

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 you name clearly pronouncing first and last names

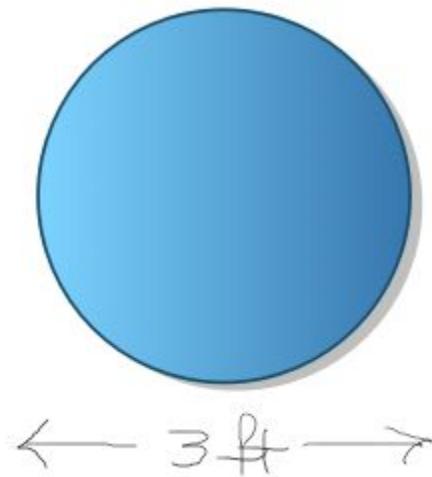
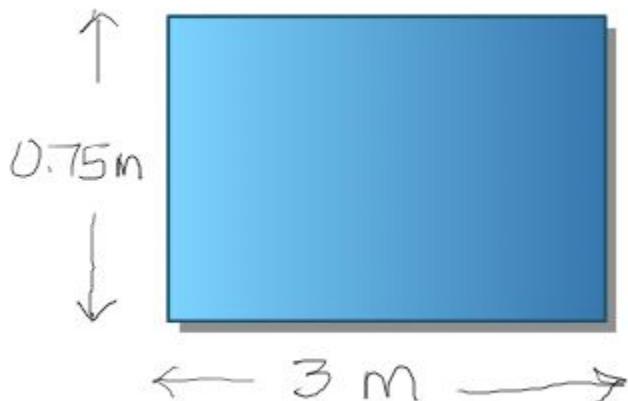
How would you like to be addressed?

Your personal pronouns

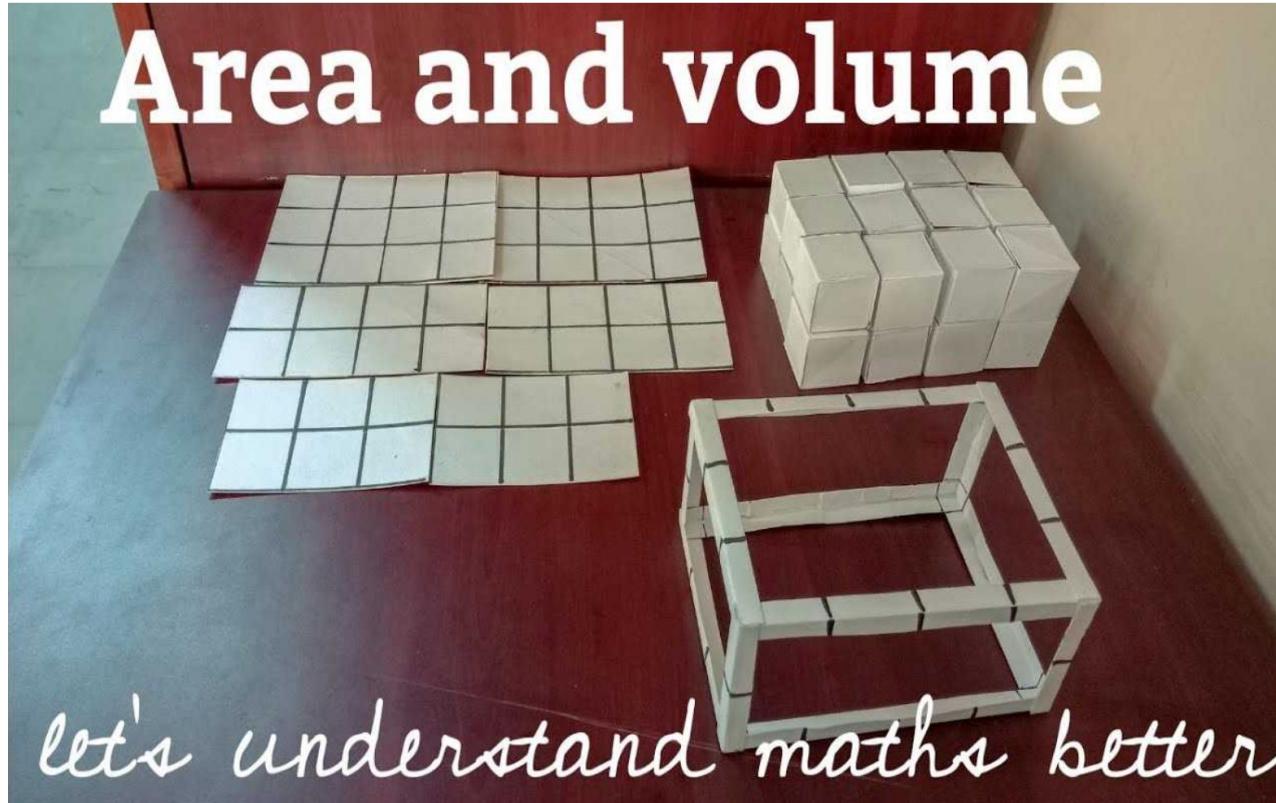
Something interesting or special/peculiar about you?

What are your expectations from this class?

What is the Perimeter of these Shapes ? Units ?



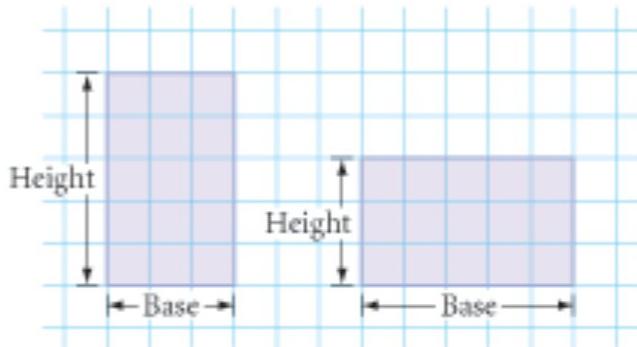
Area & Volume - What are these? Units?



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

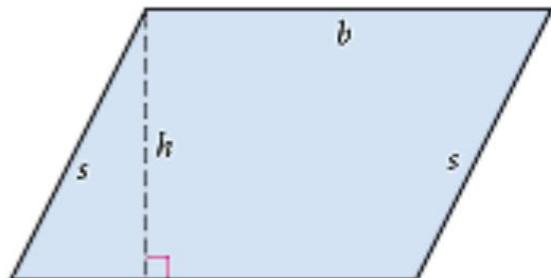
Area of Rectangle & Parallelogram Conjectures



C-74

Rectangle Area Conjecture

The area of a rectangle is given by the formula $\underline{\hspace{2cm}}$, where A is the area, b is the length of the base, and h is the height of the rectangle.

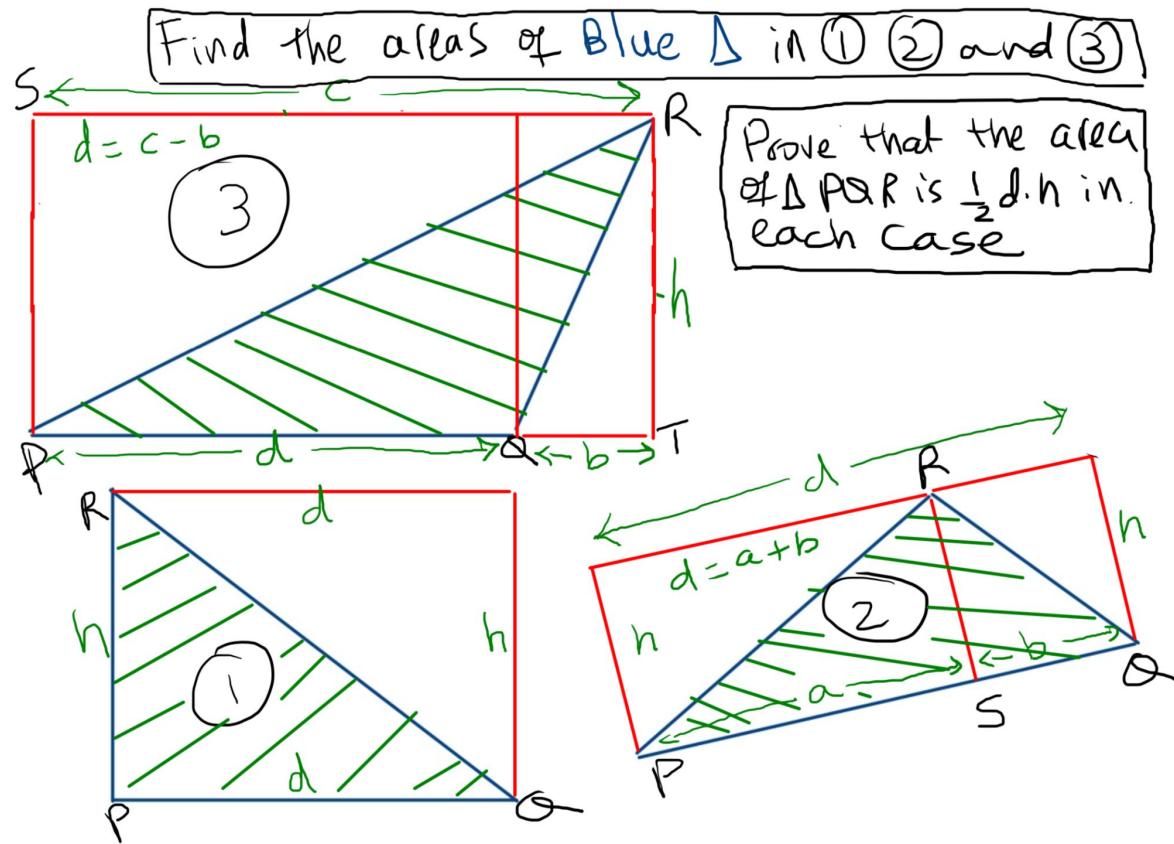


C-75

Parallelogram Area Conjecture

The area of a parallelogram is given by the formula $\underline{\hspace{2cm}}$, 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

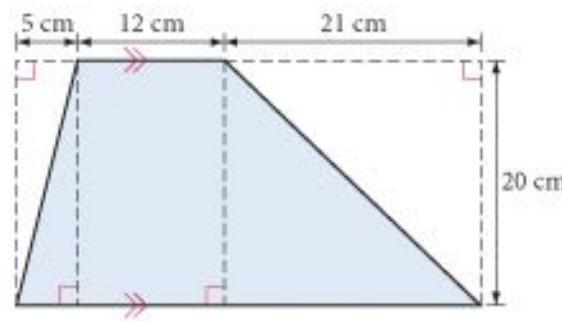


Let's do a few problems

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



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

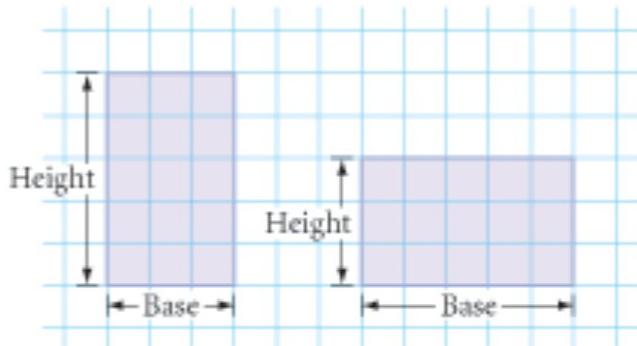
Review some Rect, Parallelogram Area Problems

A Plethora of Area Formulas to be Discovered!

Reminder

Investigation & 8.1 Homework Due today

Area of Rectangle & Parallelogram Conjectures

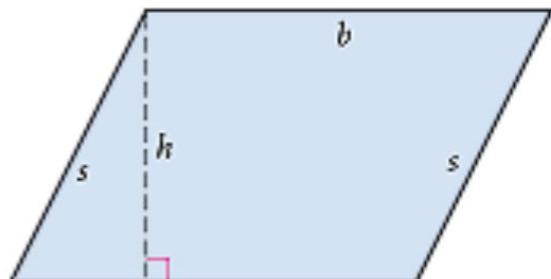


Rectangle Area Conjecture

C-74

The area of a rectangle is given by the formula $\underline{\hspace{2cm}}$, where A is the area, b is the length of the base, and h is the height of the rectangle.

$$A = \text{BASE} * \text{HEIGHT}$$



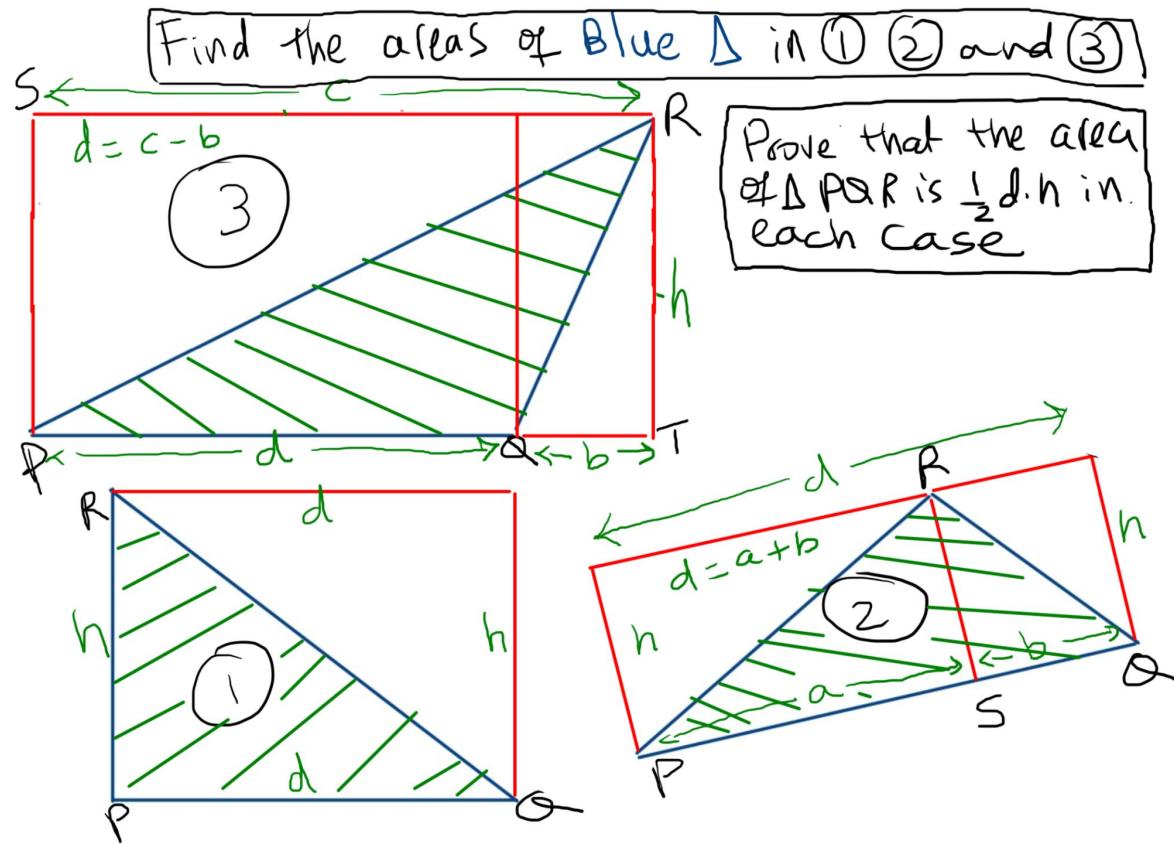
Parallelogram Area Conjecture

C-75

The area of a parallelogram is given by the formula $\underline{\hspace{2cm}}$, where A is the area, b is the length of the base, and h is the height of the parallelogram.

$$A = bh$$

Derive Area of any Triangle based on Rect area Conjectures



Area of Triangles Conjecture

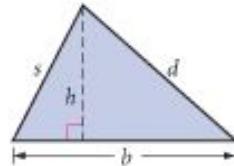


Investigation 1

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 $\frac{1}{2} b h$, where A is the area, b is the length of the base, and h is the height of the triangle.

