAN$  if  $m\angle RAK = 13^\circ$ ? **39°**



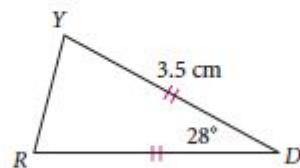
# Practice Isosceles Triangle Problems(also a Homework)

## Chapter 4.2 Questions 4-6

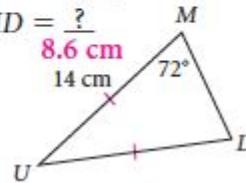
4.  $m\angle R = ?$   $44^\circ$   
 $RM = ?$   $35 \text{ cm}$



5.  $m\angle Y = ?$   $76^\circ$   
 $RD = ?$   $3.5 \text{ cm}$



6. The perimeter of  $\triangle MUD$  is  $36.6 \text{ cm}$ .  
 $m\angle D = ?$   $72^\circ$   
 $m\angle U = ?$   $36^\circ$   
 $MD = ?$   $8.6 \text{ cm}$



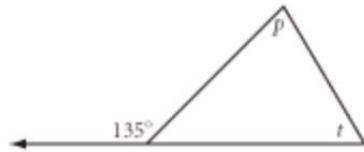
# Practice Triangle Problems (also a Homework)

Section 4-3: 11, 14, 15, 16, 17

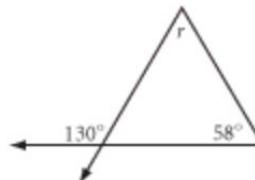
11. If 54 and 48 are the lengths of two sides of a triangle, what is the range of possible values for the length of the third side? h

In Exercises 14–16, use one of your new conjectures to find the missing measures.

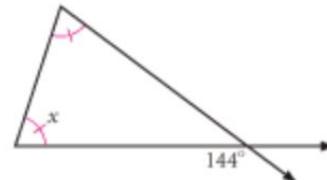
14.  $t + p = \underline{\hspace{1cm}}$



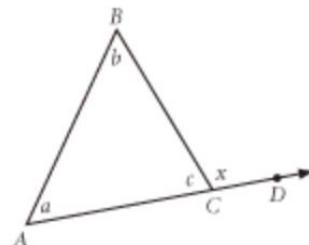
15.  $r = \underline{\hspace{1cm}}$



16.  $x = \underline{\hspace{1cm}}$



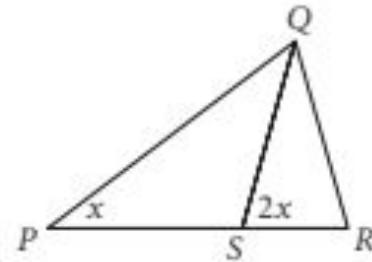
17. **Developing Proof** Use the Triangle Sum Conjecture to explain why the Triangle Exterior Angle Conjecture is true. Use the figure at right.



# Practice Triangle Problems (Bonus!)

Hint: Apply Linear Pair (LP), Triangle Sum (TS), Triangle Exterior Angle (TEA) and Converse Isosceles Triangle (CIT) Conjectures.  
Express as algebraic equations!

- Explain why  $\triangle PQS$  is isosceles.



Wednesday, Oct 6th

# What's happening today?

Check-in

Did you see my email and AK I posted?

Triangle Congruence Investigation New Chapter 4.4 (1:40 to 2:15)

Get Handout from Chandru

Open to Textbook Section 4.4: 3-6

Open to Textbook Section 4.5: 3-6

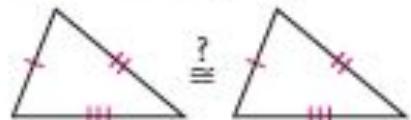
Break (5 minutes)

Quiz #2 (2:20 to 3:10) (Get copy of Quiz from Chandru)

Get Quiz from Chandru

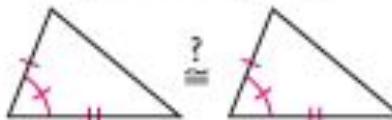
# Six Triangle Congruence Conjectures and Shortcuts (Chapter 4.4)

## Side-Side-Side (SSS)



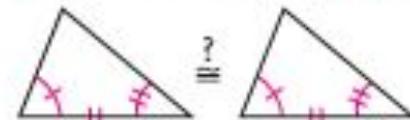
Three pairs of congruent sides

## Side-Angle-Side (SAS)



Two pairs of congruent sides and one pair of congruent angles (angles between the pairs of sides)

## Angle-Side-Angle (ASA)



Two pairs of congruent angles and one pair of congruent sides (sides between the pairs of angles)

## Side-Angle-Angle (SAA)



Two pairs of congruent angles and one pair of congruent sides (sides not between the pairs of angles)

## Side-Side-Angle (SSA)



Two pairs of congruent sides and one pair of congruent angles (angles not between the pairs of sides)

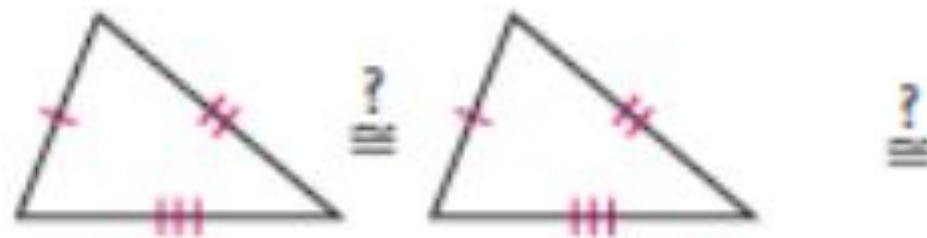
## Angle-Angle-Angle (AAA)



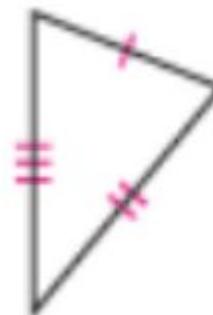
Three pairs of congruent angles

# SSS

## Side-Side-Side (SSS)



Three pairs of congruent sides

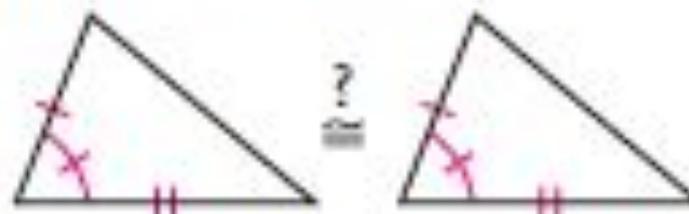


CONGRUENT ?? YES!

# SAS

Sequence is important - note "included" Angle!

## Side-Angle-Side (SAS)



Two pairs of congruent sides and one pair of congruent angles (angles between the pairs of sides)

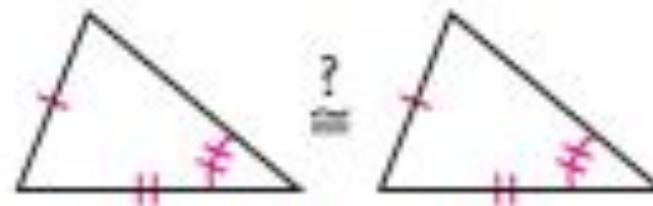
CONGRUENT ?? YES!

# SSA

Sequence is  
NOT important  
- note Reverse  
order ASS is  
same as SSA!

Hint: Remember Quiz #1  
problem?

## Side-Side-Angle (SSA)



Two pairs of congruent sides  
and one pair of congruent  
angles (angles not between  
the pairs of sides)

CONGRUENT ?? NO!

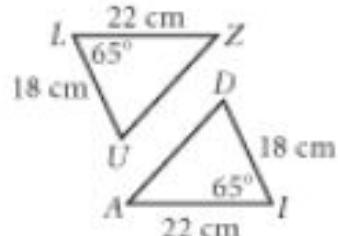
# Let's do some problems!

3. In the third investigation you discovered that the SSA case is not a triangle congruence shortcut. Sketch a counterexample to show why.

For Exercises 4–9, determine whether the triangles are congruent, and name the congruence shortcut. If the triangles cannot be shown to be congruent, write “cannot be determined.”

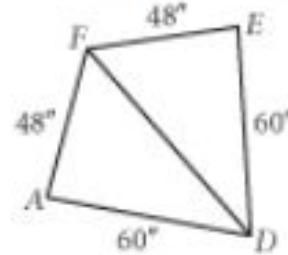
4. Which conjecture tells you

$$\triangle LUZ \cong \triangle IDA? \text{ (H)}$$



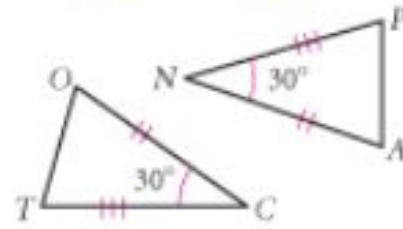
5. Which conjecture tells you

$$\triangle AFD \cong \triangle EFD? \text{ (H)}$$



6. Which conjecture tells you

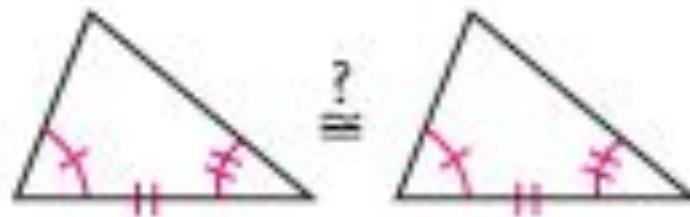
$$\triangle COT \cong \triangle NPA? \text{ (H)}$$



# ASA

Sequence is important - note "included" Side!

## Angle-Side-Angle (ASA)



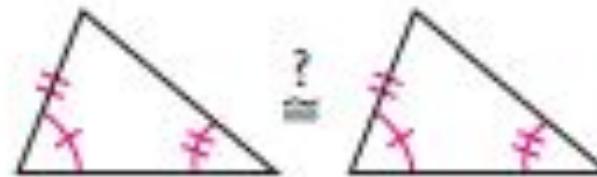
Two pairs of congruent angles and one pair of congruent sides (sides between the pairs of angles)

CONGRUENT ?? YES!

# SAA

Sequence is  
NOT important  
- note Reverse  
order AAS is  
same as SAA!

## Side-Angle-Angle (SAA)



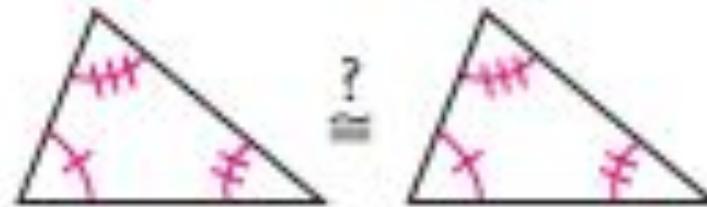
Two pairs of congruent angles  
and one pair of congruent  
sides (sides not between the  
pairs of angles)

CONGRUENT ?? YES!

# AAA

Sequence is  
Not important  
- note Reverse  
order AAA is  
still AAA!

## Angle-Angle-Angle (AAA)



Three pairs of congruent angles

Hint: Remember Quiz #1  
problem?

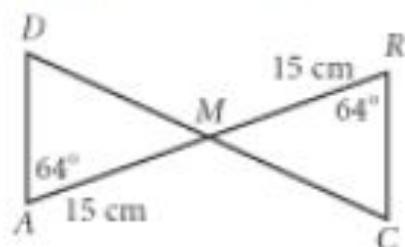
CONGRUENT ?? NO!

# Let's do some more problems!

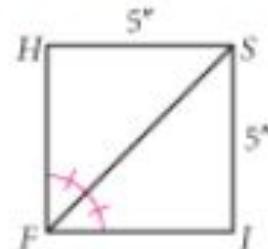
3. In the third investigation you discovered that the AAA case is not a triangle congruence shortcut. Sketch a counterexample to show why.

For Exercises 4–9, determine whether the triangles are congruent, and name the congruence shortcut. If the triangles cannot be shown to be congruent, write “cannot be determined.”

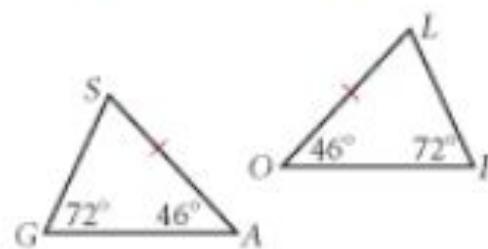
4.  $\triangle AMD \cong \triangle RMC$



5.  $\triangle FSH \cong \triangle FSI$



6.  $\triangle GAS \cong \triangle IOL$  ⓘ



# Quiz Time!

Get Quiz from Chandru

You have until end of period

Tuesday, Oct 12th

# What's happening today?

## Check-in

Did you have a nice long break?

Graded Quiz #2 returned

Quiz Corrections are due

See me in conferences

## Announcements

Triangle Congruence Investigations

Triangle Congruence Review Chapter 4.4/4.5

Congruent Parts of Congruent Triangles are Congruent (CPCTC) Chapter 4.6

# Announcements

Announcing my absence Nov 3rd and 5th

Announcing Unit 1 Test - October 25th

[See Test Study Guide!](#)

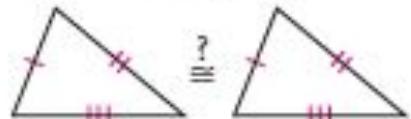
Announcing Unit 2 Quiz 1 - Nov 5th (after comments break)

Announcing Triangle Center Project - Nov 5th (after comments break)

[See Details!](#)

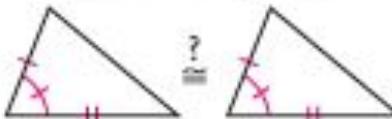
# Review Triangle Congruence Chapter 4.4/4.5

## Side-Side-Side (SSS)



Three pairs of congruent sides

## Side-Angle-Side (SAS)



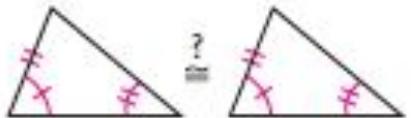
Two pairs of congruent sides and one pair of congruent angles (angles between the pairs of sides)

## Angle-Side-Angle (ASA)



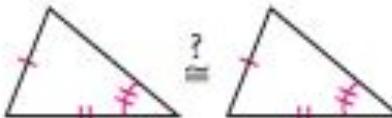
Two pairs of congruent angles and one pair of congruent sides (sides between the pairs of angles)

## Side-Angle-Angle (SAA)



Two pairs of congruent angles and one pair of congruent sides (sides not between the pairs of angles)

## Side-Side-Angle (SSA)



Two pairs of congruent sides and one pair of congruent angles (angles not between the pairs of sides)

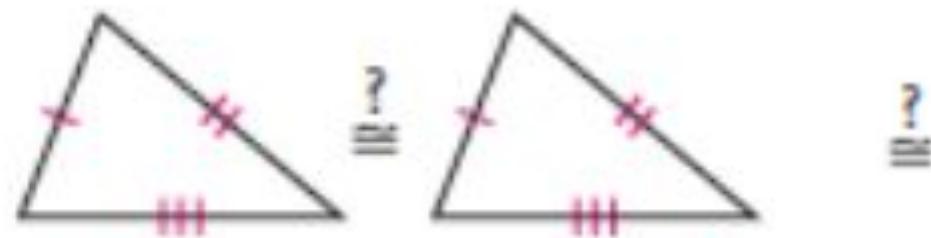
## Angle-Angle-Angle (AAA)



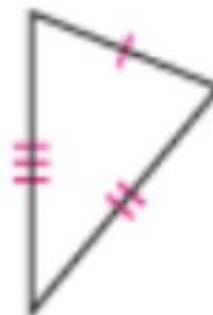
Three pairs of congruent angles

# SSS

## Side-Side-Side (SSS)



Three pairs of congruent sides

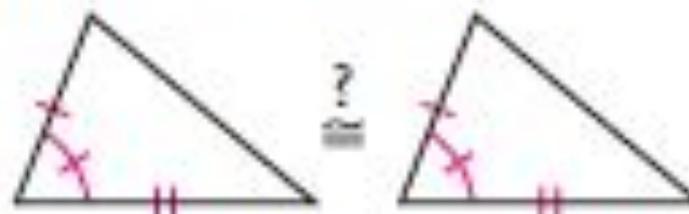


CONGRUENT ?? YES!

# SAS

Sequence is important - note "included" Angle!

## Side-Angle-Side (SAS)



Two pairs of congruent sides and one pair of congruent angles (angles between the pairs of sides)

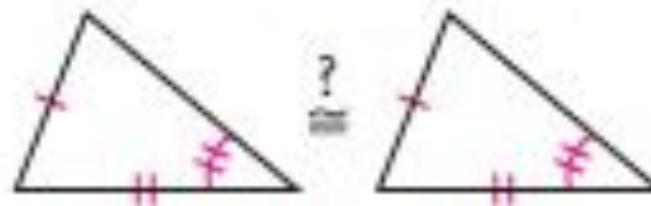
CONGRUENT ?? YES!

# SSA

Sequence is  
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- note Reverse  
order ASS is  
same as SSA!

Hint: Remember Quiz #1  
problem?

## Side-Side-Angle (SSA)



Two pairs of congruent sides  
and one pair of congruent  
angles (angles not between  
the pairs of sides)

CONGRUENT ?? NO!

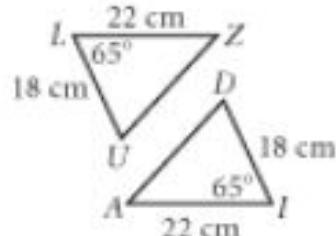
# Let's do some problems!

3. In the third investigation you discovered that the SSA case is not a triangle congruence shortcut. Sketch a counterexample to show why.

For Exercises 4–9, determine whether the triangles are congruent, and name the congruence shortcut. If the triangles cannot be shown to be congruent, write “cannot be determined.”

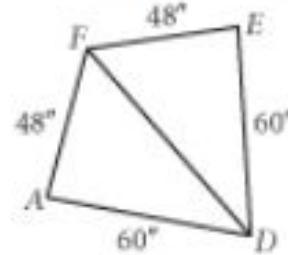
4. Which conjecture tells you

$$\triangle LUZ \cong \triangle IDA? \text{ (H)}$$



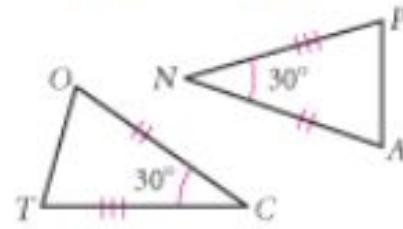
5. Which conjecture tells you

$$\triangle AFD \cong \triangle EFD? \text{ (H)}$$



6. Which conjecture tells you

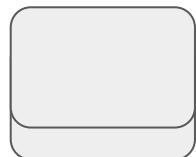
$$\triangle COT \cong \triangle NPA? \text{ (H)}$$



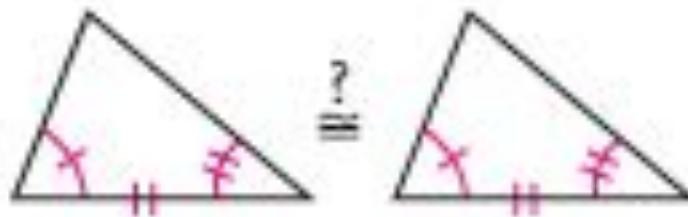
# ASA

Sequence is important - note "included" Side!

CONGRUENT ??



## Angle-Side-Angle (ASA)



Two pairs of congruent angles and one pair of congruent sides (sides between the pairs of angles)

# SAA

Sequence is  
NOT important  
- note Reverse  
order AAS is  
same as SAA!

## Side-Angle-Angle (SAA)



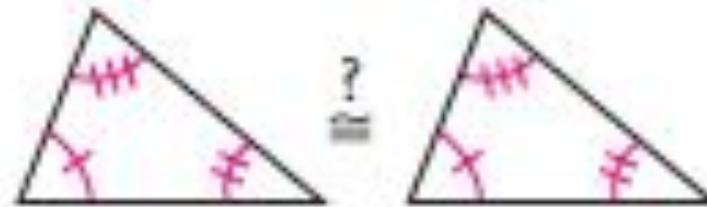
Two pairs of congruent angles  
and one pair of congruent  
sides (sides not between the  
pairs of angles)

CONGRUENT ?? YES!

**AAA**

Sequence is  
Not important  
- note Reverse  
order AAA is  
still AAA!

## Angle-Angle-Angle (AAA)



Three pairs of congruent angles

Hint: Remember Quiz #1  
problem?

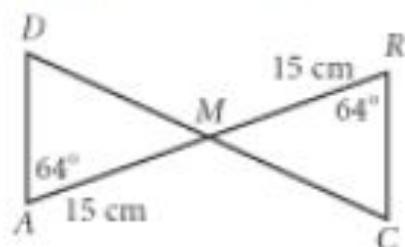
CONGRUENT ?? NO!

# Let's do some more problems!

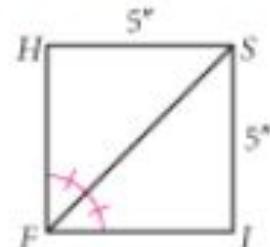
3. In the third investigation you discovered that the AAA case is not a triangle congruence shortcut. Sketch a counterexample to show why.

