

# 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 come back 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

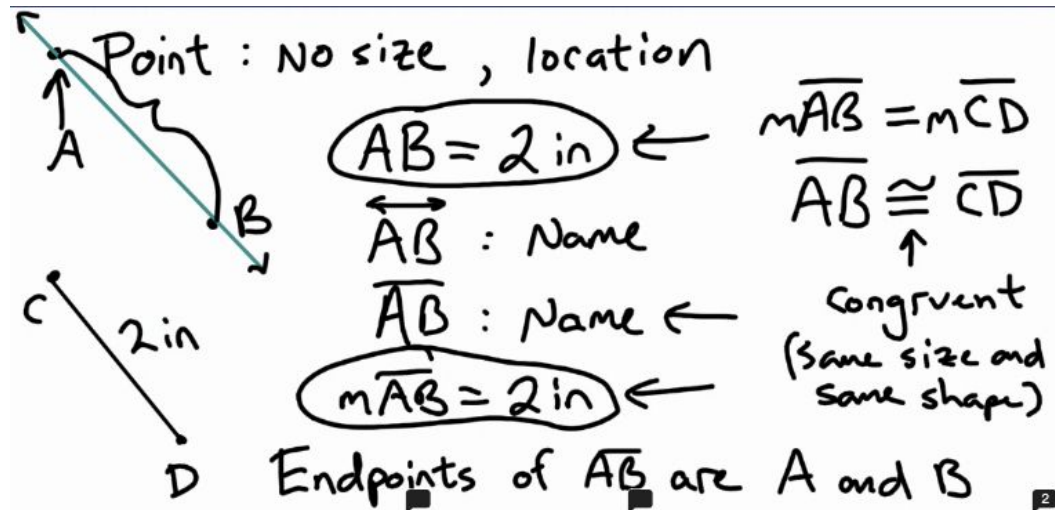
[Book Chapter 1.1](#) (Page 28)





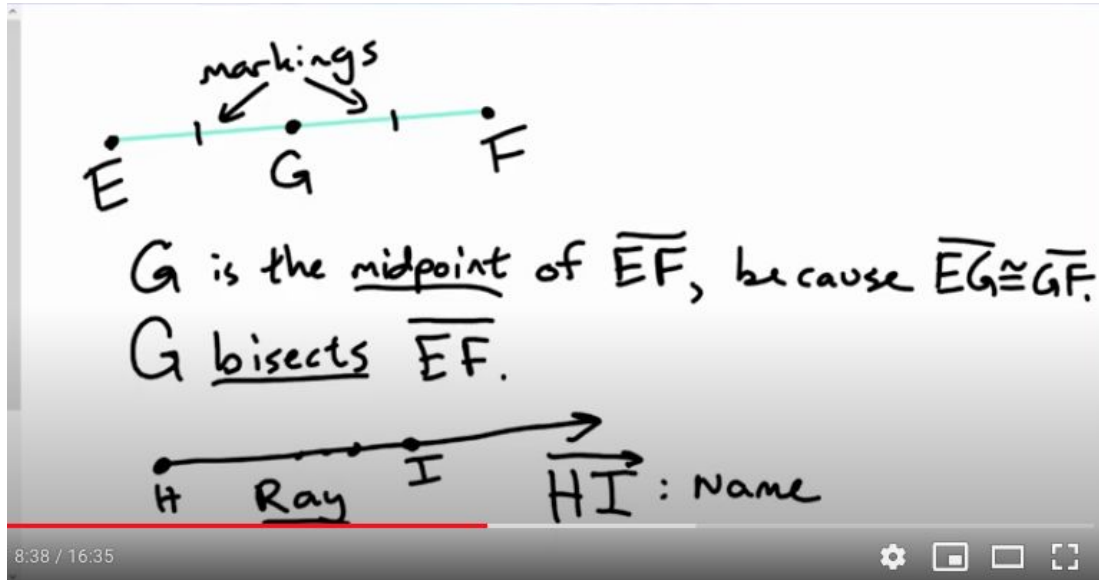
# Building Blocks of Geometry - Vocabulary & Notations