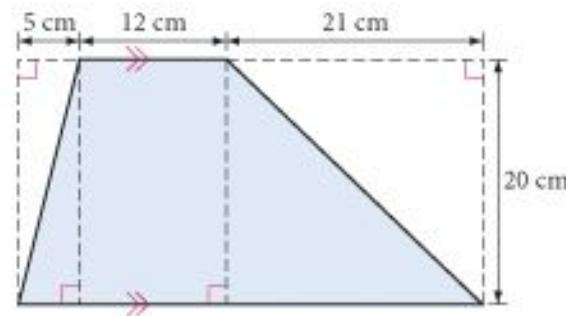
$$\frac{1}{2} b h$$

Review Problems problems

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



23. Find the area of the trapezoid at right.



Let's derive the Area Formula for a Trapezoid

Area of Trapezoids Conjecture

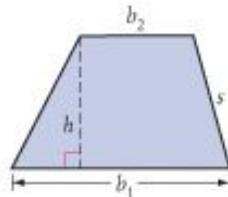


Investigation 2

Area Formula for Trapezoids

You will need

- heavy paper or cardboard



Step 1

Construct any trapezoid as shown. Label the trapezoid as shown. Label the height h as shown. Label the bases b_1 and b_2 as shown. Label the slanted sides s as shown. Label the height h as shown.

Step 2

Cut out the trapezoid and label a copy.

Step 3

Arrange the two trapezoids 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? Make a conjecture.

Trapezoid Area Conjecture

C-77

The area of a trapezoid is given by the formula $\frac{1}{2} (b_1 + b_2) h$, 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.

$$\frac{1}{2} (b_1 + b_2) h$$

Area of Kites Conjecture



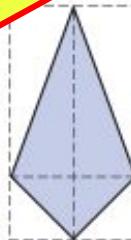
Investigation 3

Area Formula for Kites

Can you rearrange a kite into shapes that already have the area formula? Use the properties of a kite?

Create and carry out a plan of action 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

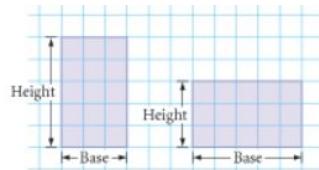
The area of a kite is given by the formula ?.

Complete & Add Conjectures to Toolbox

Rectangle Area Conjecture

C-74

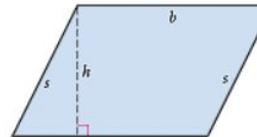
The area of a rectangle is given by the formula $\underline{\hspace{2cm}}$, where A is the area, b is the length of the base, and h is the height of the rectangle.



Parallelogram Area Conjecture

C-75

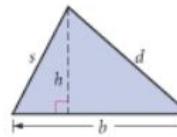
The area of a parallelogram is given by the formula $\underline{\hspace{2cm}}$, where A is the area, b is the length of the base, and h is the height of the parallelogram.



Triangle Area Conjecture

C-76

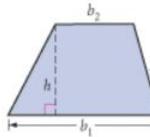
The area of a triangle is given by the formula $\underline{\hspace{2cm}}$, where A is the area, b is the length of the base, and h is the height of the triangle.



Trapezoid Area Conjecture

C-77

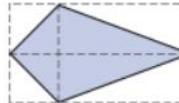
The area of a trapezoid is given by the formula $\underline{\hspace{2cm}}$, where A is the area, b_1 and b_2 are the lengths of the two bases, and h is the height of the trapezoid.



Kite Area Conjecture

C-78

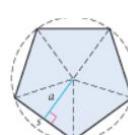
The area of a kite is given by the formula $\underline{\hspace{2cm}}$.



Regular Polygon Area Conjecture

C-79

The area of a regular polygon is given by the formula $\underline{\hspace{2cm}}$ or $\underline{\hspace{2cm}}$, 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

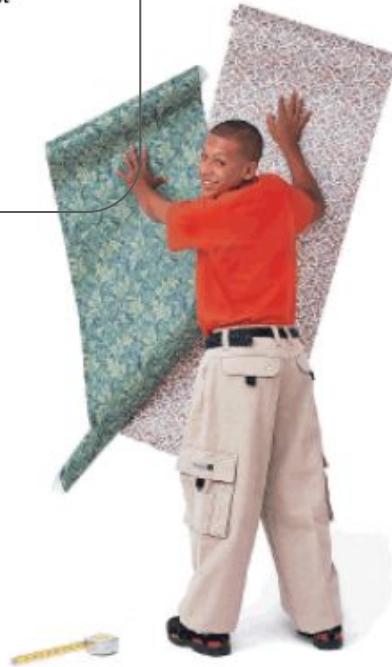
Real-world Area Problems!

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?

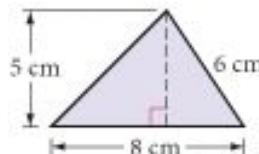


Area Problems!

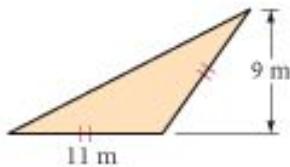
EXERCISES

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

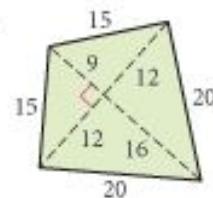
1. $A = ?$



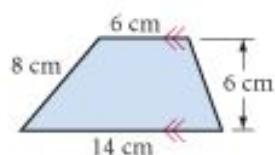
2. $A = ?$



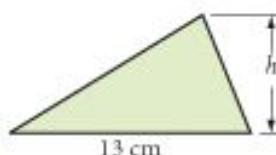
3. $A = ?$



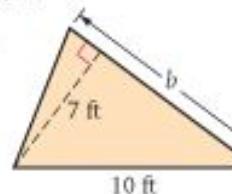
4. $A = ?$



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



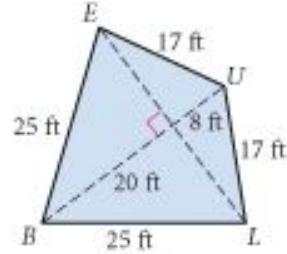
6. $A = 31.5 \text{ ft}^2$
 $b = ?$



s'more Area Problems!

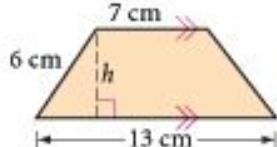
7. $A = 420 \text{ ft}^2$

$LE = ?$



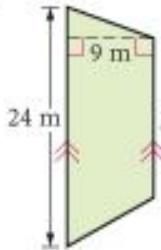
8. $A = 50 \text{ cm}^2$ (h)

$h = ?$



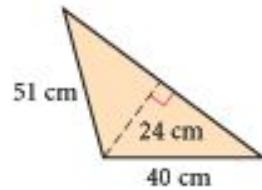
9. $A = 180 \text{ m}^2$

$b = ?$



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

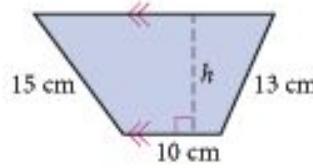
$P = ?$



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

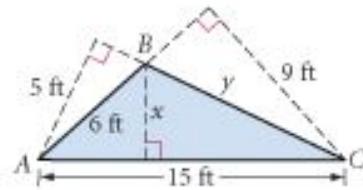
$P = 62 \text{ cm}$

$h = ?$

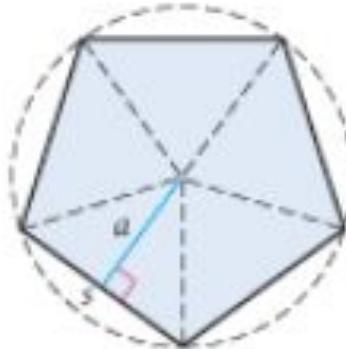
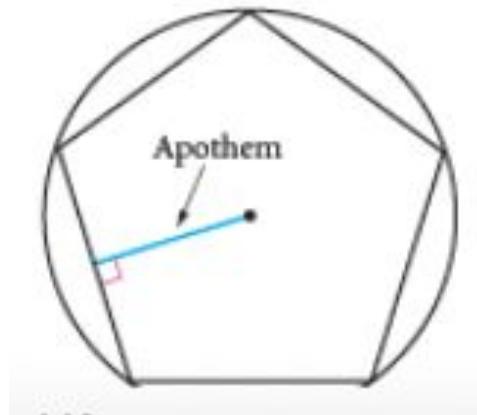
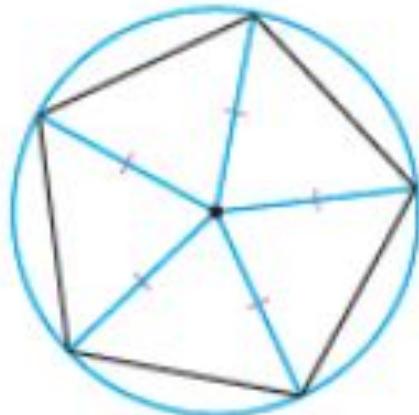


12. $x = ?$ (h)

$y = ?$



Chapter 8.4: Areas of Regular Polygons



Regular pentagon

Regular Polygon Area Conjecture

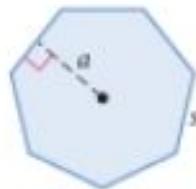
C-79

The area of a regular polygon is given by the formula $\frac{1}{2} s n a$ or $\frac{1}{2} a P$, 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.

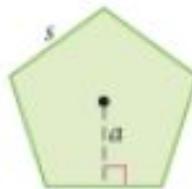
$$\frac{1}{2} s n a \quad \frac{1}{2} a P$$

Regular Polygon Area Problems!

1. $A \approx \frac{?}{s}$
 $s = 24 \text{ cm}$
 $a \approx 24.9 \text{ cm}$



2. $a \approx \frac{?}{s}$
 $s = 107.5 \text{ cm}$
 $A \approx 19,887.5 \text{ cm}^2$



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

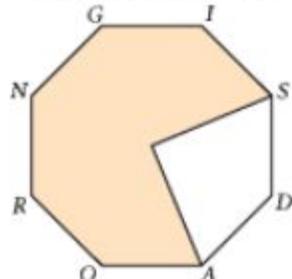
Areas Quiz 8.1-8.4 Wednesday - Jan 19th

Complete All Homework on-time to prepare for Quiz
AK will be posted regularly for review and prep

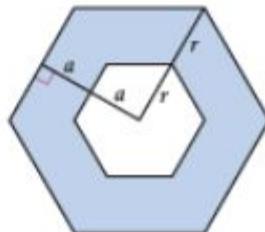
Regular Polygon Area Problems!

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 



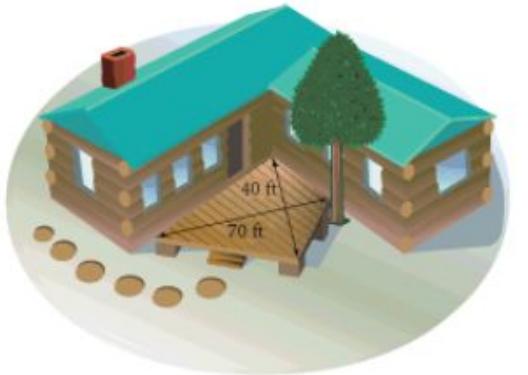
Real-world Area Problems!

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?

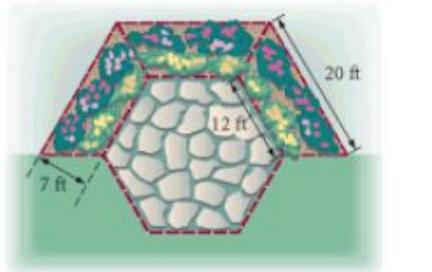


s'more Real-world Area Problems!

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

$$\textcircled{1} \quad 3y = 12x - 21$$

$$\boxed{12x + 2y = 1}$$

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

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

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

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

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

$$-4x + 3y = 3$$

$$\times 3 \quad \boxed{7x - 9y = 6} \textcircled{1}$$

$$-12x + 9y = 9 \textcircled{2}$$

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

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

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

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

System of 2 equations
with 2 unknowns

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

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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

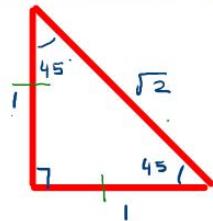
Areas Quiz 8.1-8.4

Reminders

Project on Radical Expressions & Linear Equations due 1/25

Special Triangles Chapter 9.2

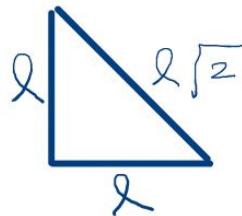
Isosceles Right-Triangle



$$\rightarrow \sqrt{3^2 + 3^2} = \sqrt{3^2(1+1)} = 3\sqrt{2}$$

Q.E.D.

A right-angled triangle with two legs of length 3. The angle between the legs is 90 degrees, and the angle at the vertex opposite the hypotenuse is 45 degrees. The hypotenuse is labeled $3\sqrt{2}$.

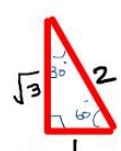


Isosceles Right Triangle Conjecture

C-83

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

$30^\circ - 60^\circ - 90^\circ$ 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

C-84

In a $30^\circ-60^\circ-90^\circ$ 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

$$\sqrt{4 \cdot 2} = \sqrt{2 \cdot 2 \cdot 2} = \sqrt{2 \cdot 2} = 2\sqrt{2}$$

Reduce Number inside
a radical to its
Prime factors

OR

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

(2) $\sqrt{25 \cdot 2} = \sqrt{5^2 \cdot 2} = 5\sqrt{2}$ 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 $\sqrt{784}$?

$$= \sqrt{2 \cdot 392} = \sqrt{2 \cdot 2 \cdot 196} = 2\sqrt{196}$$

What is $\sqrt{720}$?