For Exercises 4–9, determine whether the triangles are congruent, and name the congruence shortcut. If the triangles cannot be shown to be congruent, write “cannot be determined.”

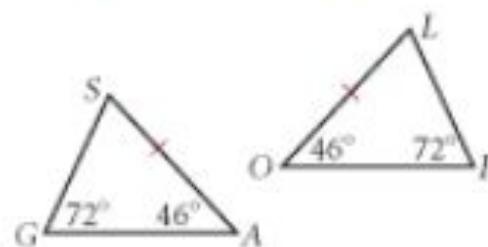
4.  $\triangle AMD \cong \triangle RMC$



5.  $\triangle FSH \cong \triangle FSI$

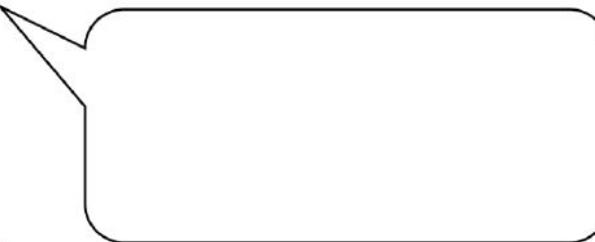
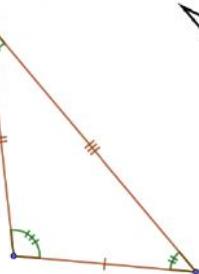
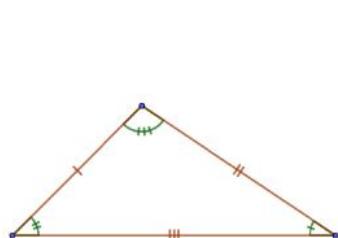


6.  $\triangle GAS \cong \triangle IOL$  ⓘ

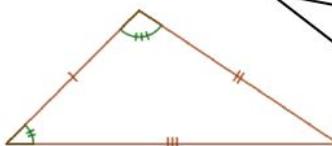
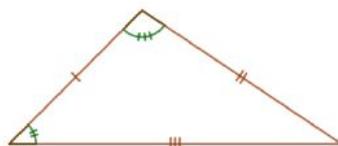


# Complete Triangle Congruence Investigation

As we discussed previously, two polygons are congruent if their corresponding \_\_\_\_\_ are \_\_\_\_\_ and their corresponding \_\_\_\_\_ are \_\_\_\_\_. Using this definition, are the following two triangles congruent?



What if we don't know all of this information? Are the following two triangles definitely congruent based upon the marked parts? Explain how you know.



If they are congruent, then we do not need to know all six measurements (three angles and three sides) in order to identify congruent triangles. There are shortcuts!

# Complete Triangle Congruence Investigation

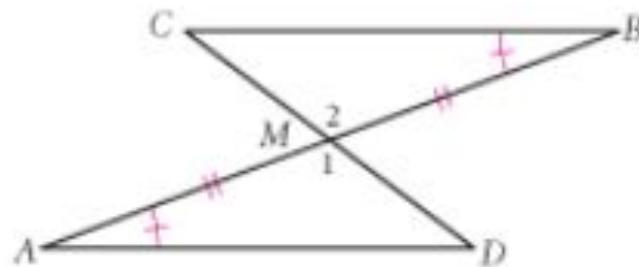
	Known Parts	Always Congruent	Not Necessarily Congruent
AAA	$m\angle A = 30^\circ, m\angle B = 60^\circ, m\angle C = 90^\circ$		
SSS	$m\overline{DE} = 5 \text{ cm}, m\overline{EF} = 3 \text{ cm}, m\overline{DF} = 6 \text{ cm}$		
SAS	$m\overline{GH} = 5 \text{ cm}, m\overline{HI} = 3 \text{ cm}, m\angle H = 60^\circ$		
SSA	$m\overline{JK} = 5 \text{ cm}, m\overline{KL} = 3 \text{ cm}, m\angle J = 20^\circ$		
ASA	$m\angle M = 30^\circ, m\overline{MO} = 6 \text{ cm}, m\angle O = 50^\circ$		
SAA	$m\angle P = 30^\circ, m\overline{PQ} = 6 \text{ cm}, m\angle R = 50^\circ$		

# Complete Triangle Congruence Investigation

	Known Parts	Always Congruent	Not Necessarily Congruent
AAA	$m\angle A = 30^\circ, m\angle B = 60^\circ, m\angle C = 90^\circ$		
SSS	$m\overline{DE} = 5 \text{ cm}, m\overline{EF} = 3 \text{ cm}, m\overline{DF} = 6 \text{ cm}$		
SAS	$m\overline{GH} = 5 \text{ cm}, m\overline{HI} = 3 \text{ cm}, m\angle H = 60^\circ$		
SSA	$m\overline{JK} = 5 \text{ cm}, m\overline{KL} = 3 \text{ cm}, m\angle J = 20^\circ$		
ASA	$m\angle M = 30^\circ, m\overline{MO} = 6 \text{ cm}, m\angle O = 50^\circ$		
SAA	$m\angle P = 30^\circ, m\overline{PQ} = 6 \text{ cm}, m\angle R = 50^\circ$		

# CPCTC - Chapter 4.6

Corresponding Parts of Congruent Triangles are Congruent (CPCTC)!

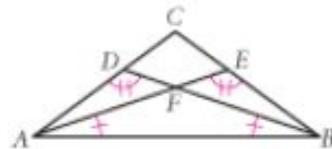


Is  $\overline{AD} \cong \overline{BC}$  in the figure above? Use a deductive argument to explain why they must be congruent.

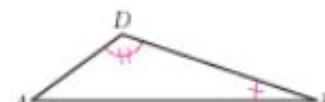
# CPCTC - Chapter 4.6

Corresponding Parts of Congruent Triangles are Congruent (CPCTC)!

Is  $\overline{AE} \cong \overline{BD}$ ? Write a paragraph proof explaining why.



The triangles you can use to show congruence are  $\triangle ABD$  and  $\triangle BAE$ . You can separate or color them to see them more clearly.



Separated triangles

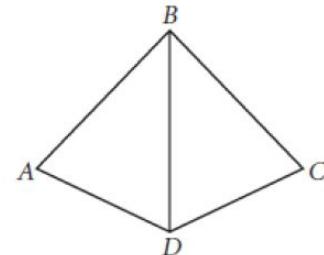


Color-coded triangles

# Complete CPCTC Investigation

**Read Section 4.6 carefully. Complete the questions and fill in the blanks.**

1. What are the four shortcuts for showing that two triangles are congruent?
  
2. The definition of congruent triangles states that if two triangles are congruent, then  
the \_\_\_\_\_.
  
3. Read Example 1 carefully, including the solution. The deductive argument is clear, organized, and proves that  $\overline{AD} \cong \overline{BC}$ . In the figure at right,  $\angle A \cong \angle C$  and  $\angle ABD \cong \angle CBD$ . Is  $\overline{AB} \cong \overline{CB}$ ? Write a deductive argument to explain your reasoning.



# Complete CPCTC Investigation

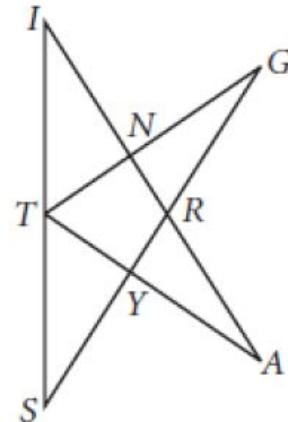
4. The following figure has many overlapping polygons. Given the information at the left, can you show that two triangles are congruent? If so, which triangles and which conjecture would you use?

Given Information:

$$\angle S \cong \angle I$$

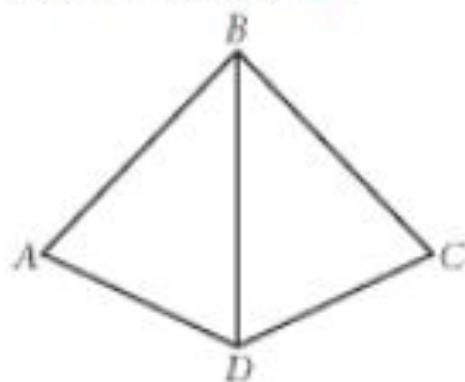
$$\angle G \cong \angle A$$

$T$  bisects  $\overline{SI}$

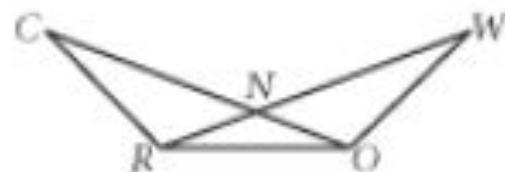


# Let's do some Problems

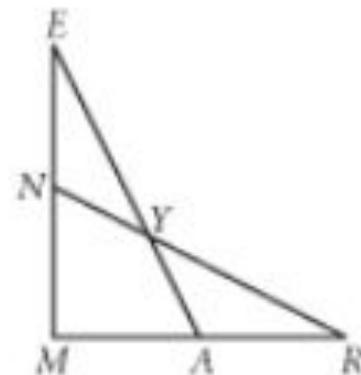
1.  $\angle A \cong \angle C$ ,  
 $\angle ABD \cong \angle CBD$   
Is  $\overline{AB} \cong \overline{CB}$ ? (H)



2.  $\overline{CN} \cong \overline{WN}$ ,  $\angle C \cong \angle W$   
Is  $\overline{RN} \cong \overline{ON}$ ? (H)



6.  $\overline{MN} \cong \overline{MA}$ ,  $\overline{ME} \cong \overline{MR}$   
Is  $\angle E \cong \angle R$ ?



# Reminders!

## Submit Quiz #2 Corrections

Schedule Conferences with me or with STEM center coaches

Elise Lombardi: [elise.lombardi@bush.edu](mailto:elise.lombardi@bush.edu) and 206-316-6948

Harriet Simons: [harriet.simons@bush.edu](mailto:harriet.simons@bush.edu) and 206-890-1767

## Do Triangle Congruence Problems Homework

## Start Practice for Unit 1 Test

Start working on Triangle Centers Project

Friday, Oct 15th

# What's happening today?

Check-in

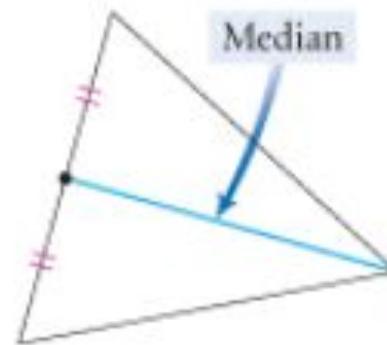
Median, Altitude, Equilateral, Equiangular Definitions

Lot's of practice doing Triangle Congruence CPCTC Problems

# New Definitions & Conjectures - Add to Toolbox

The segment connecting the vertex of a triangle to the midpoint of its opposite side is a **median**.

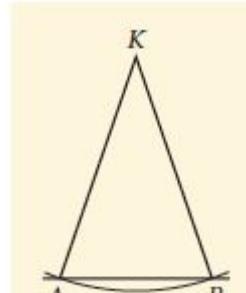
There are three midpoints and three vertices in every triangle, so every triangle has three medians.



## Vertex Angle Bisector Conjecture

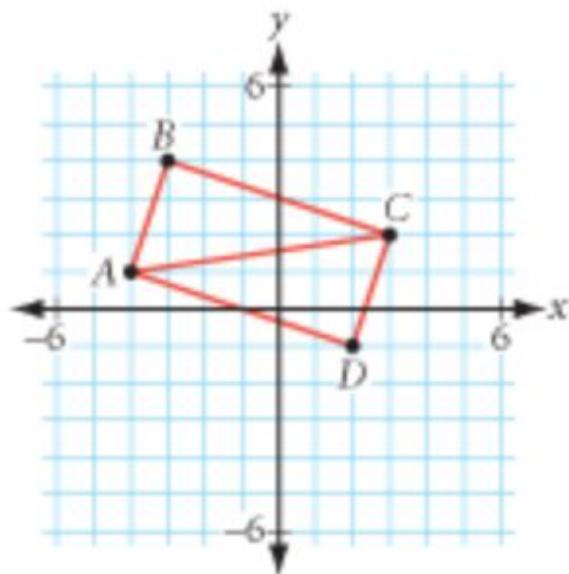
C-27

In an isosceles triangle, the bisector of the vertex angle is also the altitude; the median to the base.



# Problems to do

Use slope properties to show  $\overline{AB} \perp \overline{BC}$ ,  
 $\overline{CD} \perp \overline{DA}$ , and  $\overline{BC} \parallel \overline{DA}$ .  $\triangle ABC \cong \triangle ?$ . Why?



# Problems to do

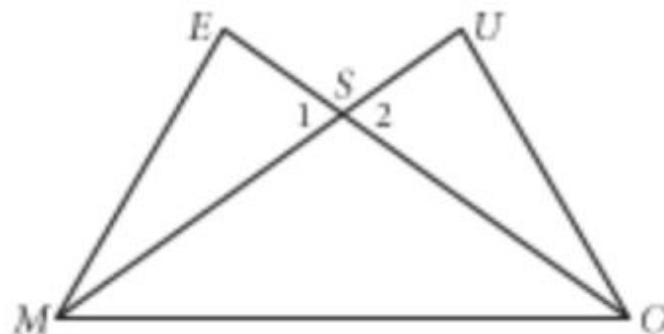
1. **Developing Proof** Copy the flowchart. Provide each missing reason or statement in the proof.

**Given:**  $\overline{SE} \cong \overline{SU}$

$\angle E \cong \angle U$

**Show:**  $\overline{MS} \cong \overline{OS}$

**Flowchart Proof**

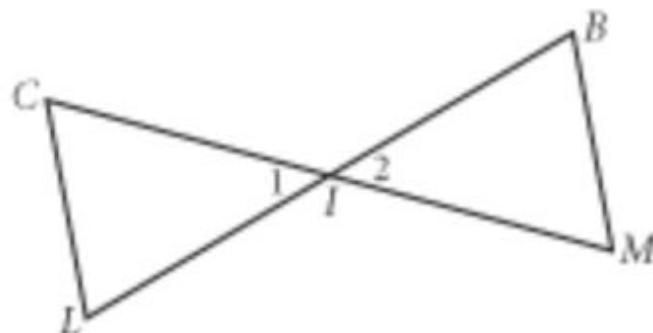


# Problems to do

2. **Developing Proof** Copy the flowchart. Provide each missing reason or statement in the proof.

**Given:**  $I$  is the midpoint of  $\overline{CM}$   
 $I$  is the midpoint of  $\overline{BL}$

**Show:**  $\overline{CL} \cong \overline{MB}$

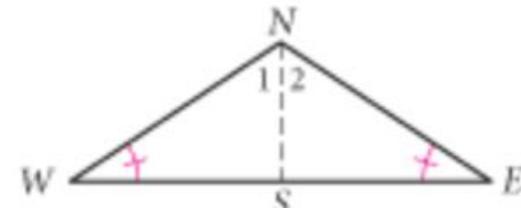


# Problems to do

4. Complete this flowchart proof of the Converse of the Isosceles Triangle Conjecture.

**Given:**  $\triangle NEW$  with  $\angle W \cong \angle E$   
 $\overline{NS}$  is an angle bisector

**Show:**  $\triangle NEW$  is an isosceles triangle



Tuesday, Oct 19th

# What's happening today?

Check-in - Quiz 1 & 2 Corrections and Prep for Unit 1 Test?

Discuss Upcoming Schedule

Start Unit 2: Chapter 5: Polygons!

Vocabulary

Do a few Polygon Sum Conjecture & Problems

Introduction to Triangle Centers Project

# Schedule for upcoming 3 weeks! \*\* IMPORTANT \*\*

- Oct 19th: Start Unit 2 Polygons! Review Unit 1.  
Introduce [Triangle Centers Project](#) in class.
- Oct 21st: Do lots of Unit 1 Review Problems. Toolbox Review. **Submit Project Idea for Part 3!**
- Oct 22nd: **No Geo Class, Last day to submit Unit 1 [Quiz #1](#) & [Quiz #2](#) Corrections!**  
[AK for Quiz #2 will be Posted.](#)
- Oct 23-24th: Practice Problems at home. Study for Quiz! Complete Toolbox!
- Oct 25th: **Unit 1 Test - whole period** - Bring Toolbox, Geo Instruments,  
Calculator, Sharpened Pencils, Eraser
- Oct 26th: **No Geo Class.** Work on Project. Do Polygons Problems
- Oct 27-29th: **No Classes** - Comments Period!
- Nov 1: Cover additional material on Polygons Chapter 5
- Nov 2: **No Geo Class.** Chandru traveling
- Nov 3: Chandru traveling. Sub teacher. Time to complete Project in class
- Nov 4: **No Geo Class.** Chandru traveling
- Nov 5: Chandru traveling. Sub Teacher. **Project is due!. Unit 2 Quiz #1 Polygons!**

# Unit 2: Chapter 5 Polygons!

Quadrilateral, Pentagon and Polygon Sum Conjectures

Add to your Toolbox!

Get Investigation handout from Chandru

**Polygon** A plane figure (2D) that is formed by three or more line segments connected endpoint to endpoint.

**Concave Polygon** A polygon with one or more interior angle(s) which measures greater than  $180^\circ$ .

**Convex Polygon** A polygon with all interior angles which measure less than  $180^\circ$ .

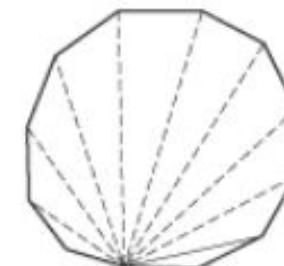
**Sides** The line segments which create the polygon

**Vertices** The points where the sides meet

**Diagonals** Line segments whose endpoints are non-consecutive vertices of polygons



# of Sides	Name
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon
$n$	$n$ -gon



# Polygon Sum Investigation

Get Investigation handout from Chandru

Number of sides of polygon	3	4	5	6	7	8	...	$n$
Sum of measures of angles	$180^\circ$						...	

## Quadrilateral Sum Conjecture

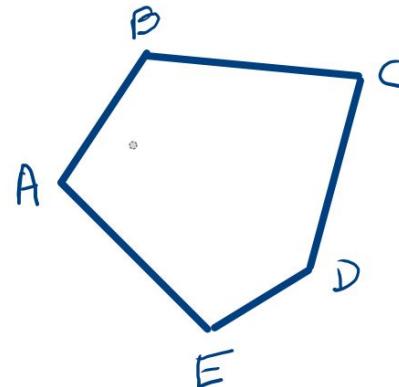
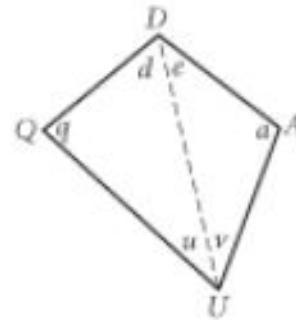
C-29

The sum of the measures of the four interior angles of any quadrilateral is ?.

## Pentagon Sum Conjecture

C-30

The sum of the measures of the five interior angles of any pentagon is ?.

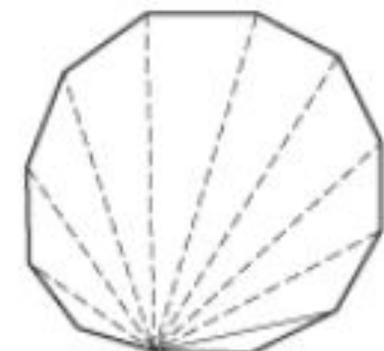
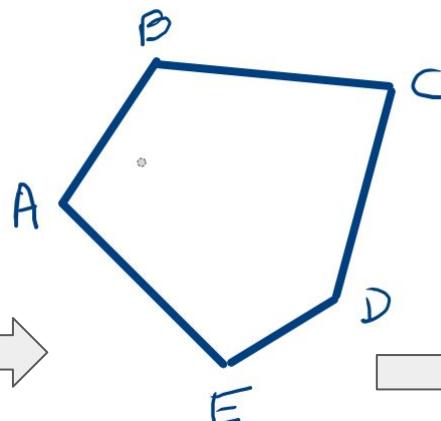
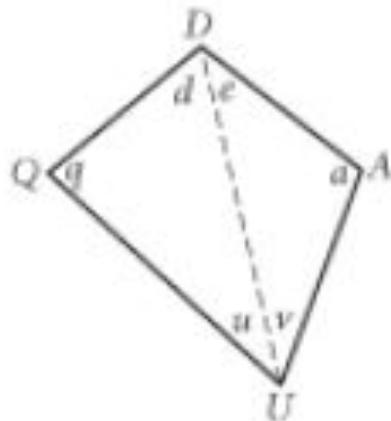


# Polygon Sum Conjecture

## Polygon Sum Conjecture

C-31

The sum of the measures of the  $n$  interior angles of an  $n$ -gon is ?

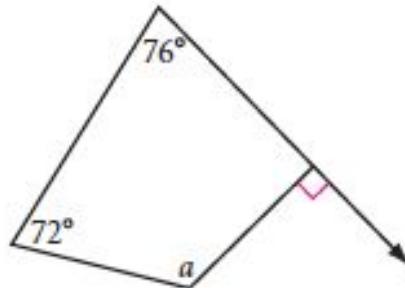


# Some Polygon Problems

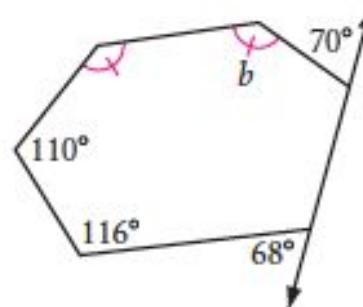
One bonus problem from this Chapter will appear on your Unit 1 Quiz!

