

# Daily Class Slides

Geometry Spring 2022  
Chandru Narayan

# 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

Thursday, Jan 6th

# What's happening today?

## Check-in

Welcome new Students!

[Reflections upon Fall Term](#)

Class Logistics

Ready to have fun! Be courteous, Participate, do lots of problems in class!

All Assignments in Portal and linked to Google Classroom. Do not be late in submitting them!

Bring fully charged laptop, geo instruments, notebook, toolbox & calculator

Dress Warmly Windows to be Open , Masks ON, No eating or drinks inside

Can you Access the textbook online?

## Today

Review Perimeter

Introduce Area & Volume - New Chapter 8 (Page 422 in book)!

5-minute Break

Area & Volume Investigation - Area of Rect, Parallelogram and any Triangle

## Reminder

Complete Investigation - Due today

Complete Homework - Due Jan 10th

# Introduce new Students!

Welcome **Luc, Charlotte, Cophine!**

State your name clearly pronouncing first and last names

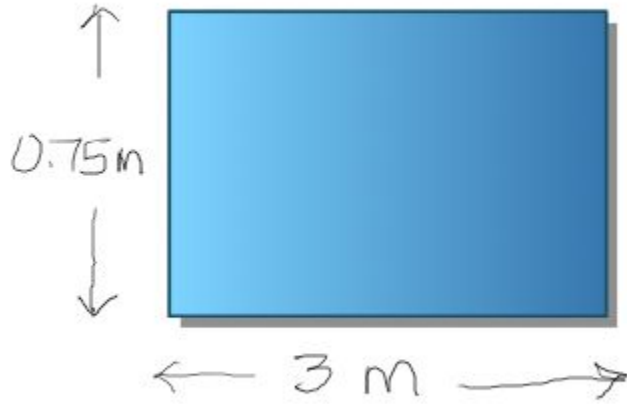
How would you like to be addressed?

Your personal pronouns

Something interesting or special/peculiar about you?

What are your expectations from this class?

What is the Perimeter of these Shapes ? Units ?



# Area & Volume - What are these? Units?

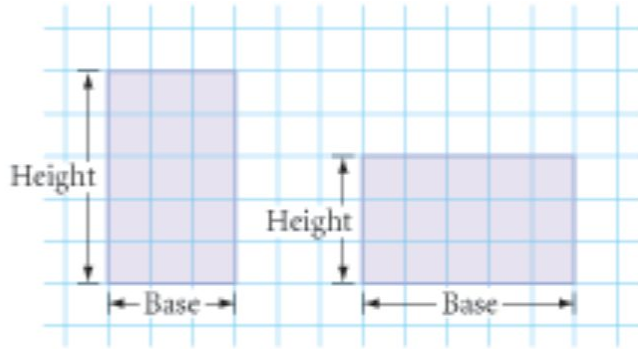


# How many tiles Investigation

- Get handout from Chandru or [print from GC](#)
- Hint for #5:
  - poster: 2x3ft, postcard: 4x6", queen bedsheet: 60x80", stamp: 1x1.5"
- Hint for #8:
  - Think of cutting out 1 triangle from one side of parallelogram and rearranging



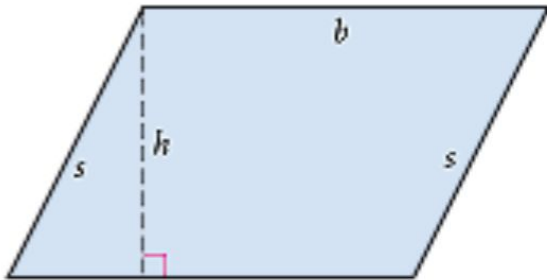
# Area of Rectangle & Parallelogram Conjectures



## Rectangle Area Conjecture

C-74

The area of a rectangle is given by the formula  $A = bh$ , where  $A$  is the area,  $b$  is the length of the base, and  $h$  is the height of the rectangle.



## Parallelogram Area Conjecture

C-75

The area of a parallelogram is given by the formula  $A = bh$ , where  $A$  is the area,  $b$  is the length of the base, and  $h$  is the height of the parallelogram.

# Derive Area of any Triangle based on Rect area

## Conjectures

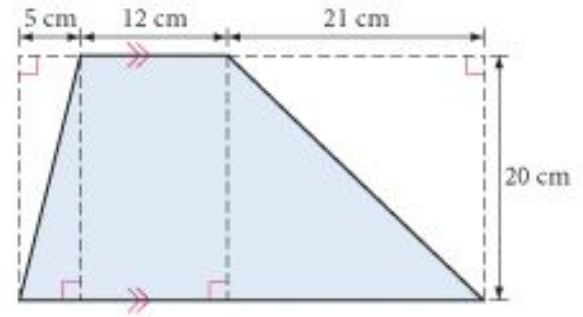


# Let's do a few problems

5.  $P = 40$  ft  
 $A = \underline{\quad ? \quad}$



23. Find the area of the trapezoid at right.



# Reminders!

## Reminders

[Complete How many Tiles Investigation](#) - Due today

[Complete Rect & Parallelogram Areas Homework](#) - Due Jan 10th

Monday, Jan 10th

# What's happening today?

## Check-in

How was your 1st week?

Did you complete the Fall Course Review. Please click here to complete

[Form Random Teams!](#)

Review Syllabus

## Today

Review Rectangle & Parallelogram Area Conjectures

Review formula for Area of any Triangle

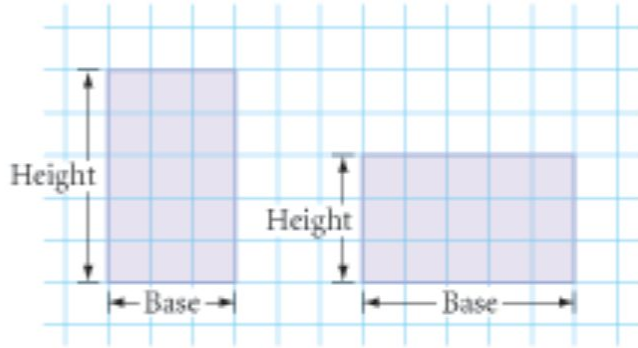
Review some Rect, Parallelogram Area Problems

A Plethora of Area Formulas to be Discovered!

## Reminder

Investigation & 8.1 Homework Due today

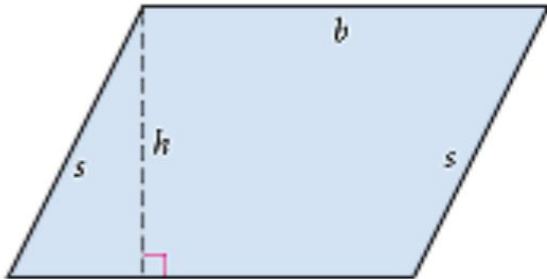
# Area of Rectangle & Parallelogram Conjectures



## Rectangle Area Conjecture

C-74

The area of a rectangle is given by the formula  $A = bh$ , where  $A$  is the area,  $b$  is the length of the base, and  $h$  is the height of the rectangle.



## Parallelogram Area Conjecture

C-75

The area of a parallelogram is given by the formula  $A = bh$ , where  $A$  is the area,  $b$  is the length of the base, and  $h$  is the height of the parallelogram.

# Derive Area of any Triangle based on Rect area

## Conjectures





# Area of Triangles Conjecture



## Investigation 1

### Area Formula for Triangles

#### You will need

- heavy paper or cardboard



- Step 1 Cut out a triangle and label its parts as shown. Make and label a copy.
- Step 2 Arrange the triangles to form a figure for which you already have an area formula. Calculate the area of the figure.
- Step 3 What is the area of one of the triangles? Make a conjecture. Write a brief description in your notebook of how you arrived at the formula. Include an illustration.

#### Triangle Area Conjecture

C-76

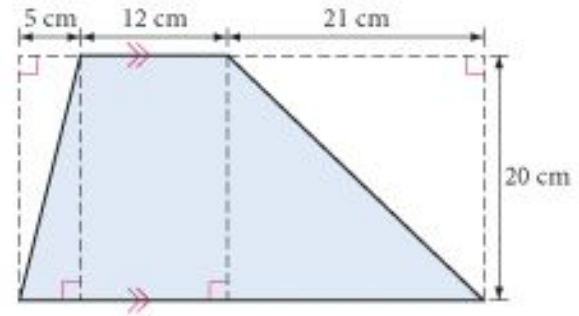
The area of a triangle is given by the formula  $\frac{1}{2}bh$ , where  $A$  is the area,  $b$  is the length of the base, and  $h$  is the height of the triangle.

# Review Problems problems

5.  $P = 40$  ft  
 $A = \underline{\quad}$



23. Find the area of the trapezoid at right.



Let's derive the Area Formula for a Trapezoid

# Area of Trapezoids Conjecture

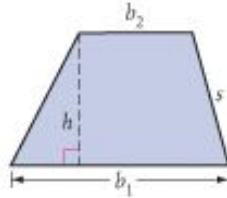


## Investigation 2

### Area Formula for Trapezoids

#### You will need

- heavy paper or cardboard



- Step 1 Construct any trapezoid. Draw a dashed line perpendicular to its bases. Label the trapezoid as shown.
- Step 2 Cut out the trapezoid. Label a copy.
- Step 3 Arrange the trapezoid to form a figure for which you already have an area formula. What polygon is this? What is its area? What is the area of one trapezoid? Write a conjecture.

#### Trapezoid Area Conjecture

C-77

The area of a trapezoid is given by the formula  $A = \frac{1}{2}(b_1 + b_2)h$ , where  $A$  is the area,  $b_1$  and  $b_2$  are the lengths of the two bases, and  $h$  is the height of the trapezoid.

Instead of following these steps, we are going to do these pure algebraic fashion!

# Area of Kites Conjecture



## Investigation 3

### Area Formula for Kites

Can you rearrange a kite into shape you already have the area formula for? What are the properties of a kite?

Create and carry out an investigation to discover a formula for the area of a kite. Discuss your results with your group. State a conjecture.



Instead of following these steps, we are going to do these pure algebraic fashion!

#### Kite Area Conjecture

C-78

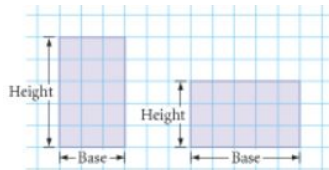
The area of a kite is given by the formula  $\frac{1}{2}d_1d_2$ .

# Complete & Add Conjectures to Toolbox

## Rectangle Area Conjecture

C-74

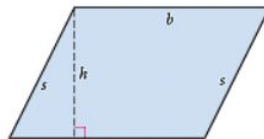
The area of a rectangle is given by the formula  $A = bh$ , where  $A$  is the area,  $b$  is the length of the base, and  $h$  is the height of the rectangle.



## Parallelogram Area Conjecture

C-75

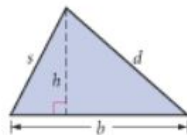
The area of a parallelogram is given by the formula  $A = bh$ , where  $A$  is the area,  $b$  is the length of the base, and  $h$  is the height of the parallelogram.



## Triangle Area Conjecture

C-76

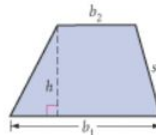
The area of a triangle is given by the formula  $A = \frac{1}{2}bh$ , where  $A$  is the area,  $b$  is the length of the base, and  $h$  is the height of the triangle.



## Trapezoid Area Conjecture

C-77

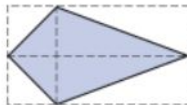
The area of a trapezoid is given by the formula  $A = \frac{1}{2}(b_1 + b_2)h$ , where  $A$  is the area,  $b_1$  and  $b_2$  are the lengths of the two bases, and  $h$  is the height of the trapezoid.



## Kite Area Conjecture

C-78

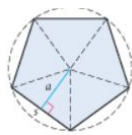
The area of a kite is given by the formula  $A = \frac{1}{2}d_1d_2$ .



## Regular Polygon Area Conjecture

C-79

The area of a regular polygon is given by the formula  $A = \frac{1}{2}Ps$  or  $A = \frac{1}{2}na^2$ , where  $A$  is the area,  $P$  is the perimeter,  $a$  is the apothem,  $s$  is the length of each side, and  $n$  is the number of sides.



Wednesday, Jan 12th

# What's happening today?

## Check-in

[Form Random Teams!](#)

Did you add conjectures to your toolbox?

Review Area formulas and how they work

Announce Areas Quiz 8.1-8.4 Wednesday Jan 19th

## Today

Do Area & Real-world problems from chapters 8.1-8.3

Cover Chapter 8.4 Areas of Regular Polygons

Do Polygon Area Problems

## Reminder

Complete Homework due by Friday to prepare for Quiz

AK will be posted regularly for review and prep

Update your Google Classroom Notification Settings

Check your emails - Comments will be made on Google classroom

Upload your work as a SINGLE PDF files (jpg not allowed)

- Use CamScanner or similar app

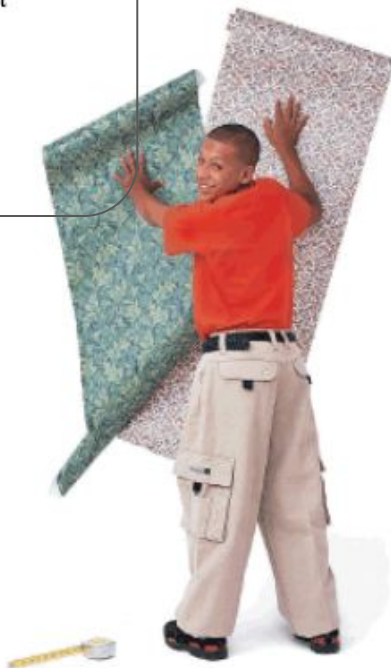
# Real-world Area Problems!

1. **Application** Tammy is estimating how much she should charge for painting 148 rooms in a new motel with one coat of base paint and one coat of finishing paint. The four walls and the ceiling of each room must be painted. Each room measures 14 ft by 16 ft by 10 ft high.

- Calculate the total area of all the surfaces to be painted with each coat. Ignore doors and windows.
- One gallon of base paint covers 500 square feet. One gallon of finishing paint covers 250 square feet. How many gallons of each will Tammy need for the job?

2. **Application** Rashad wants to wallpaper the four walls of his bedroom. The room is rectangular and measures 11 feet by 13 feet. The ceiling is 10 feet high. A roll of wallpaper at the store is 2.5 feet wide and 50 feet long. How many rolls should he buy? (Wallpaper is hung from ceiling to floor. Ignore doors and windows.)

3. **Application** It takes 65,000 solar cells, each 1.25 in. by 2.75 in., to power the Helios Prototype, shown below. How much surface area, in square feet, must be covered with the cells? The cells on Helios are 18% efficient. Suppose they were only 12% efficient, like solar cells used in homes. How much more surface area would need to be covered to deliver the same amount of power?



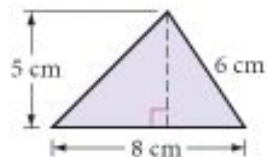


# Area Problems!

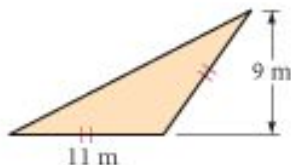
## EXERCISES

In Exercises 1–12, use your new area conjectures to solve for the unknown measures.