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

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

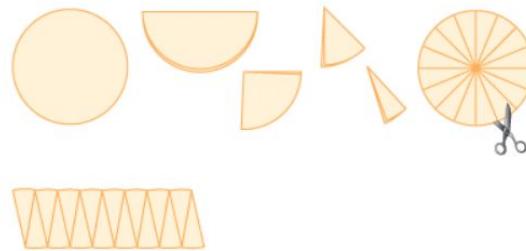
Use your compass to make a large circle. Cut out the circular region.

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.

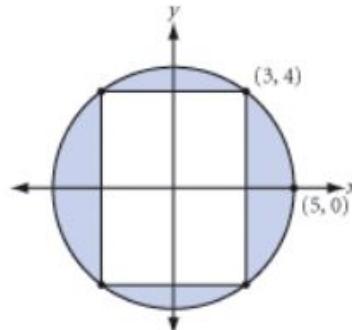
Circle Area Conjecture

$$\cdot \pi r^2$$

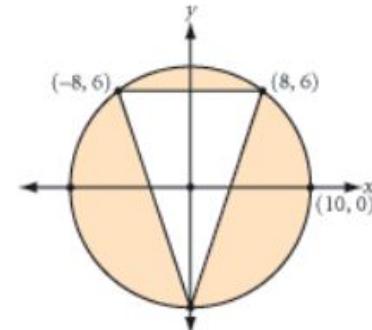
C-80

The area of a circle is given by the formula $\underline{\hspace{2cm}}$, where A is the area and r is the radius of the circle.

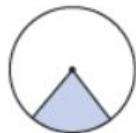
9. What is the area of the shaded region between the circle and the rectangle?



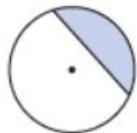
10. What is the area of the shaded region between the circle and the triangle?



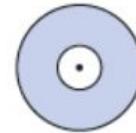
Sectors - Segments - Annuli



Sector of a circle



Segment of a circle



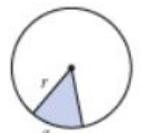
Annulus

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

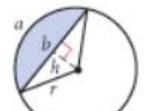
A **segment of a circle** is the region between a chord and an arc of the circle.

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

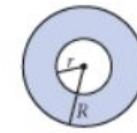
“Picture equations” are helpful when you try to visualize the areas of these regions. The picture equations below show you how to find the area of a sector of a circle, the area of a segment of a circle, and the area of an annulus.



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



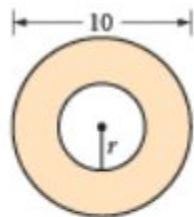
$$\frac{a}{360} \pi r^2 - \frac{1}{2}bh = A_{\text{segment}}$$



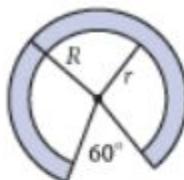
$$\pi R^2 - \pi r^2 = A_{\text{annulus}}$$

Do some Problems

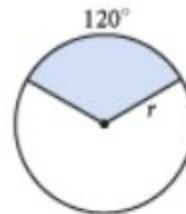
7. $r = 2 \text{ cm}$



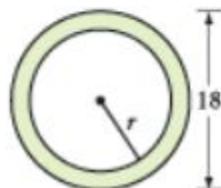
8. $R = 12 \text{ cm}$
 $r = 9 \text{ cm}$



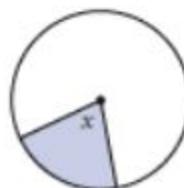
9. The shaded area is $12\pi \text{ cm}^2$.
Find r .



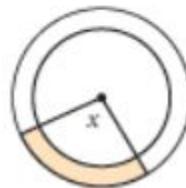
10. The shaded area is $32\pi \text{ cm}^2$. Find r .



11. The shaded area is $120\pi \text{ cm}^2$, and the radius is 24 cm. Find x .



12. 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)



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

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

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

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

$$\frac{2}{3} + \frac{2}{3} = 2 \cdot 3 = 18$$

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

$$\frac{2}{3} + \frac{3}{3} = 9 + 27 = 36$$

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

$$\frac{3}{2} \cdot \frac{4}{2} = (2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2 \cdot 2)$$

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

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

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

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

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

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

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

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

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

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

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

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

Simplifying Expressions

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

Calculate x

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

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

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

Calculate x

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

(Taking \sqrt 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 multiplying by $\frac{1}{2}$)

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

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

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

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

$$729, 9, 245$$

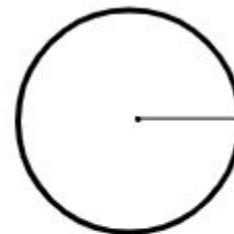
$$y = 2x - \frac{3}{2} \quad \begin{matrix} \text{slope: 2} \\ y-\text{int: } -\frac{3}{2} \end{matrix}$$

How do Units work?

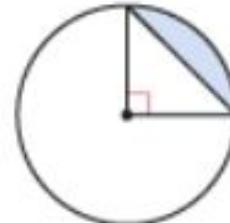
How do units work in these formulas?



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.



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



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

Calculate the area of the shaded segment

Soln to Units problems

How do Units work?

How do units work in these formulas?

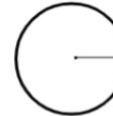


The above fig is a Trapezoid of Area 500 sq-ft & height 8 meters. Calculate the length of the small base in meters if the large base is 10 meters in length.

$$A_{\text{TRA}} = \frac{72 \text{ ft}^2}{r} = \pi r^2$$

$$r = \sqrt{\frac{72 \text{ ft}^2}{\pi}} = 4.79 \text{ ft}$$

$$= 4.79 \text{ ft} \times \frac{1 \text{ m}}{3.28 \text{ ft}}$$



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

$$= 1.46 \text{ m}$$

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

$$\text{Area} = \frac{\alpha \times \pi r^2 - \frac{1}{2} b h}{360}$$

$$= \frac{70}{360} \times \pi \times 2^2 - \frac{1}{2} \times 2 \times 2$$

Calculate the area of the shaded segment

$$= \frac{1}{6} \pi \cdot 4 - 2$$

$$A = \frac{1}{6} \pi - 2 \text{ cm}$$

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

there are 3.28 ft in a meter

$$500 \times \cancel{\text{ft}^2} \times \frac{\text{m}^2}{3.28^2 \cancel{\text{ft}^2}} = \frac{1}{2} (10 + b_2) \times 8^{\cancel{4 \text{ m}^2}}$$

$$4b_2 = 40 + 4b_2$$

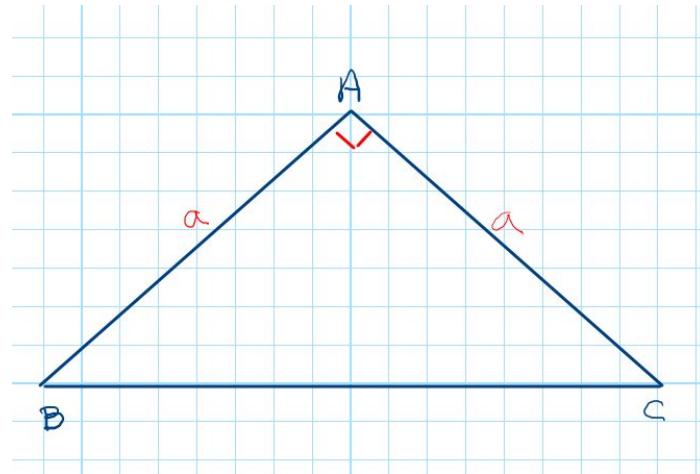
$$b_2 = 6.4 \text{ m} = 1.61 \text{ m}$$

Validate: $\text{Area} = \frac{1}{2} (10 + 1.61) \times 8 = 46.4 \text{ m}^2$

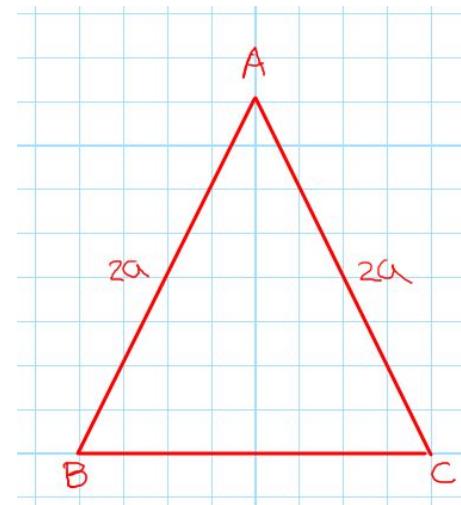
$\text{or } 46.4 \text{ m}^2 \times 3.28^2 \text{ ft}^2 / \cancel{\text{m}^2} = 499.6 \text{ ft}^2 \checkmark$

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

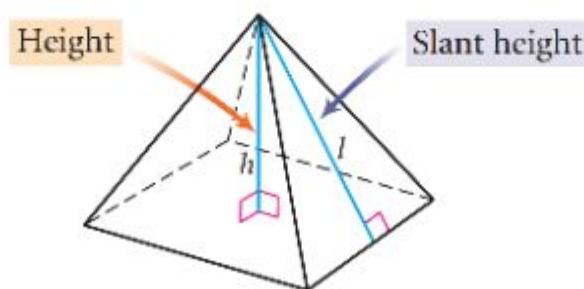
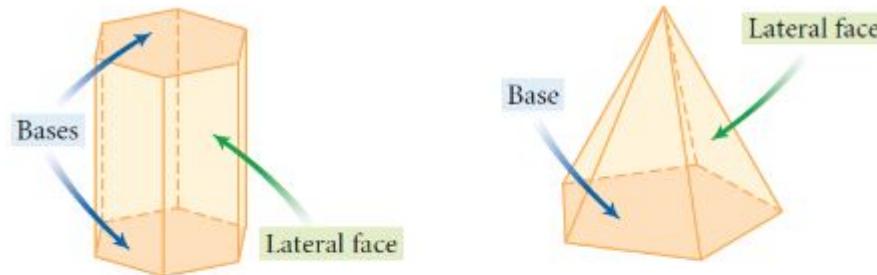


Pyramid

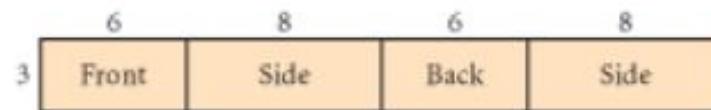
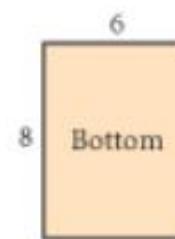
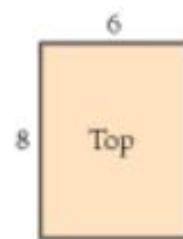
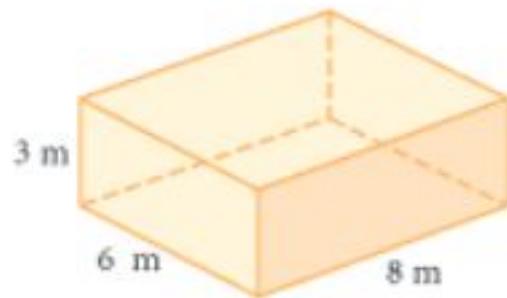


Hemisphere

Some 3-D Shapes and Vocabulary

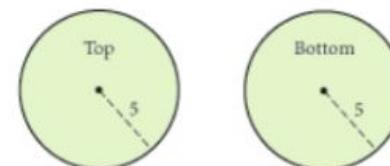
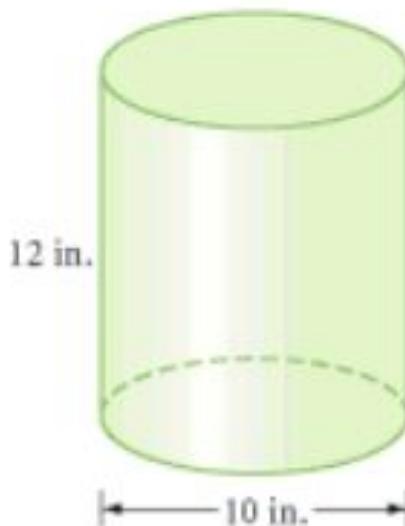


Surface Area of 3-D Shapes - Prism



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

Surface Area of 3-D Shapes - Cylinder



Bases

$$b = C = 2\pi r$$

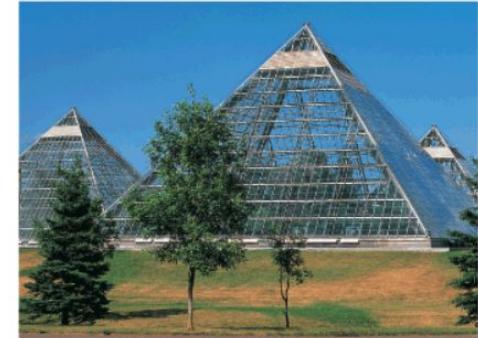


$$\text{Surface Area of Cylinder} = 2\pi r(r + h)$$

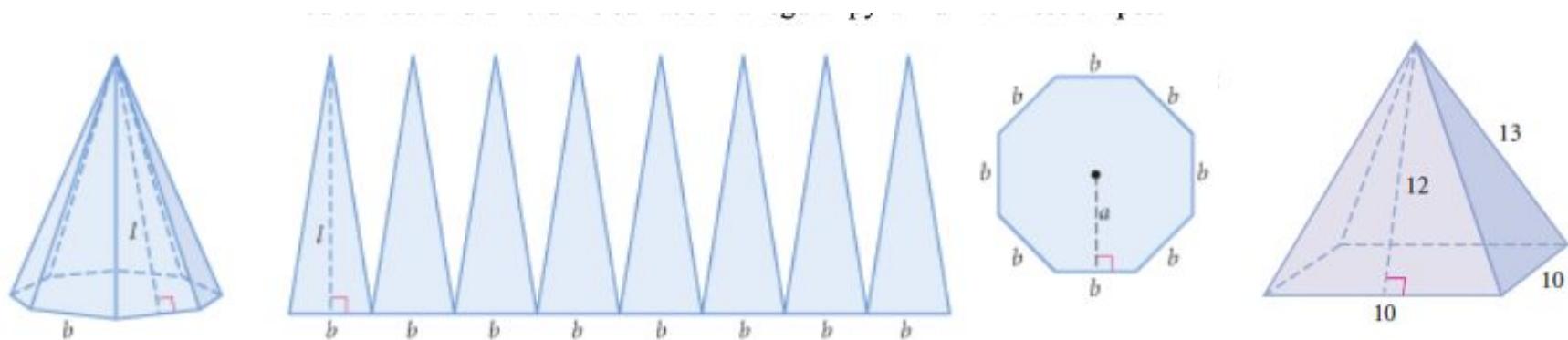


This ice cream plant in Burlington, Vermont, uses cylindrical containers for its milk and cream.