In Exercises 3–8, use your conjectures to calculate the measure of each lettered angle.

3.  $a = \underline{\hspace{2cm}} \quad 122^\circ$

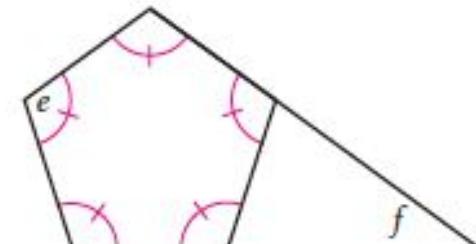


4.  $b = \underline{\hspace{2cm}} \quad 136^\circ$



5.  $e = \underline{\hspace{2cm}} \quad 108^\circ$

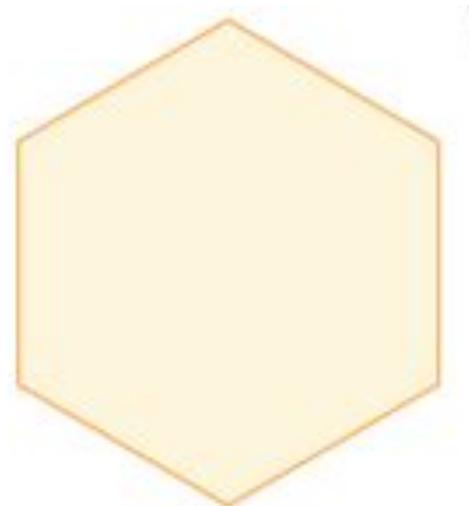
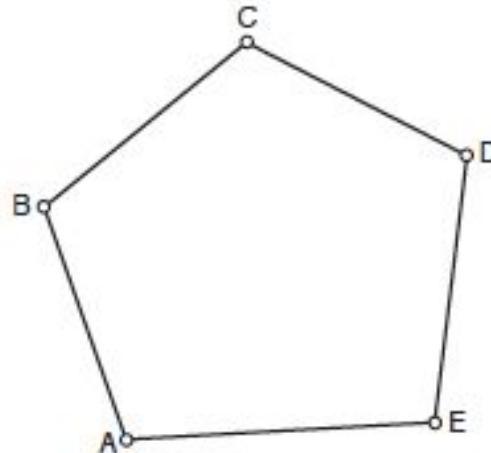
$f = \underline{\hspace{2cm}} \quad 36^\circ$



# Equiangular Polygon Conjecture

Is there an Equiangular Polygon Conjecture?

The interior angle measure of an Equiangular Polygon of  $n$  sides is: ?



# Reminders!

Unit 1 Test is on Monday, October 25th

Submit all pending assignments and do class problems - good review!

Plan your work according to [Upcoming Geo Class Schedule](#)

Bring your Toolbox for Review on Thursday!

Email an idea to me about Part 3 of the Triangle Centers project

Projects carry 20% of your grade! (Triangles Project 1 will be 10%)

Thursday, Oct 21st

# What's happening today?

Check-in

Quiz Corrections and Prep?

Sent me an idea for Part 3 of project?

If not, please do so by the weekend!

Discuss Exterior Angles of a Polygon Chapter 5.2

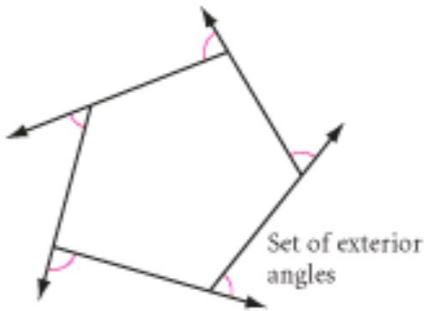
Do some problems

Do Toolbox Review

Do Lots of Unit 1 Test Review Problems

# Exterior Angles of a Polygon (Chapter 5.2)

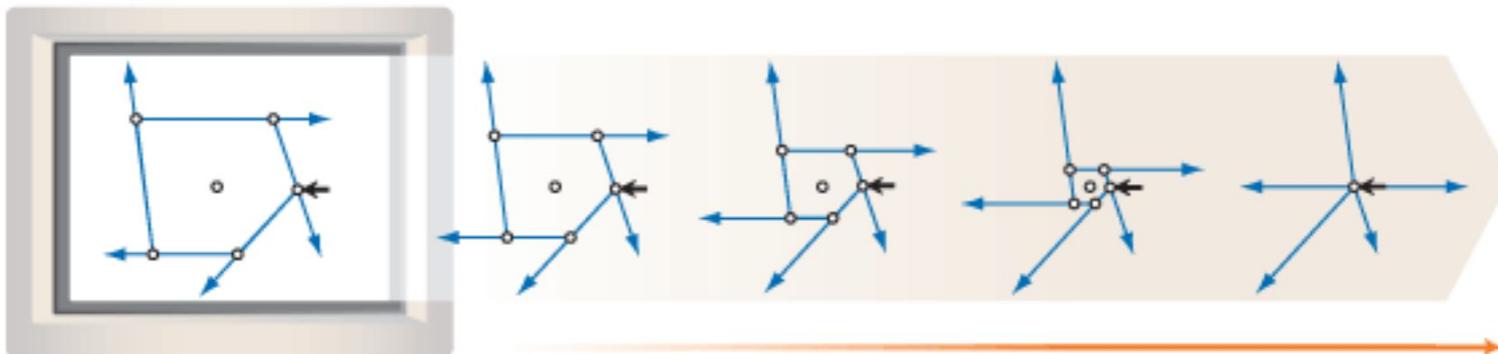
Can you think of what this conjecture might be ??



## Exterior Angle Sum Conjecture

C-32

For any polygon, the sum of the measures of a set of exterior angles is ?.



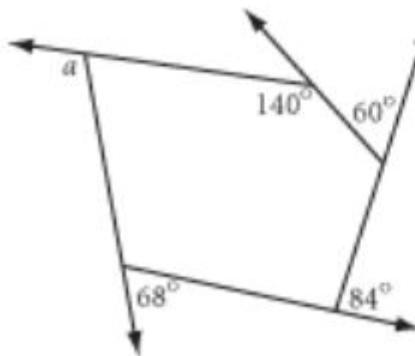
# Schedule for upcoming 3 weeks! \*\* IMPORTANT \*\*

- Oct 19th: Start Unit 2 Polygons! Review Unit 1.  
Introduce [Triangle Centers Project](#) in class.
- Oct 21st: Do lots of Unit 1 Review Problems. Toolbox Review. **Submit Project Idea for Part 3!**
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- Nov 5: Chandru traveling. Sub Teacher. **Project is due!. Unit 2 Quiz #1 Polygons!**

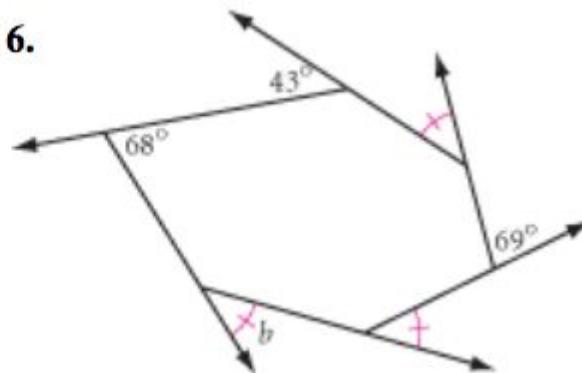
# Let's do problems on Exterior Angles of a polygon

Find the lettered angles, state the conjectures used

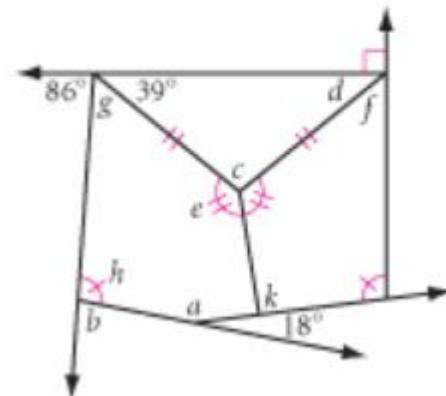
5.



6.



7.



# Review Centers of Triangles Project

[Project Specifications are in the Google Classroom](#) - 3 Parts !!Read now!!

Part 1 - Accurately construct the Incenter, Circumcenter, Centroid as instructed

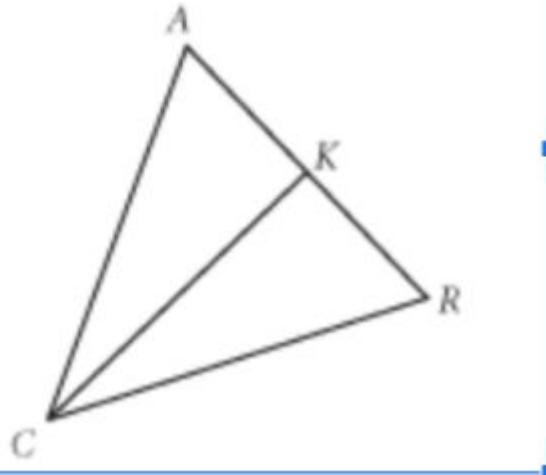
Part 2 - Find the Incenter, Circumcenter, Centroid of an equilateral Triangle

Part 3 - Need idea from you (email is fine) by Thursday Oct Oct 21st

Project is due Nov 5th

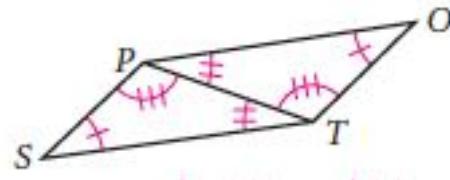
# Triangle Review Problems to do

12.  $\overline{AC} \cong \overline{CR}$ ,  $\overline{CK}$  is a median of  $\triangle ARC$ .  $\triangle RCK \cong \triangle ?$



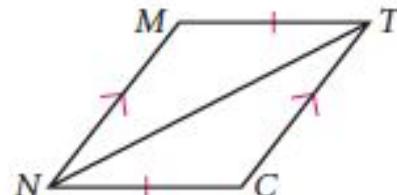
24.  $\triangle ? \cong \triangle ?$

Is STOP a parallelogram?



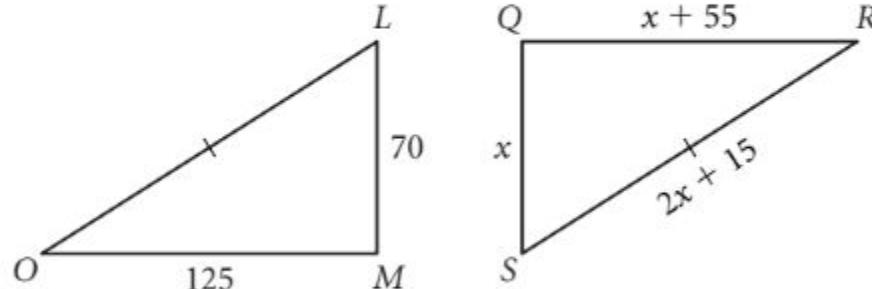
22.  $\triangle ? \cong \triangle ?$

Is NCTM a parallelogram?

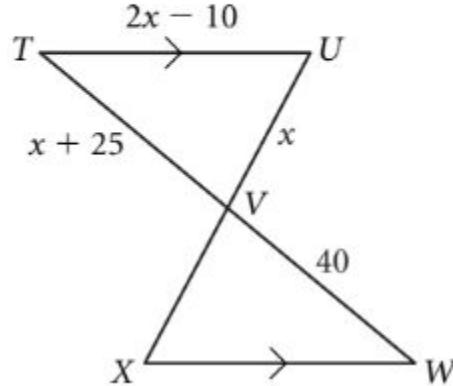


# More Triangle Review Problems

7. The perimeter of  $\triangle QRS$  is 350 cm.  
Is  $\triangle QRS \cong \triangle MOL$ ? Explain.



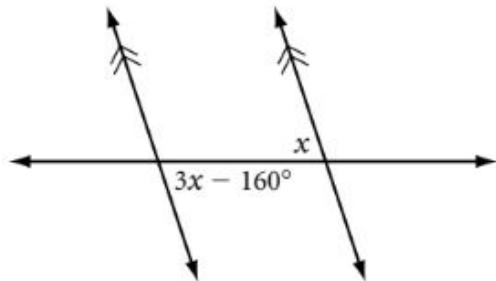
8. The perimeter of  $\triangle TUV$  is 95 cm.  
Is  $\triangle TUV \cong \triangle WXV$ ? Explain.



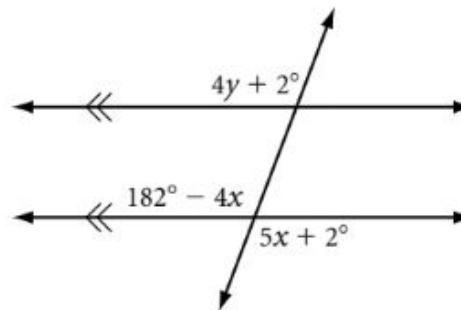
# Lines & Angles Review Problems



8. Find  $x$ .

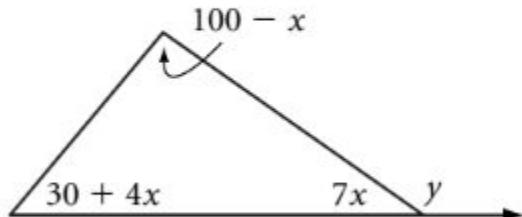


9. Find  $x$  and  $y$ .

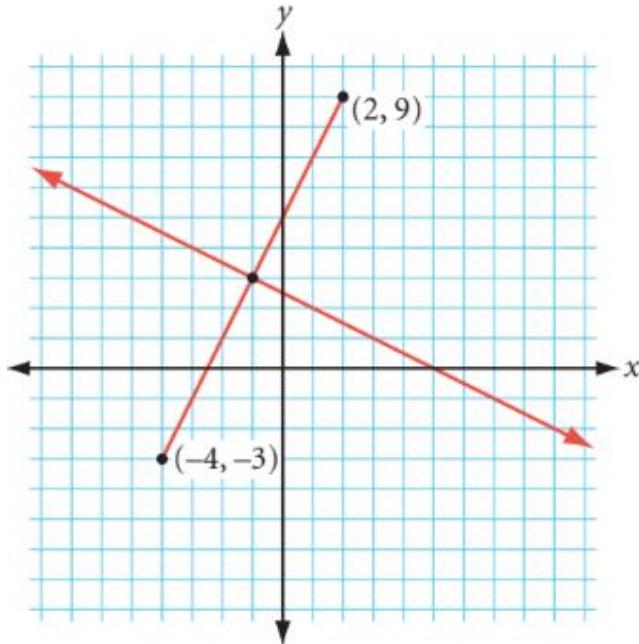


# Lines & Angles Review Problems

6.  $y = \underline{\hspace{2cm}}$

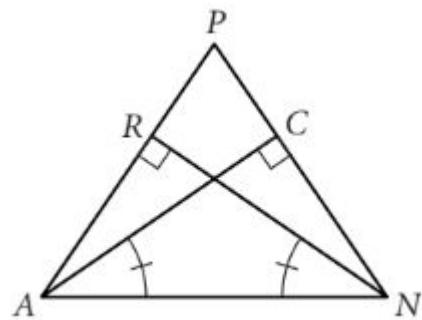


Find the equation of the perpendicular bisector of the segment with endpoints  $(2, 9)$  and  $(-4, -3)$ .

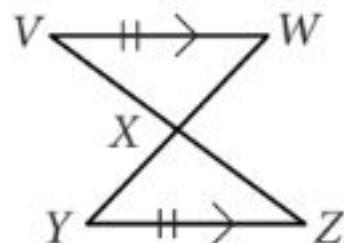


# Deductive Proofs Problems

Prob  $\Delta RAN \cong \Delta CAN$



Prob  $\Delta XYZ \cong \Delta XYZ$



Monday, Oct 25th

# What's happening today?

Check-in (5 minutes)

Unit 1 Test Day - Take 75 minutes with 5 minute break!  
Test Strategy 5 minutes

I will see you Nov 1st  
Work on Project  
NO NEW HOMEWORK!

- Have a nice break!

# Test Strategy

Remember these points while taking the test:

- Have your Toolbox ready before starting!
- Get your pencils sharpened!
- Get your calculators ready
- Get extra sheets for showing detail work
- Don't get stuck - move on and come back to problems where you are stuck
  - We will walk outside if you have questions
- Three bonus problem choices to pick from Do ONE DEFINITELY!.
- Get (only) 1/3rd of points back on Test & Project corrections. So do it correctly the first time!
- Validate your answers!

Monday, Nov 1st

# What's happening today?

Check-in (5 minutes)

Unit 1 Test Corrections! (See my email and Hints!)

Unit 2 Polygons Chapters 5.1 5.2 Problems

Chapter 9: Pythagorean Theorem

# Polygon Sum Conjectures

## Polygon Sum Conjecture

C-31

The sum of the measures of the  $n$  interior angles of an  $n$ -gon is ?.

## Exterior Angle Sum Conjecture

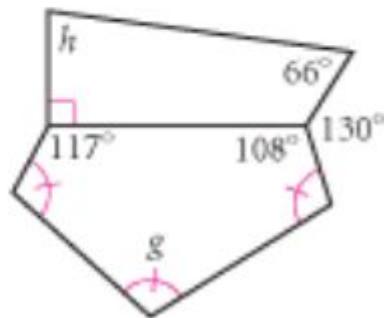
C-32

For any polygon, the sum of the measures of a set of exterior angles is ?.

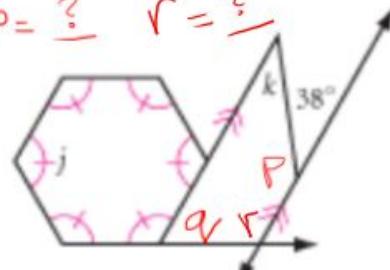
# Unit 2 Chapter 5.1 Problems

Determine lettered angles. State Conjectures. Show detail

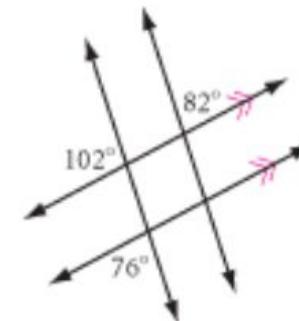
7.  $g = \underline{\hspace{1cm}}$   $\textcolor{blue}{h}$   
 $h = \underline{\hspace{1cm}}$



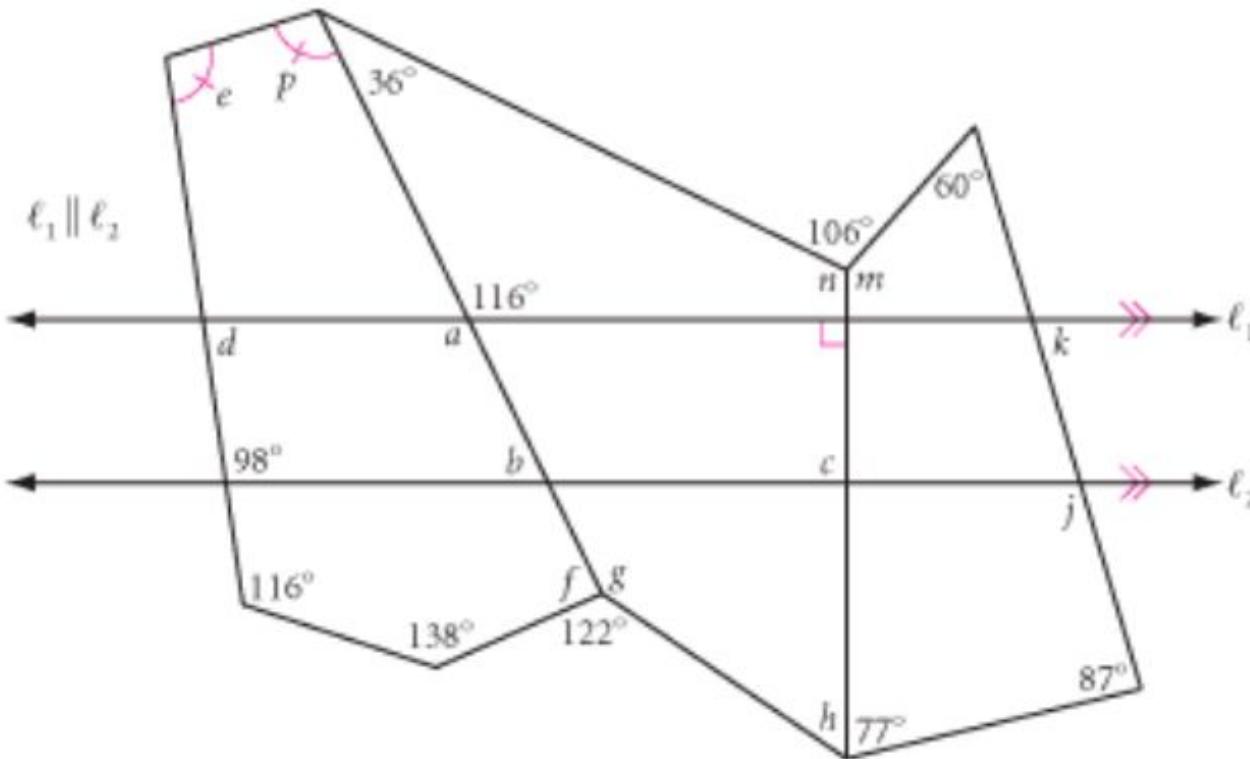
8.  $j = \underline{\hspace{1cm}}$   
 $k = \underline{\hspace{1cm}}$   
 $p = \underline{\hspace{1cm}}$   $q = \underline{\hspace{1cm}}$   
 $r = \underline{\hspace{1cm}}$



9. **Developing Proof** What's wrong with this picture?