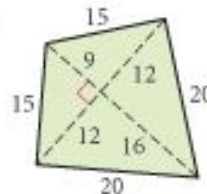
1.  $A = ?$



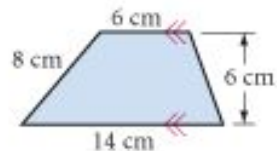
2.  $A = ?$



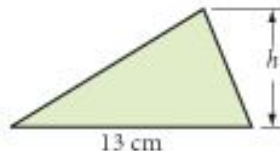
3.  $A = ?$



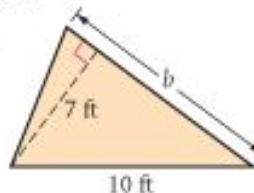
4.  $A = ?$



5.  $A = 39 \text{ cm}^2$   
 $h = ?$



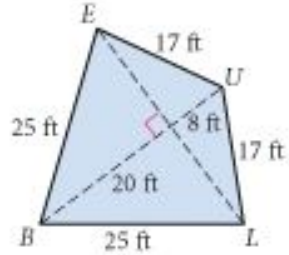
6.  $A = 31.5 \text{ ft}^2$   
 $b = ?$



# s'more Area Problems!

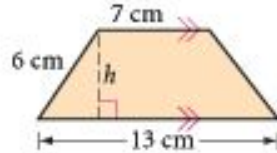
7.  $A = 420 \text{ ft}^2$

$LE = ?$



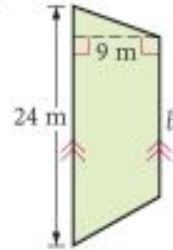
8.  $A = 50 \text{ cm}^2$  (h)

$h = ?$



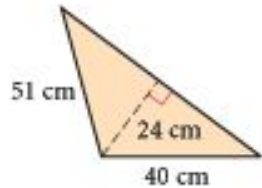
9.  $A = 180 \text{ m}^2$

$b = ?$



10.  $A = 924 \text{ cm}^2$

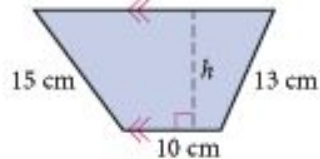
$P = ?$



11.  $A = 204 \text{ cm}^2$

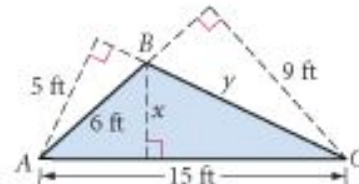
$P = 62 \text{ cm}$

$h = ?$

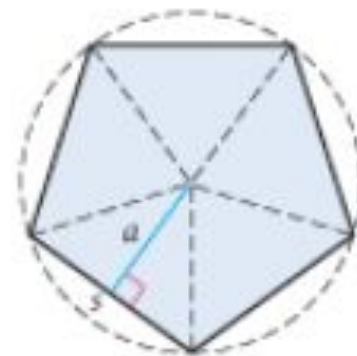
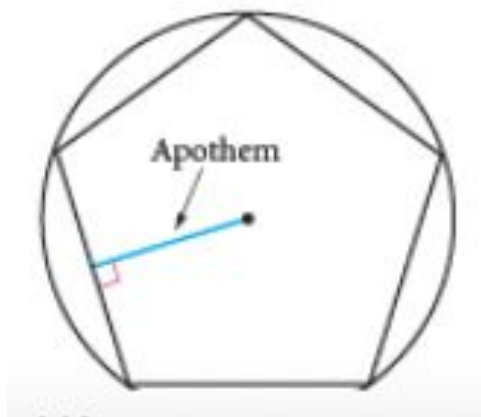


12.  $x = ?$  (h)

$y = ?$



# Chapter 8.4: Areas of Regular Polygons



Regular pentagon

## Regular Polygon Area Conjecture

C-79

The area of a regular polygon is given by the formula  $\frac{1}{2}P$  or  $\frac{1}{2}ns$ , where  $A$  is the area,  $P$  is the perimeter,  $a$  is the apothem,  $s$  is the length of each side, and  $n$  is the number of sides.

# Regular Polygon Area Problems!

1.  $A \approx ?$

$$s = 24 \text{ cm}$$

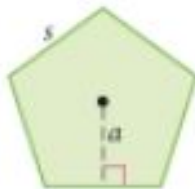
$$a \approx 24.9 \text{ cm}$$




2.  $a \approx ?$

$$s = 107.5 \text{ cm}$$

$$A \approx 19,887.5 \text{ cm}^2$$



8. Find the approximate length of each side of a regular  $n$ -gon if  $a = 80$  feet,  $n = 20$ , and  $A \approx 20,000$  square feet.
9. **Construction** Draw a segment 4 cm long. Use a compass and straightedge to construct a regular hexagon with sides congruent to this segment. Use the Regular Polygon Area Conjecture and a centimeter ruler to approximate the hexagon's area. 

# Reminders

1. Complete Homework due by Friday to prepare for Quiz
2. AK will be posted regularly for review and prep
3. Update your Google Classroom Notification Settings
4. Check your emails - Comments will be made on Google classroom
5. Upload your work as a SINGLE PDF files (jpg not allowed)
  - Use CamScanner or similar app

Friday, Jan 14th

# What's happening today?

## Check-in

Complete 8.2-8.3 Area HW problems?

## Today

Work on Area Problems - regular polygons, real-world  
Algebra techniques - Linear Equations

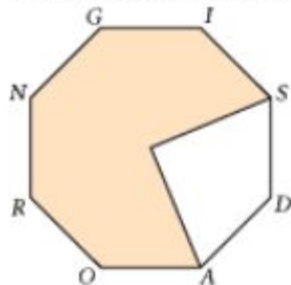
## Reminders

Areas Quiz 8.1-8.4 Wednesday - Jan 19th  
Complete All Homework on-time to prepare for Quiz  
AK will be posted regularly for review and prep

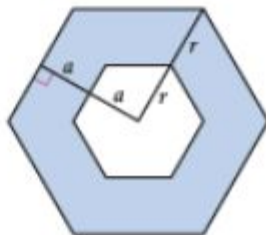
# Regular Polygon Area Problems!

11. A square is also a regular polygon. How is the apothem of a square related to the side length? Show that the Regular Polygon Area Conjecture simplifies to  $s^2$  for the area of a square.

13. Find the approximate area of the shaded region of the regular octagon *ROADSIGN*. The apothem measures 20 cm. Segment *GI* measures about 16.6 cm.



14. Find the approximate area of the shaded regular hexagonal donut. The apothem and sides of the smaller hexagon are half as long as the apothem and sides of the large hexagon.  $a \approx 6.9$  cm and  $r \approx 8$  cm [h](#)





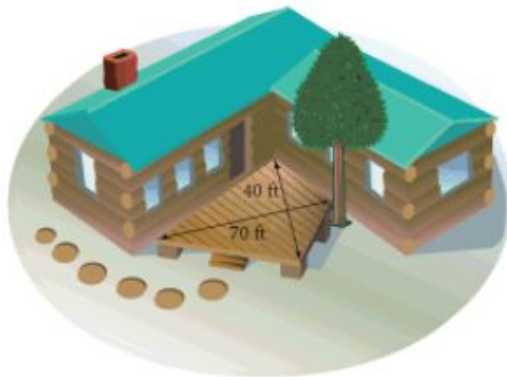
# Real-world Area Problems!

1. **Application** Tammy is estimating how much she should charge for painting 148 rooms in a new motel with one coat of base paint and one coat of finishing paint. The four walls and the ceiling of each room must be painted. Each room measures 14 ft by 16 ft by 10 ft high.
  - a. Calculate the total area of all the surfaces to be painted with each coat. Ignore doors and windows.
  - b. One gallon of base paint covers 500 square feet. One gallon of finishing paint covers 250 square feet. How many gallons of each will Tammy need for the job?

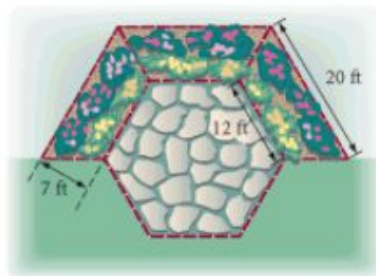


# s'more Real-world Area Problems!

4. **Application** Harold works at a state park. He needs to seal the redwood deck at the information center to protect the wood. He measures the deck and finds that it is a kite with diagonals 40 feet and 70 feet. Each gallon of sealant covers 400 square feet, and the sealant needs to be applied every six months. How many gallon containers should he buy to protect the deck for the next three years?



5. **Application** A landscape architect is designing three trapezoidal flowerbeds to wrap around three sides of a hexagonal flagstone patio, as shown. What is the area of the entire flowerbed? The landscape architect's fee is \$100 plus \$5 per square foot. What will the flowerbed cost?



# Linear Equations - pts of concurrency Chapter 6.6

$$\begin{array}{l} \textcircled{1} \quad 3y = 12x - 21 \\ \quad 12x + 2y = 1 \end{array} \quad \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \end{array}} \right\} \begin{array}{l} \text{system of 2 equations} \\ \text{with 2 unknowns} \end{array}$$

$$\textcircled{2} \quad 2y = -12x + 1$$

$$\textcircled{1} + \textcircled{2} \Rightarrow$$

$$5y = -20 \Rightarrow \boxed{y = -4} \quad \textcircled{3}$$

$$\textcircled{3} \text{ in } \textcircled{1} \Rightarrow -12 = 12x - 21$$

$$\Rightarrow x = 9/12 = 3/4 \quad \textcircled{4}$$

Plot these lines to show approximate slopes,  
Y-intercepts & pt of intersection

$$\begin{array}{l} -4x + 3y = 3 \\ \times 3 \quad 7x - 9y = 6 \quad \textcircled{1} \\ -12x + 9y = 9 \quad \textcircled{2} \end{array}$$

$$\textcircled{1} + \textcircled{2} \Rightarrow$$

$$-5x = 15 \Rightarrow \boxed{x = -3} \quad \textcircled{3}$$

$$\textcircled{3} \text{ in } \textcircled{1} \Rightarrow -21 - 9y = 6$$

$$\Rightarrow \boxed{y = 3} \quad \textcircled{4}$$

# Reminders

1. Complete Homework due by Friday to prepare for Quiz
2. AK will be posted regularly for review and prep
3. Update your Google Classroom Notification Settings
4. Check your emails - Comments will be made on Google classroom
5. Upload your work as a SINGLE PDF files (jpg not allowed)
  - Use CamScanner or similar app

Wed, Jan 19th

# What's happening today?

## Check-in

Completed Area HW problems?

Have Calculator, Conjectures Toolbox, Geo instruments for Quiz?

Starting next week - **Phones will not be allowed in class** - Bring your calculators!

## Today

30-60-90 triangles

Radical Expressions

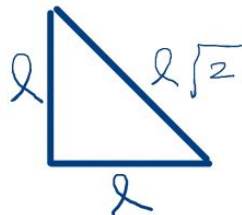
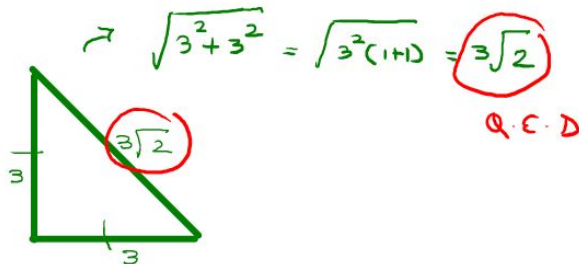
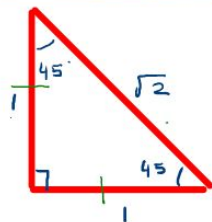
Areas Quiz 8.1-8.4

## Reminders

Project on Radical Expressions & Linear Equations due 1/25

# Special Triangles Chapter 9.2

## Isosceles Right Triangle

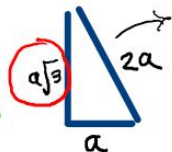
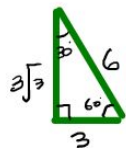
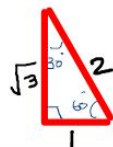


### Isosceles Right Triangle Conjecture

(-83)

In an isosceles right triangle, if the legs have length  $l$ , then the hypotenuse has length  $l\sqrt{2}$ .

## 30°-60°-90° Triangle



$$\sqrt{(2a)^2 - a^2} = \sqrt{4a^2 - a^2} = \sqrt{3a^2} = a\sqrt{3}$$

Q.E.D.!

### 30°-60°-90° Triangle Conjecture

(-84)

In a 30°-60°-90° triangle, if the shorter leg has length  $a$ , then the longer leg has length  $a\sqrt{3}$  and the hypotenuse has length  $2a$ .

# Radical Expressions

## Simplifying Radical Expressions

$\sqrt{4 \cdot 2} = \sqrt{2 \cdot 2 \cdot 2} = \sqrt{2^2 \cdot 2} = 2\sqrt{2}$   
 $\sqrt{10 \cdot 5} = \sqrt{2 \cdot 5 \cdot 5} = \sqrt{2 \cdot 5^2} = 5\sqrt{2}$   
 $\sqrt{25 \cdot 2} = \sqrt{5^2 \cdot 2} = 5\sqrt{2}$

Reduce number inside a radical to its Prime factors

OR look for perfect squares

what is  $(3\sqrt{6})(2\sqrt{3})$ ?

$$= 3 \cdot 2 \cdot \sqrt{6} \sqrt{3} = 6 \cdot \sqrt{3 \cdot 2} \sqrt{3} = 6 \sqrt{3 \cdot 2 \cdot 3} = 18\sqrt{2}$$

what is  $\sqrt{784}$   $= \sqrt{2 \cdot 392} = \sqrt{2 \cdot 2 \cdot 196} = 2\sqrt{2 \cdot 49}$

what is  $\sqrt{720}$   $= \sqrt{2 \cdot 360} = 2\sqrt{2 \cdot 2 \cdot 49} = 4\sqrt{49} = 28$

$$= \sqrt{2 \cdot 2 \cdot 180} = 2\sqrt{2 \cdot 90} = 2\sqrt{2 \cdot 2 \cdot 45} = 4\sqrt{59} = 12\sqrt{5}$$



Fri Jan 21st

# What's happening today?

## Check-in

Submit Quiz Corrections with explanations for 100% marks

You need to explain your mistake and how you corrected it in your submission or verbally

Project on Radical Expressions & Special right-triangle conjectures due today

[Homework assigned on 8.5 & 8.6](#)

## Today

Questions on Project?

## Reminders

# Complete Investigation - Do Problems (Teams)

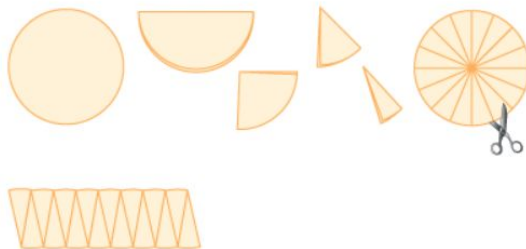


## Investigation

### Area Formula for Circles

Circles do not have straight sides like polygons do. However, the area of a circle can be rearranged. Let's investigate.

- Step 1 Use your compass to make a large circle. Cut out the circular region.
- Step 2 Fold the circular region in half. Fold it in half a second time, then a third time and a fourth time. Unfold your circle and cut it along the folds into 16 wedges.
- Step 3 Arrange the wedges in a row, alternating the tips up and down to form a shape that resembles a parallelogram.



If you cut the circle into more wedges, you could rearrange these thinner wedges to look even more like a rectangle, with fewer bumps. You would not lose or gain any area in this change, so the area of this new "rectangle," skimming off the bumps as you measure its length, would be closer to the area of the original circle.

If you could cut infinitely many wedges, you'd actually have a rectangle with smooth sides. What would its base length be? What would its height be in terms of  $C$ , the circumference of the circle?

- Step 4 The radius of the original circle is  $r$  and the circumference is  $2\pi r$ . Give the base and the height of a rectangle made of a circle cut into infinitely many wedges. Find its area in terms of  $r$ . State your next conjecture.

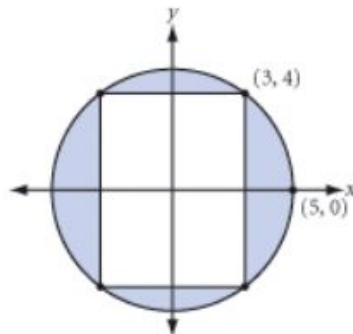
### Circle Area Conjecture

$$\pi r^2$$

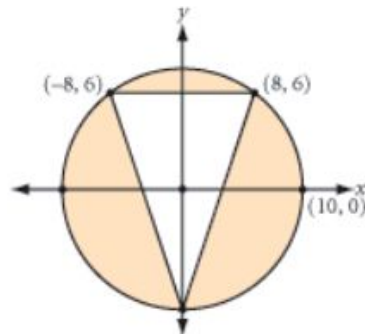
C-80

The area of a circle is given by the formula  $\pi r^2$ , where  $A$  is the area and  $r$  is the radius of the circle.

9. What is the area of the shaded region between the circle and the rectangle?



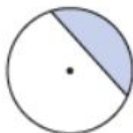
10. What is the area of the shaded region between the circle and the triangle?