Surface Area of 3-D Shapes - Pyramid



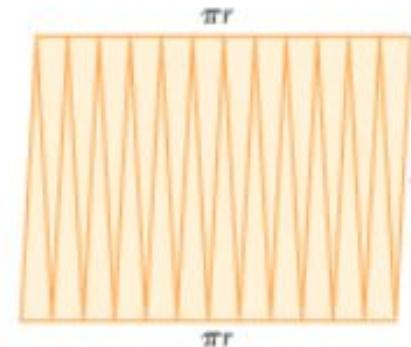
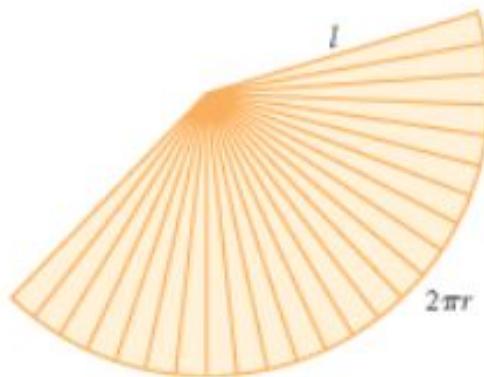
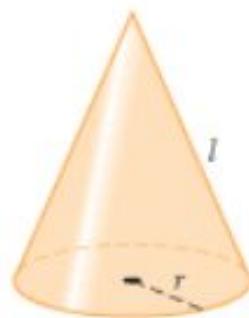
These conservatories in Edmonton, Canada, are glass pyramids.



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

$$\text{Surface Area} = 340 \text{ sq-cm}$$

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 cm².

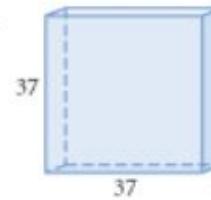


for Exercise 13

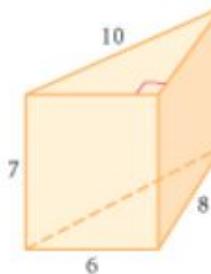
1. <http://www.keymath.com/DG4/chapter8/mpys>



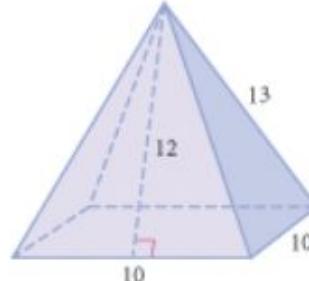
2.



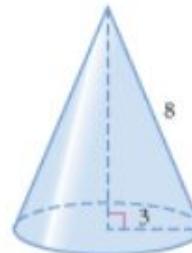
3.



4.



5.

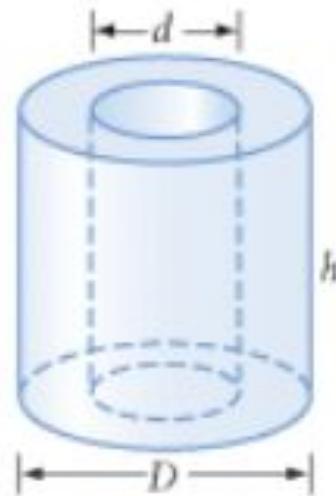


6.



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?

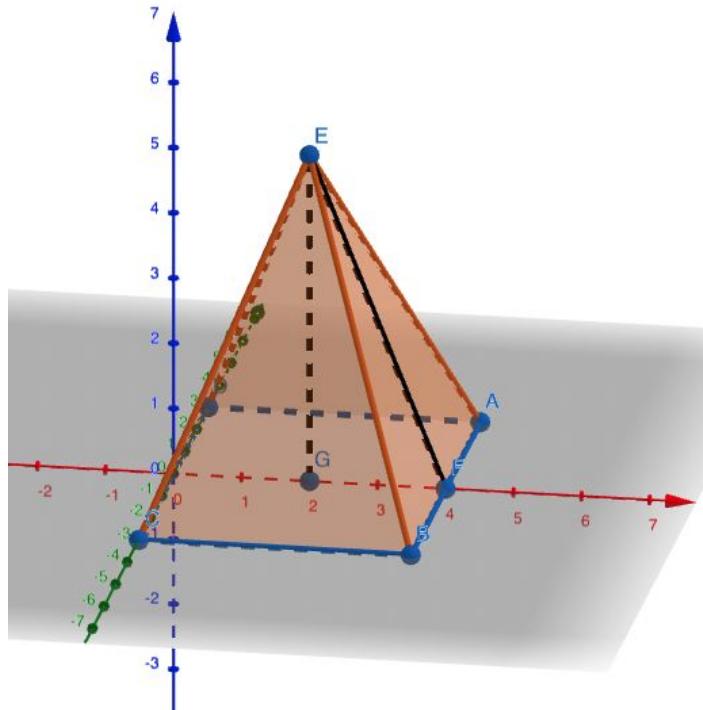
Sectors, Segments, Annulii, Surface Area

Examine Conjectures Notebook (Toolbox) - Conjectures List Posted

Reminders

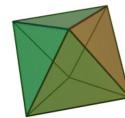
U4Q2 - Quiz on 8.4, 8.5, 8.6, 8.7, 9.3 scheduled for Friday, Feb 4th

Let's build some 3D Shapes in Geogebra



Can you build a Cone??

Can you build a Octahedron?

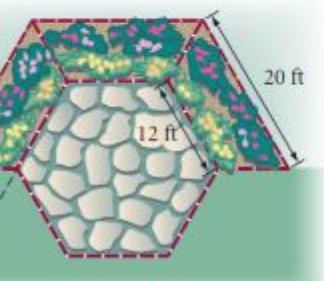


Problems that make you think

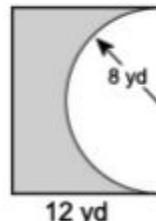
Try these Area Practice Problems

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?



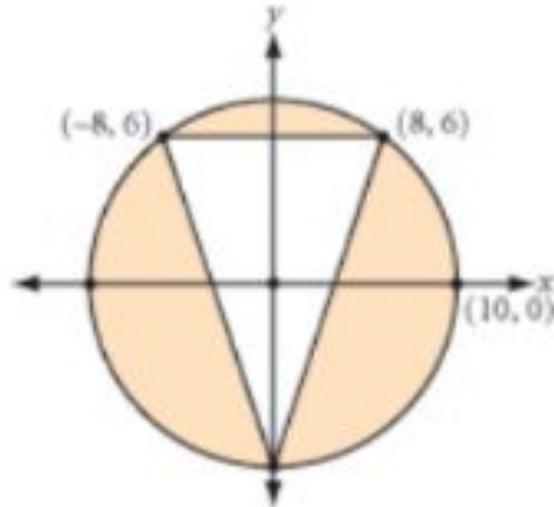
5. Find the area of the shaded region. (Hint: draw a line segment in a clever place)



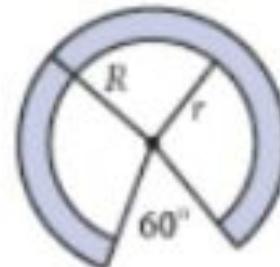
6. Find the area of an equilateral triangle with sides of length 8 cm. Give an exact, reduced answer.

Problems that make you think ..

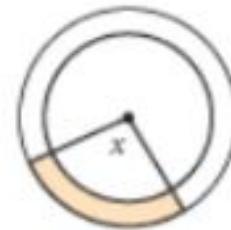
What is the area of the shaded region between the circle and the triangle?

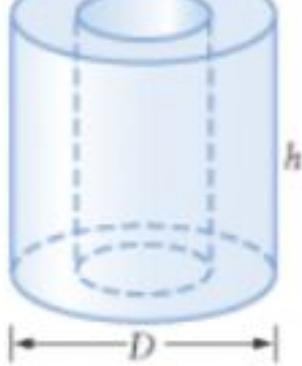


$$R = 12 \text{ cm}$$
$$r = 9 \text{ cm}$$



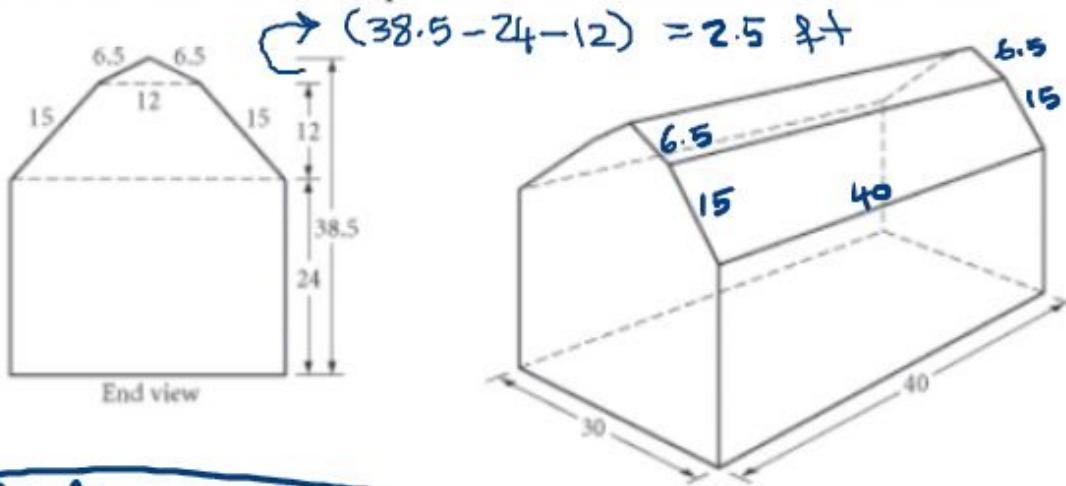
The shaded area is $10\pi \text{ cm}^2$.
The radius of the large circle is 10 cm, and the radius of the small circle is 8 cm. Find x .





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.



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

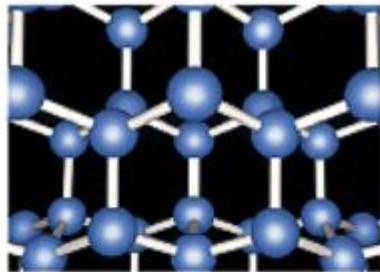
Complete your Conjectures Notebook - [Conjectures List Posted](#)

[Work on Volume Problems Assigned](#)

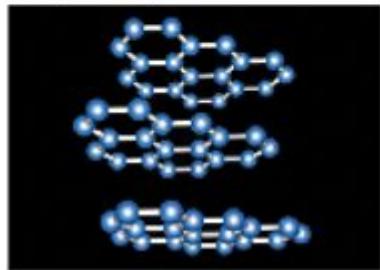
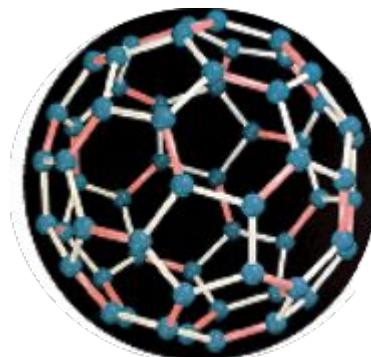
Work on [Area-Volumes Project](#)

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

Solids - Volume Vocabulary

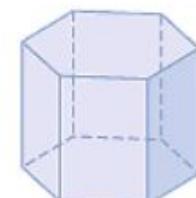
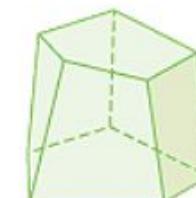
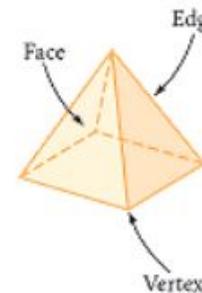
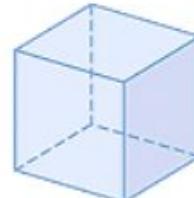


The geometry of diamonds

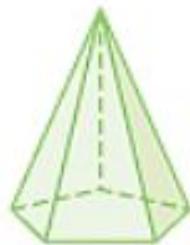


The geometry of graphite

Polyhedron
Face
Edge
Vertex



Polyhedrons



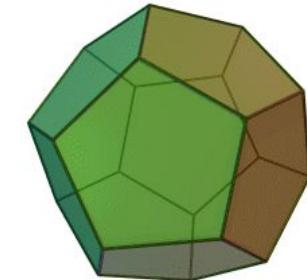
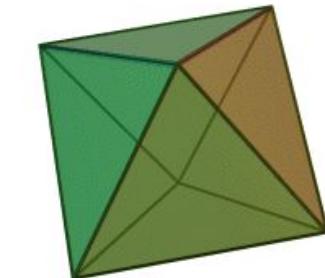
Hexahedrons



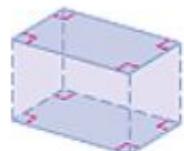
Heptahedrons



Decahedrons



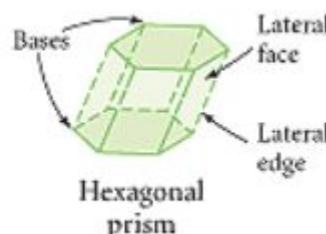
Pyramids Prisms Cylinders Cones Spheres- Oblique & Right



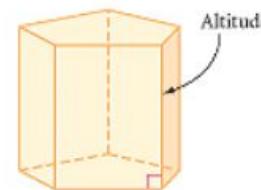
Rectangular prism



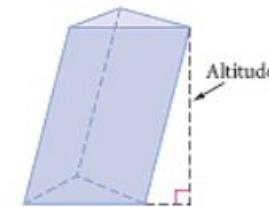
Triangular prism



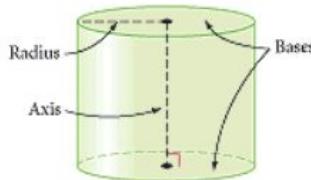
Hexagonal prism



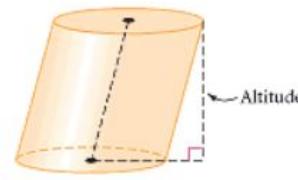
Right pentagonal prism



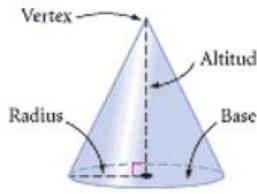
Oblique triangular prism



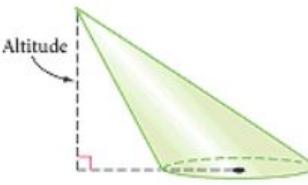
Right cylinder



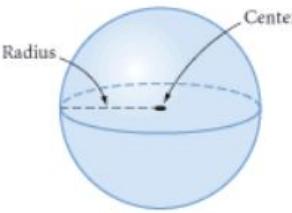
Oblique cylinder



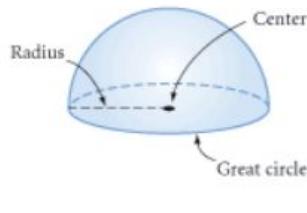
Right cone



Oblique cone

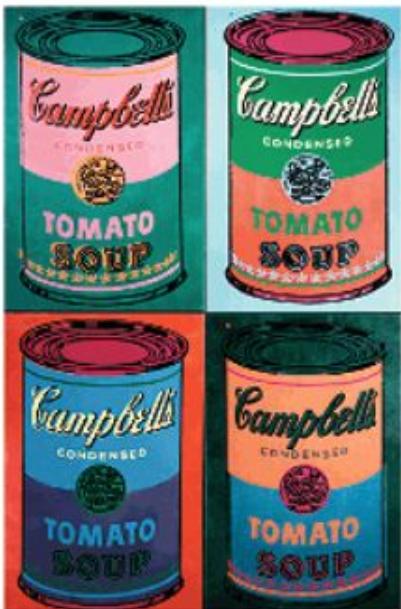


Sphere



Hemisphere

Volume



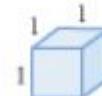
100 Cans (1962 oil on canvas), by pop art artist Andy Warhol (1925–1987), repeatedly uses the cylindrical shape of a soup can to make an artistic statement with a popular image.