# Unit 2 Chapter 5.1 Problems

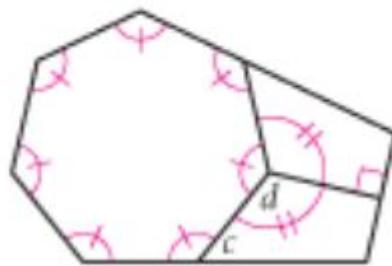


12. **Developing Proof** Trace the figure at right. Calculate each lettered angle measure. Explain how you determined the measures of angles  $d$ ,  $e$ , and  $f$ .

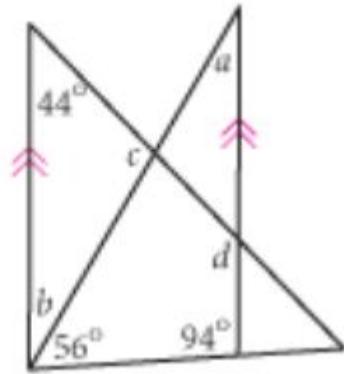
# Unit 2 Chapter 5.2 Problems

Determine lettered angles. State Conjectures. Show detail

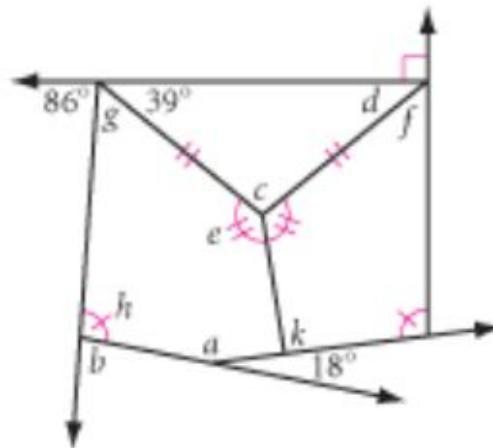
7.



9.

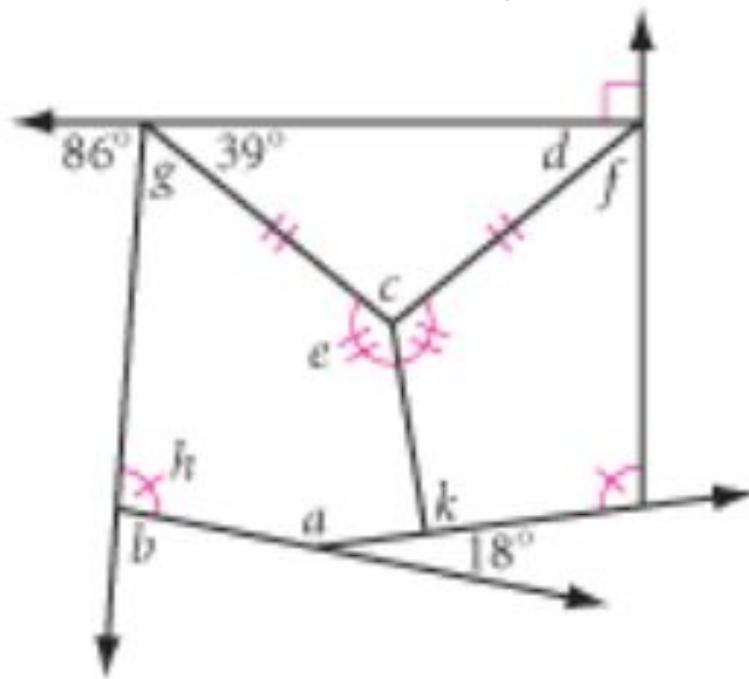


10.



Determine lettered angles. State Conjectures. Show detail

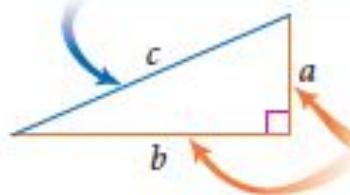
10.



12. Is there a maximum number of obtuse exterior angles that any polygon can have? If so, what is the maximum? If not, why not? Is there a minimum number of acute interior angles that any polygon must have? If so, what is the minimum? If not, why not?

# The theorem of Pythagoras

In a right triangle, the side opposite the right angle is called the **hypotenuse**, here with length  $c$ .



The other two sides are **legs**, here with lengths  $a$  and  $b$ .

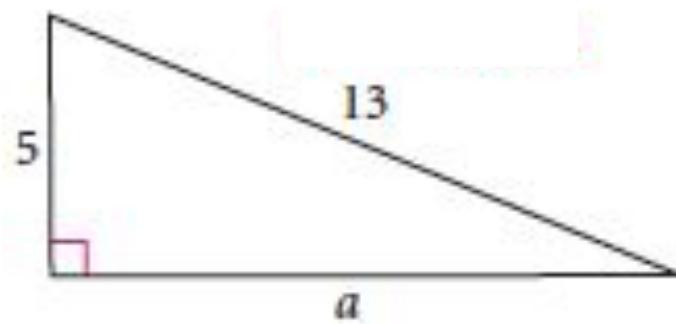
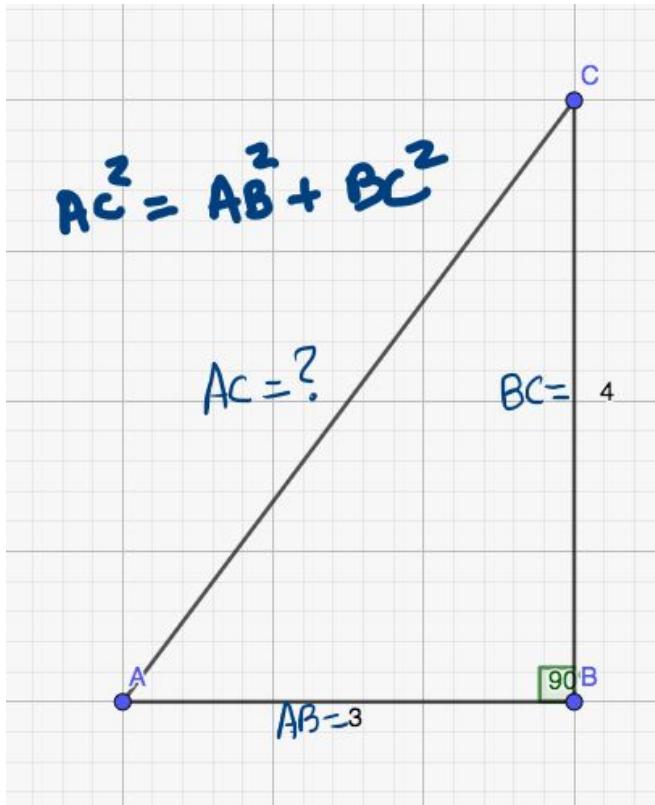
## The Pythagorean Theorem

C-81

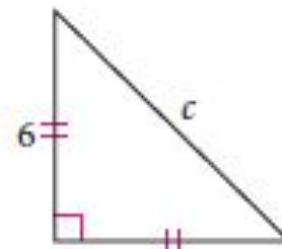
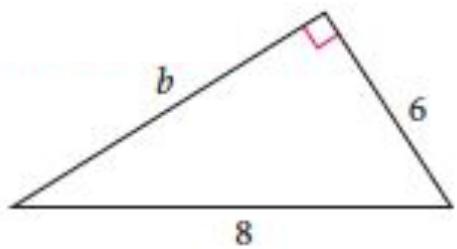
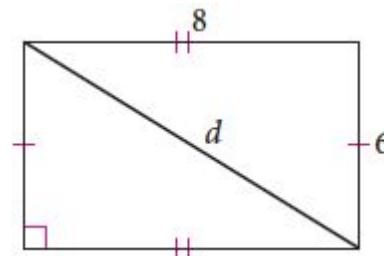
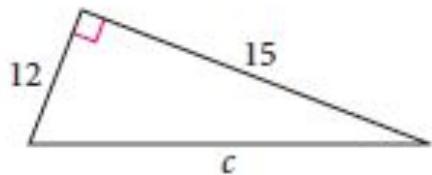
In a right triangle, the sum of the squares of the lengths of the legs equals ?.

the square of the length of the hypotenuse

# Pythagorean Triples



# Some problems - Find the lettered measures



Wednesday, Nov 3rd  
9:30 AM Wis 204a

# What's happening today?

(10 minutes) Introduce yourself to Sub teacher Halinka Wodzicki (Wissner 204A)

(40 minutes) [Work on Centers of Triangles Project](#) - Practice your 3 triangle centers constructions. Be precise. It is worth 10% of your grade!!!

Submit me your idea on Part 3

(10 minute break)

(40 minutes) [Fully solve and submit Unit 2 Polygons Chapters 5.1 5.2 Problems](#) to Google Classroom stating all conjectures and showing details of your work! Do it individually - not in teams! We discussed these in class last week.

Friday, Nov 5th  
11:10 AM Wis 204a

# What's happening today?

Check-in (5 minutes)

Submit Unit 1 Test Correction! (35 minutes)

READ HINTS!!

DO BONUS PROBLEM

5-minute break

Unit 2 Quiz 1 (45 minutes)

Handout printed copy of test

Have students upload to classroom at the end of class

They can leave after that

Tuesday, Nov 8th

# What's happening today?

Check-in

Missed all of you and so proud ..

Review - Completed Polygon Sums and Pythagorean Theorem

Completed Unit 2 Quiz 1 on Polygon Sums - [Quiz graded Correction due](#)  
Triangles Project is due today

## Schedule for the Rest of the Semester!

New Today - Triangle Midsegments

Properties of Special Quadrilaterals Chapters 5.3 to 5.6

There are a LOT of them - but they are all related

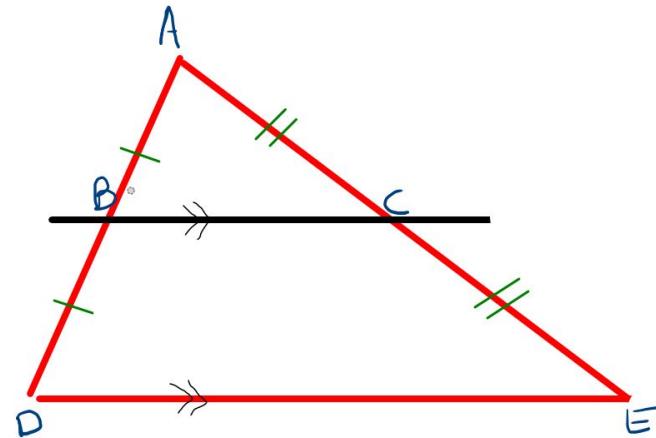
Introduce Polygons Project due

NO CLASS THURSDAY - VETERANS DAY (WORK ON PROJECT!)

# Schedule for the rest of the Semester

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Nov 8		Triangle Centers Project Due Quadrilateral Conjectures Introduce Polygons Project		Veterans Day	
Nov 15		The Distance Formula Practice Geogebra Introduce Proofs		Quadrilateral Problems Pythagorean Problems Proofs Problems	
Nov 22	CLOSED (Thanksgiving)				
Nov 29	New unit: Circles! Definitions and Tangent Conjectures		Central Angles, Arc Measures, and Inscribed Angles		Polygons Project Due Quadrilaterals Quiz (5.3 on)
Dec 6		Pi		Review Day	
Dec 13	Review Day	Reading Day/Faculty Workday	Final Exam		

# Triangle Midsegments



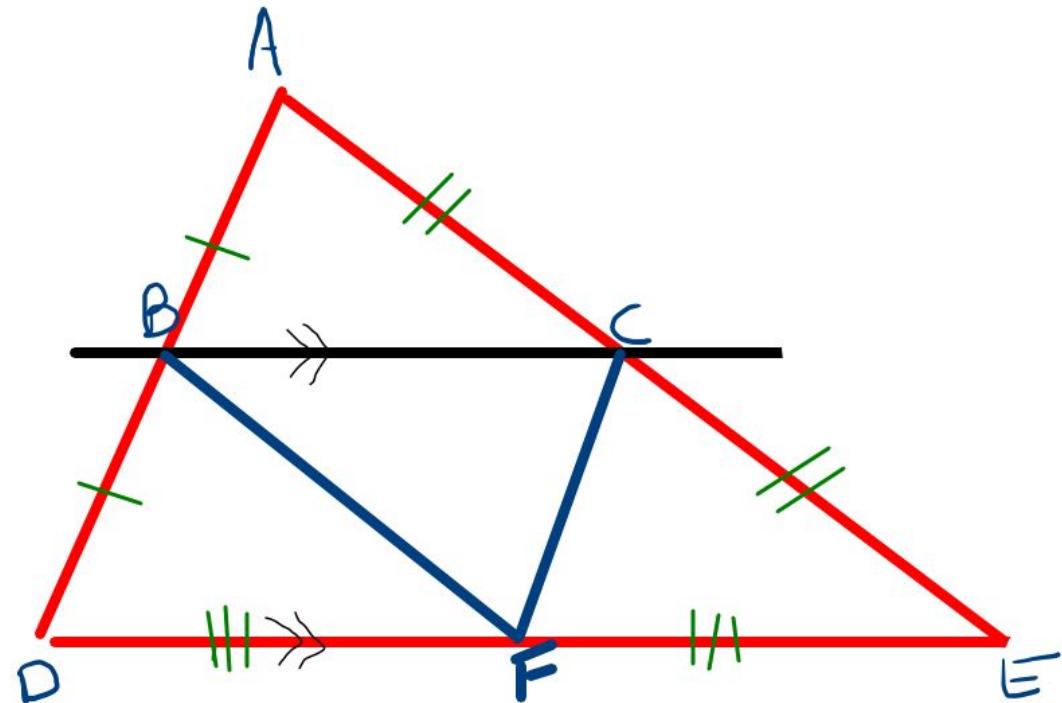
$$BC = \frac{DE}{2}$$

Triangle Midsegment Conjecture parallel, half, the third side

C-42

A midsegment of a triangle is ? to the third side and ? the length of ?.

# Triangle Midsegments



## Three Midsegments Conjecture

C-41

The three midsegments of a triangle divide it into ?. four congruent triangles

# Overall Organization of Quadrilateral Shapes

Just Three Kinds of Shapes:

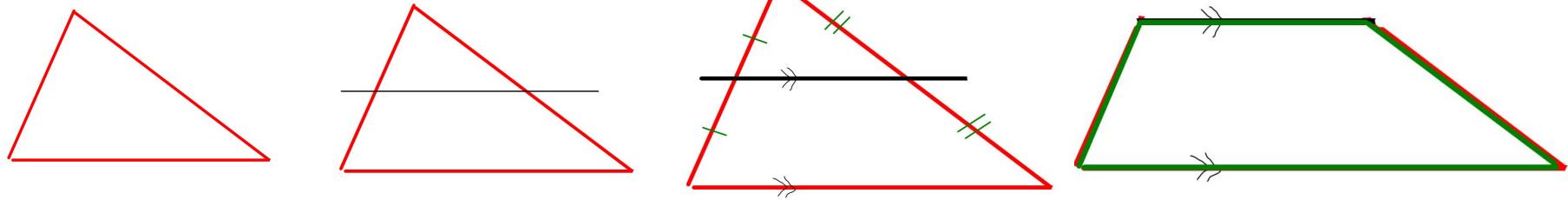
1. Trapezoids (Truncated triangles)
  - a. (Generic) Trapezoid (Quad with exactly one pair of parallel sides that are not congruent)
  - b. Isosceles Trapezoid (Quad with exactly one pair of parallel & congruent sides)
2. Kite (Isosceles triangles with congruent bases stuck together)
3. Parallelograms (Quadrilateral where opposite sides are parallel)
  - a. (Generic) Parallelogram (Quad with opposite sides parallel but not congruent)
  - b. Rhombus (Parallelogram with Four congruent sides)
  - c. Rectangle (Parallelogram with Four congruent angles)
  - d. Square (Parallelogram with Four congruent angles & sides)

A special Google Assignment has been created with all the Conjectures that follow.

A website to help visualize these Quads is also provided here

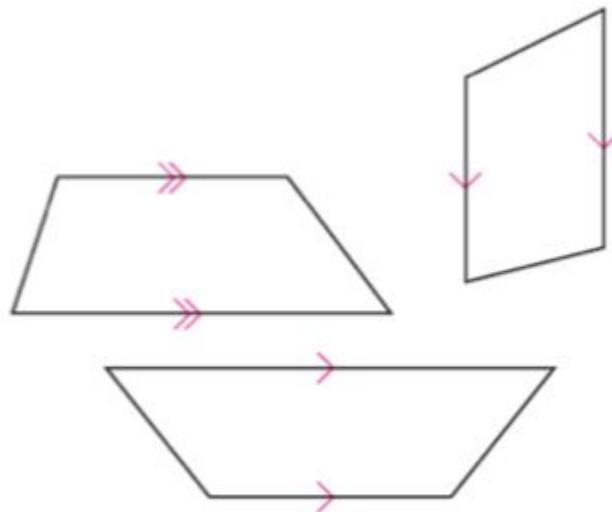
# Make a Trapezoid!

“Take a triangle and chop off the top of it!”

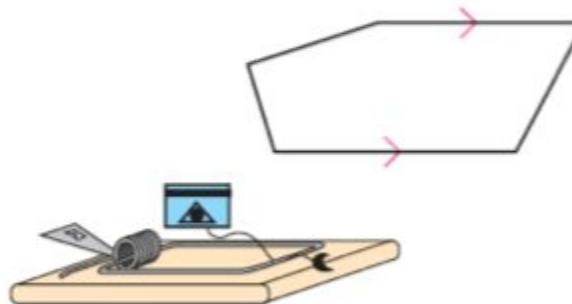


Make sure that you truncate with a line that is parallel to one of the sides!