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



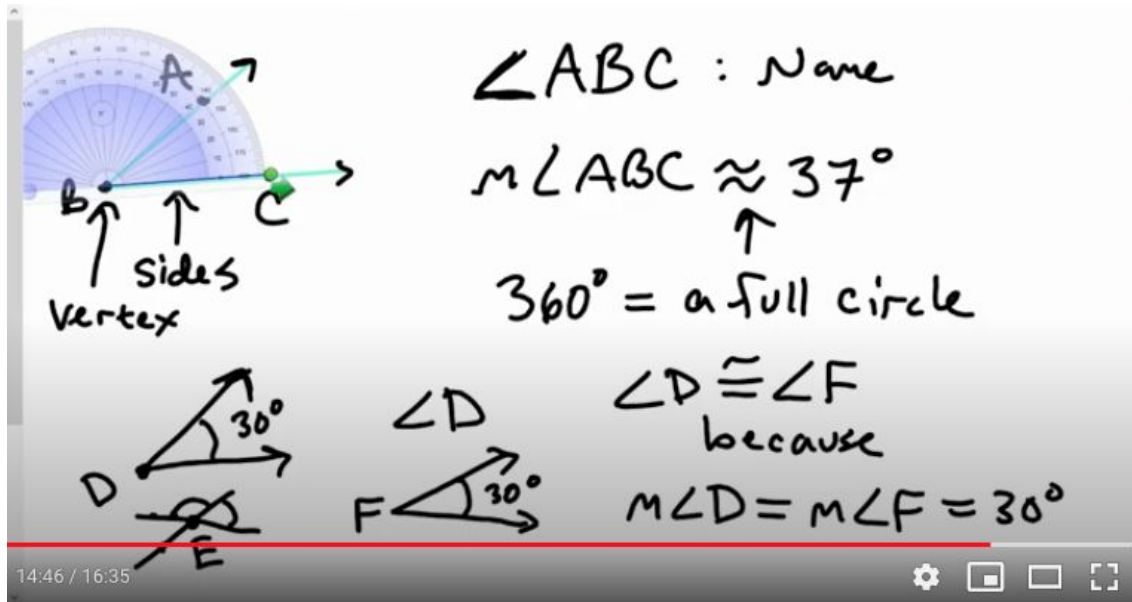
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# Building Blocks of Geometry - Vocabulary & Notations

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



# 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!

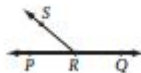
Extend the line assuming  $(5, 6)$  as the new midpoint, find the other endpoint

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

# 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

## 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

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)

# 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

### Vocabulary Words a

Point

Line

Line segment

Endpoints

Midpoint

Congruent line segments

Collinear

Bisects

Ray

Plane

Coplanar

Angle

Vertex

Side

Measure of an angle

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Angle bisector

Congruent angles

~~Complementary Angles~~

~~Supplementary Angles~~

~~Linear Pair of Angles~~

~~Vertical Angles~~

Right Angle

Acute Angle

Obtuse Angle

# 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](#)

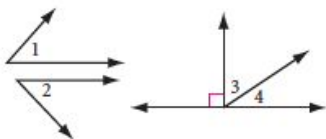
Special Angles on Parallel Lines

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:

$\angle 1$  and  $\angle 2$

$\angle 3$  and  $\angle 4$

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



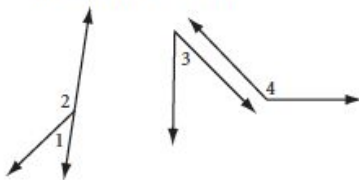
Not pairs of complementary angles:

$\angle G$  and  $\angle H$      $\angle 1$  and  $\angle 2$

$\angle 3$  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:

$\angle 1$  and  $\angle 2$

$\angle 3$  and  $\angle 4$

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



Not pairs of supplementary angles:

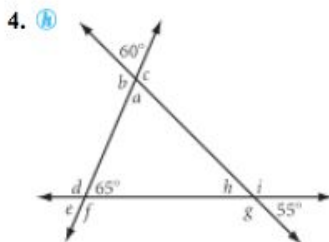
$\angle 1$ ,  $\angle 2$ , and  $\angle 3$

$\angle 4$  and  $\angle 5$

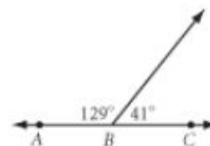


# LP & VA POD

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



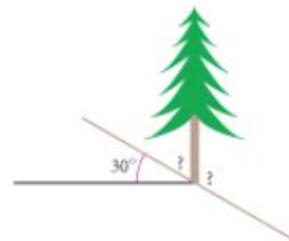
6. **Developing Proof** Points  $A$ ,  $B$ , and  $C$  at right are collinear. What's wrong with this picture?



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

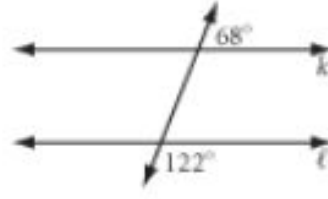
1.  $w = ?$



2.  $x = ?$



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



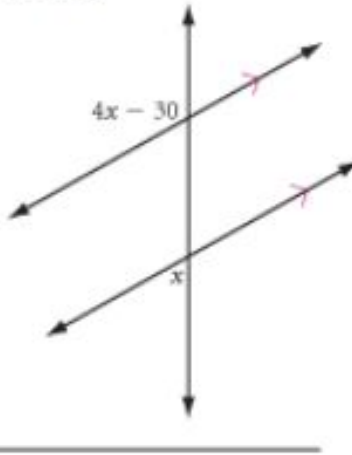
6.  $m \parallel n$   
 $z = ?$  (h)



# Do Parallel Lines Problems

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

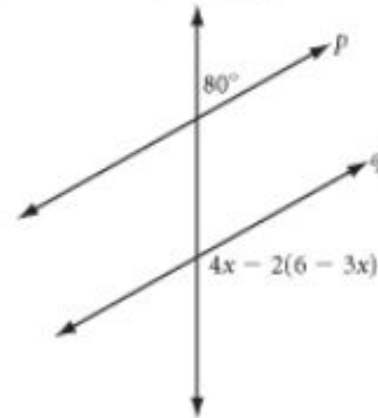
14. Find  $x$ .



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? 
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  $BD = 12$  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

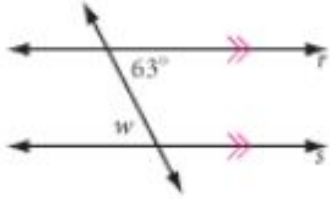
Isosceles & Equilateral Triangle problems

Review Quiz 1

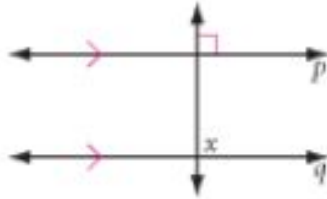
# Do Parallel Lines Problems

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

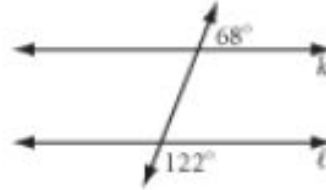
1.  $w = ?$



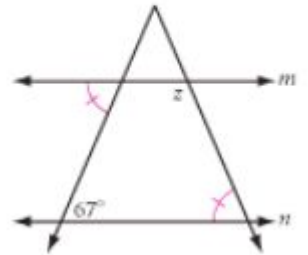
2.  $x = ?$



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



6.  $m \parallel n$   
 $z = ?$  (h)