# Sectors - Segments - Annuli



Sector of a circle



Segment of a circle



Annulus

A **sector of a circle** is the region between two radii and an arc of the circle.

A **segment of a circle** is the region between a chord and an arc of the circle.

An **annulus** is the region between two concentric circles.

“Picture equations” are helpful when you try to visualize the areas of these regions. The picture equations below show you how to find the area of a sector of a circle, the area of a segment of a circle, and the area of an annulus.

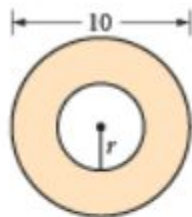
$$\frac{a}{360} \cdot \pi r^2 = A_{\text{sector}}$$

$$\frac{a}{360} \pi r^2 - \frac{1}{2} b h = A_{\text{segment}}$$

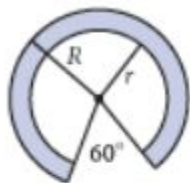
$$\pi R^2 - \pi r^2 = A_{\text{annulus}}$$

# Do some Problems

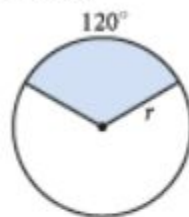
7.  $r = 2$  cm



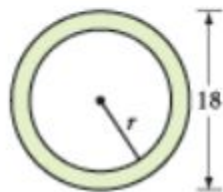
8.  $R = 12$  cm  
 $r = 9$  cm



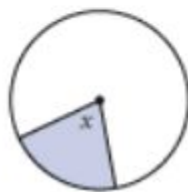
9. The shaded area is  $12\pi$  cm<sup>2</sup>.  
Find  $r$ .




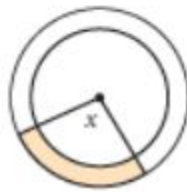
10. The shaded area is  $32\pi$  cm<sup>2</sup>. Find  $r$ .



11. The shaded area is  $120\pi$  cm<sup>2</sup>, and the radius is 24 cm. Find  $x$ .



12. The shaded area is  $10\pi$  cm<sup>2</sup>.  
The radius of the large circle is 10 cm, and the radius of the small circle is 8 cm. Find  $x$ . 



Tue Jan 25th

# What's happening today?

## Check-in

Submit Quiz Corrections for 100% marks

You need to explain your mistake and how you corrected it in your submission or verbally

Project on Radical Expressions & Special right-triangles due today (this weekend)

[Homework assigned 8.5 & 8.6](#)

Conjectures Notebook Review and Reflection Assigned

## Today

Points of trouble - Power Rules, Simplifying Expressions, PEMDAS, Units, Bases & Heights

Project Hints

## Reminders

# Power Rules & Radicals

## Power Rules & Radicals

$$\frac{1}{a} = a^{-1}, \sqrt{a} = a^{\frac{1}{2}}, a^0 = 1$$

$$\frac{1}{3} = 3^{-1}, \sqrt{5} = 5^{\frac{1}{2}}, 17^0 = 1$$

$$a^p + a^p = a^p(1+1) = 2a^p$$

$$3^2 + 3^2 = 2 \cdot 3^2 = 18$$

$$a^p + a^q \text{ (cannot be simplified further)}$$

$$3^2 + 3^3 = 9 + 27 = 36$$

$$a^p \cdot a^q = a^{(p+q)}$$

$$2^3 \cdot 2^4 = (2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2 \cdot 2) = 2^7 = 128$$

$$\frac{a^p}{a^q} = a^{(p-q)}$$

$$\frac{2^3}{2^4} = \frac{2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 2} = \frac{1}{2} \text{ or } 2^{(3-4)} = 2^{-1} = \frac{1}{2}$$

$$(a^p)^q = a^{pq}$$

$$(2^3)^4 = 2^{3 \cdot 4} = 2^{12} = (2 \cdot 2 \cdot 2)^4 = (2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)$$

$$\sqrt{a} \cdot \sqrt{a} = \sqrt{a^2} = a$$

$$\sqrt{5} \cdot \sqrt{5} = \sqrt{5^2} = \sqrt{25} = 5$$

$$\sqrt{a} \sqrt{b} = \sqrt{ab}$$

$$\sqrt{3} \cdot \sqrt{5} = \sqrt{3 \cdot 5} = \sqrt{15}$$

$$\sqrt{a} + \sqrt{b} \text{ cannot be simplified further}$$

$$\sqrt{3} + \sqrt{5}$$

$$\sqrt{a} + \sqrt{a} = \sqrt{a}(1+1) = 2\sqrt{a}$$

$$\sqrt{5} + \sqrt{5} = 2\sqrt{5}$$



# Simplifying Expressions

$$1. -7x^2 = a^2 - c^2$$

Calculate x

$$2. \frac{b^2}{2} = c^2 - x^2$$

Calculate x

(Taking  $\sqrt{\quad}$  is same as taking to power  $\frac{1}{2}$ )

$$3. \sqrt{a} + \sqrt{a}, \sqrt{a} + \sqrt{b}, \sqrt{a} \cdot \sqrt{b}$$

Simplify ③ & ④

$$4. (a^2)^3, (\sqrt{a} \sqrt{a})^2, c(a+b)^2$$

(Dividing by 2 is same as multiply by  $\frac{1}{2}$ )

$$5. -4x + 3 = -2y \text{ what is slope \& y-int}$$

$$a=3, b=4, c=5$$

$$x = \sqrt{\frac{c^2 - a^2}{7}} = \sqrt{\frac{16}{7}}$$

$$x = \sqrt{c^2 - \frac{b^2}{2}} = \sqrt{17}$$

$$2\sqrt{a}, \sqrt{a} + \sqrt{b}, \sqrt{ab}$$

$$2\sqrt{3}, \sqrt{3} + \sqrt{4}, 2\sqrt{3}$$

$$a^6, a^2, c(a^2 + 2ab + b^2)$$

$$729, 9, 245$$

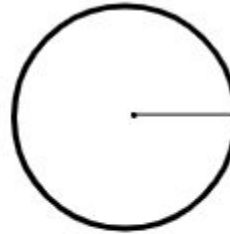
$$y = 2x - \frac{3}{2} \quad \text{slope: } 2 \\ \text{y-int: } -\frac{3}{2}$$

# How do Units work?

How do units work in these formulas?

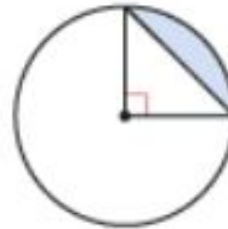


The above fig is a Trapezoid of Area 500 sq-ft & height 8 meters. Calculate the length of the small base in meters if the large base is 10 meters in length.



Area of circle is 72 sq. ft  
What is the radius in meters?

4.  $r = 2 \text{ cm}$



Calculate the area of the shaded segment

# Soln to Units problems

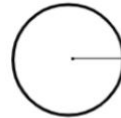
## How do Units work?

How do units work in these formulas?



The above fig is a Trapezoid of Area 500 sq-ft & height 8 meters. Calculate the length of the small base in meters if the large base is 10 meters in length.

$$\begin{aligned} \text{Area} &= 72 \text{ ft}^2 = \pi r^2 \\ r &= \sqrt{\frac{72}{\pi}} \text{ ft} = 4.79 \text{ ft} \\ &= 4.79 \text{ ft} \times \frac{1 \text{ m}}{3.28 \text{ ft}} \end{aligned}$$

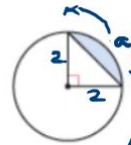


Area of circle is 72 sq. ft  
What is the radius in meters?

$$= 1.46 \text{ m}$$

4.  $r = 2 \text{ cm}$

$$\begin{aligned} \text{Area} &= \frac{\theta}{360} \times \pi r^2 = \frac{1}{2} b h \\ &= \frac{90}{360} \times \pi \times 2^2 = \frac{1}{2} \times 2 \times 2 \\ \text{Calculate the area of the shaded segment} \\ &= \frac{1}{4} \pi \cdot 4 - 2 \\ A &= \pi - 2 \text{ cm} \end{aligned}$$



$$500 \text{ ft}^2 \times \frac{\text{m}^2}{\text{ft}^2} = \frac{1}{2} (10 + b_2) \text{ m} \times 8 \text{ m}$$

there are 3.28 ft in a meter

$$500 \times \text{ft}^2 \times \frac{\text{m}^2}{3.28^2 \text{ ft}^2} = \frac{1}{2} (10 + b_2) \times 8 \text{ m}^2$$

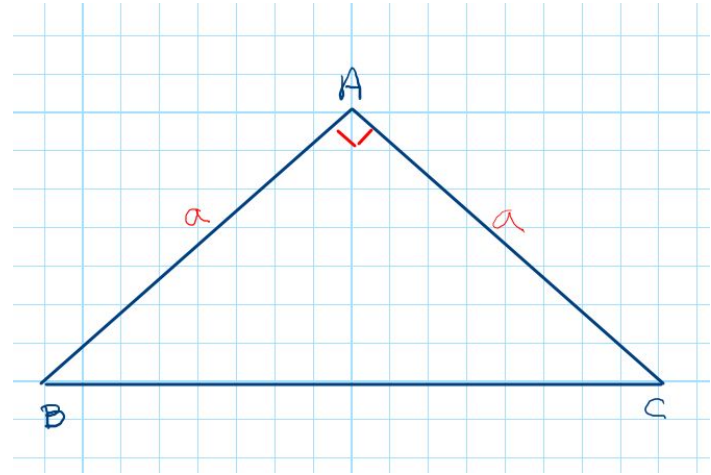
$$46.4 = 40 + 4b_2$$

$$b_2 = 6.4/4 = 1.6 \text{ m}$$

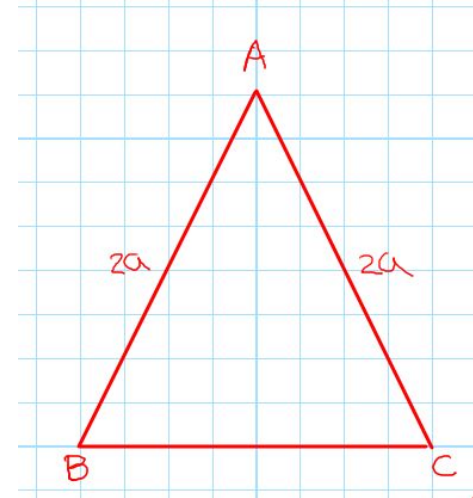
Validate:  $\text{Area} = \frac{1}{2} (10 + 1.6) \times 8 = 46.4 \text{ m}^2$   
or  $46.4 \text{ m}^2 \times 3.28^2 \text{ ft}^2/\text{m}^2 = 499.6 \text{ ft}^2$

# Project Hints

Find the hypotenuse of an Isosceles Right-Triangle of side 'a'



Find the Height of an Equilateral Triangle of side ' $2a$ '



Thu Jan 27th

# What's happening today?

Check-in

Today

Going 3-D today - Surface Areas Chapter 8.7!

Use Geogebra to build 3D Shapes

Reminders

Submit Quiz Corrections for 100% marks

You need to explain your mistake and how you corrected it in your submission or verbally

Project on Radical Expressions & Special right-triangles due today (this weekend)

[Homework assigned 8.7 Surface Area](#)

Conjectures Notebook Review and Reflection Assigned

Start studying for your next quiz! (8.4 - 8.7) (regular polygons, circles, pieces of circles, and surface area)

# Some 3-D Shapes and Vocabulary

## 3-Dimensional Shapes



Cylinder



Prism



Sphere



Cone

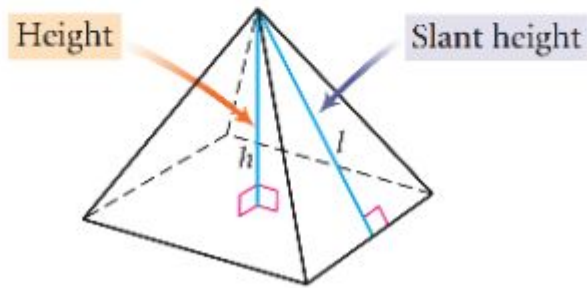
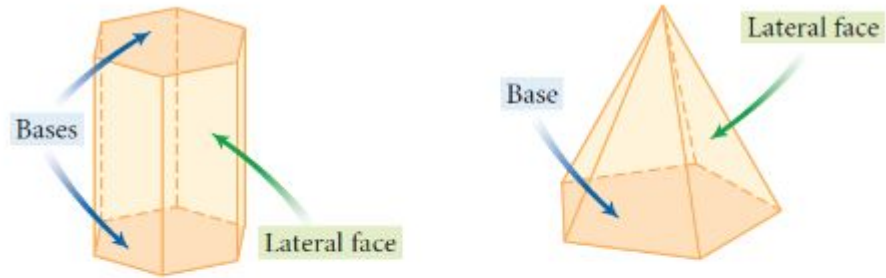


Pyramid



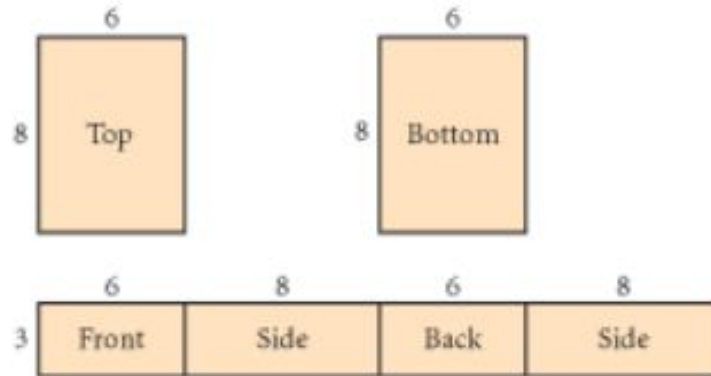
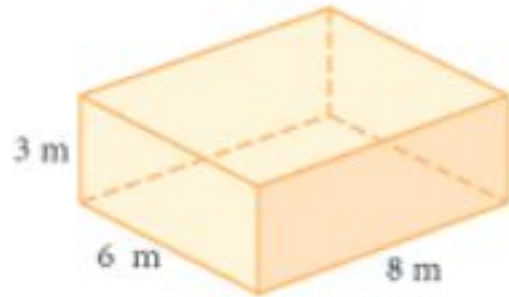
Hemisphere