# Trapezoids - Not Trapezoids



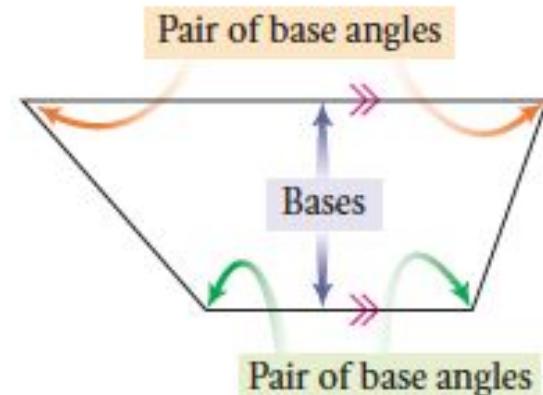
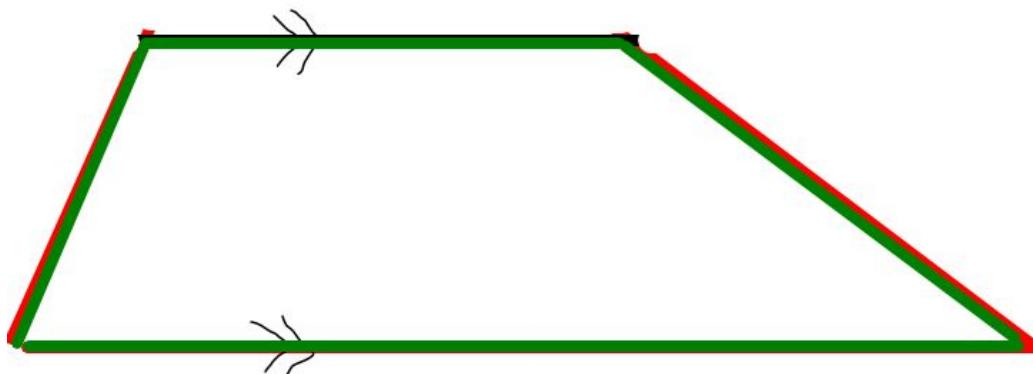
Trapezoids



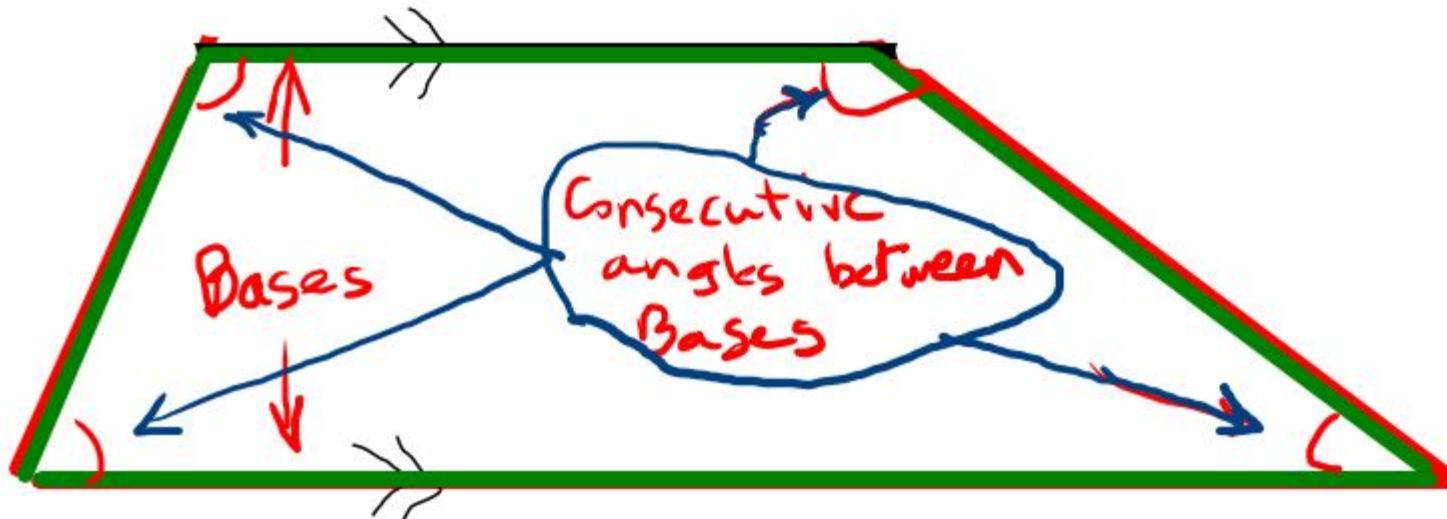
Not trapezoids

# A Trapezoid

**A Trapezoid is a Quadrilateral with exactly one-pair of parallel sides**



# Trapezoid Angle Properties

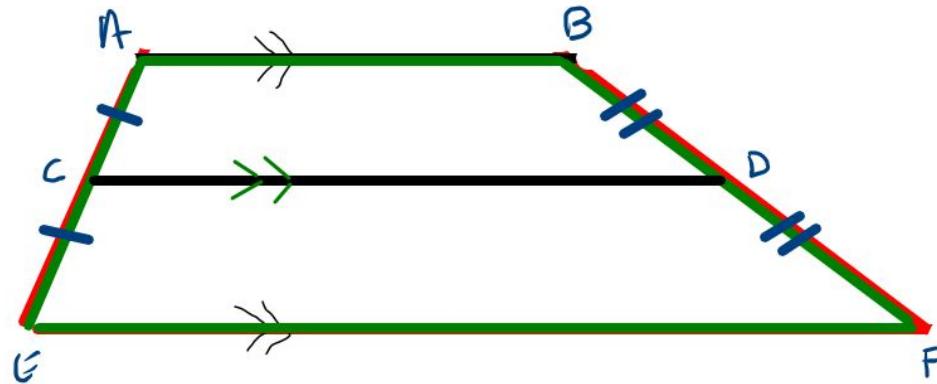


## Trapezoid Consecutive Angles Conjecture

C-38

The consecutive angles between the bases of a trapezoid are ?. supplementary

# Trapezoid Midsegment Properties



$$CD = \frac{AB + EF}{2} \leftarrow \text{average!}$$

Trapezoid Midsegment Conjecture

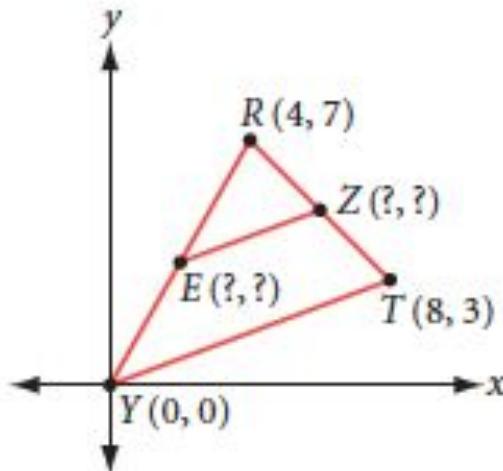
C-43

the average of the lengths of the bases

The midsegment of a trapezoid is ? to the bases and is equal in length to ?.  
parallel

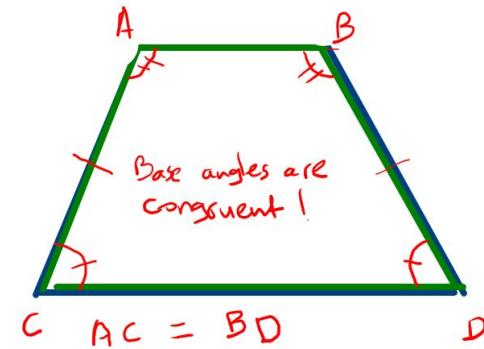
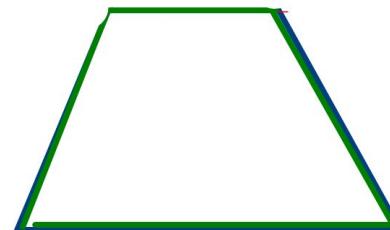
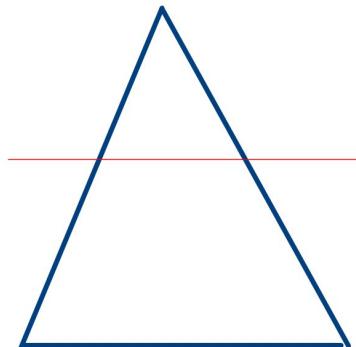
# Trapezoid Midsegment Problems Chapter 5.4

17. Find the coordinates of midpoints  $E$  and  $Z$ . Show that the slope of the line containing midsegment  $\overline{EZ}$  is equal to the slope of the line containing  $\overline{YT}$ .



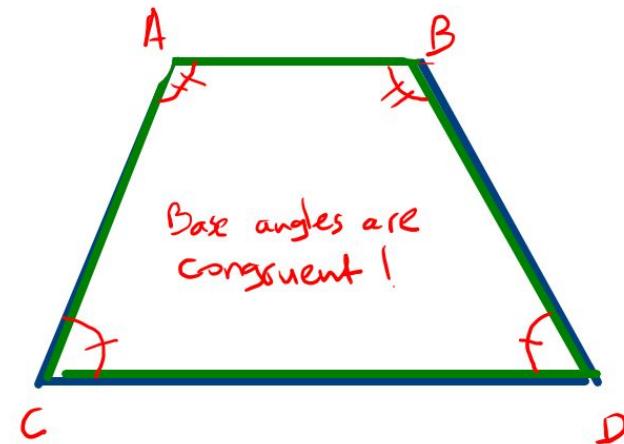
# Make an Isosceles Trapezoid

“Take an Isosceles triangle and chop off the top of it!”



# Isosceles Trapezoid Properties

An Isosceles Trapezoid is a Quadrilateral with exactly one-pair of parallel & congruent sides



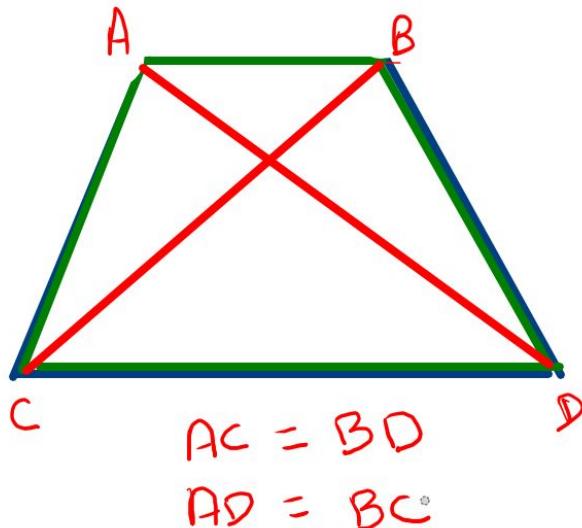
## Isosceles Trapezoid Conjecture

C-39

The base angles of an isosceles trapezoid are ?. congruent

$$AB = \frac{CD}{2} \leftarrow \text{Half the size of the larger base!}$$

# Isosceles Trapezoid Properties



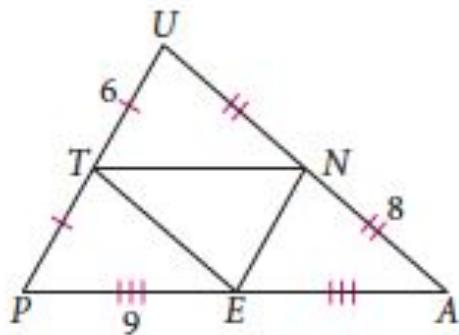
Isosceles Trapezoid Diagonals Conjecture

C-40

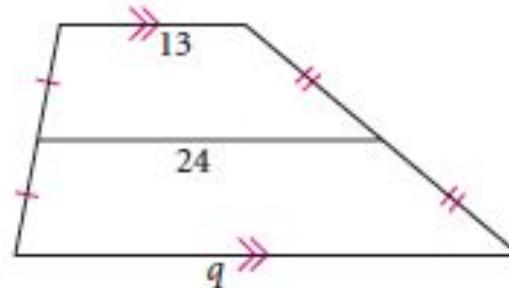
The diagonals of an isosceles trapezoid are ?. **congruent**

# Trapezoid Problems Chapter 5.4

5. What is the perimeter of  $\triangle TEN$ ?

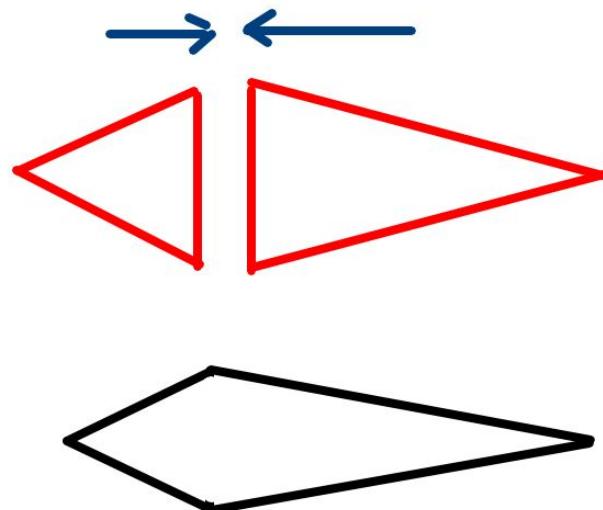


7.  $q = \underline{\hspace{2cm}} ? \hspace{2cm} 35$

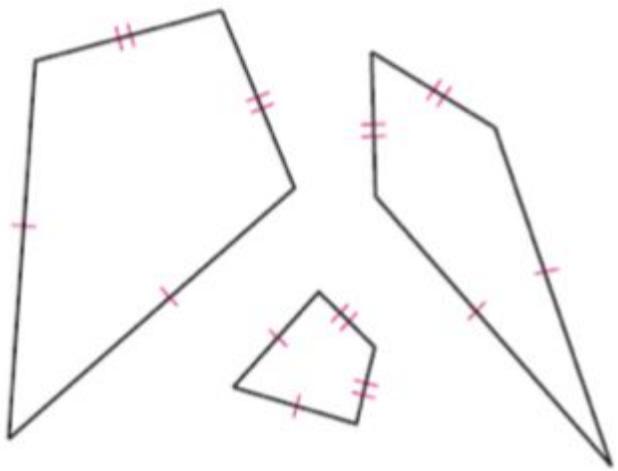


# Make a Kite

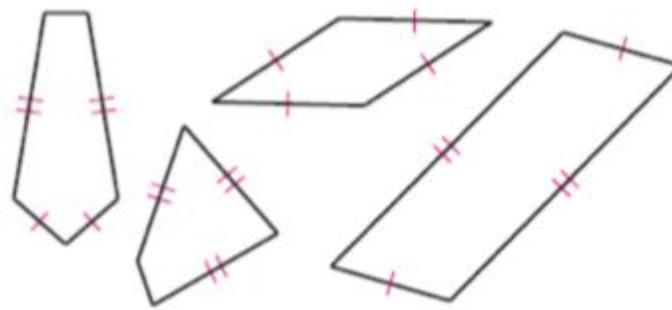
**“Two Isosceles Triangles with their bases jammed together!”**



# Kites - Not Kites



Kites

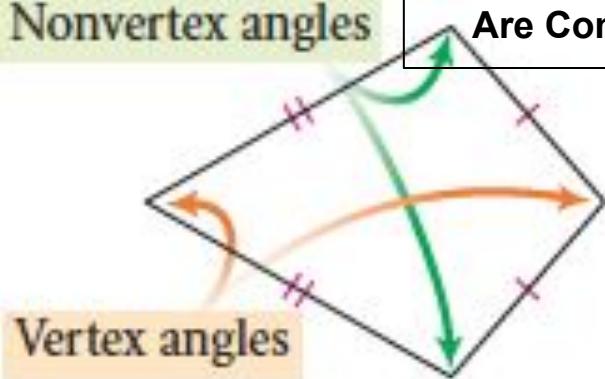


Not kites

# Kite Properties

Nonvertex angles

Are Congruent!

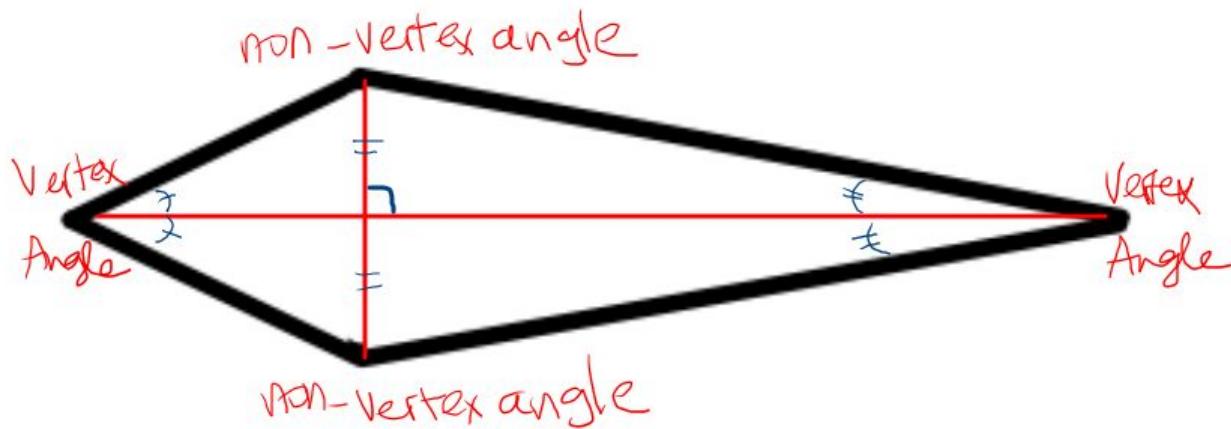


Kite Angles Conjecture

C-34

The ? angles of a kite are ?. **nonvertex, congruent**

# Kite Properties

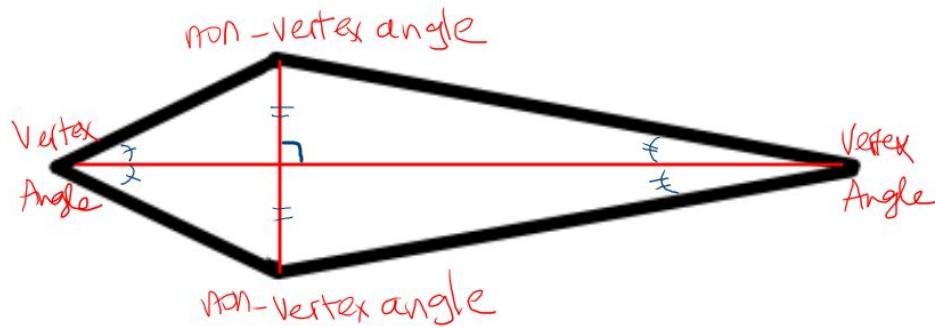


## Kite Diagonals Conjecture

C-35

The diagonals of a kite are ?. perpendicular

# Kite Properties



## Kite Diagonals Conjecture

C-35

The diagonals of a kite are ?. **perpendicular**

## Kite Diagonal Bisector Conjecture

C-36

The diagonal connecting the vertex angles of a kite is the ? of the  
other diagonal.  
**perpendicular bisector**

## Kite Angle Bisector Conjecture

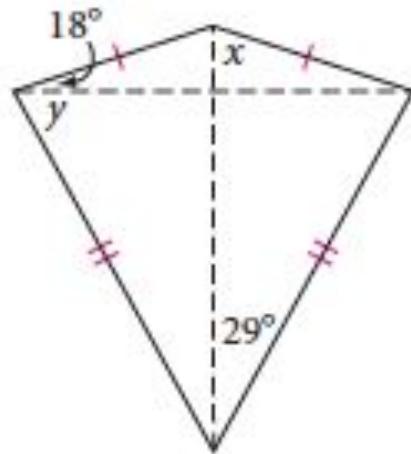
C-37

The ? angles of a kite are ? by a ?. **vertex, bisected, diagonal**

# Kite Problems Chapter 5.3

5.  $x = \underline{\hspace{2cm}} 72^\circ$

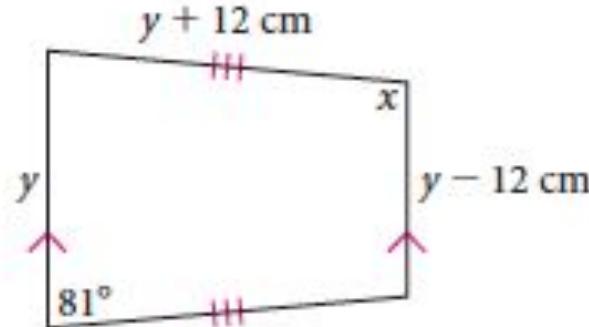
$y = \underline{\hspace{2cm}} 61^\circ$



6.  $x = \underline{\hspace{2cm}} 99^\circ$

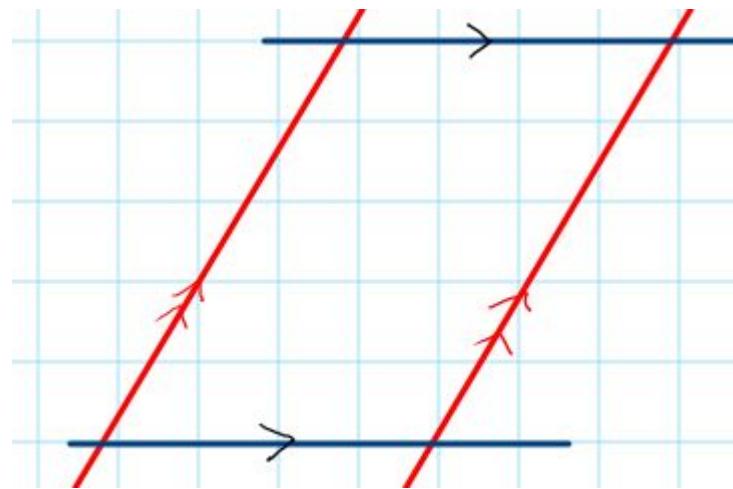
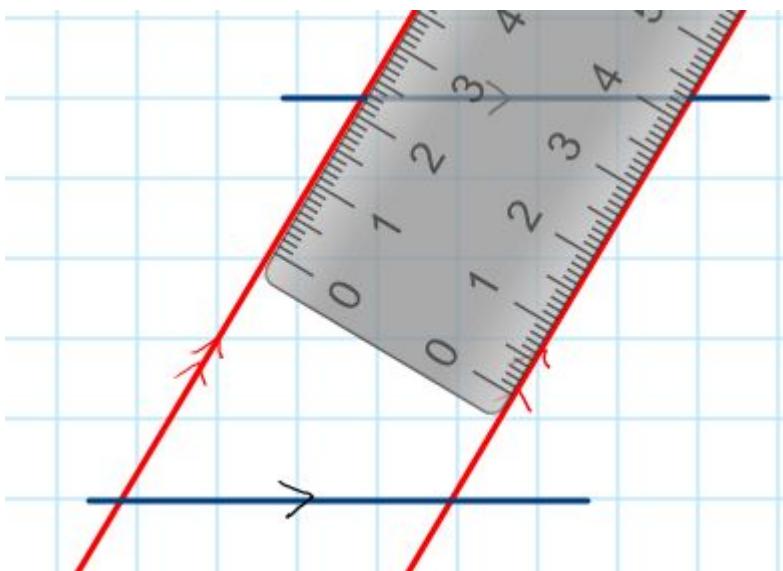
$y = \underline{\hspace{2cm}} 38 \text{ cm}$

perimeter = 164 cm

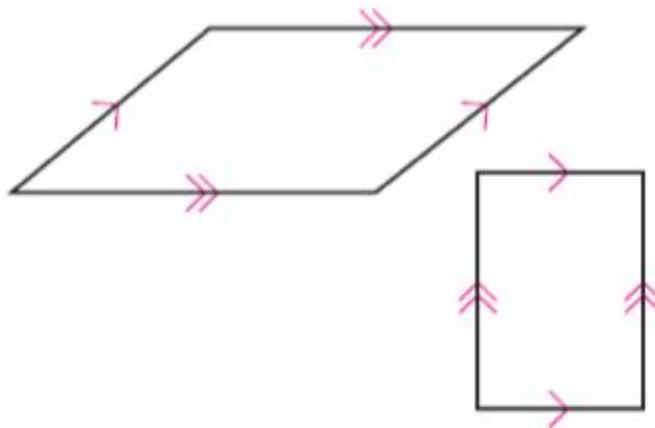


# Make a Parallelogram

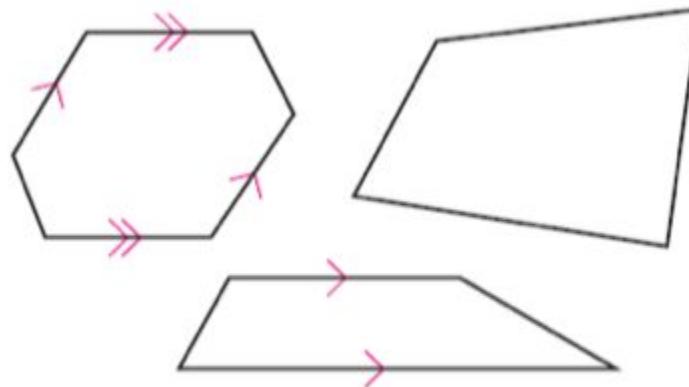
**“A Quadrilateral with 2-pairs of parallel sides”**