Volume is the measure of the amount of space contained in a solid. You use cubic units to measure volume: cubic inches (in^3), cubic feet (ft^3), cubic yards (yd^3), cubic centimeters (cm^3), cubic meters (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

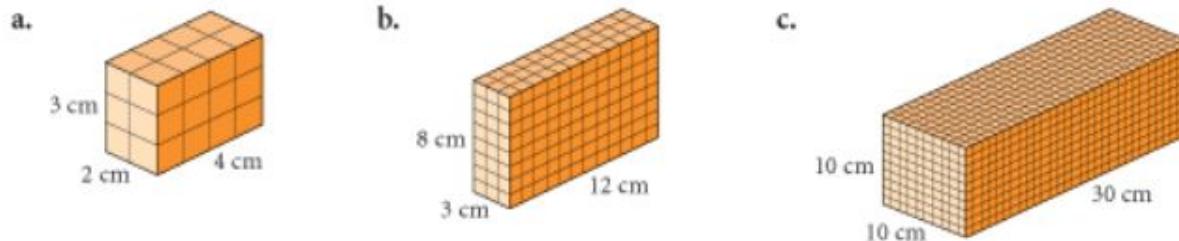


Volume: 1 cubic unit



Volume: 20 cubic units

Volume Conjectures



Rectangular Prism Volume Conjecture

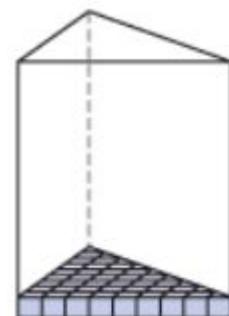
C-86a

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 $V = \underline{\hspace{2cm}} \cdot BH$.

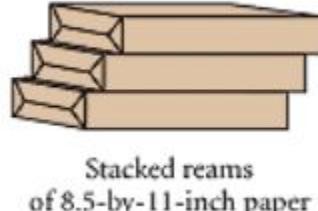
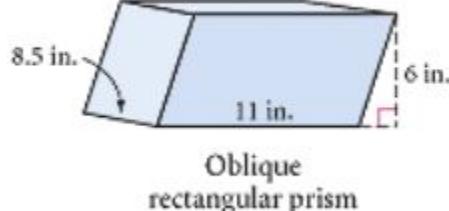
Right Prism-Cylinder Volume Conjecture

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 $V = \underline{\hspace{2cm}} \cdot BH$.



Right or Oblique Volume - is it different?



Prism-Cylinder Volume Conjecture

C-86

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

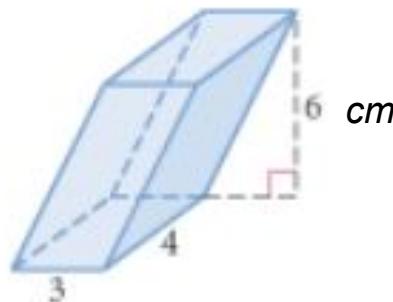
Base Area

Height
perpendicular
to Base

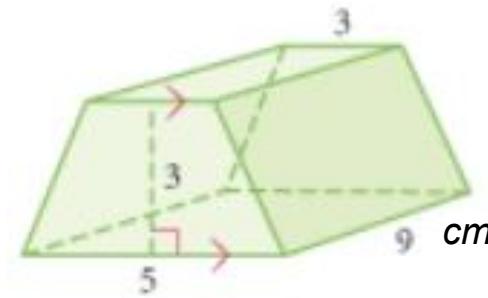


Volume Problems

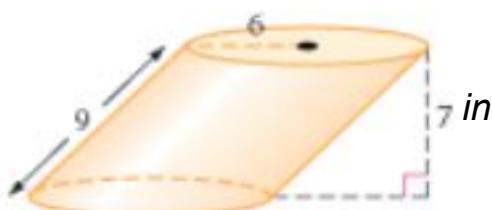
Oblique rectangular prism



Right trapezoidal prism



Oblique Cylinder

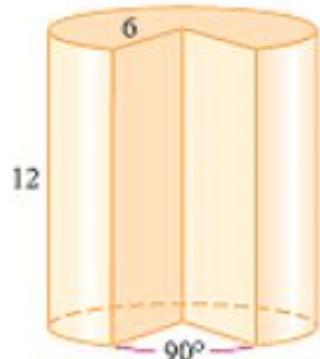


$$252\pi \text{ in}^3$$

Right cylinder with a
90° slice removed 

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

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



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

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

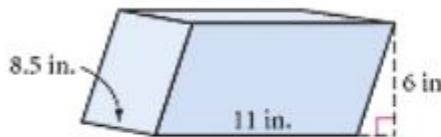
Construct a Platonic Solid!

Do Volume of a Sphere Worksheet

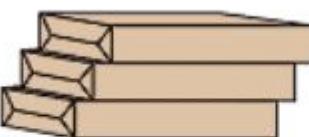
Work on U4Q2 Quiz Corrections

Review Volume of Right/Oblique Prisms/Cylinders

GOALS FOR THIS LESSON



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



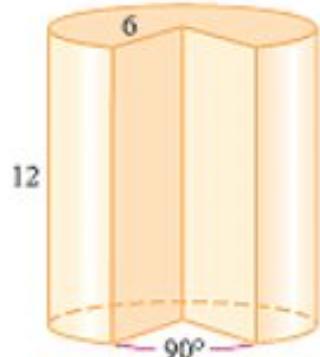
Review Problems

Oblique Cylinder

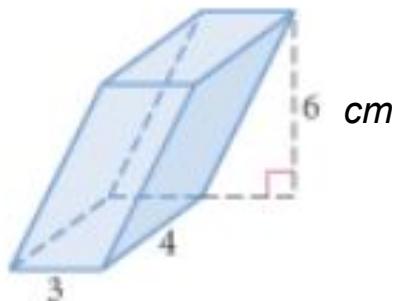


$$252\pi \text{ in}^3$$

Right cylinder with a
90° slice removed 

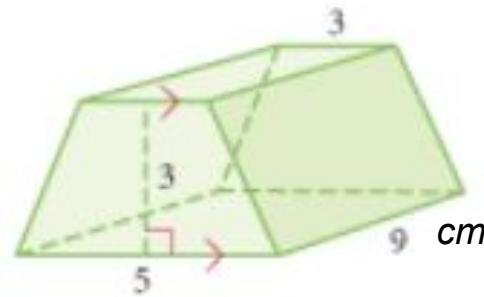


Oblique rectangular prism



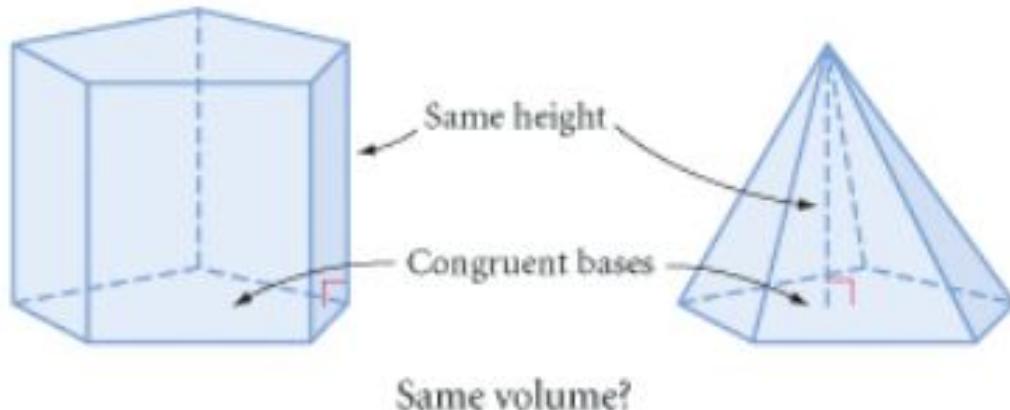
$$72 \text{ cm}^3$$

Right trapezoidal prism



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

Volume of a Pyramid



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

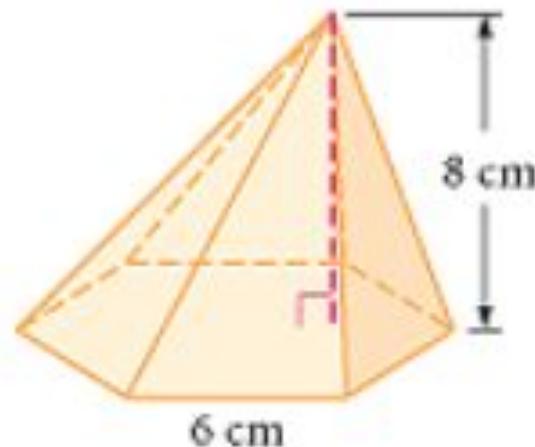
Pyramid-Cone Volume Conjecture

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 $V = \underline{\hspace{2cm}}$.

Example Problem

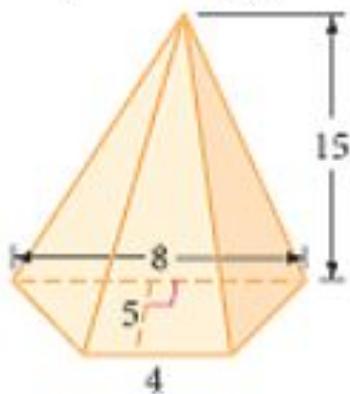
Find the volume of a regular hexagonal pyramid with a height of 8 cm. Each side of its base is 6 cm.



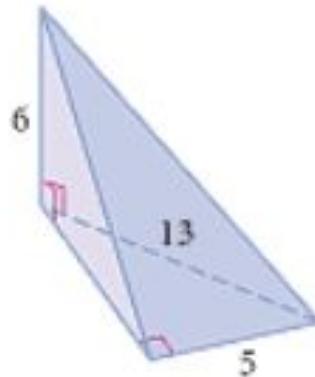
Problems

3. Trapezoidal pyramid

(h)

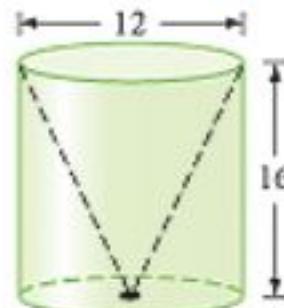


4. Triangular pyramid



6. Cylinder with cone removed

(h)



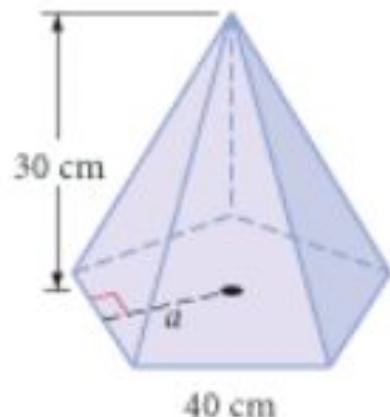
Once you solve this, [See Published Answer Key](#) for solution

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

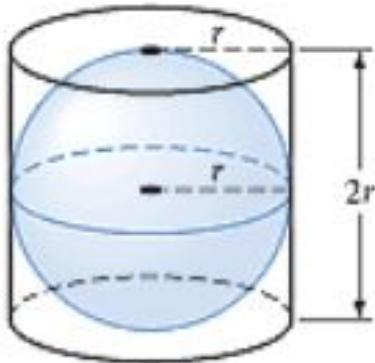
- Volumes of Cylinder & Prism
- Volumes of Cone & Pyramid

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

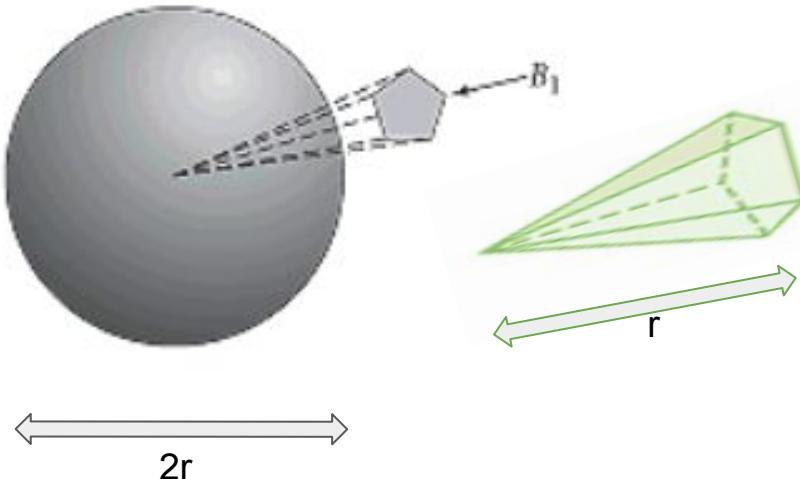
C-88

The volume of a sphere with radius r is given by the formula $\frac{4}{3} \pi r^3$.

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

Surface Area of Sphere

[Link to Sphere SA Conj Derivation](#)



Sphere Surface Area Conjecture

C-89

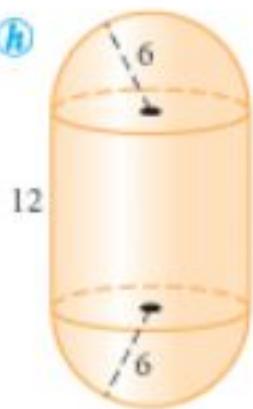
The surface area, S , of a sphere with radius r is given by the formula ?.

$$4\pi r^2$$

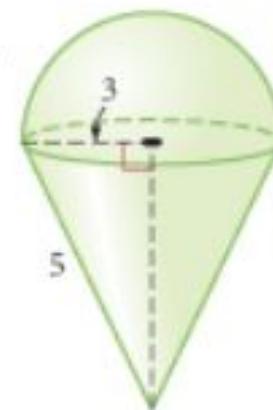
Do some Sphere Volume Problems

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

4.



5.

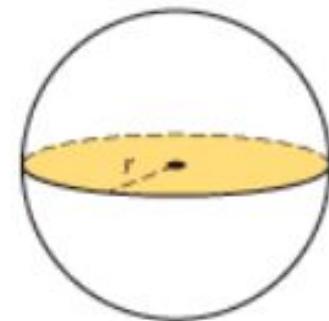


Once you solve this, [See Published Answer Key](#) for solution

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

$$\boxed{a \cdot p + b}$$

what if I want to factor out p ?