# Some 3-D Shapes and Vocabulary



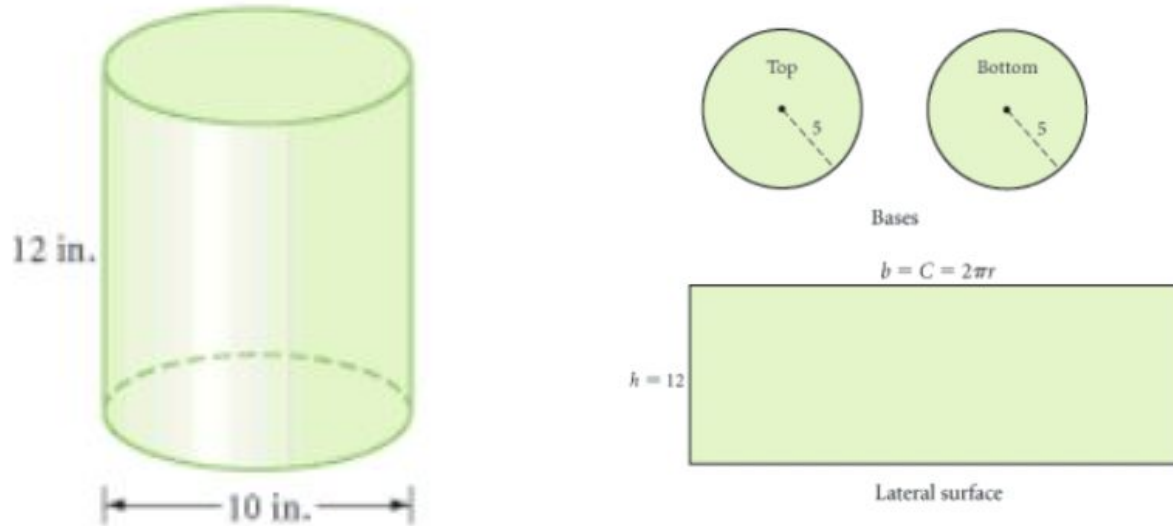


# Surface Area of 3-D Shapes - Prism



$$\text{surface area} = 2(\text{base area}) + (\text{lateral surface area})$$

# Surface Area of 3-D Shapes - Cylinder

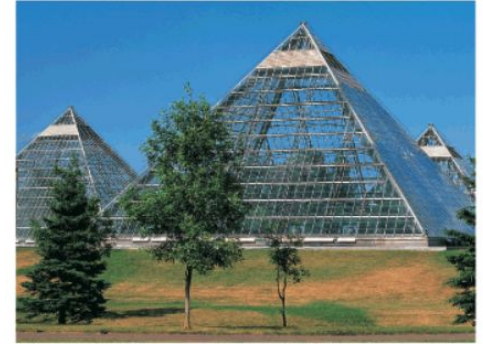


$$\text{Surface Area of Cylinder} = 2\pi r(r + h)$$

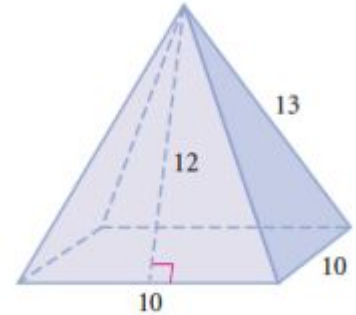
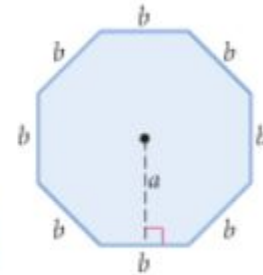
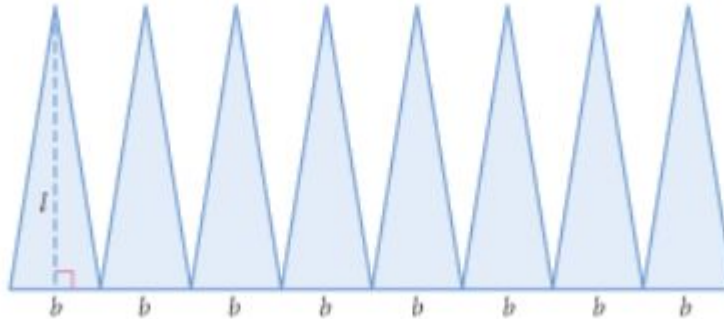
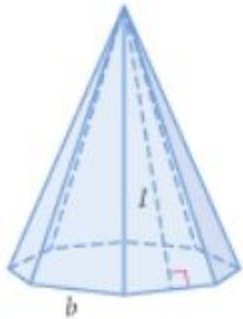


This ice cream plant in Burlington, Vermont, uses cylindrical containers for its milk and cream.

# Surface Area of 3-D Shapes - Pyramid



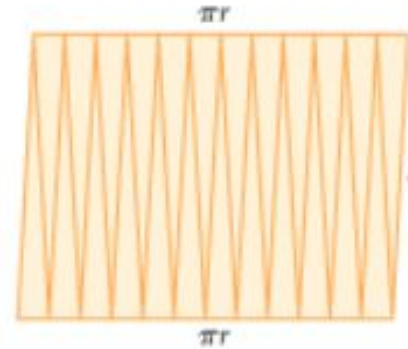
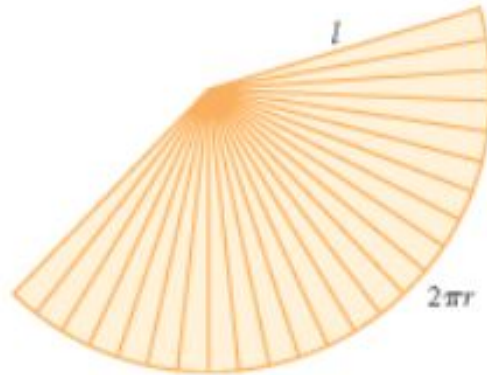
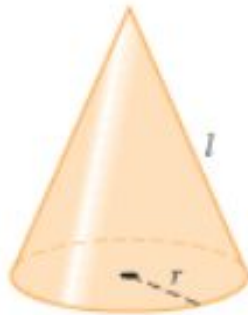
These conservatories in Edmonton, Canada, are glass pyramids.



$$\text{Surface Area of Pyramid} = \frac{1}{2}bn(l + a)$$

$$\begin{aligned} \text{Surface Area} \\ &= 340 \text{ sq-cm} \end{aligned}$$

# Surface Area of 3-D Shapes - Cone



$$\text{Surface Area of Cone} = \pi r(r + l)$$

# Do problems from Homework

## Homework assigned 8.7 Surface Area

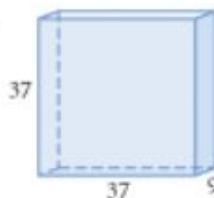
In Exercises 1–10, find the surface area of each solid. All quadrilaterals are rectangles, and all given measurements are in centimeters. Round your answers to the nearest 0.1  $\text{cm}^2$ .



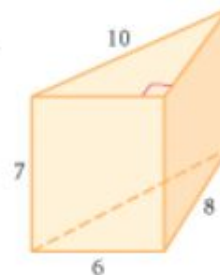
1. <http://www.keymath.com/DG4/chapter8/mpys>



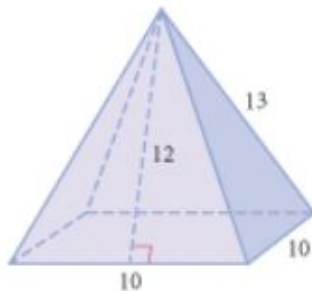
2.



3.



4.




5.

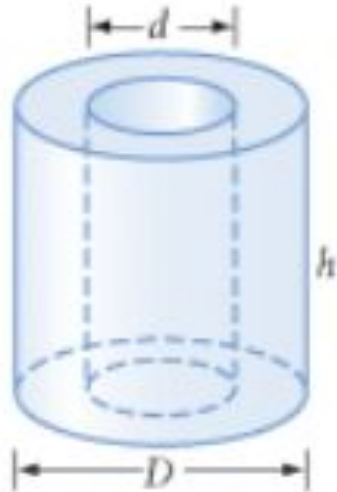


6.



# Do problems from Homework

9.  $D = 8, d = 4, h = 9$  



# Reminders

Submit Quiz Corrections for 100% marks

You need to explain your mistake and how you corrected it in your submission or verbally

Project on Radical Expressions & Special right-triangles due today (this weekend)

[Homework assigned 8.7 Surface Area](#)

Conjectures Notebook Review and Reflection Assigned

Start studying for your next quiz! (8.4 - 8.7) (regular polygons, circles, pieces of circles, and surface area)

Best way to do this is to do & VALIDATE your Homework Problems using AK!

**Mon Jan 31st**



# What's happening today?

## Check-in

[Submitted Quiz Corrections for 100% marks?](#)

[Completed Chap 9.3 Radicals & Equations Project?](#)

[Completed Chap 8.5 and 8.6 Problems on Sectors, Segments & Annulii?](#)

[Completed Chap 8.7 Surface Area Problems?](#)

## References

[AKs for Chapter Homework 8.4, 8.5, 8.6, 8.7, 9.3 posted - Review & Validate!](#)

[What Goes in your Toolbox?](#)

## Today

[Divide into teams of 2](#)

Geogebra 3D!

[Area Problems Practice!](#) Where do you need help?

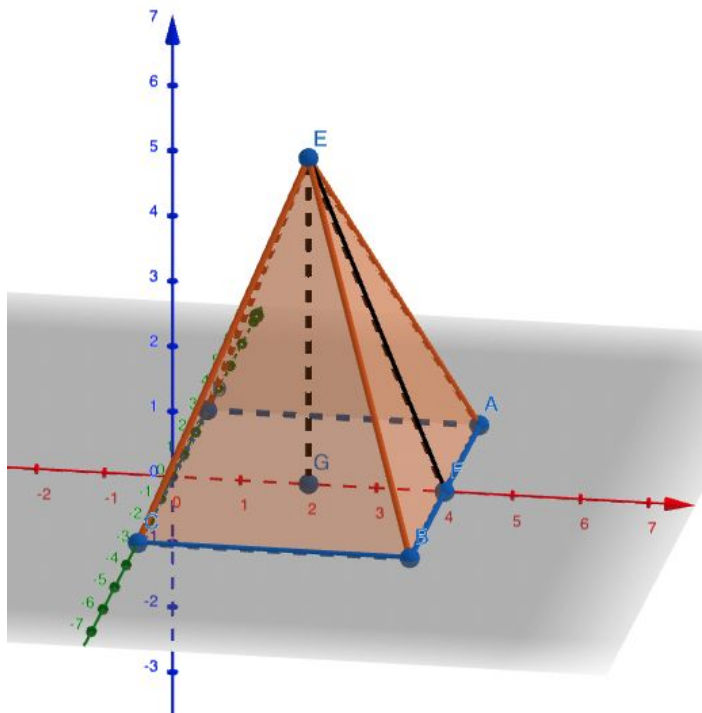
Sectors, Segments, Annulii, Surface Area

Examine Conjectures Notebook (Toolbox) - Conjectures List Posted

## Reminders

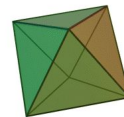
U4Q2 - Quiz on 8.4, 8.5, 8.6, 8.7, 9.3 scheduled for Friday, Feb 4th

# Let's build some 3D Shapes in Geogebra



Can you build a Cone??

Can you build a Octahedron?

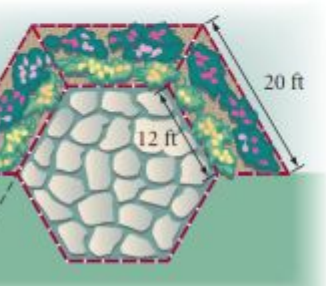


# Problems that make you think

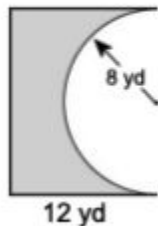
## Try these Area Practice Problems

Start with these ..

2. A landscape architect is designing three trapezoidal flowerbeds to wrap around three sides of a hexagonal flagstone patio, as shown. What is the area of the entire flowerbed? The landscape architect's fee is \$100 plus \$5 per square foot. What will the flowerbed cost?



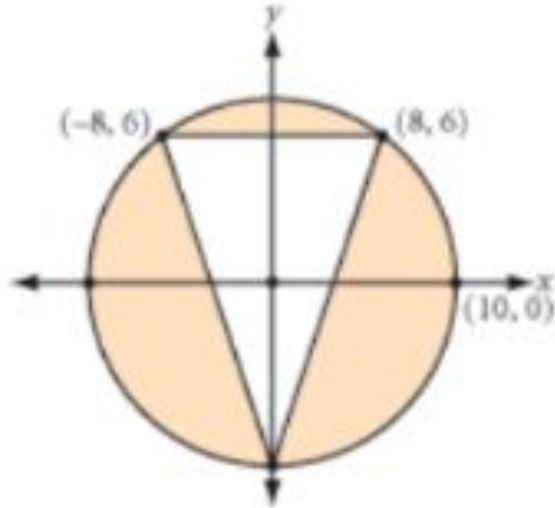
5. Find the area of the shaded region. (Hint: draw a line segment in a clever place)



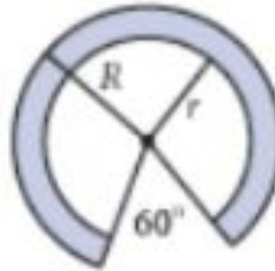
6. Find the area of an equilateral triangle with sides of length 8 cm. Give an exact, reduced answer.

# Problems that make you think ..

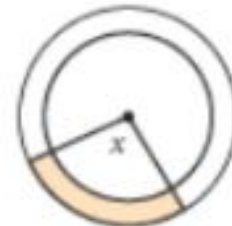
What is the area of the shaded region between the circle and the triangle?

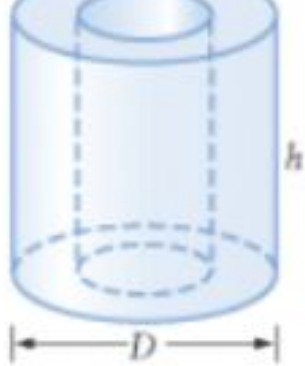


$$R = 12 \text{ cm}$$
$$r = 9 \text{ cm}$$



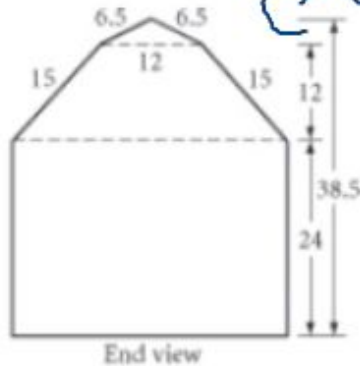
The shaded area is  $10 \pi \text{ cm}^2$ .  
The radius of the large circle is 10 cm, and the radius of the small circle is 8 cm. Find  $x$ . [h](#)



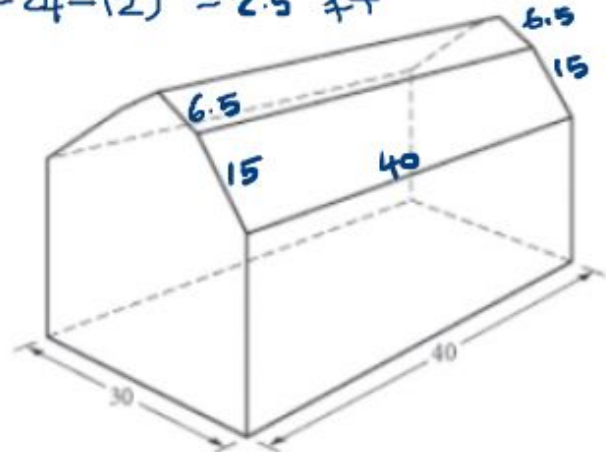


ake you think ..

12. **Application** Claudette and Marie are planning to paint the exterior walls of their country farmhouse (all vertical surfaces) and to put new cedar shingles on the roof. The paint they like best costs \$25 per gallon and covers 250 square feet per gallon. The wood shingles cost \$65 per bundle, and each bundle covers 100 square feet. How much will this home improvement cost? All measurements are in feet.



$$\rightarrow (38.5 - 24 - 12) = 2.5 \text{ ft}$$



Wed Feb 2nd

# What's happening today?

Check-in

References - [Conjectures List Posted](#), [Area-Volume Project Posted](#)

Today

Solids - Chapter 10 Volume!