# Parallelograms - Not Parallelograms

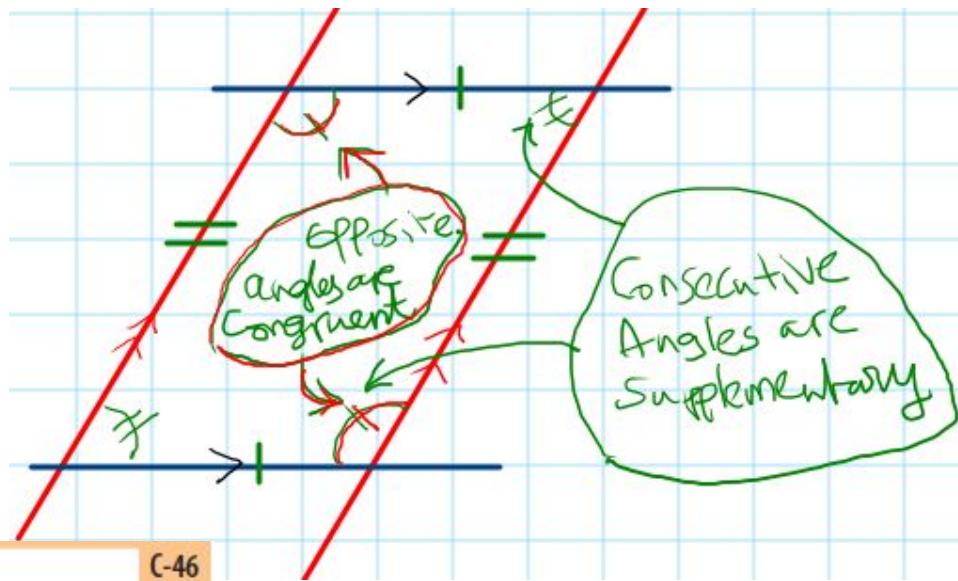


Parallelograms



Not parallelograms

# Parallelogram Properties



## Parallelogram Opposite Sides Conjecture

The opposite sides of a parallelogram are ?. **congruent**

C-46

## Parallelogram Opposite Angles Conjecture

C-44

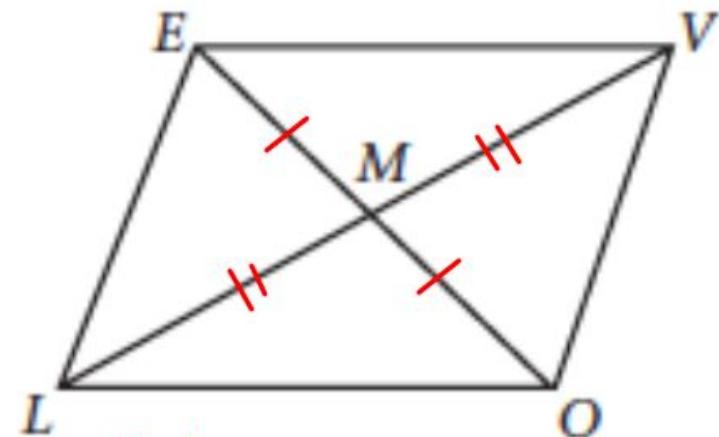
The opposite angles of a parallelogram are ?. **congruent**

## Parallelogram Consecutive Angles Conjecture

C-45

The consecutive angles of a parallelogram are ?. **supplementary**

# Parallelogram Properties



$$EM = OM$$

$$LM = VM$$

## Parallelogram Diagonals Conjecture

C-47

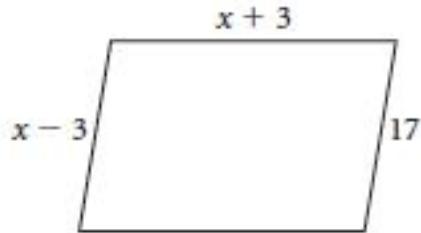
The diagonals of a parallelogram ?. **bisect each other**

# Parallelogram Problems Chapter 5.5

2.  $a = \underline{?}$  **132°**  
 $b = \underline{?}$  **48°**

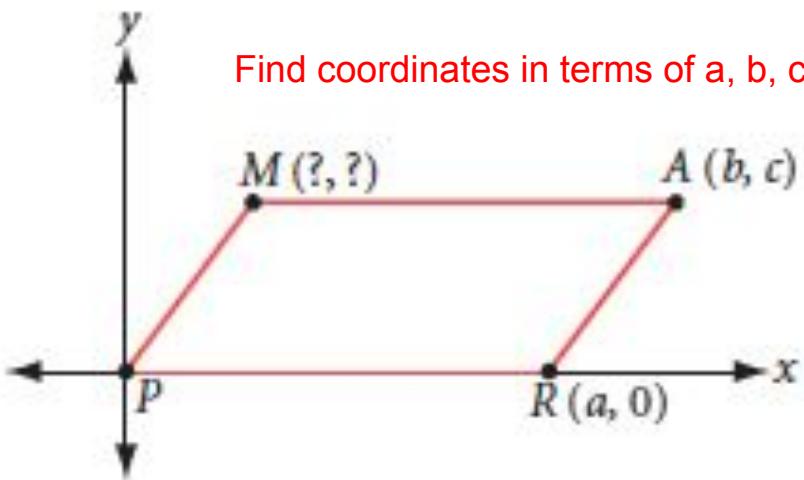


5. What is the perimeter? **80**



# Parallelogram Problems Chapter 5.5

11. Find the coordinates of point  $M$  in parallelogram  $PRAM$ . (

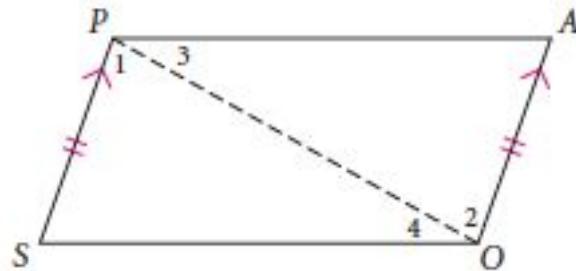


# Parallelogram Problems Chapter 5.7

4. **Developing Proof** Write a flowchart proof to demonstrate that quadrilateral  $SOPA$  is a parallelogram. (h)

**Given:** Quadrilateral  $SOPA$  with  $\overline{SP} \parallel \overline{OA}$  and  $\overline{SP} \cong \overline{OA}$

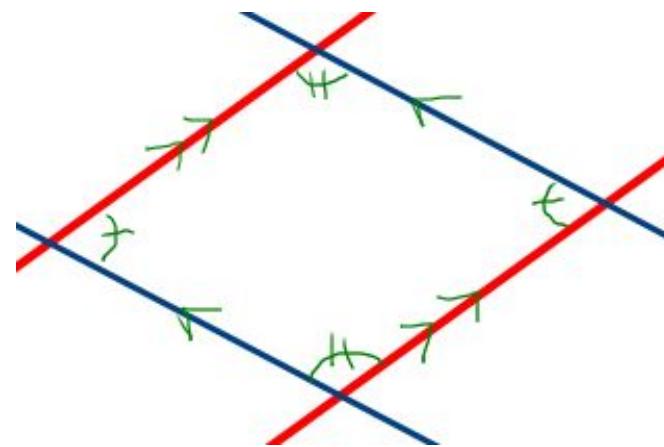
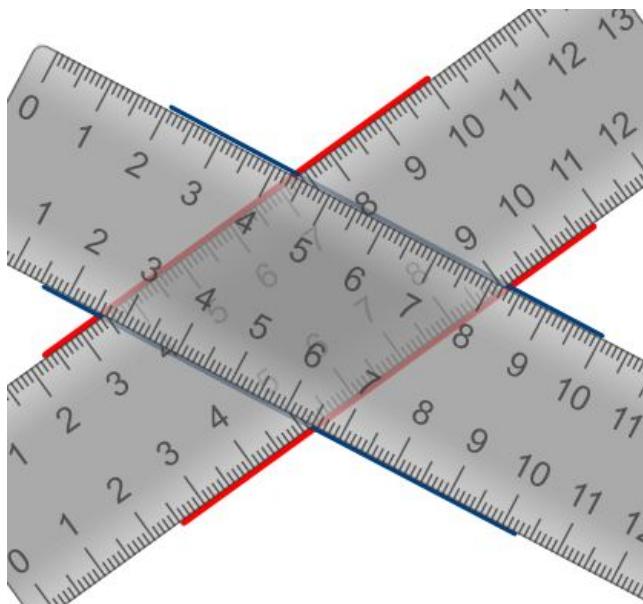
**Show:**  $SOPA$  is a parallelogram



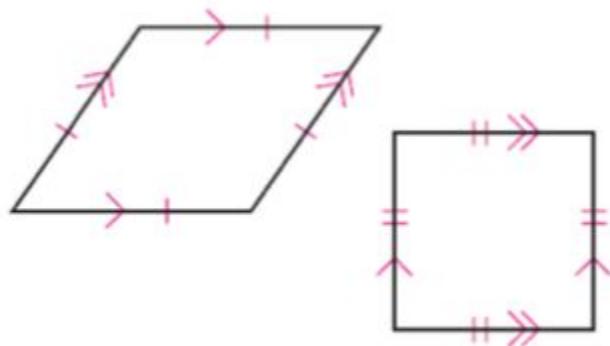
• The student will learn to prove that a quadrilateral is a parallelogram.

# Make a Rhombus

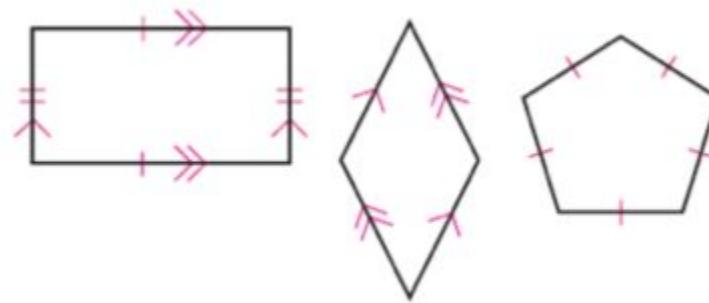
**“A Parallelogram with 4 congruent Sides”**



# Rhombuses - Not Rhombuses



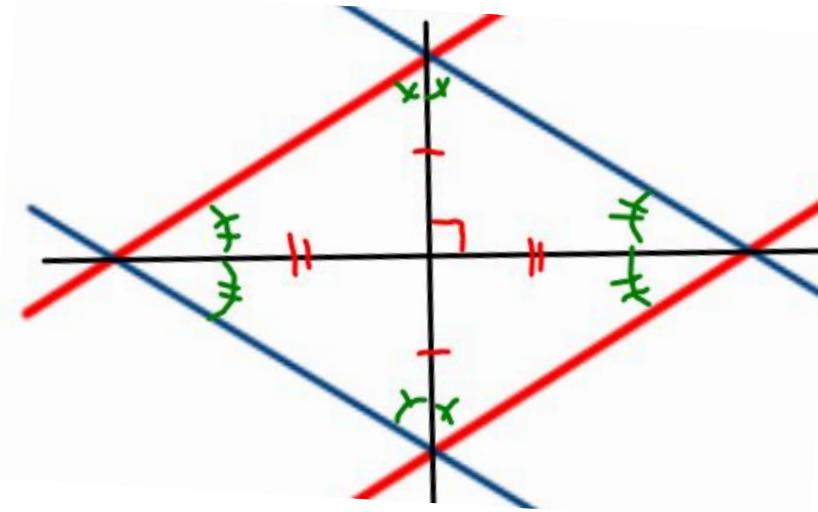
Rhombuses



Not rhombuses

# Rhombus Properties

A Rhombus has all properties of a Parallelogram  
PLUS



## Rhombus Diagonals Conjecture

C-49

The diagonals of a rhombus are ?, and they ? perpendicular, bisect each other

## Rhombus Angles Conjecture

C-50

The ? of a rhombus ? the angles of the rhombus. diagonals, bisect

# Polygons Project

Project is due Nov 29th - after the Thanksgiving Break

1. Create and write a report on four Special Quadrilaterals.
2. Create a Geogebra sketch for each of the 4 Quads selected.
3. None of the sides of the polygons can be parallel to the X or Y axes. The Diagonals can be parallel.
4. Name the vertices, and annotate sides/angles by hand for congruency
5. Find Equations for the 4 sides for each of the 4 Quads and write them neatly on the report. Note special midsegment requirements for the Trapezoids

Friday, Nov 11th

# What's happening today?

## Check-in

Graded Project - returned graded assignment via google notification  
Please see me in conference about this

## Review - Triangle midsegments

Many Special Quad Conjectures and Problems  
Trapezoid, Isosceles Trapezoid, Kite, Parallelogram, Rhombus

## Triangle Centers Project Review

New Today - Rectangle, Square conjectures & Problems  
Pythagorean Distance formula  
There are a LOT of them - but they are all related  
Introduce Polygons Project due

# Definitions of Quadrilateral Shapes

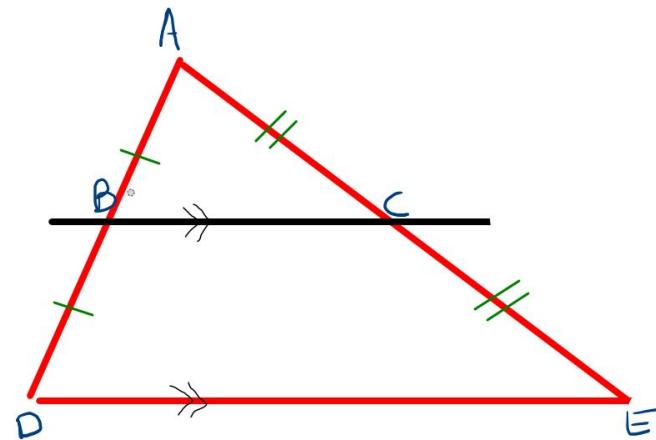
Just Three Kinds of Shapes:

1. Trapezoids (Truncated triangles)
  - a. (Generic) Trapezoid (Quad with exactly one pair of parallel sides that may not be congruent)
  - b. Isosceles Trapezoid (Quad with exactly one pair of parallel & congruent sides)
2. Kite (Isosceles triangles with congruent bases stuck together)
3. Parallelograms (Quadrilateral where opposite sides are parallel)
  - a. (Generic) Parallelogram (Quad with opposite sides parallel but may not be congruent)
  - b. Rhombus (Parallelogram with Four congruent sides)
  - c. Rectangle (Parallelogram with Four congruent angles)
  - d. Square (Parallelogram with Four congruent angles & sides)

A special Google Assignment has been created with all the Conjectures that follow.

A website to help visualize these Quads is also provided here

# Triangle Midsegments



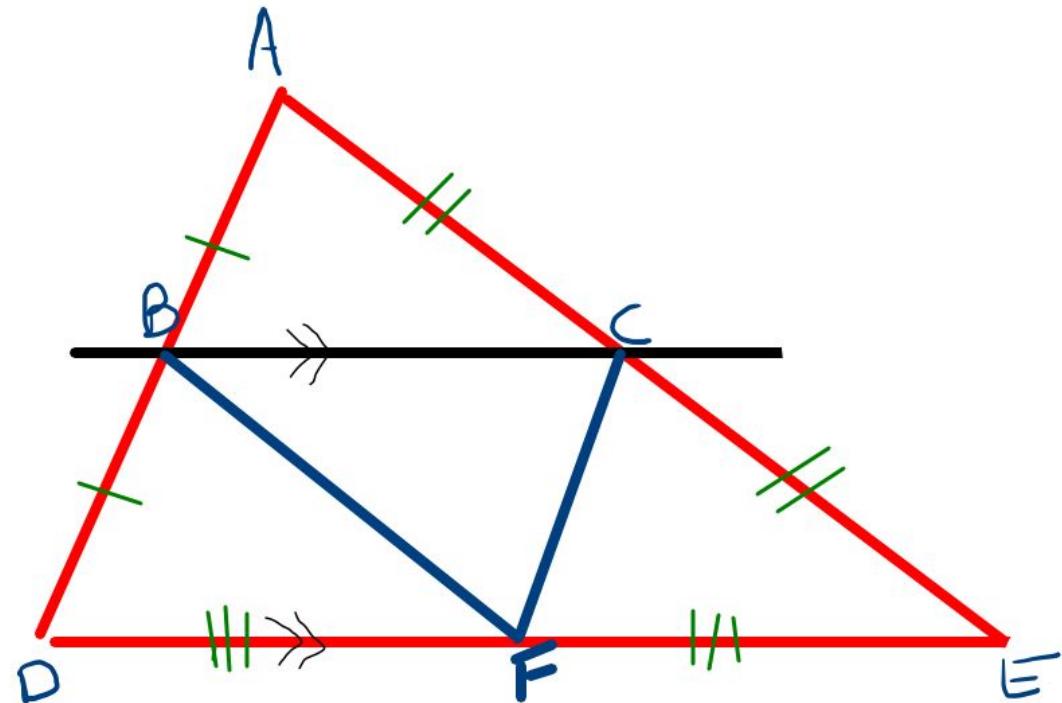
$$BC = \frac{DE}{2}$$

Triangle Midsegment Conjecture parallel, half, the third side

C-42

A midsegment of a triangle is ? to the third side and ? the length of ?.

# Triangle Midsegments



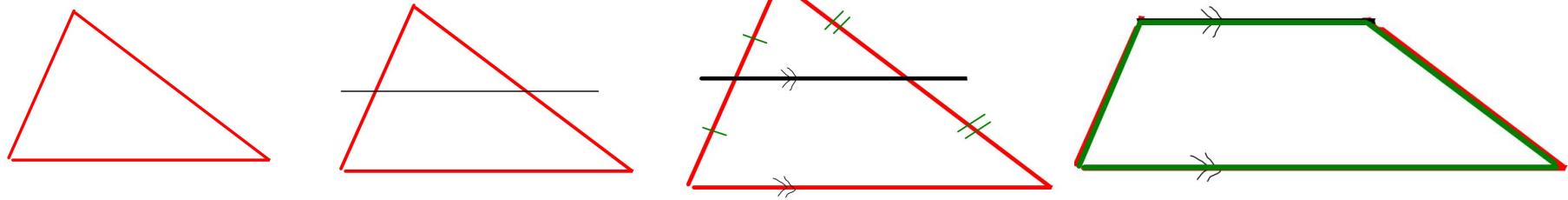
## Three Midsegments Conjecture

C-41

The three midsegments of a triangle divide it into ?. four congruent triangles

# Make a Trapezoid!

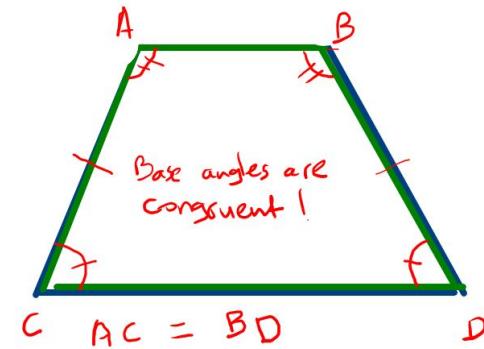
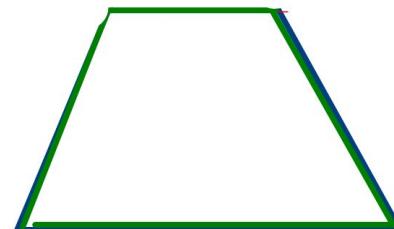
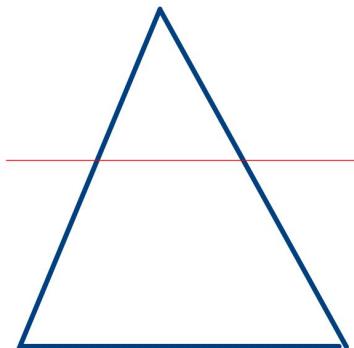
“Take a triangle and chop off the top of it!”



Make sure that you truncate with a line that is parallel to one of the sides!