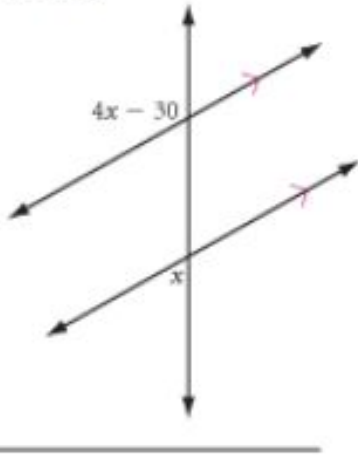


# Do Parallel Lines Problems

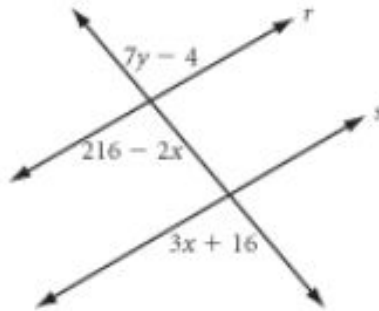
Section 2.6: 1-3, 6, 14-16, 20

Remember: If a transversal intersects two parallel lines, then the corresponding angles are congruent.

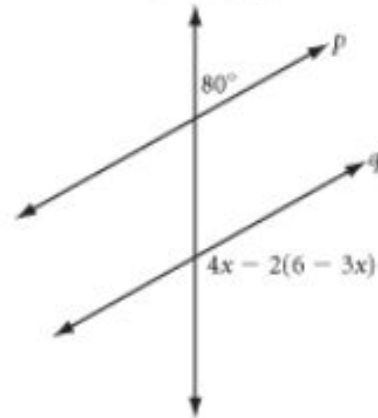
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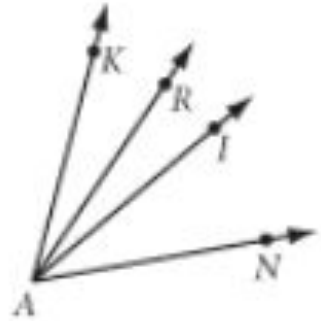
16. If  $x = 12^\circ$ , is  $p \parallel q$ ?



# Do Parallel Lines Problems

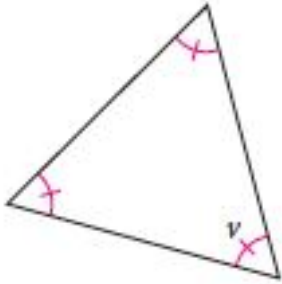
Section 2.6: 1-3, 6, 14-16, 20

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? 
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  $BD = 12$  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  $m\angle RAK = 13^\circ$ ?

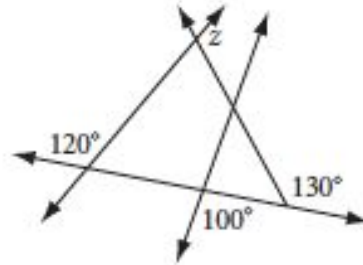


# Do some Triangle Problems!

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

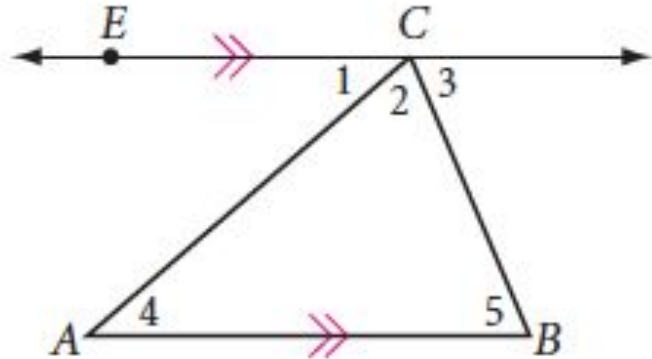
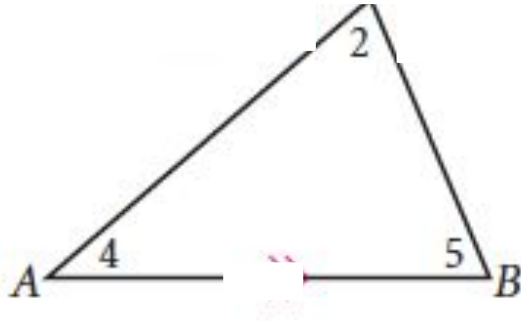
Prove Vertical Angles are Congruent give Linear Pair Conjecture

They may need your help!!