Assign Project: Partners -

```
[' Luli', ' Anusha']  
[' Lincoln', 'Lulu']  
[' Hedia', ' Charlotte']  
[' Luc', ' Bella']  
[' Declan', ' Cophine']  
[' Cam', ' Kenzo']
```

Examine Conjectures Notebook (Toolbox)

Reminders

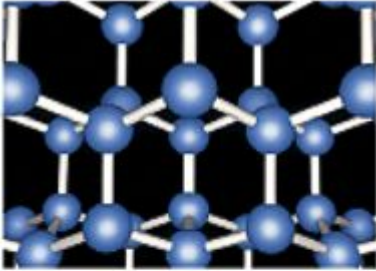
Complete your Conjectures Notebook - [Conjectures List Posted](#)

[Work on Volume Problems Assigned](#)

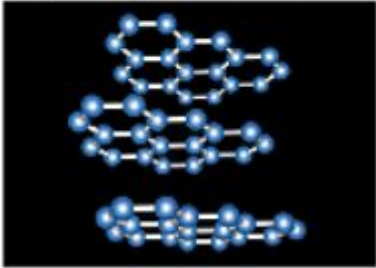
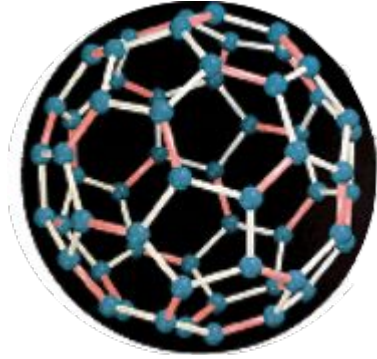
Work on [Area-Volumes Project](#)

U4Q2 - Quiz on 8.4-7, 9.3 scheduled for Friday, Feb 4th

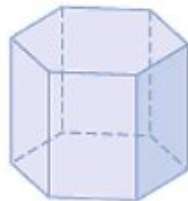
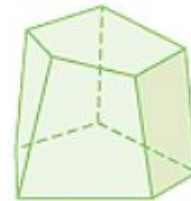
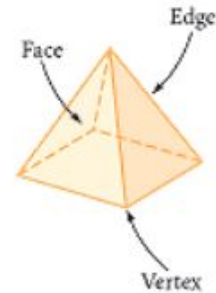
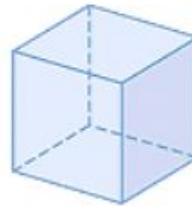
# Solids - Volume Vocabulary



The geometry of diamonds



The geometry of graphite



Polyhedron

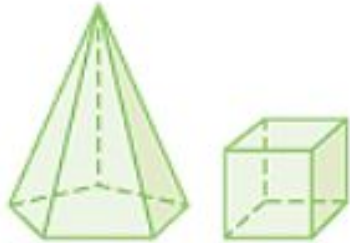
Face

Edge

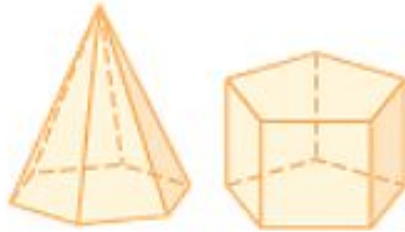
Vertex



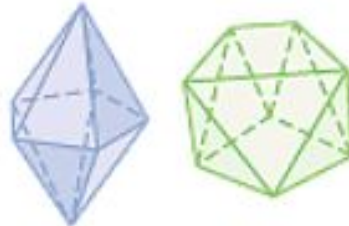
# Polyhedrons



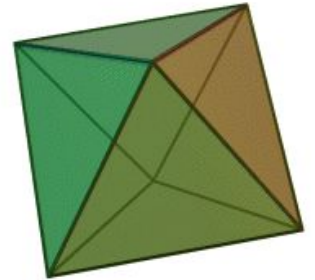
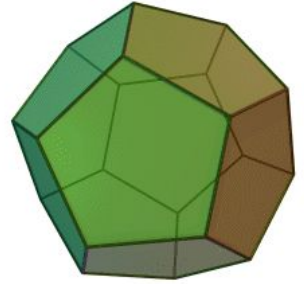
Hexahedrons



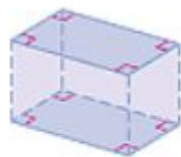
Heptahedrons



Decahedrons



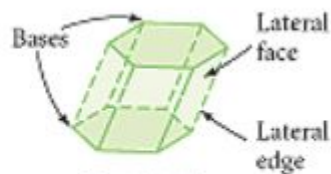
# Pyramids Prisms Cylinders Cones Spheres- Oblique & Right



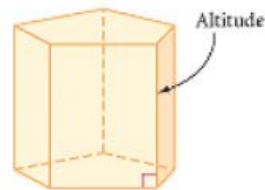
Rectangular prism



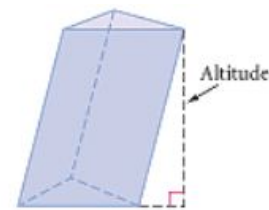
Triangular prism



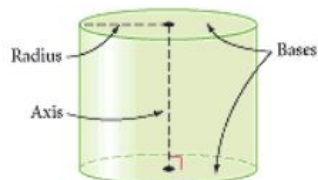
Hexagonal prism



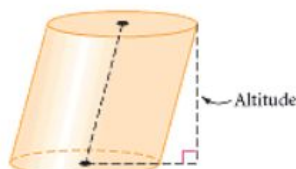
Right pentagonal prism



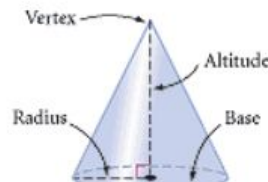
Oblique triangular prism



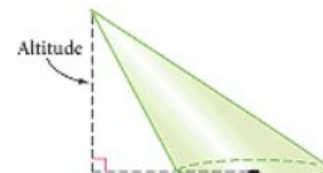
Right cylinder



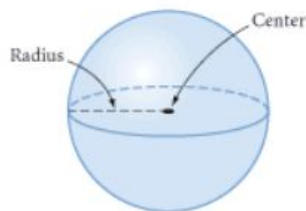
Oblique cylinder



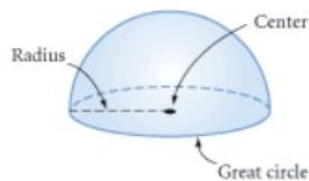
Right cone



Oblique cone



Sphere



Hemisphere

# Volume



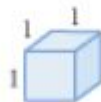
100 Cans (1962 oil on canvas), by pop art artist Andy Warhol (1925–1987), repeatedly uses the cylindrical shape of a soup can to make an artistic statement with a popular image.

**Volume** is the measure of the amount of space contained in a solid. You use cubic units to measure volume: cubic inches ( $\text{in}^3$ ), cubic feet ( $\text{ft}^3$ ), cubic yards ( $\text{yd}^3$ ), cubic centimeters ( $\text{cm}^3$ ), cubic meters ( $\text{m}^3$ ), and so on .

The volume of an object is the number of unit cubes that completely fill the space within the object.

1

Length: 1 unit

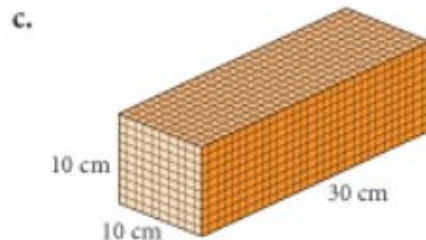
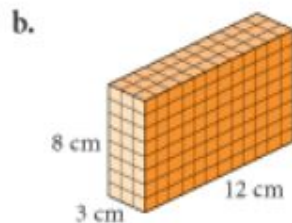
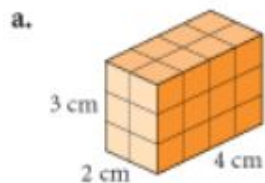


Volume: 1 cubic unit



Volume: 20 cubic units

# Volume Conjectures



## Rectangular Prism Volume Conjecture

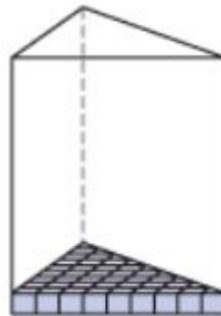
C-86a

If  $B$  is the area of the base of a right rectangular prism and  $H$  is the height of the solid, then the formula for the volume is  $V = \underline{\quad ? \quad} BH$

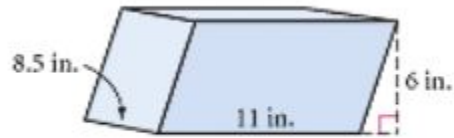
## Right Prism-Cylinder Volume Conjecture

C-86b

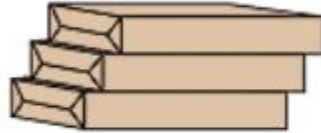
If  $B$  is the area of the base of a right prism (or cylinder) and  $H$  is the height of the solid, then the formula for the volume is  $V = \underline{\quad ? \quad} BH$



# Right or Oblique Volume - is it different?



Oblique  
rectangular prism



Stacked reams  
of 8.5-by-11-inch paper



Stacked sheets  
of paper



Sheets of paper  
stacked straight

## Prism-Cylinder Volume Conjecture

C-86

The volume of a prism or a cylinder is the   ?   multiplied by the   ?  .

Base Area

Height  
perpendicular  
to Base



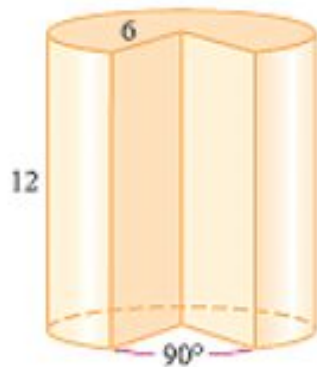
# Volume Problems

Oblique Cylinder



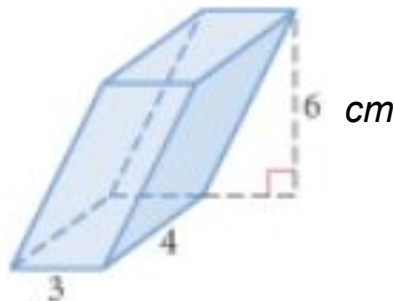
$$252\pi \text{ in}^3$$

Right cylinder with a  
90° slice removed [h](#)



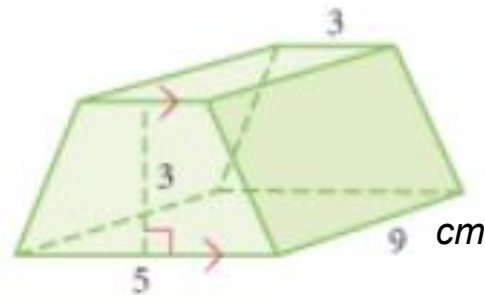
$$324\pi \text{ cm}^3$$

Oblique rectangular prism



$$72 \text{ cm}^3$$

Right trapezoidal prism



$$108 \text{ cm}^3$$

Fri, Feb 4th

# What's happening today?

Check-in

References

Today

- Work on Volume Problems (Chap 10.1 10.2)

- Work on Volumes Project

- U4Q2 - Areas Quiz

Reminders

- Work on Volumes Project



Tue, Feb 8th

# What's happening today?

## Check-in

U2Q2 Quizzes Returned

Submit Quiz Corrections!

## References

## Today

Review Prisms & Cylinders Volume

Do Volume Exercise with water

Chapter 10.3 Volume of Cones and Pyramids

Do some problems - [Homework assigned](#)

## Reminders

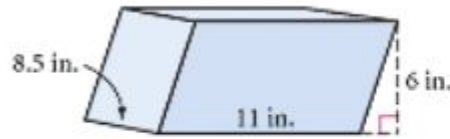
Work on Volumes Project

Construct a Platonic Solid!

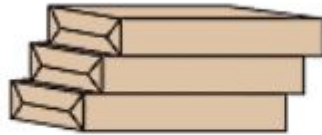
Do Volume of a Sphere Worksheet

Work on U4Q2 Quiz Corrections

# Review Volume of Right/Oblique Prisms/Cylinders



Oblique  
rectangular prism



Stacked reams  
of 8.5-by-11-inch paper



Stacked sheets  
of paper



Sheets of paper  
stacked straight

## Prism-Cylinder Volume Conjecture

C-86

The volume of a prism or a cylinder is the   ?   multiplied by the   ?  .

Base Area

Height  
perpendicular  
to Base



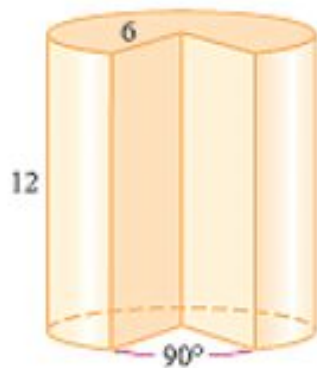
# Review Problems

Oblique Cylinder

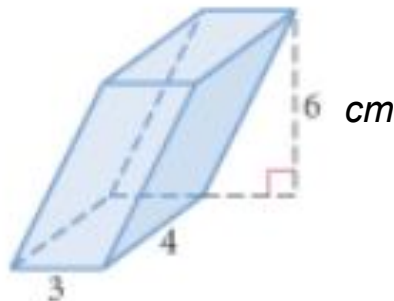


$$252\pi \text{ in}^3$$

Right cylinder with a  
90° slice removed [h](#)

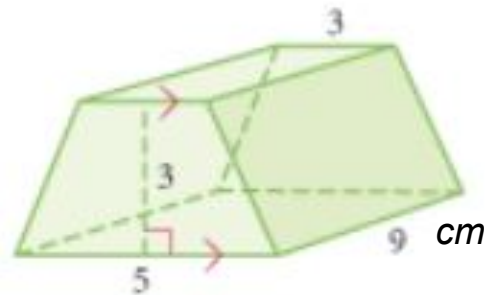


Oblique rectangular prism



$$72 \text{ cm}^3$$

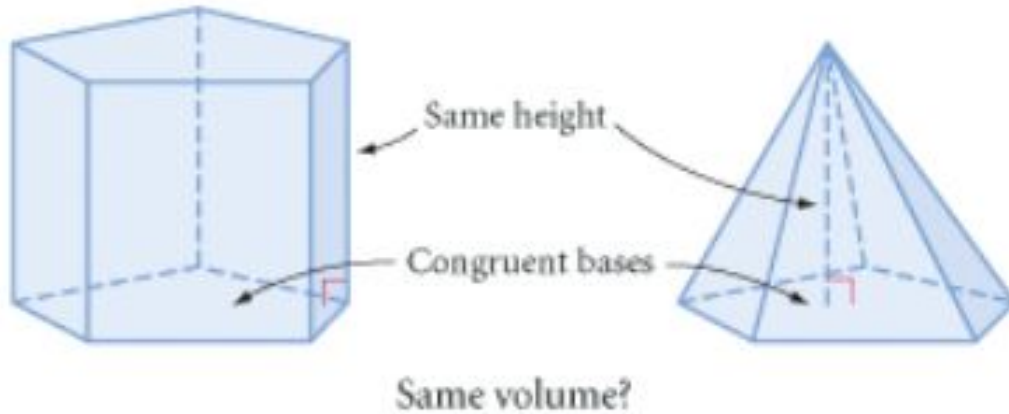
Right trapezoidal prism



$$108 \text{ cm}^3$$

$$324\pi \text{ cm}^3$$

# Volume of a Pyramid



It's actually 1/3rd! Pyramid/Cone Volume =  $(\frac{1}{3}) * BH$

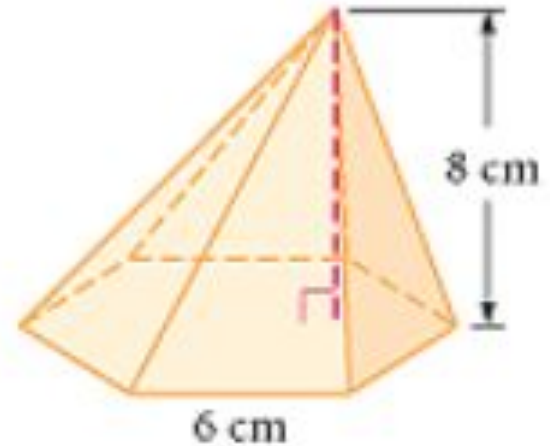
## Pyramid-Cone Volume Conjecture

C-87

If  $B$  is the area of the base of a pyramid or a cone and  $H$  is the height of the solid, then the formula for the volume is  $V = \underline{\quad ? \quad}$ .

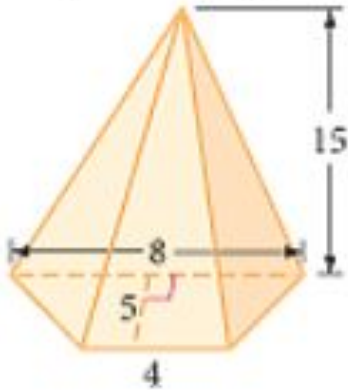
# Example Problem

Find the volume of a regular hexagonal pyramid with a height of 8 cm. Each side of its base is 6 cm.