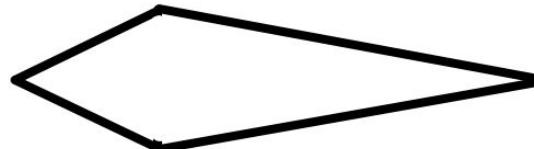
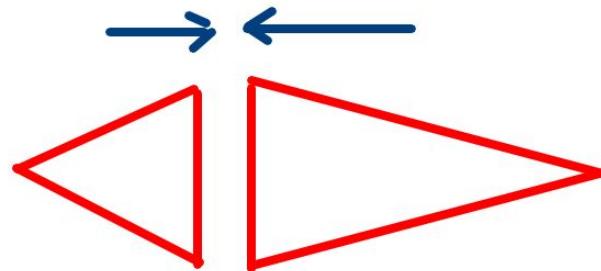
# Make an Isosceles Trapezoid

“Take an Isosceles triangle and chop off the top of it!”



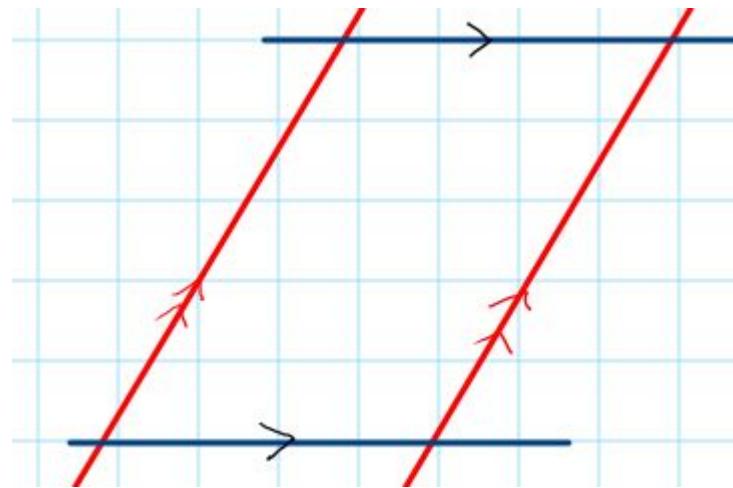
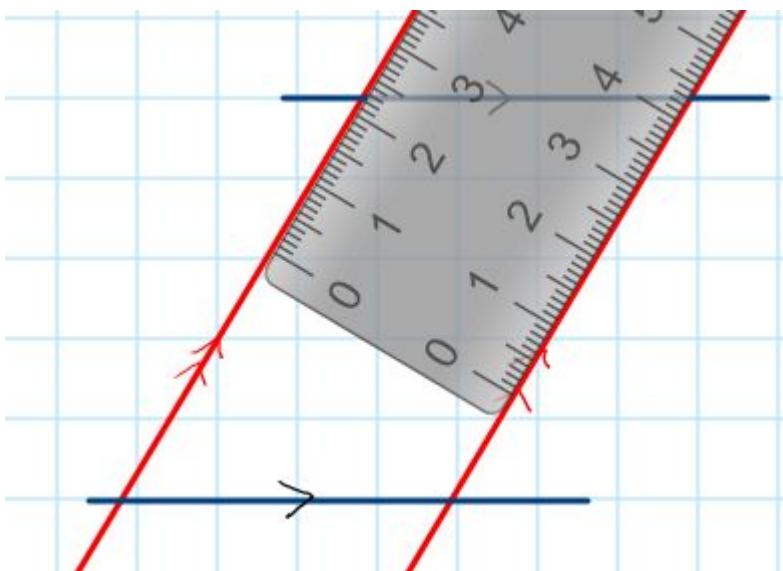
# Make a Kite

**“Two Isosceles Triangles with their bases jammed together!”**



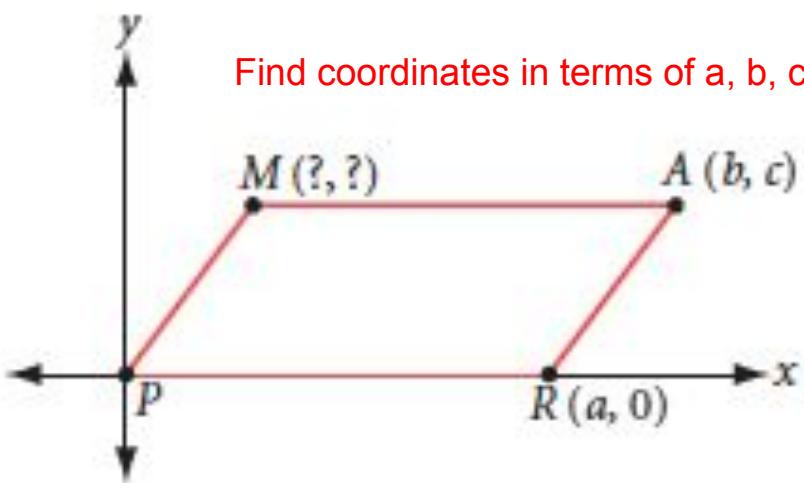
# Make a Parallelogram

**“A Quadrilateral with 2-pairs of parallel sides”**



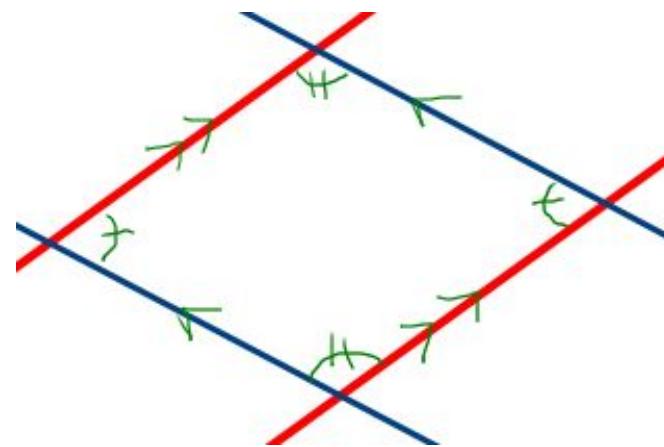
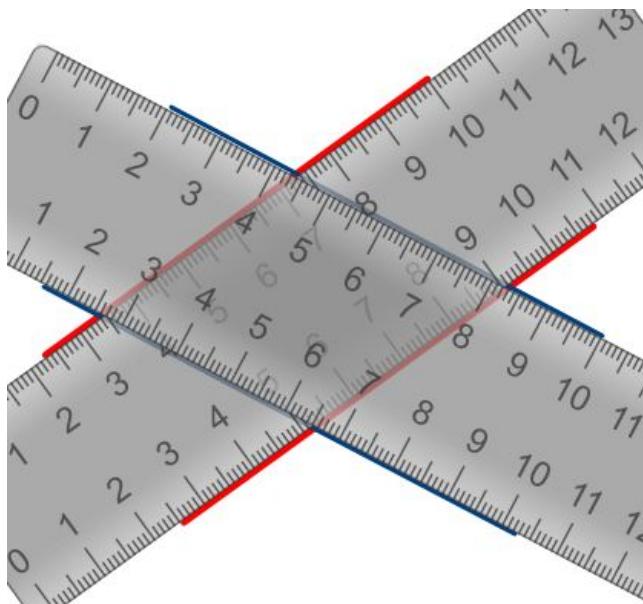
# Missed Problem from last week

11. Find the coordinates of point  $M$  in parallelogram  $PRAM$ . (  $(b - a, c)$  )



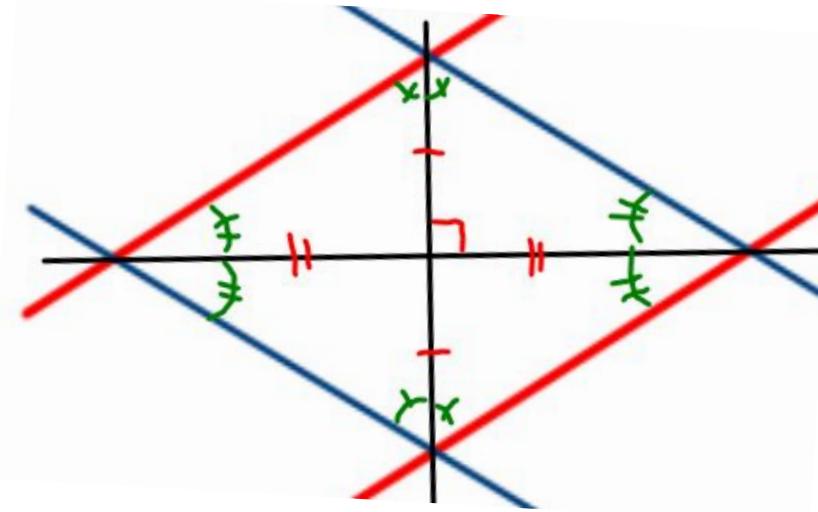
# Make a Rhombus

**“A Parallelogram with 4 congruent Sides”**



# Rhombus Properties

A Rhombus has all properties of a Parallelogram  
PLUS



## Rhombus Diagonals Conjecture

C-49

The diagonals of a rhombus are ?, and they ? perpendicular, bisect each other

## Rhombus Angles Conjecture

C-50

The ? of a rhombus ? the angles of the rhombus. diagonals, bisect

# Polygons Project

Project is due Nov 29th - after the Thanksgiving Break

1. Create and write a report on four Special Quadrilaterals.
2. Create a Geogebra sketch for each of the 4 Quads selected.
3. None of the sides of the polygons can be parallel to the X or Y axes. The Diagonals can be parallel.
4. Name the vertices, and annotate sides/angles by hand for congruency
5. Find Equations for the 4 sides for each of the 4 Quads and write them neatly on the report. Note special midsegment requirements for the Trapezoids

Tuesday, Nov 16th

# What's happening today?

## Check-in/Reminders

Complete the distance formula - problem #8 & #9?

Are you working on the Special Quad Problems Assignment?

Submitting redo of the Triangle Centers project?

Start work on the Polygons Project

- Today -      Review remaining schedule  
                Review Quad Definitions & Rhombus  
                Rectangle & Square  
                Proofs  
                Distance Formula  
                Introduce Polygons Project  
                Learn Geogebra!

# Schedule for the rest of the Semester

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Nov 15		The Distance Formula Quadrilateral Problems Introduce Polygons Project		Polygons Project Learn Geogebra Proofs Problems	
Nov 22	CLOSED (Thanksgiving)				
Nov 29	New unit: Circles! Definitions and Tangent Conjectures		Central Angles, Arc Measures, and Inscribed Angles		Pi Investigation Polygons Project is due Quadrilateral Quiz
Dec 6		Complete Circles Chapter Proofs Review Day		Review Day	
Dec 13	Review Day <b>ALL PENDING ASSIGNMENTS DUE!</b>	Reading Day/Faculty Workday		Geo E-Block Final Exam	

# Definitions of Quadrilateral Shapes

Just Three Kinds of Shapes:

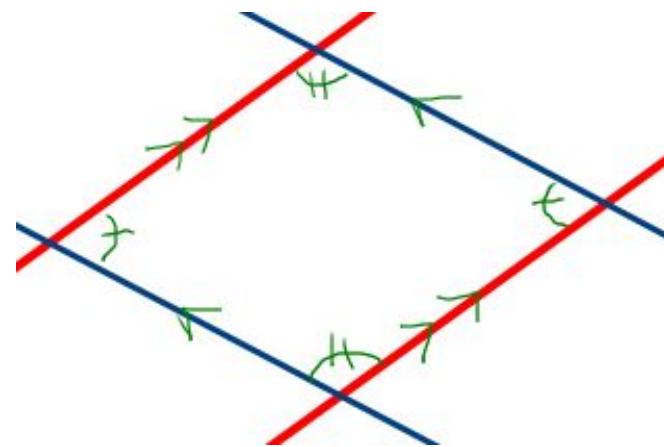
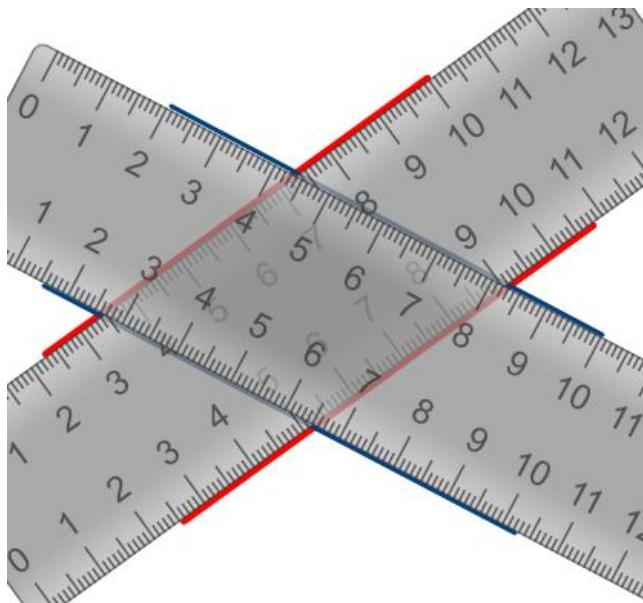
1. Trapezoids (Truncated triangles)
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  - b. Rhombus (Parallelogram with Four congruent sides)
  - c. Rectangle (Parallelogram with Four congruent angles)
  - d. Square (Parallelogram with Four congruent angles & sides)

A special Google Assignment has been created with all the Conjectures that follow.

A website to help visualize these Quads is also provided here

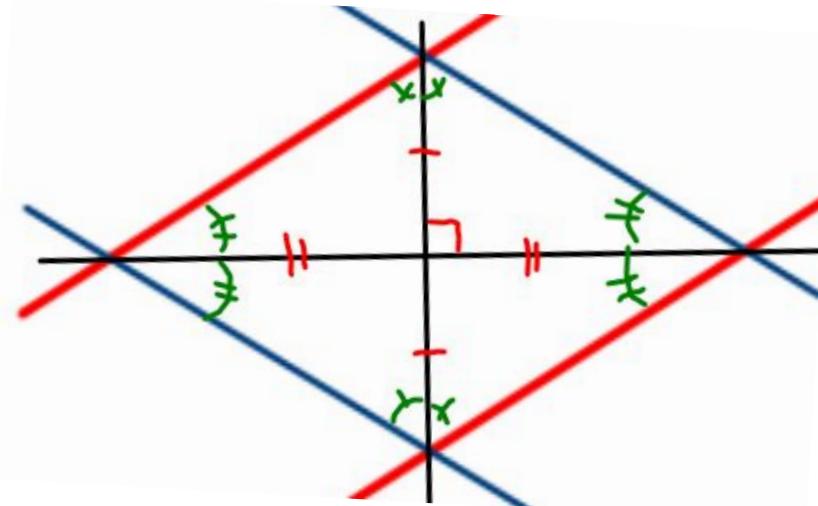
# Make a Rhombus

**“A Parallelogram with 4 congruent Sides”**



# Rhombus Properties

A Rhombus has all properties of a Parallelogram  
PLUS



## Rhombus Diagonals Conjecture

C-49

The diagonals of a rhombus are ?, and they ? perpendicular, bisect each other

## Rhombus Angles Conjecture

C-50

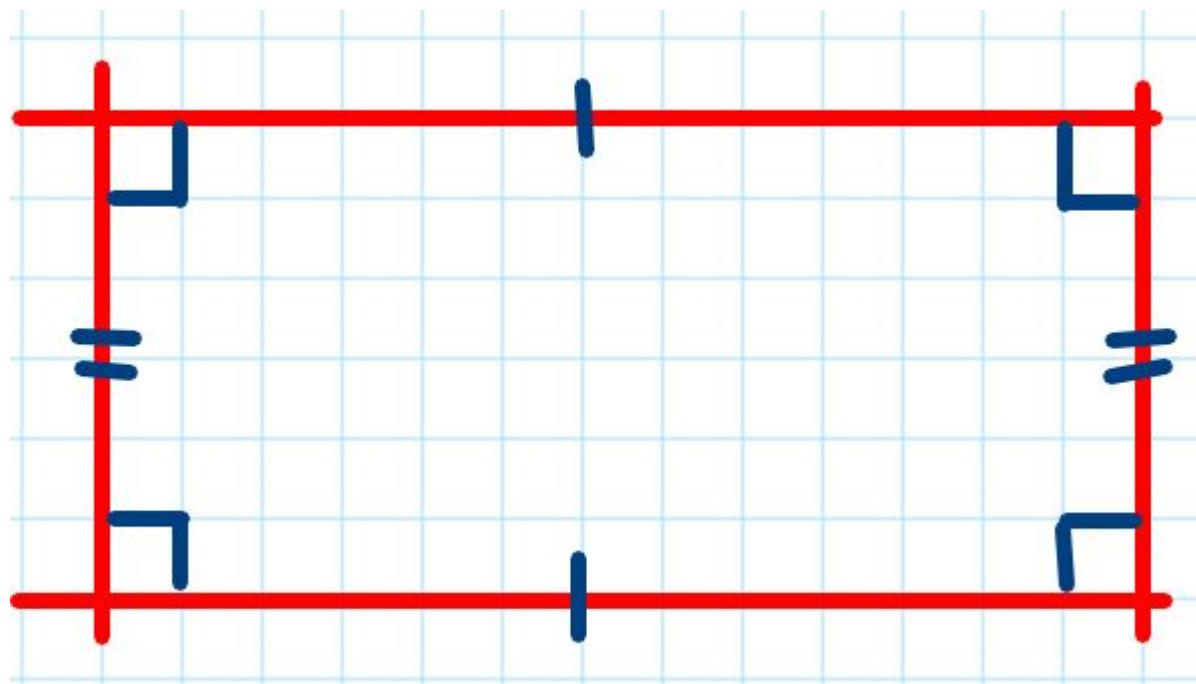
The ? of a rhombus ? the angles of the rhombus. diagonals, bisect

Prove the Rhombus angles conjecture using only the definition of a Rhombus and prior conjectures

# Make a Rectangle!

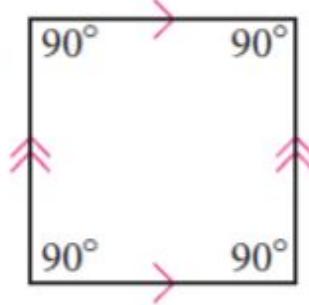
**“A Parallelogram with 4 congruent Angles”**

Prove that the rectangle has all right angles using only the definition of a rectangle and prior conjectures

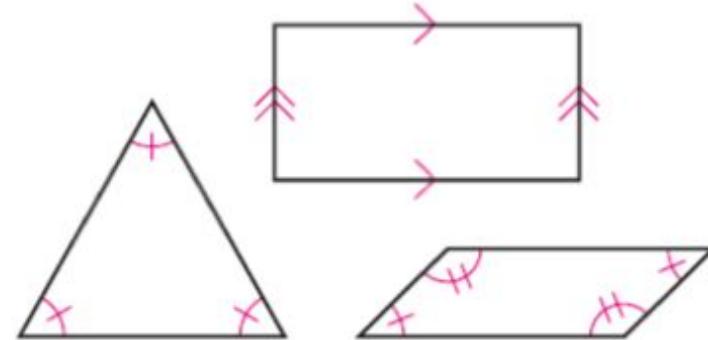


Prove that the rectangle has all congruent sides using only the definition of a Rectangle and prior conjectures

# Rectangles - Not Rectangles



Rectangles



Not rectangles

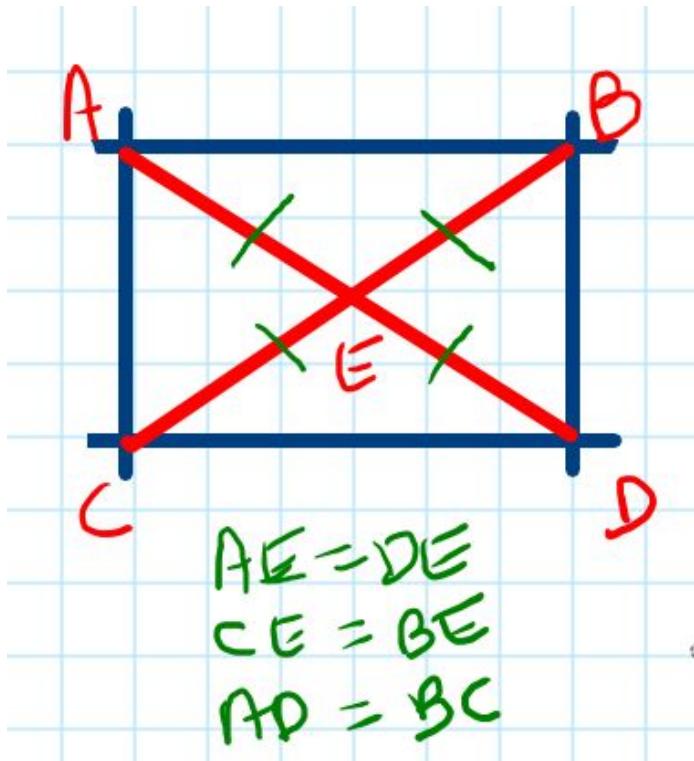
# Rectangle Properties

A Rectangle has all properties of a Parallelogram  
PLUS

## Rectangle Diagonals Conjecture

The diagonals of a rectangle are ? and ?. congruent, bisect each other

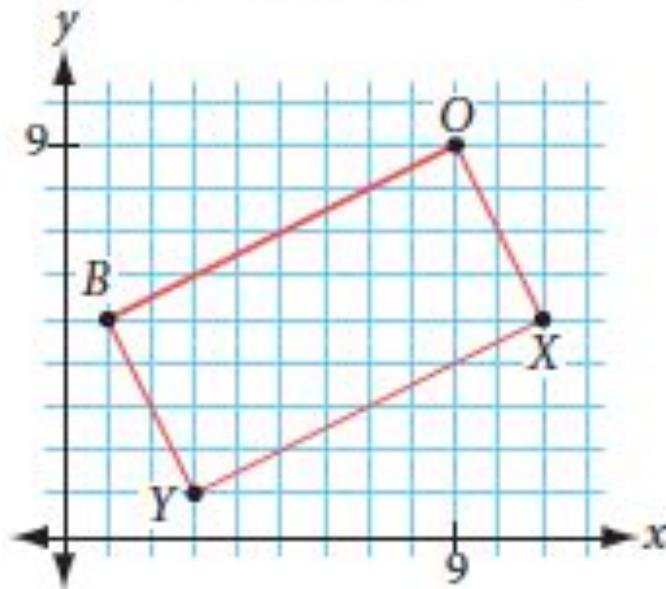
C-51



Can you Prove the Rectangle Diagonals Conjecture using only the definition of a Rectangle and prior conjectures?