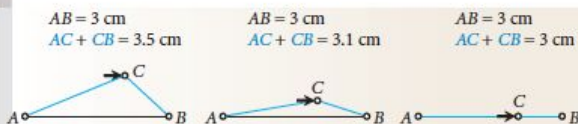
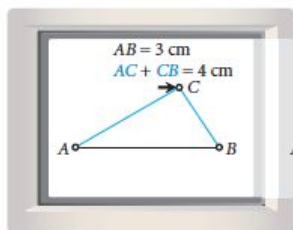
# Triangle Sum Deductive Argument!

Section 4.1: Page 201

Hint: Apply Parallel Lines Conjectures!



# Triangle Legitimacy



## Investigation 1

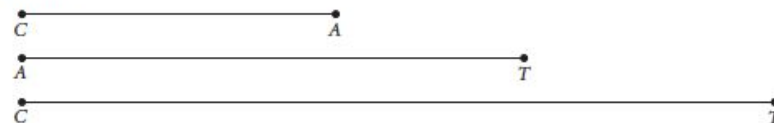
### What Is the Shortest Path from A to B?

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

Step 1

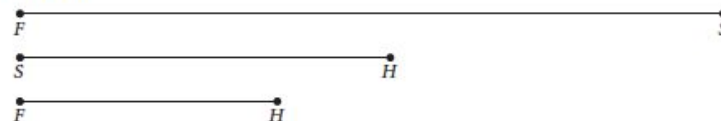
Construct a triangle with each set of segments as sides.

Given:



Construct:  $\triangle CAT$

Given:



Construct:  $\triangle FSH$

Step 2

ie

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

C-20

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



# 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

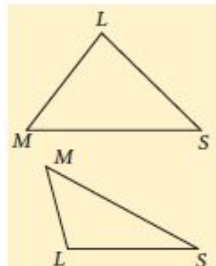
Measure the angles in your triangle. Label the angle with greatest measure  $\angle L$ , the angle with second greatest measure  $\angle M$ , and the smallest angle  $\angle S$ .

Step 2

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

Step 3  
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.

Which side is opposite  $\angle L$ ?  $\angle M$ ?  $\angle S$ ?



### 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

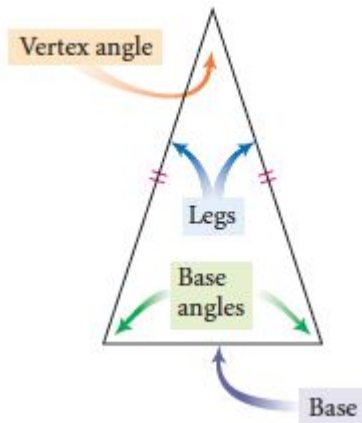
If a triangle is isosceles, then ?.

### Converse of the Isosceles Triangles Conjecture (Page 208)

#### Converse of the Isosceles Triangle Conjecture

C-19

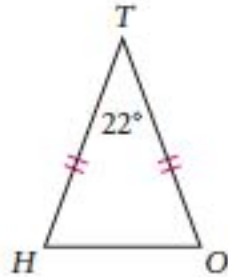
If a triangle has two congruent angles, then ?.