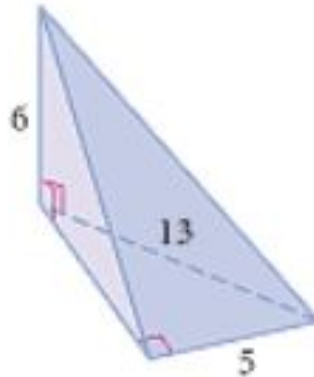


# Problems

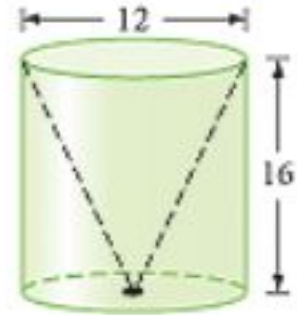
## 3. Trapezoidal pyramid



## 4. Triangular pyramid



## 6. Cylinder with cone removed

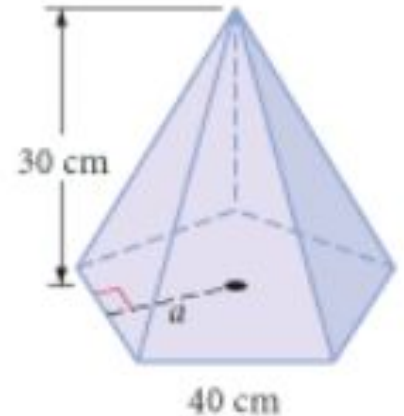


Once you solve this, [See Published Answer Key](#) for solution

# Concept of Mass & Density

$$\text{Mass (gm)} = \text{Volume (cc)} * \text{Density (g/cc)}$$

- 14.** Bretislav has designed a crystal glass sculpture. Part of the piece is in the shape of a large regular pentagonal pyramid, shown at right. The apothem of the base measures 27.5 cm. How much will this part weigh if the glass he plans to use weighs 2.85 grams per cubic centimeter?



Once you solve this, [See Published Answer Key](#) for solution



# Word Problem

Your garden is shaped like a rectangle with dimensions 50 feet by 20 feet.

You want to buy compost, covering the entire garden at a depth of 2 inches.

How many cubic yards of compost should you buy?

# Reminders

Work on Volumes Project

Do Volume of a Sphere Worksheet

Submit U4Q2 Quiz Corrections by Thursday!

Complete your Volumes of Prism & Cylinder Homework

Complete your Volumes of Pyramid & Cone Homework

**Consolidated Unit 4 Test is on Friday, Feb 18th**

**Includes Chapters 8.1, 8.2, 8.4, 8.5, 8.6, 8.7, 9.3, 10.1, 10.2, 10.3, 10.6, 10.7**

Study for it by:

Completing your Homework Assignments & Projects!

Verifying your Answers with the AKs

Submitting your Quiz Corrections

Conference with me - ALL OF YOU!

Thu, Feb 10th

# What's happening today?

Check-in

Review

- Volumes of Cylinder & Prism

- Volumes of Cone & Pyramid

Today

- Chap 10.6: Derive Volume of Sphere

- Chap 10.7: Derive Surface Area of Sphere

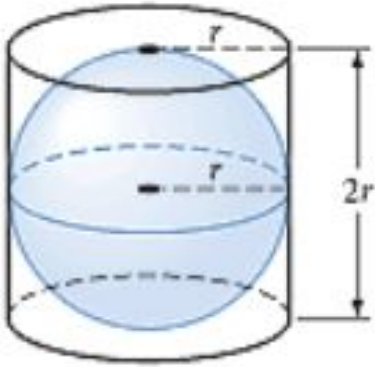
- Do Sphere Volume and SA problems

- Project Work

- Previous Homework

Reminders

# Volume of Sphere



## Sphere Volume Conjecture

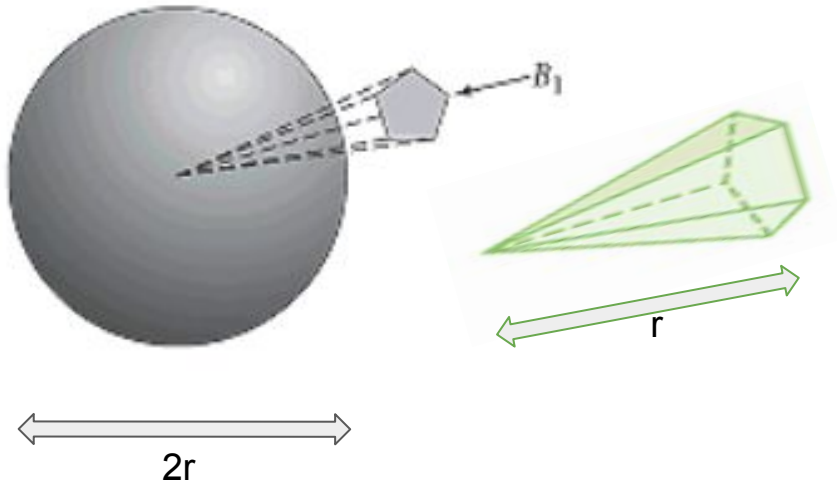
C-88

The volume of a sphere with radius  $r$  is given by the formula     ?.

$$\frac{4}{3} \pi r^3$$

# Surface Area of Sphere

[Link to Sphere SA Conj Derivation](#)



## Sphere Surface Area Conjecture

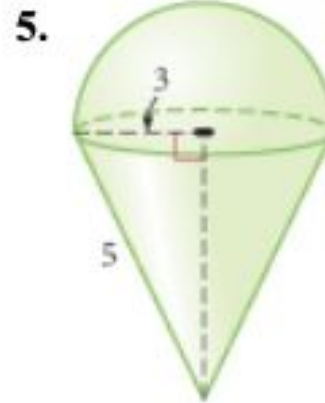
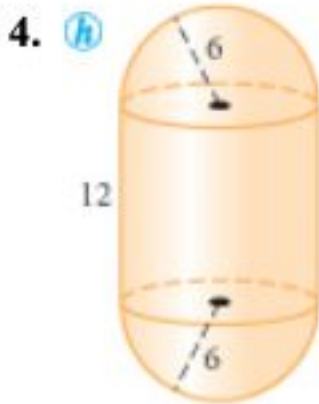
C-89

The surface area,  $S$ , of a sphere with radius  $r$  is given by the formula ?.

$$4\pi r^2$$

# Do some Sphere Volume Problems

10.6 E&P 2: 4, 6, 8, 13, 16

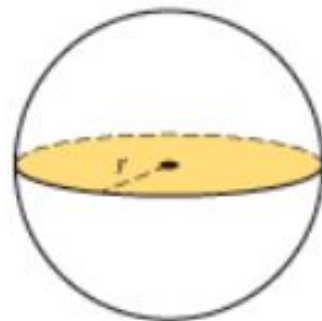


Once you solve this, [See Published Answer Key](#) for solution

# Do some Sphere Surface Area Problems

10.7 E&P 1: 2, 5, 6, 10, 11

4. The shaded circle at right has area  $40\pi\text{cm}^2$ . Find the surface area of the sphere. [h](#)
5. Find the volume of a sphere whose surface area is  $64\pi\text{cm}^2$ .
6. Find the surface area of a sphere whose volume is  $288\pi\text{cm}^3$ .



Once you solve this, [See Published Answer Key](#) for solution



# Reminders

Work on Volumes Project  
Do Volume of a Sphere Worksheet  
Do Sphere Volume & SA Problems  
Submit U4Q2 Quiz Corrections by Thursday!  
Complete your Volumes of Prism & Cylinder Homework  
Complete your Volumes of Pyramid & Cone Homework  
Complete your Volume & SA of Sphere Homework!

**Consolidated Unit 4 Test is on Friday, Feb 18th**  
**Includes Chapters 8.1, 8.2, 8.4, 8.5, 8.6, 8.7, 9.3, 10.1, 10.2, 10.3, 10.6, 10.7**

Study for it by:

Completing ALL Homework Assignments & Projects!  
Verifying your Answers with the AKs  
Submitting your Quiz Corrections  
Conference with me - **ALL OF YOU!**

Mon-Wed-Fri,  
Feb 14-16-18th

# What's happening today?

## Check-in

Happy Valentine's day!

## References

[AKs to Homework assignments & Quiz U4Q1 have been published](#)

[AKs to Quiz U4Q2 have been published for those who have already submitted QC](#)

[AKs to Practice Problems have been published](#)

[48-problem Practice slideshow published](#)

## Today

Review Toolbox (Conjectures Notebook Day)

Work Catch-up Day

Project Catch-up Day

Unit 4 Test Prep Day

Construct a Platonic Solid Day

## Reminders

# Details for today

1. Review Toolbox (Conjectures Notebook).
2. Complete & Submit your Quiz Corrections with an explanation of problems. you got incorrectly. [The AK U4Q1 is posted here.](#) For AK\_U4Q2 you need to schedule conference & submit a Quiz Correction first for problems you got wrong.
3. Review and Validate your answers to your Homework Problems (most recent first). [The AKs for all Homework problems and Practice are posted here.](#) If incorrect redo them taking clues from AK.
4. [\(New\) I have linked a slideshow of 48 Problems that you can test yourself on. You are welcome to attempt up to 4 problems from the set.](#) Solve problem on paper first with images of sketches as needed. Paste it into the slide along with your name on the Title. It will automatically save it there. This is NOT a graded assignment. It is given as a practice problem set. I will accept in lieu for a Quiz Correction problem if you are missing them.

# Unit 4 Test Details

1. **Consolidated Unit 4 Test is on Friday, Feb 18th**
  - a. **Includes Chapters 8.1, 8.2, 8.4, 8.5, 8.6, 8.7, 9.3, 10.1, 10.2, 10.3, 10.6, 10.7**
2. Test expected to be 1-hour long
3. Bring your Conjectures Notebook (Toolbox), Geo Instruments, Calculator.
4. Phones will not be permitted for use as a calculator. Laptops are not allowed,
5. Upto a maximum of 30% can be earned back after submitting a Test Correction with verbal explanation via conference

Tue, Mar 1st

# Tuesday, March 1st

## Check-in

Welcome back! Nice break?

Test Review & Corrections(Please see me in conference)

1. [Access your graded Unit 4 Test & submit Corrections here](#)
2. Good sketches!
3. Trouble with Units for Area/Volume and Units Conversions
4. Issues with 30-60-90 & Isosceles rt-triangles
5. Algebra mistakes
6. Volume & SA Formulas issues

HW - Due Thursday, March 3rd

1. [Watch Ratio, Similarity, and Proportions Video linked here](#) and Portal
2. [Complete Similarity Investigation linked here](#) and on Portal
3. [Submit your Test Corrections here](#)

# Algebra Mistakes

Consider the expression

$$a \cdot p + b$$

what if I want to factor out  $p$ ?

Is it  $(a + b)p$  ?? NO!!

what is

$$6\pi + 4$$

??

•  $2 \cdot (3\pi + 2)$



# Length Area Volume Units & Conversion

- Units of length in, ft, yd, cm, m, km
- Units of area  $\text{cm}^2$ ,  $\text{m}^2$ ,  $\text{ft}^2$ ,  $\text{in}^2$ ,  $\text{yd}^2$
- Units of volume  $\text{cm}^3$  (cc),  $\text{m}^3$ ,  $\text{in}^3$ ,  $\text{yd}^3$ , gal, litre
- Units of weight kg, gm, lb
- Units of density  $\text{g/cm}^3$ ,  $\text{kg/m}^3$ ,  $\text{lb/in}^3$
- Units of speed miles/hr, km/hr, m/s
- Units of time sec, min, hr
- 12 inches to a foot
- 3-feet per yard
- 2.54 cm to an inch
- 2.2 pounds in a kg
- 100 cm in 1 m
- 8 km in 5 mile
- 1000 g in a kg
- 1000 cc in a litre
- 128 fl-oz in a gal
- 231  $\text{in}^3$  in a gal

How many m are in 1 cm ?  $(1/100) = 0.01 \text{ m}$

How many km are in 1 mile?  $(8/5) = 1.6 \text{ km}$

How many  $\text{m}^2$  are in  $200 \text{ cm}^2$  ?  $(1/100)*(1/100)*200 = 0.02 \text{ m}^2$

How many  $\text{yd}^3$  of empty space are in a 5-ft diameter & 18" deep hole with a 5x8" post in it?

$$\begin{aligned} &= \{ [\pi * (5/2)^2 \text{ ft}^2] - 5*8 \text{ in}^2 * (1/12)(1/12) \text{ ft}^2/\text{in}^2 \} * 18 \text{ in} * (1/12) \text{ ft/in} \} * (1/27) \text{ yd}^3/\text{ft}^3 \\ &= \{ [19.635 - 0.278] * 3/2 \} * (1/27) = 1.075 \text{ yd}^3 \end{aligned}$$

# Volume conversion problem

How many  $\text{yd}^3$  of empty space are in a 5-ft diameter & 18" deep hole with a 5x8" post in it?

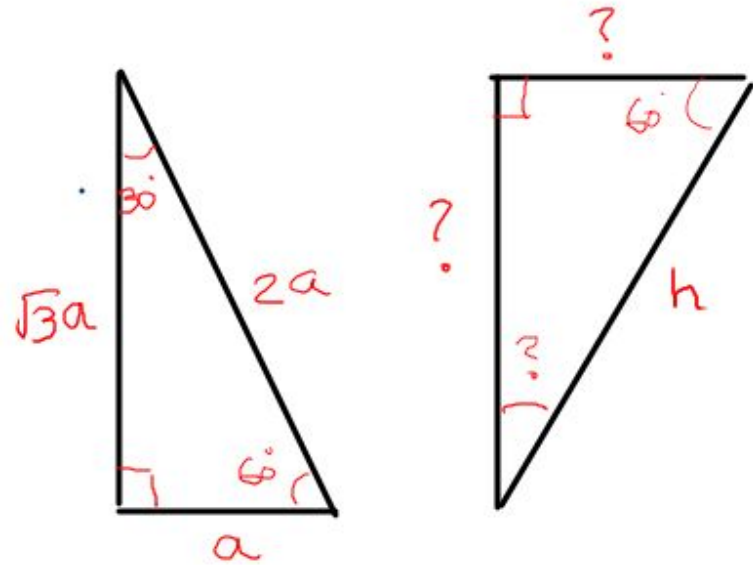
$$\begin{aligned}
 1 \text{ yd} &= 3 \text{ ft} & 12 \text{ in} &= 1 \text{ ft} \\
 \text{Area of Annulus or 'Base Area':} \\
 \pi \left(\frac{5}{2}\right)^2 \text{ ft}^2 - (5 \times 8) \text{ in}^2 &\cdot \frac{1}{144} \frac{\text{ft}^2}{\text{in}^2} \\
 = \frac{25}{4} \pi \text{ ft}^2 - \frac{40}{144} \text{ ft}^2 &= \frac{25}{4} \pi - \frac{5}{18} \text{ ft}^2 \\
 \text{Hole depth} &= 18 \text{ in} \times \frac{1}{12} \frac{\text{ft}}{\text{in}} = \frac{18}{12} = \frac{3}{2} \text{ ft} \\
 \text{Volume of hole} &= \left(\frac{25}{4} \pi - \frac{5}{18}\right) \left(\frac{3}{2}\right) \text{ ft}^3 \\
 &= \left(\frac{25}{4} \pi - \frac{5}{18}\right) \left(\frac{3}{2}\right) \text{ ft}^3 \times \frac{1}{27} \frac{\text{yd}^3}{\text{ft}^3} \\
 &= \left(\frac{25}{4} \pi - \frac{5}{18}\right) \frac{1}{18} \text{ yd}^3 \\
 &= 1.075 \text{ yd}^3
 \end{aligned}$$

$$\begin{aligned}
 12 \text{ in} &= 1 \text{ ft} \\
 1 \text{ in} &= \frac{1}{12} \text{ ft} \\
 (1 \text{ in})^2 &= \left(\frac{1}{12}\right)^2 \text{ ft}^2 \\
 1 \text{ in}^2 &= \frac{1}{144} \text{ ft}^2 \\
 1 \text{ yd} &= 3 \text{ ft} \\
 \frac{1}{3} \text{ yd} &= 1 \text{ ft} \\
 \frac{1}{27} \text{ yd}^3 &= 1 \text{ ft}^3
 \end{aligned}$$

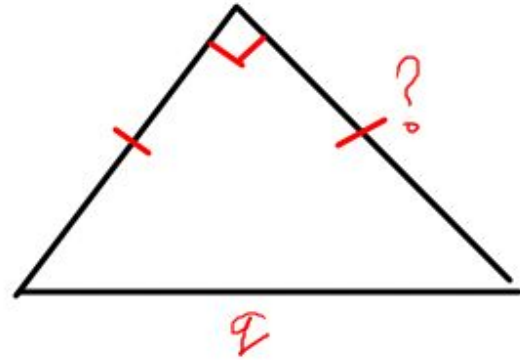
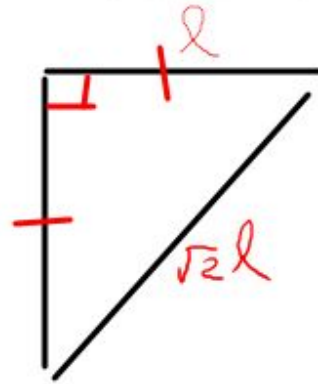
How many  $\text{yd}^3$  of empty space are in a 5-ft diameter & 18" deep hole with a 5x8" post in it?