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

What is

$$\boxed{6\pi + 4} \quad ??$$

- $2^*(3\pi+2)$

Length Area Volume Units & Conversion

- Units of length in, ft, yd, cm, m, km
- Units of area cm^2 , m^2 , ft^2 , in^2 , yd^2
- Units of volume cm^3 (cc), m^3 , in^3 , yd^3 , gal, litre
- Units of weight kg, gm, lb
- Units of density g/cm^3 , kg/m^3 , 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 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 m^2 are in 200 cm^2 ? $(1/100)*(1/100)*200 = 0.02 \text{ m}^2$

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

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

$$\text{Hole depth} = 18 \text{ in} \times \frac{1}{12} \frac{\text{ft}}{\text{in}} = \frac{18}{12} = \frac{3}{2} \text{ ft}$$

$$\begin{aligned} \text{Volume of hole} &= \left(\frac{25}{4} \pi - \frac{5}{18}\right) \left(\frac{3}{2}\right) \text{ ft}^3 \\ &= \left(\frac{25}{4} \pi - \frac{5}{18}\right) \cancel{\left(\frac{3}{2}\right)} \text{ ft}^3 \times \frac{1}{27} \frac{\text{yd}^3}{\text{ft}^3} \\ &= \left(\frac{25}{4} \pi - \frac{5}{18}\right) \frac{1}{18} \text{ yd}^3 \\ &= 1.075 \text{ yd}^3 \end{aligned}$$

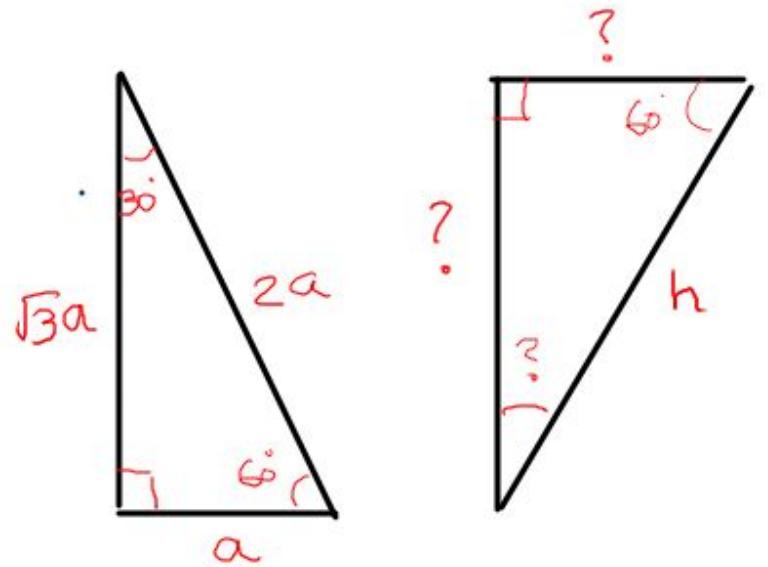
$$\begin{aligned} 12 \text{ in} &= 1 \text{ ft} \\ 1 \text{ in} &= \frac{1}{12} \text{ ft} \\ (1 \text{ in})^2 &= \left(\frac{1}{12}\right)^2 \text{ ft}^2 \\ 1^2 \text{ in}^2 &= \frac{1}{144} \text{ ft}^2 \end{aligned}$$

$$\begin{aligned} 1 \text{ yd} &= 3 \text{ ft} \\ \frac{1}{3} \text{ yd} &= 1 \text{ ft} \\ \frac{1}{27} \text{ yd}^3 &= 1 \text{ ft}^3 \end{aligned}$$

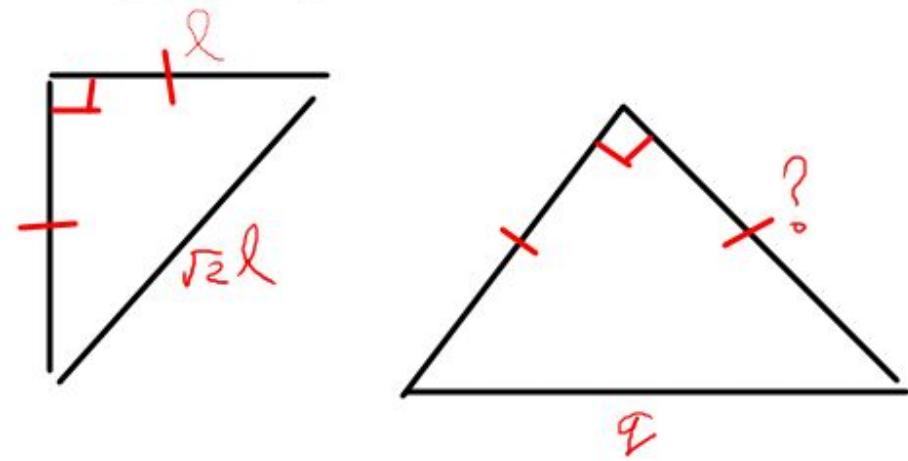
How many yd^3 of empty space are in a 5-ft diameter & 18" deep hole with a 5x8" post in it?

30-60-90 Triangles & Isosceles Rt-Triangles

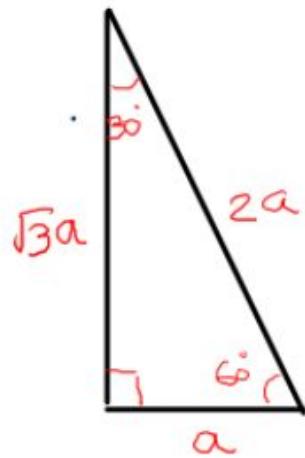
$30^\circ-60^\circ-90^\circ$ triangles



Isosceles Rt-triangles



30-60-90 Triangles & Isosceles Rt-Triangles



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

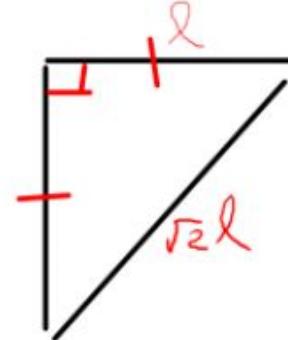
$$\frac{x}{h} = \frac{a}{2a} = \frac{1}{2}$$

$$x = \frac{h}{2}$$

$$h^2 = \left(\frac{h}{2}\right)^2 + \left(\frac{\sqrt{3}h}{2}\right)^2$$

$$= \frac{h^2}{4} + \frac{3h^2}{4}$$

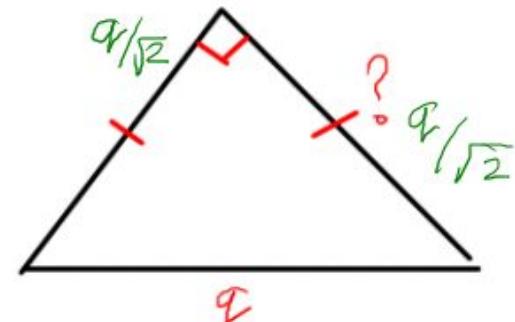
$$= h^2 \quad \checkmark$$



$$c^2 = l^2 + l^2$$

$$= 2l^2$$

$$c = \sqrt{2}l \quad \checkmark$$



$$\frac{q}{x} = \sqrt{2}$$

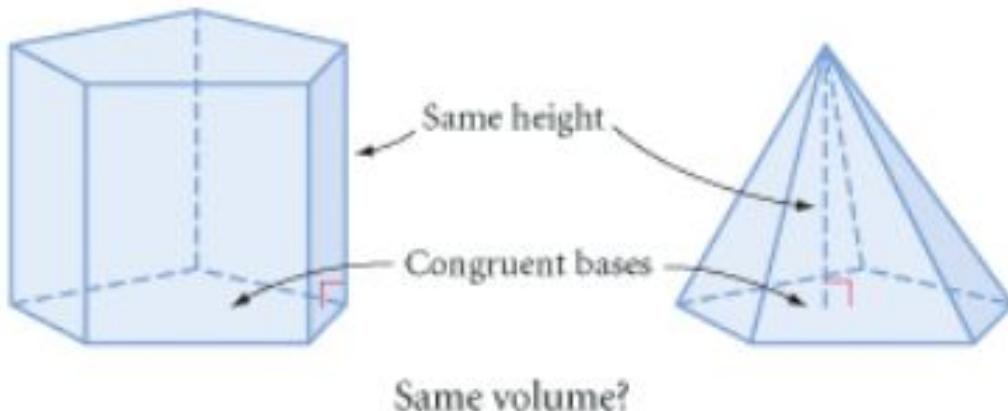
$$x = \frac{q}{\sqrt{2}}$$

$$q^2 = \left(\frac{q}{\sqrt{2}}\right)^2 + \left(\frac{q}{\sqrt{2}}\right)^2$$

$$= \frac{q^2}{2} + \frac{q^2}{2}$$

$$= q^2 \quad \checkmark$$

Volume of a Pyramid



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

Pyramid-Cone Volume Conjecture

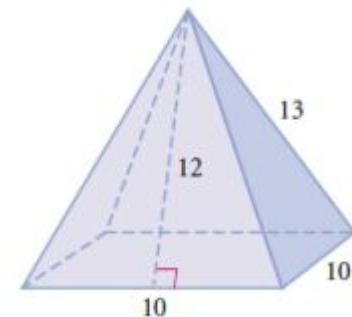
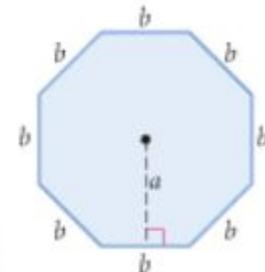
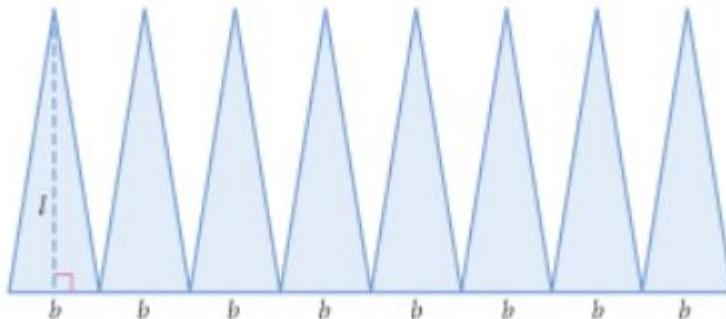
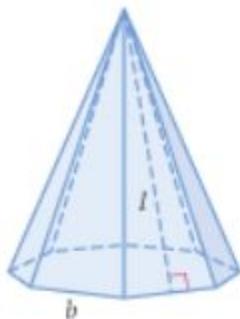
C-87

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 $V = \underline{\hspace{2cm}}$.

Surface Area of 3-D Shapes - Pyramid



These conservatories in Edmonton, Canada, are glass pyramids.



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

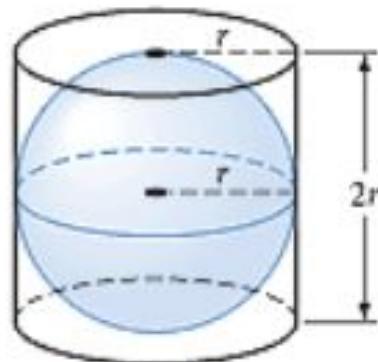
$$\text{Surface Area} = 340 \text{ sq-cm}$$

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 $\underline{\quad}$.

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

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 ft² garden.
 - a. How many yd³ should he buy?
 4. A steel ball has a 1-ft diameter
 - a. Steel has a density of 0.28 lb/in³, How heavy is it? Can you lift it?
 - b. Al has a density of 2.7 g/cm³, 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 => 1 Full tank

380 miles => 15 Gallons

174 miles => ?? Gallons

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

1 hour => 55 miles

?? Hours => 174 miles

?? Hours => $174 \times 1 \div 55 = 3.16 \text{ Hours or } 3 \text{ hours } 10 \text{ minutes}$

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 = $4/3 \pi r^3$

Cross-multiply - Pb #2

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

$$1 \text{ Mile} \Rightarrow 9 \text{ Minutes}$$

Divide!!

Multiply!

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

$$118 \Rightarrow \text{Minutes} = 1 \text{ hr } 58 \text{ minutes}$$

- 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

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

Divide!!

Multiply!

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

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 ft² garden. How many yd³ should he buy?

Volume of Compost = Area of Base X Height

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

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

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

$$\begin{array}{rcl} 1 \text{ yd} & = & 3 \text{ ft} \\ 1 * 1 * 1 \text{ yd}^3 & = & 3 * 3 * 3 \text{ ft}^3 \end{array}$$

$$\begin{array}{rcl} 1 \text{ yd}^3 & = & 27 \text{ ft}^3 \\ \text{Divide!!} & & \\ \text{Multiply!} & & \\ ??? \text{ yd}^3 & = & 50 \text{ ft}^3 \end{array}$$

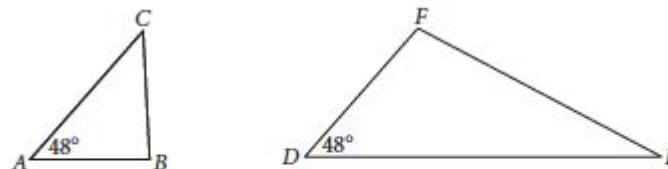
$$??? \text{ yd}^3 = 50 * 1 \div 27 = 1.85 \text{ yd}^3$$

- 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 Sea
- Chandru's car tank = 15 gallon
- 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?