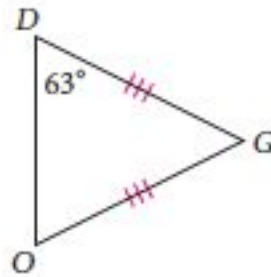
# POD: Isosceles Triangle Problems

## Chapter 4.2 Questions 1-3

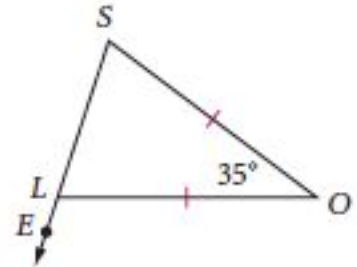
1.  $m\angle H = \underline{\quad ? \quad}$  (h)



2.  $m\angle G = \underline{\quad ? \quad}$

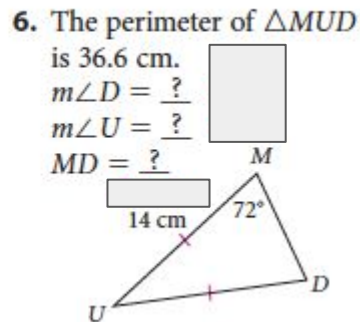
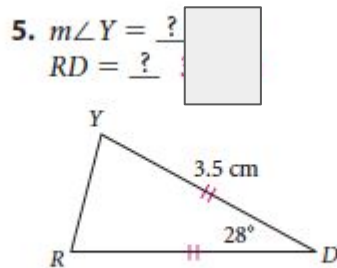
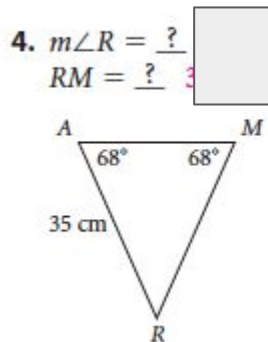


3.  $m\angle OLE = \underline{\quad ? \quad}$



# POD: Isosceles Triangle Problems

## Chapter 4.2 Questions 4-6



# 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)



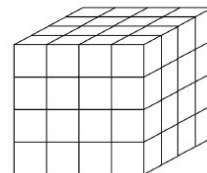
Case 1

?

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

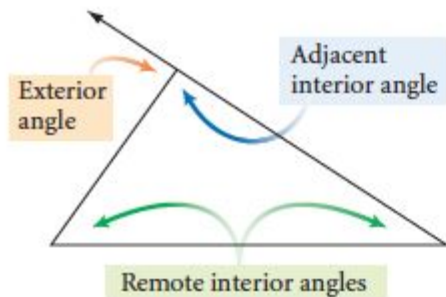
Review & Practice (40 min)

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

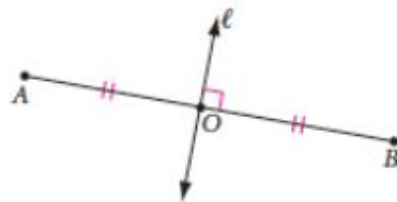
C-6

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.



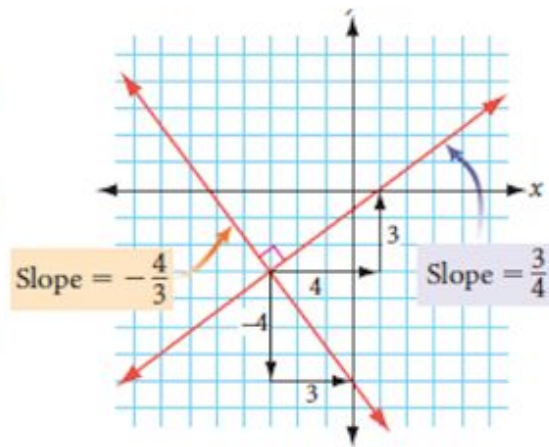
Line  $\ell$  is the perpendicular bisector of  $\overline{AB}$ .

## 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.

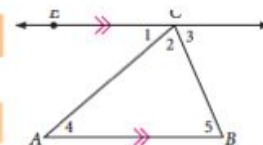


# Triangle Conjectures!

## Triangle Sum Conjecture

C-17

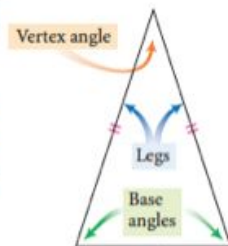
The sum of the measures of the angles in every triangle is ?.