# 30-60-90 Triangles & Isosceles Rt-Triangles

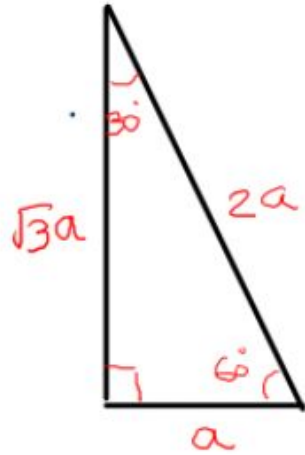
30°-60°-90° triangles



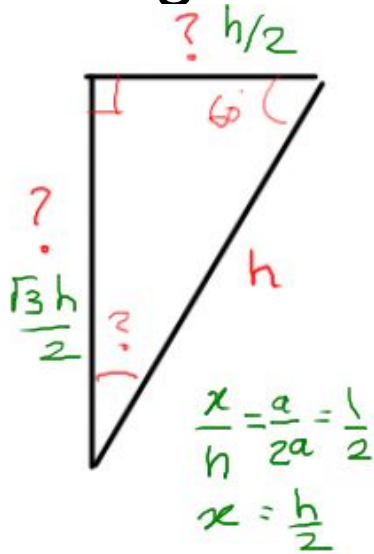
Isosceles Rt-triangles



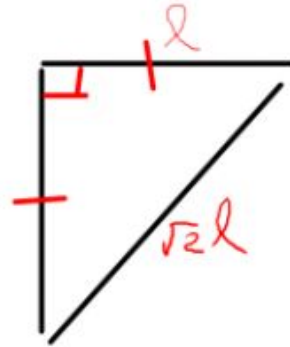
# 30-60-90 Triangles & Isosceles Rt-Triangles



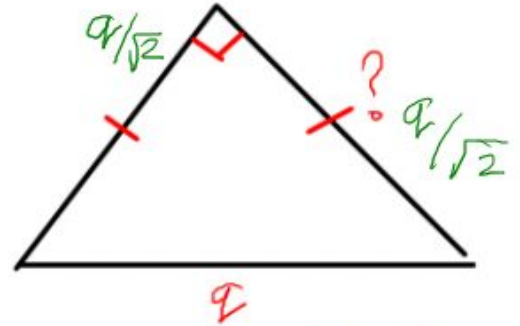
$$\begin{aligned} (\sqrt{3}a)^2 + a^2 &= c^2 \\ c &= \sqrt{3a^2 + a^2} \\ &= 2a \quad \checkmark \end{aligned}$$



$$\begin{aligned} \frac{x}{h} &= \frac{a}{2a} = \frac{1}{2} \\ x &= \frac{h}{2} \\ h^2 &= \left(\frac{h}{2}\right)^2 + \left(\frac{\sqrt{3}h}{2}\right)^2 \\ &= \frac{h^2}{4} + \frac{3h^2}{4} \\ &= h^2 \quad \checkmark \end{aligned}$$

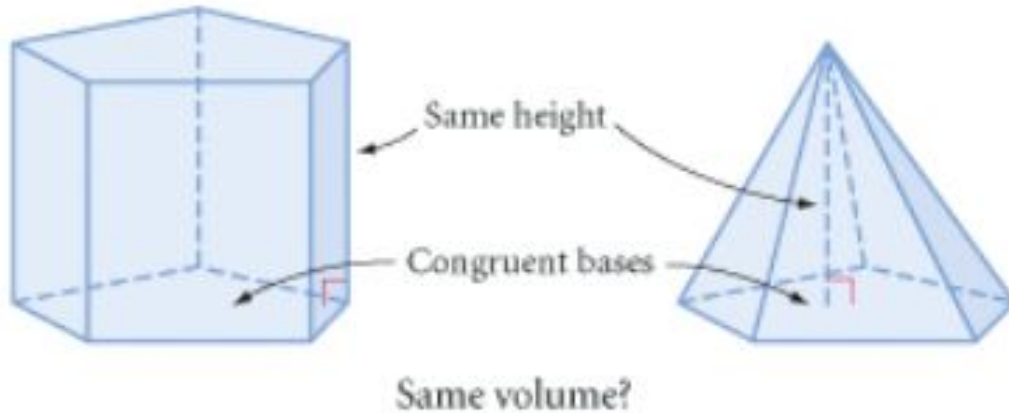


$$\begin{aligned} c^2 &= l^2 + l^2 \\ &= 2l^2 \\ c &= \sqrt{2}l \quad \checkmark \end{aligned}$$



$$\begin{aligned} \frac{q}{x} &= \sqrt{2} \\ x &= \frac{q}{\sqrt{2}} \\ q^2 &= \left(\frac{q}{\sqrt{2}}\right)^2 + \left(\frac{q}{\sqrt{2}}\right)^2 \\ &= \frac{q^2}{2} + \frac{q^2}{2} \\ &= q^2 \quad \checkmark \end{aligned}$$

# Volume of a Pyramid



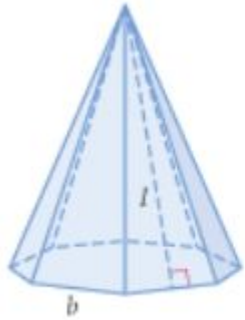
It's actually 1/3rd!    Pyramid/Cone Volume =  $(\frac{1}{3}) * BH$

## Pyramid-Cone Volume Conjecture

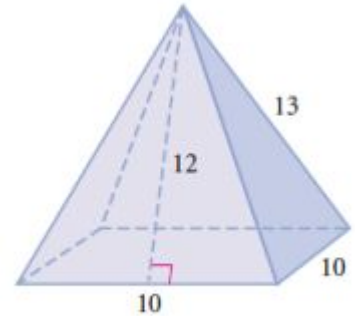
C-87

If  $B$  is the area of the base of a pyramid or a cone and  $H$  is the height of the solid, then the formula for the volume is  $V = \underline{\quad ? \quad}$ .

# Surface Area



These conservatories in Edmonton, Canada, are glass pyramids.



$$\text{Surface Area of Pyramid} = \frac{1}{2}bn(l + a)$$

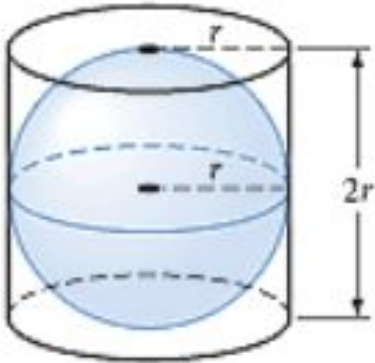
$$\begin{aligned} \text{Surface Area} \\ &= 340 \text{ sq-cm} \end{aligned}$$

# Volume of Sphere

By Investigation we discovered that 1 hemisphere of water fills  $\frac{1}{3}$  rd of the cylinder containing it

OR a sphere of water fills  $\frac{2}{3}$  rd of the cylinder containing it

Therefore: Volume of Sphere = ?? in terms of the Cylinder containing it ??



## Sphere Volume Conjecture

C-88

The volume of a sphere with radius  $r$  is given by the formula ?.

$$\frac{4}{3} \pi r^3$$

Thu, Mar 3rd



# What's happening today?

## Check-in

Did you watch video? Complete 11.1 Investigation?

Working on Test Correction?

## Today

[Form Random Teams!](#)

Triangle similarity Complete Inv 11.1 & 11.2

Do problems 11.1: 3, 7, 8, 13, 15

# Units and Proportions practice

1. My car can go 380 miles for a full tank of gasoline
    - a. How many gallons of gas do I need to go to Portland (174 miles)?
    - b. How long will it take at an avg speed of 55 mph?
  2. Chandru takes 9 minutes to run 1 mile
    - a. How long will he take to run a Half-Marathon?
    - b. What is his speed in km/hr?
  3. Tom needs 2" of compost to layer his 300 ft<sup>2</sup> garden.
    - a. How many yd<sup>3</sup> should he buy?
  4. A steel ball has a 1-ft diameter
    - a. Steel has a density of 0.28 lb/in<sup>3</sup>, How heavy is it? Can you lift it?
    - b. Al has a density of 2.7 g/cm<sup>3</sup>, How heavy is an Al ball of the same size?
    - c. What if the Aluminium (or Steel) ball has a 2 ft diameter?
    - d. Can you guess how many times the Volume (or weight) increased?
  5. All sides of a rectangle triple in size
    - a. What proportion does the area increase by?
- 12 inches to a foot
  - 3-feet per yard
  - 2.54 cm to an inch
  - 2.2 pounds in a kg
  - 100 cm in 1 m
  - 1.61 km in 1 mile
  - 1000 g in a kg
  - 1000 cc in a litre
  - Marathon is 26.2 miles
  - Portland is 174 miles from Seattle
  - Chandru's car tank = 15 gallons
  - Mass = Volume x Density in consistent units
  - Volume of a sphere =  $(4/3) \pi r^3$

# Cross-Multiplication Trick for calculating conversions

380 miles  $\Rightarrow$  1 Full tank

380 miles  $\Rightarrow$  15 Gallons  
174 miles  $\Rightarrow$  ?? Gallons

Divide!!

Multiply!

$174 \times 15 \div 380 \Rightarrow$  ?? Gallons = 6.87 Gallons

1 hour  $\Rightarrow$  55 miles

?? Hours  $\Rightarrow$  174 miles

Divide!!

Multiply!

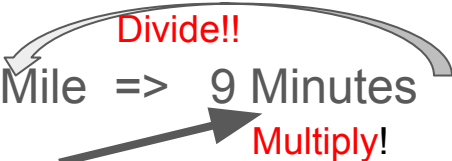
?? Hours  $\Rightarrow 174 \times 1 \div 55 = 3.16$  Hours or 3 hours 10 minutes

1. 12 inches to a foot
2. 3-feet per yard
3. 2.54 cm to an inch
4. 2.2 pounds in a kg
5. 100 cm in 1 m
6. 1.61 km in 1 mile
7. 1000 g in a kg
8. 1000 cc in a litre
9. Marathon is 26.2 miles
10. Portland is 174 miles from Seattle
11. Chandru's car tank = 15 gallons
12. Mass = Volume x Density in consistent units
13. Volume of a sphere =  $\frac{4}{3} \pi r^3$

# Cross-multiply - Pb #2

Chandru takes 9 minutes for running 1 Mile How long for  $\frac{1}{2}$  marathon?

1 Mile  $\Rightarrow$  9 Minutes



$$\frac{1}{2} * 26.2 \text{ Miles} \Rightarrow \frac{1}{2} * 26.2 * 9 \div 1 = 118 \text{ minutes}$$

118  $\Rightarrow$  Minutes = 1 hr 58 minutes

- 12 inches to a foot
- 3-feet per yard
- 2.54 cm to an inch
- 2.2 pounds in a kg
- 100 cm in 1 m
- 1.61 km in 1 mile
- 1000 g in a kg
- 1000 cc in a litre
- Marathon is 26.2 miles
- Portland is 174 miles from Seattle
- Chandru's car tank = 15 gallons
- Mass = Volume x Density
- Volume of a sphere =  $\frac{4}{3} \pi r^3$

# Trick for calculating conversions - Pb #2 continued

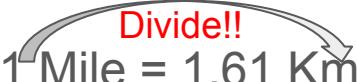
What is Chandru's speed in Km/Hr?

$$\frac{1}{2} * 26.2 \text{ Miles} \Rightarrow 118 \text{ min}$$

$$?? \text{ Miles} \Rightarrow 60 \text{ minutes}$$

$$?? \text{ Miles} \Rightarrow 60 * 13.1 \div 118 = 6.66 \text{ miles in 60 minutes}$$

or 6.6 Miles/Hr


$$1 \text{ Mile} = 1.61 \text{ Km}$$


$$6.6 \text{ M} = 10.56 \text{ Km}$$

or 10.56 Km/hr

- 12 inches to a foot
- 3-feet per yard
- 2.54 cm to an inch
- 2.2 pounds in a kg
- 100 cm in 1 m
- 1.61 km in 1 mile
- 1000 g in a kg
- 1000 cc in a litre
- Marathon is 26.2 miles
- Portland is 174 miles from Seattle
- Chandru's car tank = 15 gallons
- Mass = Volume x Density
- Volume of a sphere =  $\frac{4}{3} \pi r^3$

# Trick for calculating conversions - Pb #3

Tom needs 2" of compost to layer his 300 ft<sup>2</sup> garden. How many yd<sup>3</sup> should he buy?

Volume of Compost = Area of Base X Height

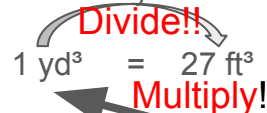
$$12 \text{ in} = 1 \text{ ft}$$

$$2 \text{ in} = 2 * 1 \div 12 \text{ ft} = \frac{1}{6} \text{ ft}$$

$$\text{Volume of compost} = 300 \text{ ft}^2 * \frac{1}{6} \text{ ft} = 50 \text{ ft}^3$$

$$1 \text{ yd} = 3 \text{ ft}$$

$$1 * 1 * 1 \text{ yd}^3 = 3 * 3 * 3 \text{ ft}^3$$


$$1 \text{ yd}^3 = 27 \text{ ft}^3$$

$$??? \text{ yd}^3 = 50 \text{ ft}^3$$

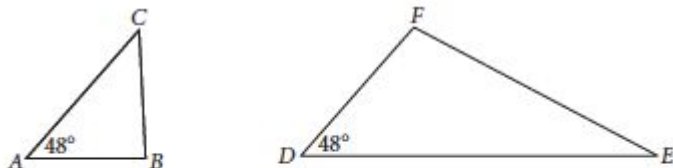
$$??? \text{ yd}^3 = 50 * 1 \div 27 = 1.85 \text{ yd}^3$$

- 12 inches to a foot
- 3-feet per yard
- 2.54 cm to an inch
- 2.2 pounds in a kg
- 100 cm in 1 m
- 1.61 km in 1 mile
- 1000 g in a kg
- 1000 cc in a litre
- Marathon is 26.2 miles
- Portland is 174 miles from Seattle
- Chandru's car tank = 15 gallons
- Mass = Volume x Density
- Volume of a sphere =  $\frac{4}{3} \pi r^3$

# Similar Triangles

Similar Quadrilaterals requires corresponding angles to be congruent and corresponding sides to be proportional

Triangles are special - We will look at Similarity Shortcuts (remember Congruency Shortcuts?)



$\angle A \cong \angle D$ , but  $\triangle ABC$  is not similar to  $\triangle DEF$  or to  $\triangle DFE$ .

How about two sets of congruent angles?