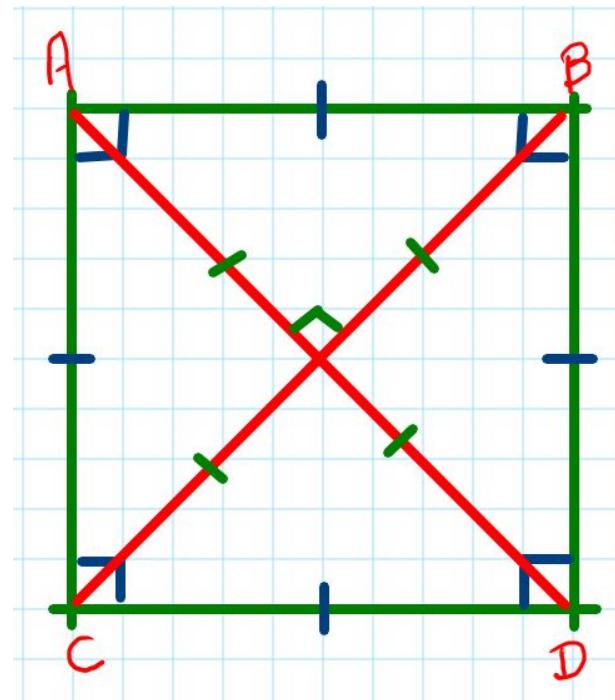
# Rectangle Problems

15. Is  $BOXY$  a rectangle? Why?

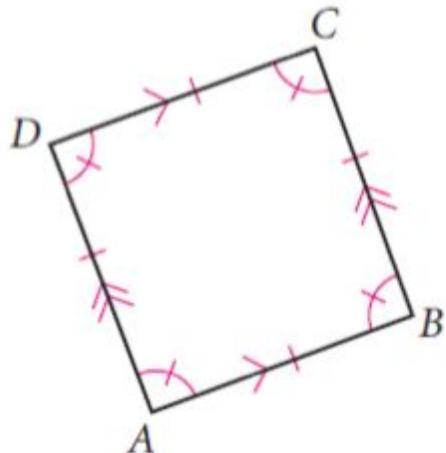
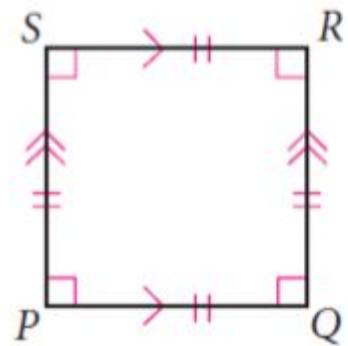


# Make a Square

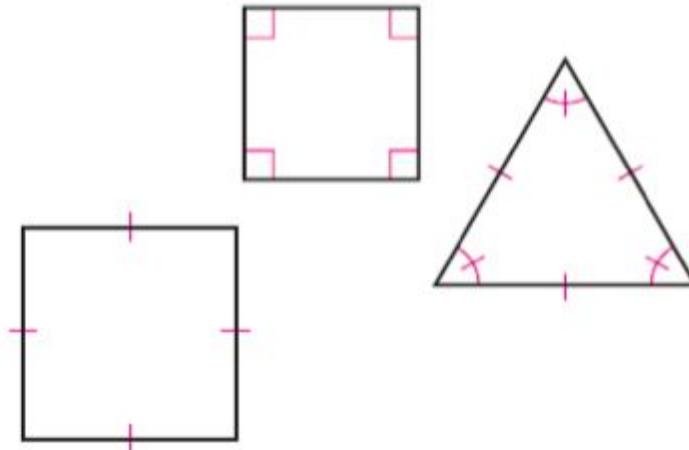
**“A Parallelogram with 4 congruent Sides and 4 congruent Angles”**



# Squares - Not Squares



Squares



Not squares

# Square Properties

A Square has all properties of a Parallelogram  
PLUS

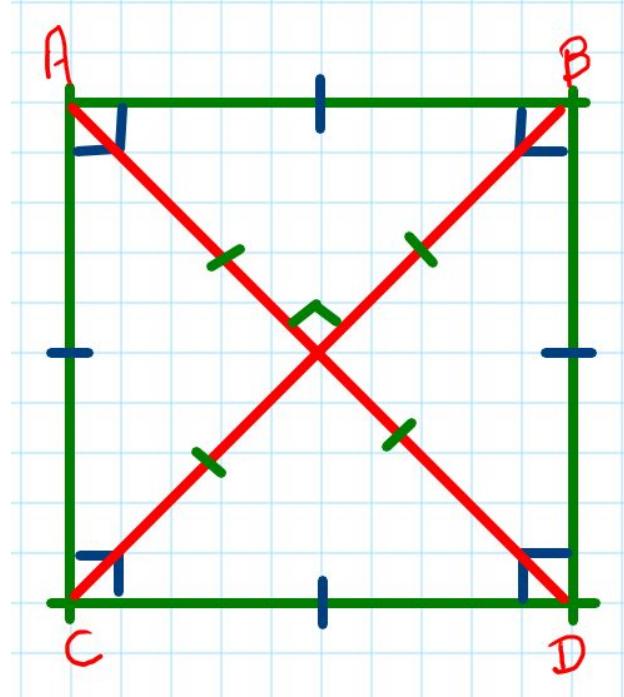
A square is an equilateral rectangle.

A square is an equiangular rhombus.

## Square Diagonals Conjecture

The diagonals of a square are ?, ?, and ?. congruent, perpendicular, bisect each other

C-52



# Polygons Project

Project is due Nov 29th - after the Thanksgiving Break

1. Create and write a report on four Special Quadrilaterals.
2. Create a Geogebra sketch for each of the 4 Quads selected.
3. None of the sides of the polygons can be parallel to the X or Y axes. The Diagonals can be parallel.
4. Name the vertices, and annotate sides/angles by hand (or Geogebra) for congruency. Look at Special Quads slides prior for examples!
5. Find Equations for the 4 sides for each of the 4 Quads and write or type (Google equations) them neatly on the report. Note special midsegment equation requirements for the Trapezoids

# Quick Geogebra Review

[Access Geogebra here](#)

[Many Geogebra examples here!](#)

How to:

Points

Line Segments

Lines

Angles

Notations

# Pythagorean Distance Formula!

We already did some back in slides 169-171 - Review These!

7. How about a more difficult question. If the length of a diagonal of a rectangle is 10 inches and the length of one of the rectangle's sides is 5 inches, how long is the other side?
  
8. Now time for another Coordinate Geometry formula! We have been able to calculate the midpoint of a graphed line segment and its slope, but what about its length? The Pythagorean Theorem can do that too! Calculate the length of  $\overline{CB}$ .



# Complete Pythagorean Investigation!

[Google Assignment \(Also in Portal\)](#)

Complete problem #8 #9 on your own

A Special Quad/Pyth Quiz Scheduled for December 3rd

Special Quads Chapters 5.3 to 5.7

Pythagorean Theorem Chapters 9.1, 9.2, 9.5

# Reminders

## Reminders

Complete the distance formula - problem #8 & #9?

Are you working on the Special Quad Problems Assignment?

Submit redo of the Triangle Centers project

Work on the Polygons Project

Thursday, Nov 18th  
Last class prior to  
Thanksgiving

# What's happening today?

Check-in/Reminders

Complete the distance formula - problem #8 & #9?

Are you working on the Special Quad Problems Assignment?

Are you working on redoing the Triangle Centers project?

Today -      Review Schedule

Review Rectangles & Square - do problems

Learn to use Geogebra!

Polygons Project Discussions

Proofs & other Problems

# Schedule for the rest of the Semester

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Nov 15		The Distance Formula Quadrilateral Problems Introduce Polygons Project		Polygons Project Learn Geogebra Proofs Problems	
Nov 22	CLOSED (Thanksgiving)				
Nov 29	New unit: Circles! Definitions and Tangent Conjectures		Central Angles, Arc Measures, and Inscribed Angles		Pi Investigation Polygons Project is due Quadrilateral Quiz
Dec 6		Complete Circles Chapter Proofs Review Day		Review Day	
Dec 13	Review Day <b>ALL PENDING ASSIGNMENTS DUE!</b>	Reading Day/Faculty Workday		Geo E-Block Final Exam	

# Definitions of Quadrilateral Shapes

Just Three Kinds of Shapes:

1. Trapezoids (Truncated triangles)
  - a. (Generic) Trapezoid (Quad with exactly one pair of parallel sides that may not be congruent)
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  - c. Rectangle (Parallelogram with Four congruent angles)
  - d. Square (

A special Google Assignment has been created with all the Conjectures that follow.

A website to help visualize these Quads is also provided here

# Rectangle Properties

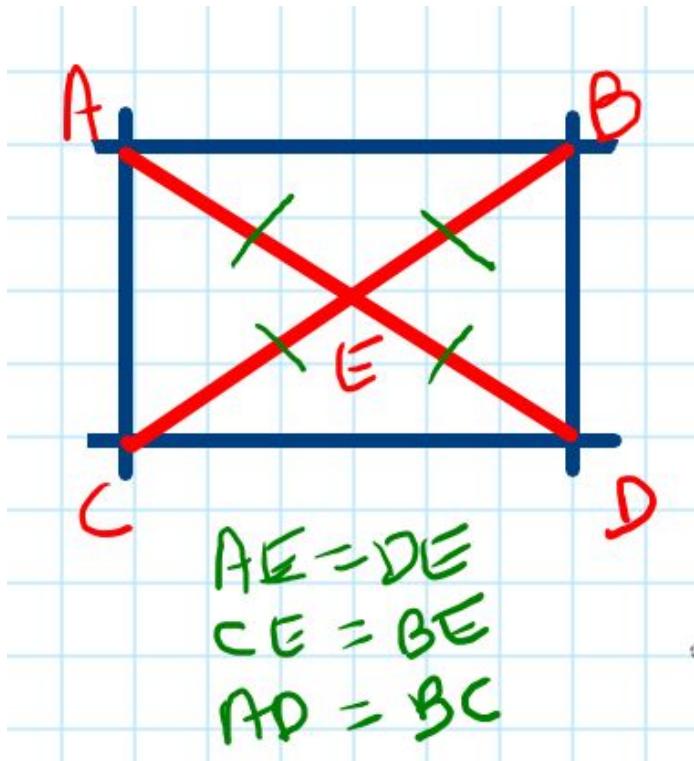
**"A Parallelogram with 4 congruent Angles"**

A Rectangle has all properties of a Parallelogram  
PLUS

**Rectangle Diagonals Conjecture**

The diagonals of a rectangle are ? and ?. congruent, bisect each other

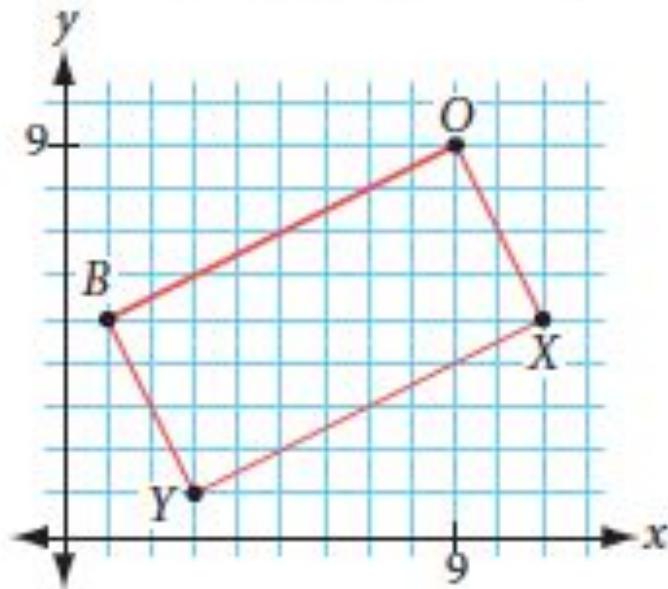
C-51



Can you Prove the Rectangle Diagonals Conjecture using only the definition of a Rectangle and prior conjectures?

# Rectangle Problems

15. Is  $BOXY$  a rectangle? Why?



# Square Properties

**“A Parallelogram with 4 congruent Sides and 4 congruent Angles”**

A Square has all properties of a Parallelogram  
PLUS

A square is an equilateral rectangle.

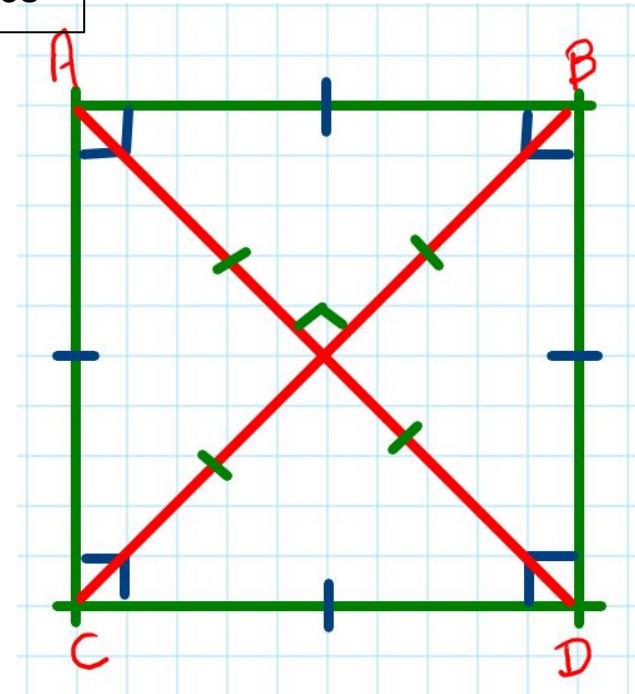
A square is an equiangular rhombus.

Square Diagonals Conjecture

The diagonals of a square are ?, ?, and ?. congruent, perpendicular,

bisect each other

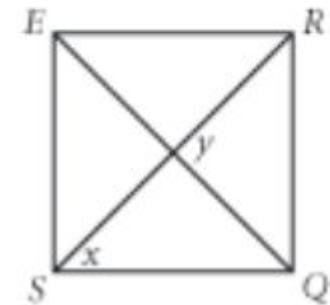
C-52



# Square Problems

- $SQRE$  is a square.

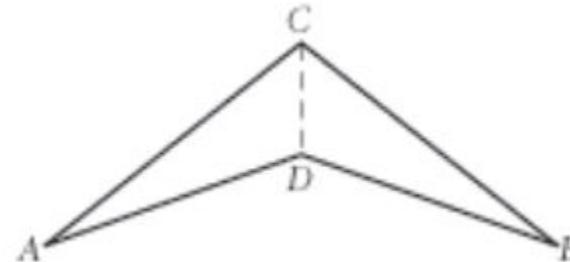
$$x = \underline{\hspace{2cm}}^?$$



# Polygon Proofs Problems - Chapter 5.7

**Given:** Dart  $ADBC$  with  $\overline{AC} \cong \overline{BC}$ ,  $\overline{AD} \cong \overline{BD}$

**Show:**  $\overline{CD}$  bisects  $\angle ACB$



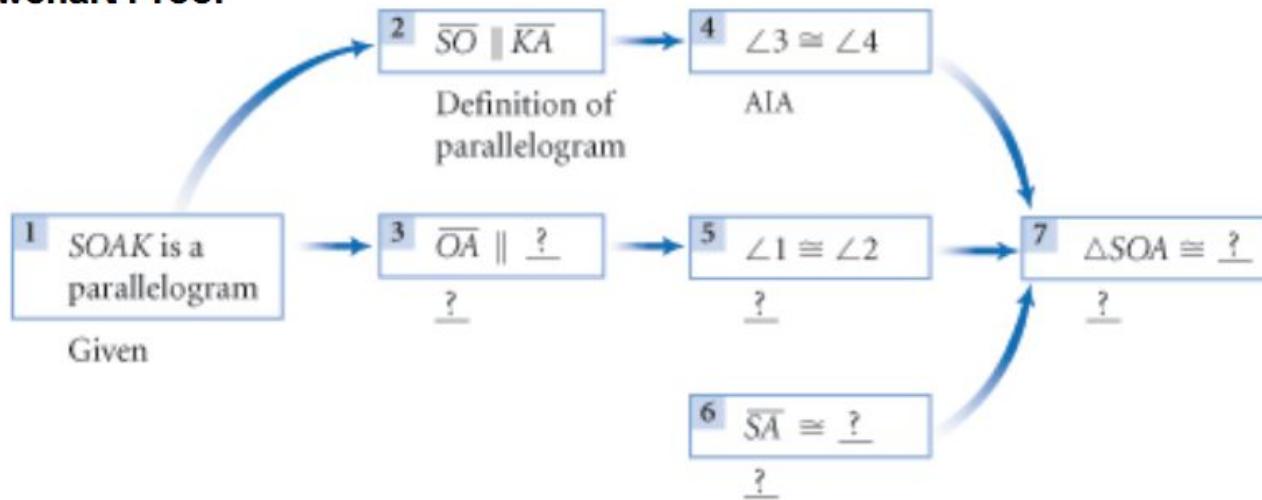
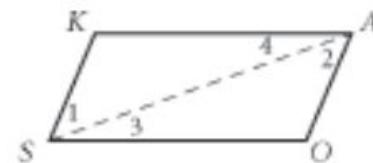
# Polygon Proofs Problems - Chapter 5.7

Prove the conjecture: The diagonal of a parallelogram divides the parallelogram into two congruent triangles.

**Given:** Parallelogram  $SOAK$  with diagonal  $\overline{SA}$

**Show:**  $\triangle SOA \cong \triangle AKS$

**Flowchart Proof**



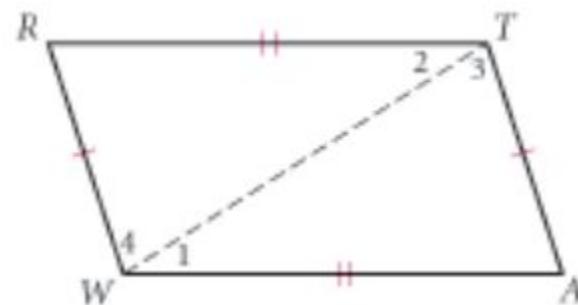
# Polygon Proofs Problems - Chapter 5.7

Prove the conjecture: If the opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

**Given:** Quadrilateral  $WATR$ , with  $\overline{WA} \cong \overline{RT}$  and  $\overline{WR} \cong \overline{AT}$ ,  
and diagonal  $\overline{WT}$

**Show:**  $WATR$  is a parallelogram

~~Plan your proof~~



# Geogebra Review

[Create a Geogebra account with bush email if you do not have one!](#)

[Access Geogebra Calculator Suite](#) (Make sure you are logged in)

Loom Video TO BE POSTED

This will take lots of practice!!

How to:

Global Settings Then Save!

Points, Lines, Angles, Notations

Line Segments

Trapezoidal Shapes

Rectangular Shapes

Kite Shapes

# Reminders

## Reminders

Complete the distance formula - problem #8 & #9?

Are you working on the Special Quad Problems Assignment?

Submit redo of the Triangle Centers project (DUE BEFORE BREAK)

Submit UNIT 1 TEST & UNIT 2 QUIZ 1 CORRECTION (DUE BEFORE BREAK)

Work on the Polygons Project (PRACTICE GEOGEBRA!)

Enjoy your Thanksgiving break!

Monday, Nov 29th

# What's happening today?

Check-in/Reminders

Welcome back!

AKs and Polygons Video Posted

[Final Exam Study Guide posted](#)

[Are you working on the Special Quad Problems Assignment?](#)

[Are you working on the Polygons project?](#)

- Today -      Review Schedule  
                Circles & Tangents! - Definitions & Conjectures  
                Quadrilaterals (final) Quiz Discussions (quiz format)  
                Polygons Project Discussions (examine current progress)  
                Proofs & other Problems  
                Final Exam Schedule related discussions (exam format)  
                Conference scheduling with all students