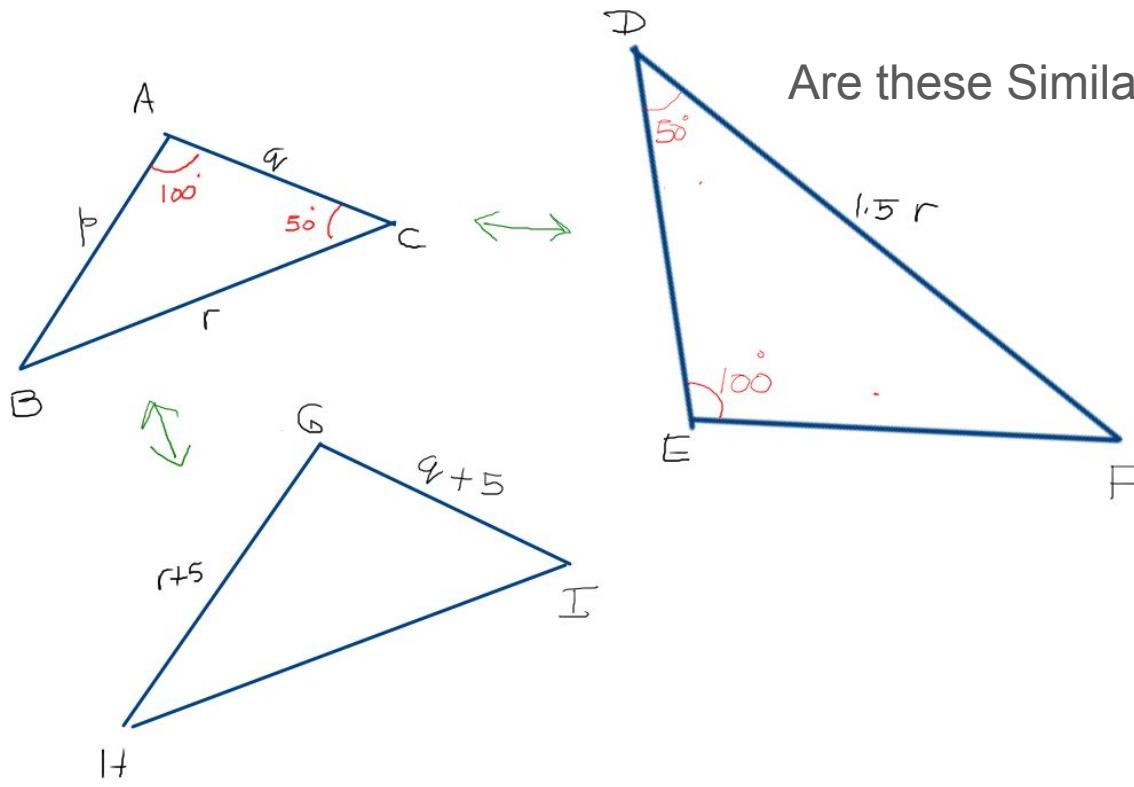
AA Similarity Conjecture

If two angles of one triangle are congruent to two angles of another triangle, then the triangles are similar.

C-91

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

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-Wed, Mar 7th & 9th

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

C-90

the polygons are similar

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

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

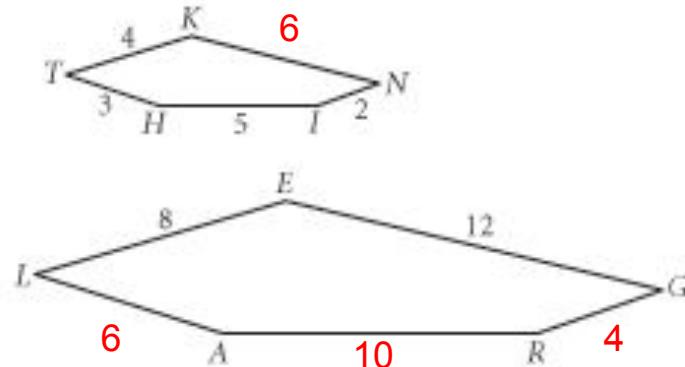
If two sides of one triangle are proportional to two sides of another triangle
and ?, then the ? **Triangles are similar**
included angle is congruent

Do some problems

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

7. *THINK ~ LARGE*

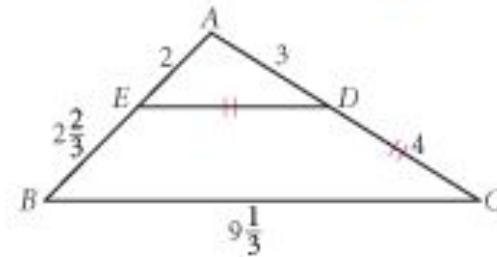
Find AL , RA , RG , and KN .



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

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

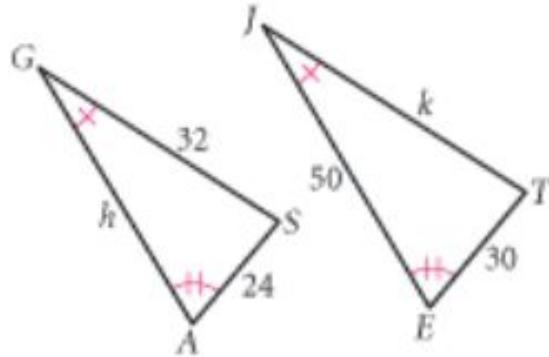
Is $\triangle AED \sim \triangle ABC$? (h)



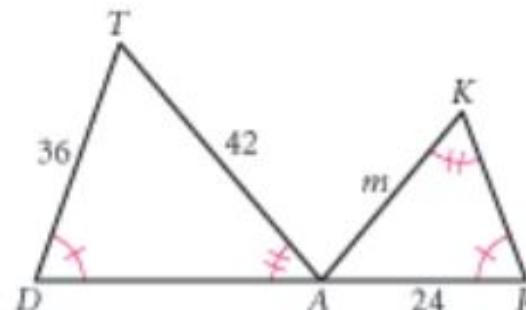
Do some problems

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

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



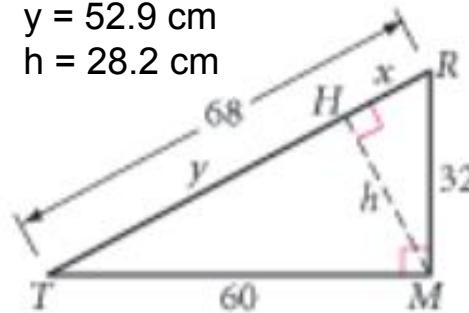
3. $m = \underline{?}$



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

Find x , y , and h .

$$\begin{aligned}x &= 15.1 \text{ cm} \\y &= 52.9 \text{ cm} \\h &= 28.2 \text{ cm}\end{aligned}$$



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

Manipulating Fractions

Conversions :

Improper to Proper
or Mixed

Examples: Proper Fraction: $\frac{4}{7}, \frac{2}{3}$
 Improper Fraction } $\frac{17}{4}, \frac{3}{2}$ Mixed Fraction: $2\frac{1}{3}, 1\frac{6}{7}$

Mixed to Improper
or Proper

$$\begin{aligned} & 7\frac{1}{8} = 7 + \frac{1}{8} = \frac{7}{1} + \frac{1}{8} = \frac{56+1}{8} \leftarrow \text{LCD} = \frac{57}{8} \\ & \text{or simply } 7\frac{1}{8} = \frac{57}{8} \quad \checkmark \end{aligned}$$

Multiplying 3

$$7\frac{2}{3} \times 6\frac{5}{4} = \frac{23}{3} \times \frac{29}{4} = \frac{667}{12}$$

Adding :

$$\frac{3}{7} + \frac{4}{5} = \frac{15+28}{35} \quad \text{find LCD} = \frac{43}{35}$$

Dividing 3

$$\frac{\frac{a}{c}}{\left(\frac{b}{c}\right)} = \frac{ac}{b} \quad \text{and} \quad \frac{\left(\frac{a}{b}\right)}{c} = \frac{a}{bc}$$

$$\left(\frac{1}{3}\right)$$

$$\begin{aligned} \frac{1}{5} &= \frac{7}{15} = \frac{5+2}{15} = \frac{1}{3} + \frac{2}{15} \\ &\hookrightarrow \text{num} \downarrow \quad \text{Reciprocal of den} \\ &= \left(\frac{1}{3}\right) \times \frac{1}{5} = \frac{1}{15} \end{aligned}$$

Cross Multiplying

$$\begin{aligned} \text{If } \frac{a}{b} = \frac{c}{d} \quad \text{then } ad = bc \quad \text{Calc X} \end{aligned}$$

Linked PDF here

Procedure for Solving Similar Polygons/Triangles

- ① Name all vertices
- ② Mark all givens and measures
- ③ Find Congruent angles & Mark them
- ④ Find Congruent Sides & Mark them
- ⑤ Split into suspected Similar triangles using same vertex Names
- ⑥ Transfer all notations to all split triangles
- ⑦ Apply AA, SSS, SAS Similarity Conjectures to determine Similarity
- ⑧ Apply Polygon Similarity Conjecture if not triangle (All angles Congruent)
(All sides Proportional)
- ⑨ For Similar triangles Mark all angles Congruent (Reverse Similarity Conjecture)
- ⑩ Set up ratio Numerators for each triangle pair Line Segments only
- ⑪ Follow Congruent angle to the similar triangle to find opposite side
- ⑫ Set up ratio Denominators for each triangle pair Line Segments Only
- ⑬ Substitute known and unknown measures for Line Segments
- ⑭ Cross multiply and solve for unknowns!

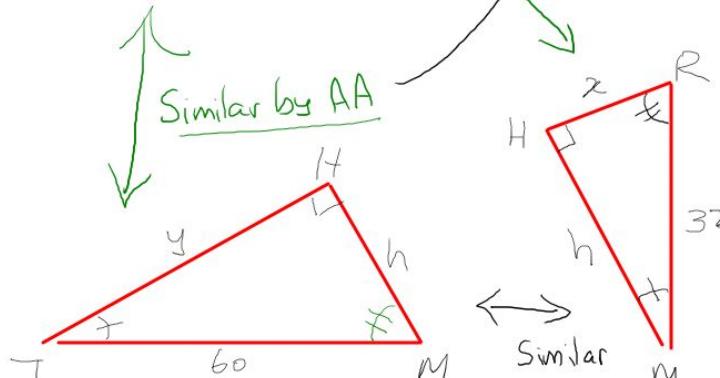
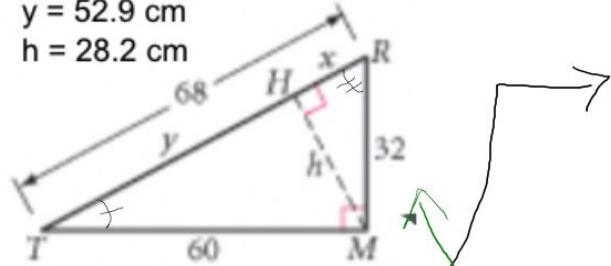
[Linked PDF here](#)

Problem #8 solution

$$x = 15.1 \text{ cm}$$

$$y = 52.9 \text{ cm}$$

$$h = 28.2 \text{ cm}$$



$$\angle TMH \cong \angle TRM !$$

Because $\triangle TMR \sim \triangle THM$

$$\frac{RM}{HM} = \frac{TM}{TH} = \frac{TR}{TM}$$

$$\frac{32}{h} = \frac{60}{y} = \frac{x+y}{60} = \frac{68}{60}$$

$$h = \frac{60 \times 32}{68} = 28.2 \quad y = \frac{60 \times 60}{68} = 52.9$$

$$\frac{TM}{RM} = \frac{MH}{HR} = \frac{TH}{HM}$$

$$\frac{60}{32} = \frac{h}{x} = \frac{y}{h}$$

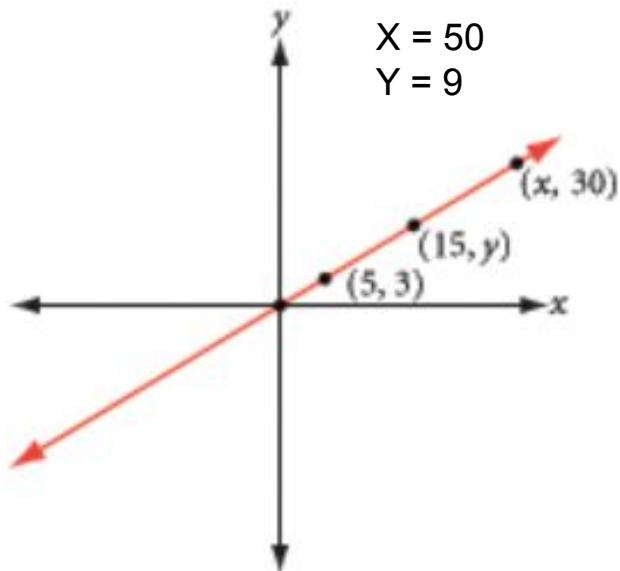
$$\frac{60}{32} = \frac{28.2}{x} = \frac{52.9}{28.2}$$

$$x = \frac{28.2 \times 32}{60} = 15.05$$

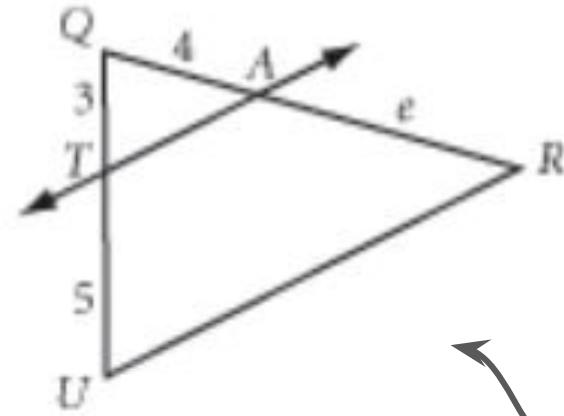
Do some more problems

Chapter 11.2: 9, 15 (Pg 592)

15. Find x and y . (h)



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



Find the similar triangles first before proceeding.

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

Fri, Mar 11th

What's happening today?

Check-in

Unit 4 Test Correction is closed. Grades returned. If you want to still improve your grade, you can do and submit a bonus problem from that test

Grade sheets sent

Today in class

Do some Quiz practice problems using procedure discussed in last class

Review Similarity Project (Do during weekend)

Chapter 11.3: Indirect Measurements with Similar Triangles Project

Do Chapter 11.3 Problems & Proofs

Reminders

Complete 11.1, 11.2, 11.3 Homework & Project. This is the Practice for Quiz!!

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

11.1 AK published, 11.2 & 11.3 AK will be published over weekend

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

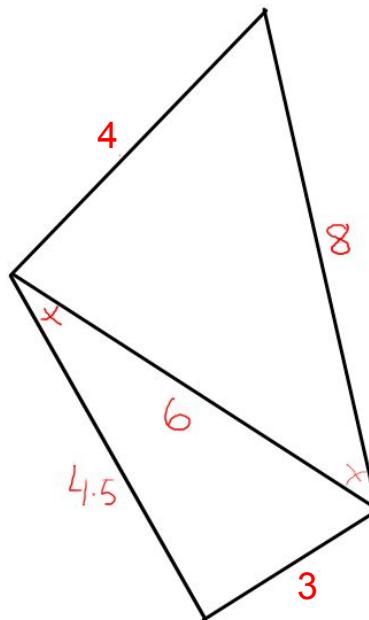
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- ⑭ Cross multiply and Solve for Unknowns!

[Linked PDF here](#)

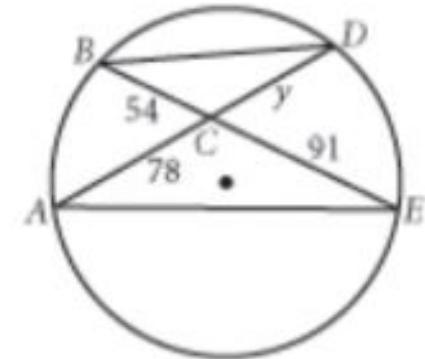
Quiz Practice - Check if you can figure this out

Strictly follow the steps established in previous class
Think of these problems as a mini quiz!