## Isosceles Triangle Conjecture

C-18

If a triangle is isosceles, then ?.



## Converse of the Isosceles Triangle Conjecture

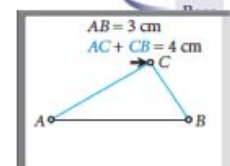
C-19

If a triangle has two congruent angles, then ?.

## Triangle Inequality Conjecture

C-20

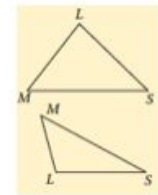
The sum of the lengths of any two sides of a triangle is ? the length of the third side.



## Side-Angle Inequality Conjecture

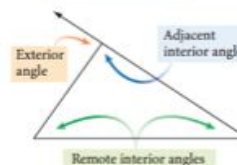
C-21

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



## Triangle Exterior Angle Conjecture

The measure of an exterior angle of a triangle ?.

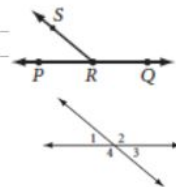


# Lines & Angles C

## Linear Pair Conjecture

C-1

If two angles form a linear pair, then  $\underline{?}$ .



## Vertical Angles Conjecture

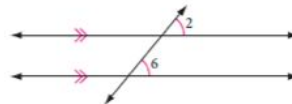
C-2

If two angles are vertical angles, then  $\underline{?}$ .

## Corresponding Angles Conjecture, or CA Conjecture

C-3a

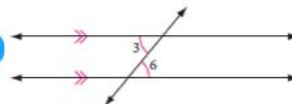
If two parallel lines are cut by a transversal, then corresponding angles are  $\underline{?}$ .



## Alternate Interior Angles Conjecture, or AIA Conjecture

C-3b

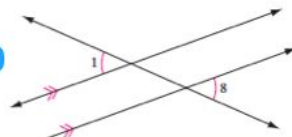
If two parallel lines are cut by a transversal, then alternate interior angles are  $\underline{?}$ .



## Alternate Exterior Angles Conjecture, or AEA Conjecture

C-3c

If two parallel lines are cut by a transversal, then alternate exterior angles are  $\underline{?}$ .



## Parallel Lines Conjecture

C-3

If two parallel lines are cut by a transversal, then corresponding angles are  $\underline{?}$ , alternate interior angles are  $\underline{?}$ , and alternate exterior angles are  $\underline{?}$ .

## Converse of the Parallel Lines Conjecture

C-4

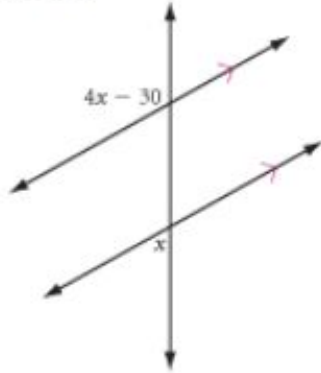
If two lines are cut by a transversal to form pairs of congruent corresponding angles, congruent alternate interior angles, or congruent alternate exterior angles, then the lines are  $\underline{?}$ .

# Practice Parallel Lines Problems (also a Homework)

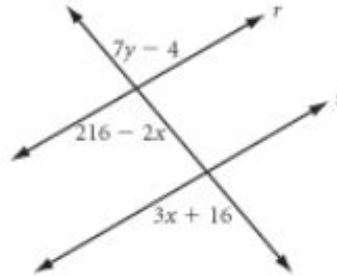
Section 2.6: 14, 15, 16, 20 (How can you verify these?)

Remember to select a day. Make the converse of the statement to the converse day.

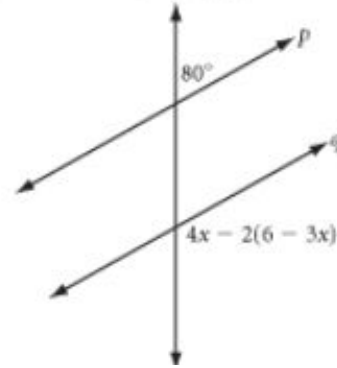
14. Find  $x$ .