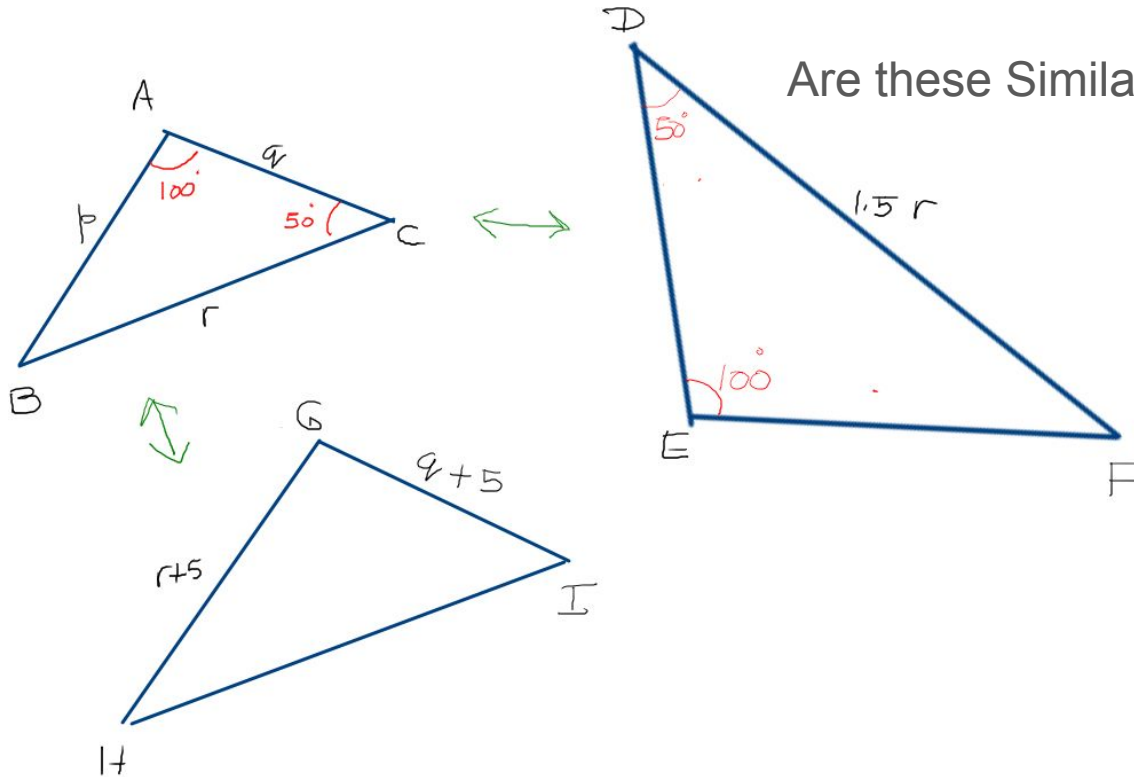
## AA Similarity Conjecture

C-91

If <sup>two</sup>  $\underline{\hspace{1cm}}$  angles of one triangle are congruent to <sup>two</sup>  $\underline{\hspace{1cm}}$  angles of another triangle, then  $\underline{\hspace{1cm}}$ . **the triangles are similar**

$\frac{AB}{DE} \approx \frac{AC}{DF} \approx \frac{BC}{EF}$ ? **The ratios should be equal.**

# Similar Triangles



Are these Similar Triangles ??



# Congruence Shortcuts and Similarity Shortcuts

The Triangle Congruence you studied are: ?

SSS, SAS, ASA, SAA

Can you think how you might write Similarity Shortcuts?

[AA Triangle Similarity Geogebra](#)

[SSS Triangle Similarity Geogebra](#)

[SAS Triangle Similarity Geogebra](#)

# Similar Triangles

Is SSS a similarity Shortcut (Corresponding Sides are Proportional)

Is SAS a similarity Shortcut (Sides Proportional with Included Angle congruent)

What about ASA and SAA ?? (Congruent Angles, Proportional Side)

Lastly SSA - not a Congruency shortcut - is NOT a Similarity shortcut

With this you should be able to do [Similarity Investigation 11-2](#)

Split into teams: [Form Random Teams!](#)

Mon, Mar 6th & 8th

# What's happening today & next class?

## Check-in/Reminders

Unit 4 Test Correction is due today. AK will be posted early tomorrow and corrections can no longer be accepted.

## Today in class (doing lots of problems in class)

Review Triangle similarity Conjectures

Do Similar Polygons Homework problems 11.1: 3, 7, 8, 13, 15

Do Similar Triangles Homework problems 11.2: 2, 3, 5, 6, 8

Chapter 11.3: Indirect Measurements with Similar Triangles Project

## Announcement

Unit 5 Quiz 1 on 11.1 11.2 11.3 11.4 on Tuesday March 15th

# What does Similar mean?

## Similar Polygons

- Corresponding Angles are Congruent and the Corresponding Sides being Proportional in length
- This definition works for Polygons not so much for Circles and Spheres!
- For Triangles Corresponding Sides can be found by using the “Opposite Side” of the angle idea

# What is Dilation?

Dilation is to Enlarge or Reduce figures by the same Proportion (a.k.a Scale Factor) without distorting the shape

Think enlarging/reducing photographs without making one look fatter or thinner!

For a Rectangle: Scale Factor is the ratio Width / Height

Original 1"x.84"

Proportional 2"x1.68"

Not Proportional

2"x2.84"



## Dilation Similarity Conjecture

If one polygon is a dilated image of another polygon, then ?.

the polygons are similar

C-90

# Similar Triangles Conjectures

## AA Similarity Conjecture

C-91

If 2 angles of one triangle are congruent to 2 angles of another triangle, then Similar

## SSS Similarity Conjecture

C-92

If the three sides of one triangle are proportional to the three sides of another triangle, then the two triangles are Similar

## SAS Similarity Conjecture

C-93

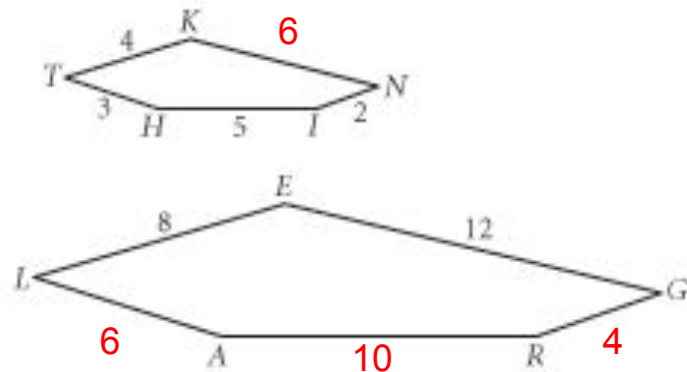
If two sides of one triangle are proportional to two sides of another triangle and ?, then the ? Triangles are similar  
included angle is congruent

# Do some problems

Chapter 11.1: 3, 7, 8, 13, 15 (Pg 587)

## 7. THINK $\sim$ LARGE

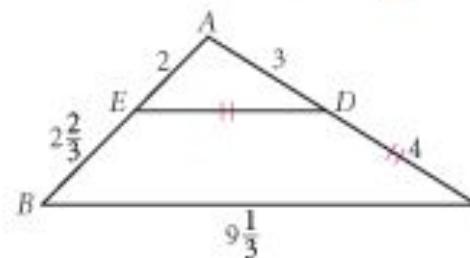
Find  $AL$ ,  $RA$ ,  $RG$ , and  $KN$ .



## 13. $\overline{DE} \parallel \overline{BC}$

Are the corresponding angles congruent in  $\triangle AED$  and  $\triangle ABC$ ? Are the corresponding sides proportional?

Is  $\triangle AED \sim \triangle ABC$ ?  $\textcircled{h}$



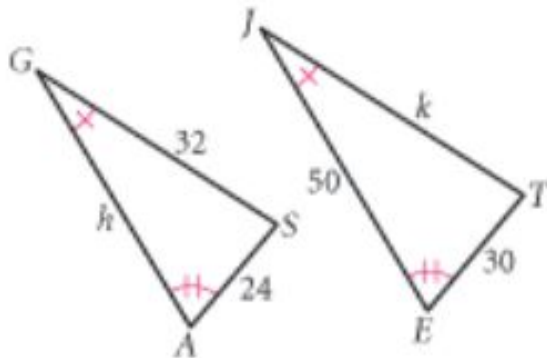
If so, show that triangles are similar and all sides are proportional



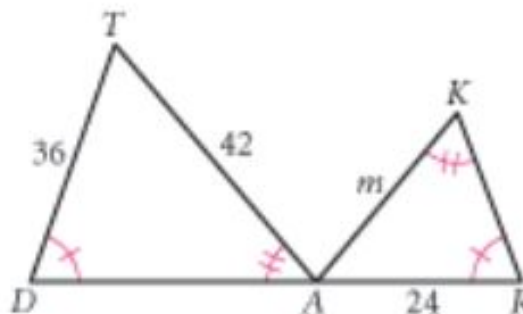
# Do some problems

Chapter 11.2: 2, 3, 5, 6, 8 (Pg 591)

2.  $h = \underline{\quad}, k = \underline{\quad}$   $h = k = 40 \text{ cm}$



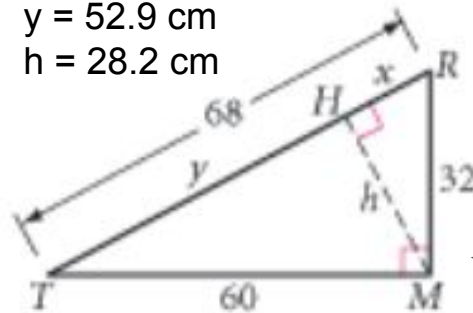
3.  $m = \underline{\quad}$   $28 \text{ cm}$



8. Why is  $\triangle TMR \approx \triangle THM$   
 $\approx \triangle MHR$ ?

Find  $x$ ,  $y$ , and  $h$ .  $h$

$x = 15.1 \text{ cm}$   
 $y = 52.9 \text{ cm}$   
 $h = 28.2 \text{ cm}$




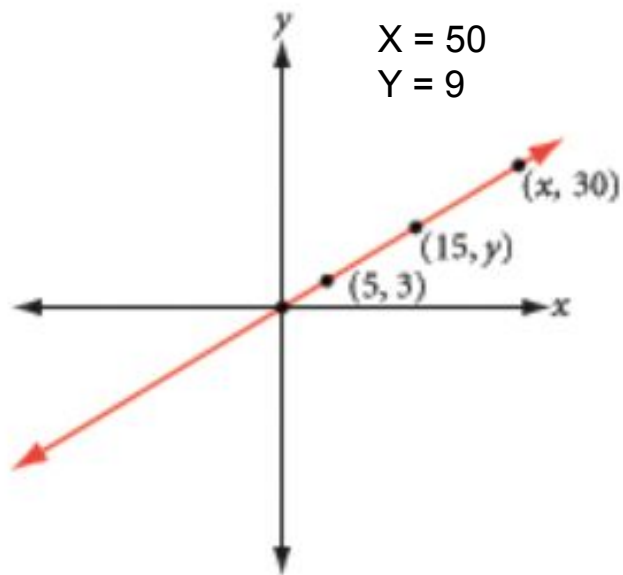
Find the similar triangles first before proceeding. There are 3 of them!

## Problem #8 solution

# Do some more problems

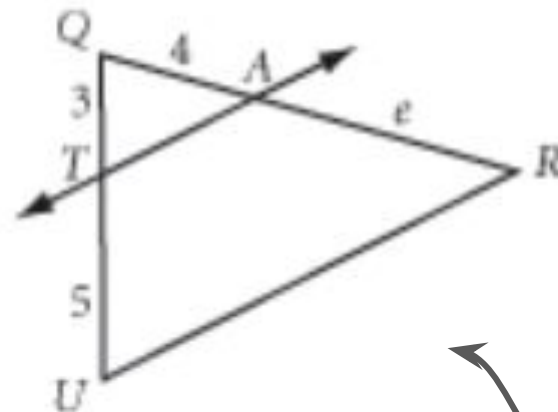
Chapter 11.2: 9, 15 (Pg 592)

15. Find  $x$  and  $y$ . 



$X = 50$   
 $Y = 9$

9.  $\overline{TA} \parallel \overline{UR}$   
 $e = \underline{\quad ? \quad}$  6.666 cm



Find the similar triangles first before proceeding.

# Chapter 11.3: Indirect Measurements

Pg# 598

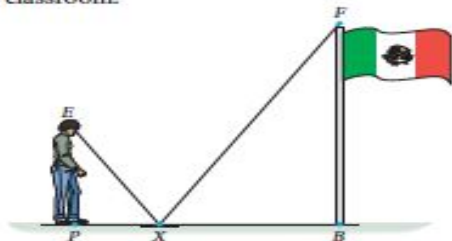


## Investigation Mirror, Mirror

### You will need

- metersticks
- masking tape or a soluble pen
- a mirror

Choose a tall object with a height that would be difficult to measure directly, such as a football goalpost, a basketball hoop, a flagpole, or the height of your classroom.



**Step 4** Because the flagpole and the person are perpendicular to the ground,  $\triangle EPX \sim \triangle FBX$  by AA.

Step 1

Step 2

**Step 5** The proportion should be equivalent to  $\frac{PE}{XP} = \frac{FB}{BX}$ .

Step 3

**Step 6** Two possible causes for errors are

(1) not measuring on flat ground

Step 4

(which would mean the triangles formed

Step 5

are not truly similar right triangles) and (2)

Step 6

measuring an object when it is difficult to see the top.

Mark crosshairs on your mirror. Use tape or a soluble pen. Call the intersection point  $X$ . Place the mirror on the ground several meters from your object.

An observer should move to a point  $P$  in line with the object and the mirror in order to see the reflection of an identifiable point  $F$  at the top of the object at point  $X$  on the mirror. Make a sketch of your setup, like this one.

Measure the distance  $PX$  and the distance from  $X$  to a point  $B$  at the base of the object directly below  $F$ . Measure the distance from  $P$  to the observer's eye level,  $E$ .

Think of  $\overline{FX}$  as a light ray that bounces back to the observer's eye along  $\overline{XE}$ . Why is  $\angle B \cong \angle P$ ? Name two similar triangles. Tell why they are similar.

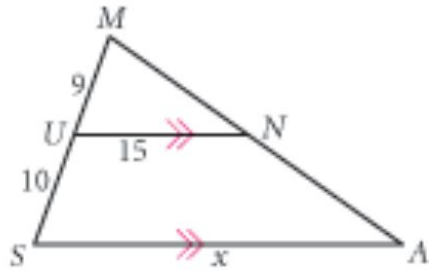
Set up a proportion using corresponding sides of similar triangles. Use it to calculate  $FB$ , the approximate height of the tall object.

Write a summary of what you and your group did in this investigation. Discuss possible causes for error.

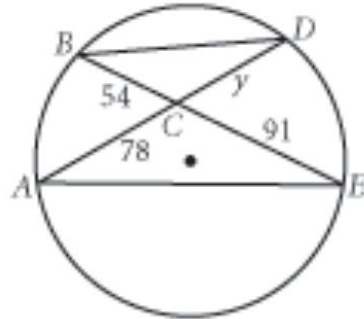
PROJECT: Mirror Mirror Investigation Assigned


# 11.3 - Do some more problems!

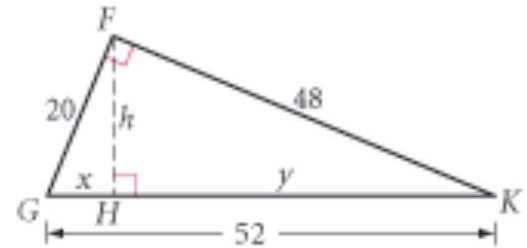
11. Find  $x$ . 




12. Find  $y$ .

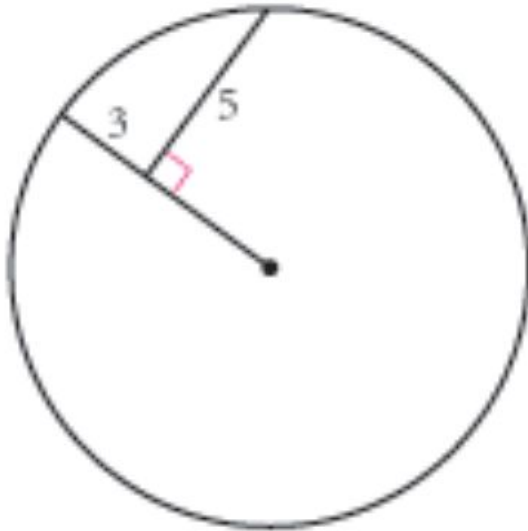



13. Find  $x$ ,  $y$ , and  $h$ . 



## 11.3 - Do some problems

**15.** Find the radius of the circle.



Hint: Nothing to do with similar triangles!



# Reminders

Work on Test Correction

Complete [11.1 Homework](#) by Wednesday

Complete [11.2 Homework](#) by Friday

Complete [11.3 Homework](#) by Tuesday, March 15th

Complete [Mirror Mirror Project](#) by Tuesday, March 15th

U5Q1: Quiz on 11.1, 11.2 & 11.3 on March 15th