Find all missing dimensions

12. Find y .

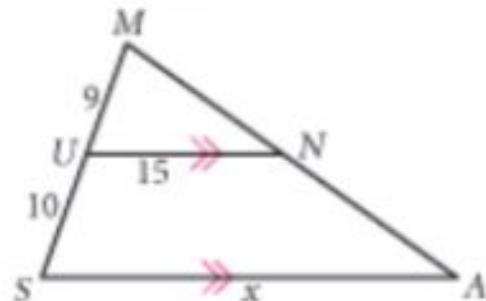


$$y = 63$$

Hint: Use Inscribed Angles Conjecture.
Look in your notebook for Circles conjectures

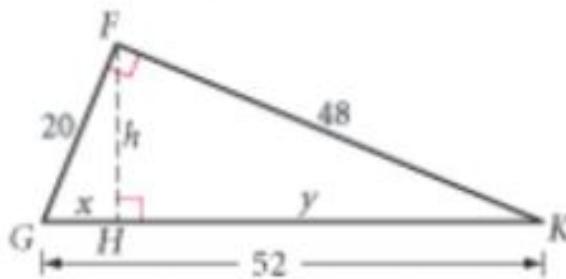
More Quiz Practice

11. Find x . 



$$x = 31.666$$

13. Find x , y , and h . 



$$x = 7.69$$

$$y = 44.3$$

$$h = 18.46$$

Chapter 11.3: Indirect Measurements

Pg# 598

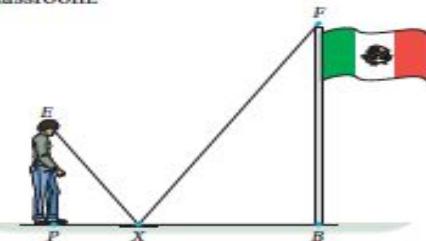


Investigation Mirror, Mirror

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.



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.

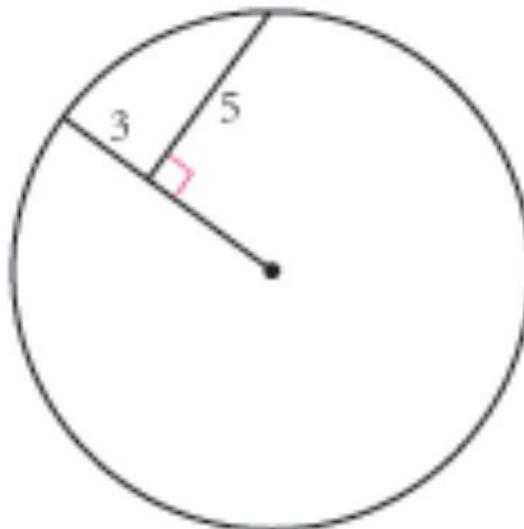
Set up a proportion using corresponding sides of similar triangles. Use it to calculate FB , the approximate height of the tall object.

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 problems

15. Find the radius of the circle.



Hint: Nothing to do with
similar triangles!

$$\begin{aligned}\text{Radius} &= 5 \frac{2}{3} \\ &= 5.666\end{aligned}$$

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

Tue, Mar 15th

What's happening today?

Check-in

[AK for 11_2, 11_3 Published](#)

Today in class

Review

Project completed?

Quiz U5Q1

Reminders

Tue/Thu, Mar 22/24

What's happening today?

Check-in

Welcome back!

Thought question - Are all circles similar?

Today in class - Area, Surface Area and Volume Ratios of similar shapes

Open grades week

Review Quiz, Project

Skipping Chapter 11.4 ...

Proportions with Areas & Volumes (Chapter 11.5 & 11.6)

Do problems from 11.5:1-4 & 11.6:1-4

Skipping Chapter 11.7 ...

Reminders

Finish these as Homework

Proportions with Areas

Proportional Areas Conjecture

C-96

If corresponding side lengths of two similar polygons or the radii of two circles compare in the ratio $\frac{m}{n}$, then their areas compare in the ratio $\frac{?}{\frac{m^2}{n^2}}$.

This conjecture is also true for Circles!

This conjecture is also true for Surface Areas of solids!

How do you construct proportional 2D shapes

Let's examine formulas for Areas & Surface Areas: Slides Chap 8 slides 54-60, 94, 110

Let's examine formulas for Volumes: Slides 76, 77, 83, 85, 93 etc

Let's do some problems

EXAMPLE

If you need 3 oz of shredded cheese to cover a medium 12 in. diameter pizza, how much shredded cheese would you need to cover a large 16 in. diameter pizza?

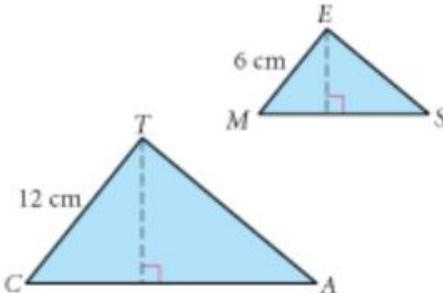
$$5\frac{1}{3} \text{ oz}$$

Let's do some problems

Chap 11:1-4

1. $\triangle CAT \sim \triangle MSE$

$$\begin{aligned} \text{area of } \triangle CAT &= 72 \text{ cm}^2 \\ \text{area of } \triangle MSE &= ? \quad \textcircled{h} \\ &\quad 18 \text{ cm}^2 \end{aligned}$$



2. $RECT \sim ANGL$

$$\frac{\text{area of } RECT}{\text{area of } ANGL} = \frac{9}{16}$$

$$TR = ? \quad 18$$

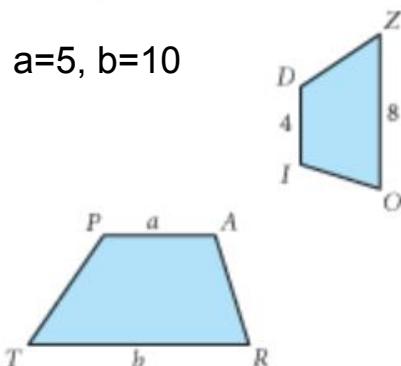


3. $TRAP \sim ZOID$ (h)

$$\frac{\text{area of } ZOID}{\text{area of } TRAP} = \frac{16}{25}$$

$$a = ?, b = ?$$

$$a=5, b=10$$

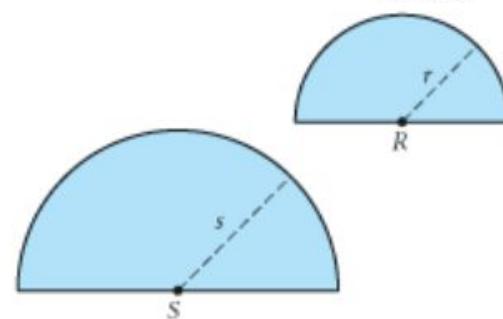


4. semicircle $R \sim$ semicircle S

$$\frac{r}{s} = \frac{3}{5}$$

$$\text{area of semicircle } S = 75\pi \text{ cm}^2$$

$$\text{area of semicircle } R = ? \quad 27\pi \text{ cm}^2$$



Proportions with Volumes

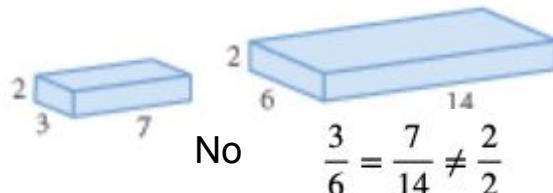
Proportional Volumes Conjecture

C-97

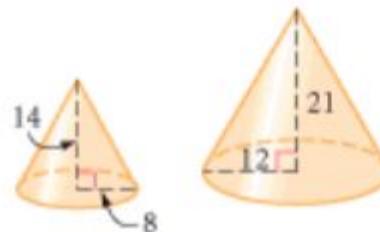
If corresponding edge lengths (or radii, or heights) of two similar solids compare in the ratio $\frac{m}{n}$, then their volumes compare in the ratio $\frac{m^3}{n^3}$.

This conjecture is true for Prisms & Pyramids, Cylinders & Cones

Are these right rectangular prisms similar?



Are these right circular cones similar?



Yes

$$\frac{21}{14} = \frac{12}{8} = \sqrt[3]{\frac{12^2 * 21}{8^2 * 14}} = 1.5$$

Let's do some real-world problems

The diameter of a soccer ball is about 8.75 in. and the diameter of a tennis ball is about 2.5 in. How many times more surface material is needed to make the outside of a soccer ball than a tennis ball? How many times more air does a soccer ball hold than a tennis ball?

$$12 \frac{1}{4} \quad 42 \frac{7}{8}$$

Let's do some Volume ratios problems

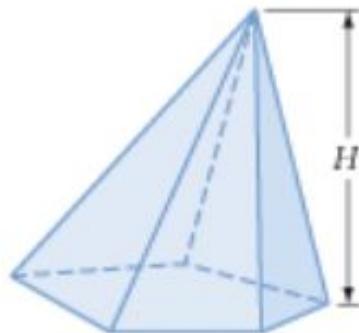
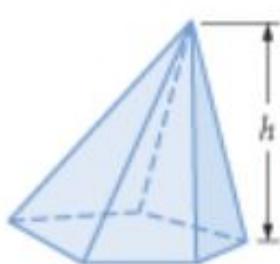
Chap 12:1-4

1. The pentagonal pyramids are similar.

$$\frac{h}{H} = \frac{4}{7}$$

volume of large pyramid = ?

volume of small pyramid = 320 cm^3 



2. These right cones are similar.

$$H = \underline{\hspace{2cm}}, h = \underline{\hspace{2cm}}$$



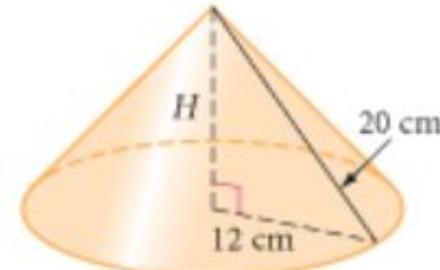
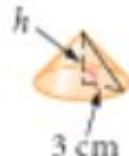
Construction tools

for Exercises 19 and 20

volume of large cone = ?

volume of small cone = ?

$\frac{\text{volume of large cone}}{\text{volume of small cone}} = \underline{\hspace{2cm}}$



Let's do some problems

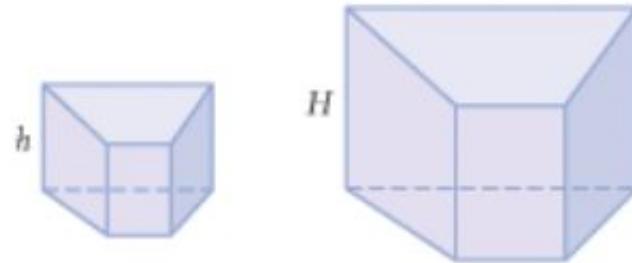
3. These right trapezoidal prisms are similar.

$$\text{volume of small prism} = 324 \text{ cm}^3$$

$$\frac{\text{area of base of small prism}}{\text{area of base of large prism}} = \frac{9}{25}$$

$$\frac{h}{H} = \underline{\hspace{2cm}} \quad \boxed{}$$

$$\frac{\text{volume of large prism}}{\text{volume of small prism}} = \underline{\hspace{2cm}} \quad \boxed{}$$



Chap 12:1-4

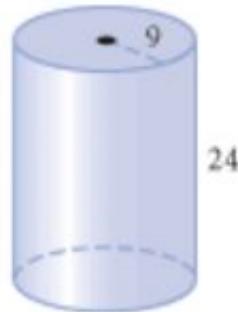
4. These right cylinders are similar.

$$\text{volume of large cylinder} = 4608\pi \text{ ft}^3$$

$$\text{volume of small cylinder} = \underline{\hspace{2cm}} \quad \boxed{}$$

$$\frac{\text{volume of large cylinder}}{\text{volume of small cylinder}} = \underline{\hspace{2cm}} \quad \boxed{}$$

$$H = \underline{\hspace{2cm}} \quad \boxed{}$$



7. The ratio of the weights of two spherical steel balls is $\frac{8}{27}$. What is the ratio of their diameters?

8. **Application** The energy (and cost) needed to operate an air conditioner is proportional to the volume of the space that is being cooled. It costs ZAP Electronics about \$125 per day to run an air conditioner in their small rectangular warehouse. The company's large warehouse, a few blocks away, is 2.5 times as long, wide, and high as the small warehouse. Estimate the daily cost of cooling the large warehouse with the same model of air conditioner.

(h)



9. **Application** A sculptor creates a small bronze statue. She wants to make a version that will be four times as large in every dimension. How much would this larger statue weigh if it is also bronze? $4^3 \cdot 38$

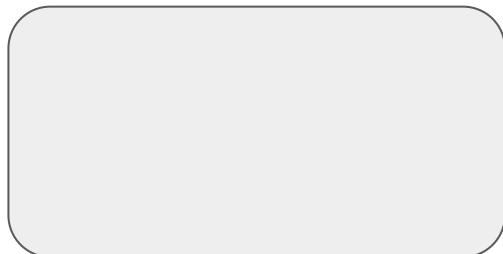
the place
each weight

This bronze sculpture by Camille Claudel (1864–1943) is titled *La Petite Chatelaine*. Claudel was a notable French artist and student of Auguste Rodin, whose famous sculptures include *The Thinker*.



10. A tabloid magazine at a supermarket checkout exclaims, "Scientists Breed 4-Foot-Tall Chicken." A photo shows a giant chicken that supposedly weighs 74 pounds and will solve the world's hunger problem. What do you think about this headline? Assuming an average chicken stands 14 inches tall and weighs 7 pounds, would a 4-foot chicken weigh 74 pounds? Is it possible for a chicken to be 4 feet tall? Explain your reasoning

14. Imagine stretching all three dimensions of a 2-cm-by-3-cm-by-1-cm rectangular prism by multiplying them by scale factor x . Make a table of the surface area and volume of the prism for values of x from 1 to 5 and plot both sets of points on a graph. Write function $S(x)$ that gives the surface area of the prism as a function of x and function $V(x)$ that gives the volume of the prism as a function of x . How do their equations and graphs differ?



Let's answer some real-world questions!

Body Temperature

Every living thing processes food for energy. An animal's body produces energy in proportion to its volume. This energy creates heat that radiates from the animal's surface.



- Step 1 Imagine two similar animals, one with dimensions three times as large as those of the other.
- Step 2 How would the surface areas of these two animals compare? How much more heat could the larger animal radiate through its surface?
- Step 3 How would the volumes of these two animals compare? How many times as much heat would the larger animal produce?
- Step 4 Review your answers from Steps 2 and 3. How many times as much heat must each square centimeter of the larger animal radiate? Would this be good or bad?
- Step 5 Use what you have concluded to answer these questions. Consider size, surface area, and volume.
 - a. Why do large objects cool more slowly than similar small objects?
 - b. Why is a beached whale more likely than a beached dolphin to experience overheating?
 - c. Why are larger mammals found closer to the poles than the equator?
 - d. If a woman and a small child fall into a cold lake, why is the child in greater danger of hypothermia?