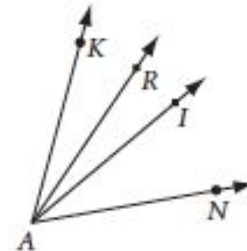
15. If  $r \parallel s$ , find  $y$ .



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

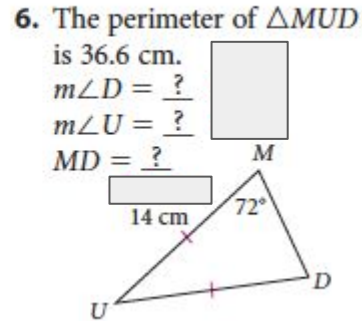
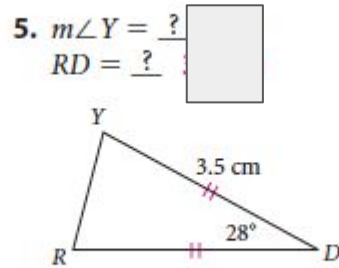
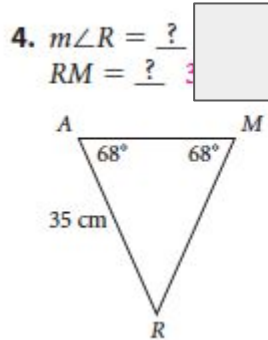


20. If  $\overrightarrow{AI}$  is the angle bisector of  $\angle KAN$  and  $\overrightarrow{AR}$  is the angle bisector of  $\angle KAI$ , what is  $m\angle RAN$  if  $m\angle RAK = 13^\circ$ ?



# Practice Isosceles Triangle Problems(also a Homework)

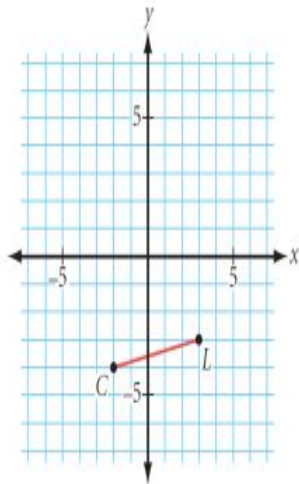
## Chapter 4.2 Questions 4-6



# 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?

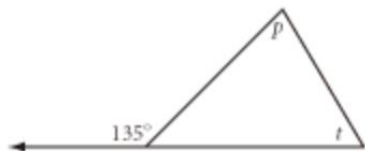
# Practice Triangle Problems (also a Homework)

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

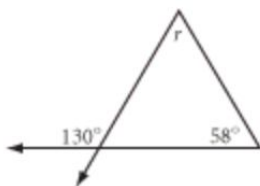
11. If 54 and 48 are the lengths of two sides of a triangle, what is the range of possible values for the length of the third side? 

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

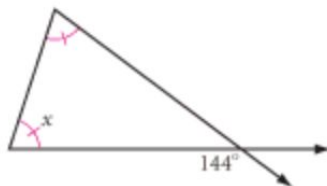
14.  $t + p = \underline{\quad ? \quad}$



15.  $r = \underline{\quad ? \quad}$

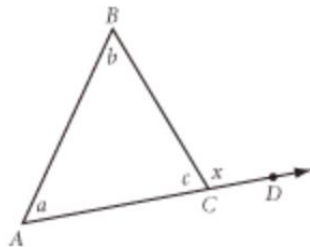


16.  $x = \underline{\quad ? \quad}$



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!!

Prep for quiz 2?

# What's happening today?

Triangle Congruence Chapter 4.4

Review & Practice for Quiz 2

- Complete your Conjectures!

- Do some Parallel Lines Problems

- Do some Triangles Problems