GreatHearts®

Euclidean Geometry

March 30 – April 3

Time Allotment: 40 minutes per day

Student Name: ___________________________________

Teacher Name: ___________________________________

Euclidean Geometry
March 30 – April 3

Packet Overview

Date	Objective(s)	Page Number
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Tuesday, March 31	1. Calculate Area of different shapes given formulas 2. Practice Problems	8
Wednesday, April 1	1. Use the Pythagorean Theorem to find missing lengths of right triangles 2. Practice Problems	14
Thursday, April 2	1. Name Polygons and calculate the sums of their interior angles 2. Practice Problems	18
Friday, April 3	1. Name Polygons and calculate the sums of their interior angles (continued)	23

Additional Notes: Hello students!,

We have missed yall. We wish more than anything that we could be back together and doing propositions. However, for the time being we are going to be diving into some more modern geometry and doing some calculations.

There will be Euclidean review as we go through as well as review of concepts that you have covered in pre-algebra and algebra. It is important for us to review so that you can have notes for reference and so you can get back into the habit of using formulas and calculating.

All of this work is moving towards our unit on 3-D figures, but before we can jump into the land of 3-D objects we have to make sure our foundations are solid. To that end, we will be reviewing perimeter, area, the Pythagorean theorem, and polygons this week.

Make sure you are reading with a pencil in your hand (NO PENS). You should always be underlining, circling, taking margin notes etc.

Love,
Miss McCafferty and Mr. Bernstein

The answer key to each lesson will be at the end of each lesson. The answer keys should only be used when checking work.

Academic Honesty

I certify that I completed this assignment independently in accordance with the GHNO Academy Honor Code.

Student signature:

____

I certify that my student completed this assignment independently in accordance with the GHNO Academy Honor Code.

Parent signature:

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Monday, March 30

Geometry Unit: 3-D Figures
Lesson 1: Perimeters

Objective: Be able to do this by the end of this lesson.

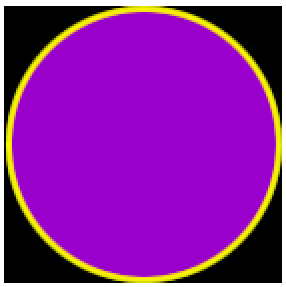
1. Calculate Perimeter of different shapes given Formulas

Lesson 1

Perimeters

***Perimeter*- n. the continuous line forming the boundary of a closed geometric figure.**

The circumference of a circle (the perimeter of a circle):

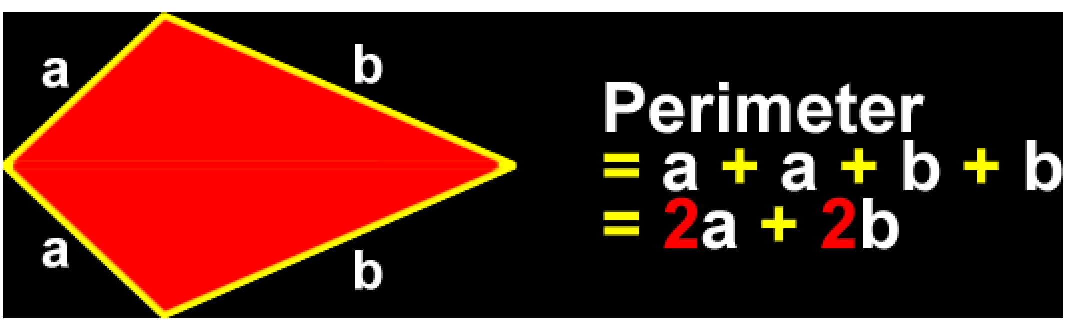


The circumference of a circle is the perimeter -- the distance around the outer edge.

Circumference =$2\pi r$
where r = the radius of the circle
and pi = 3.141592...

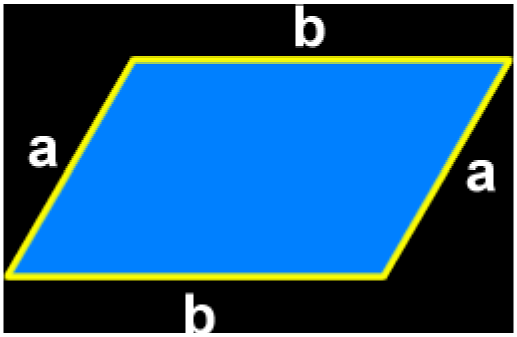
The perimeter of a kite:

To find the perimeter of a kite, just add up all the lengths of the sides:



To find the perimeter of a parallelogram, just add up all the lengths of the sides:

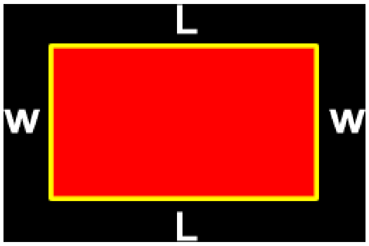
$$\text{Perimeter} = a + b + a + b$$
$$= 2a + 2b$$



Fill in the blank, or write out the answers in your notebook labeled: Lesson 1, pg. 3:

Euclid Review

1. **Book I Prop 34 tells us that "In parallelogrammic areas _____________ sides and areas are equal to one another"**



Rectangle:

To find the perimeter of a rectangle, just add up all the lengths of the sides:

$$\text{Perimeter} = L + w + L + w$$
$$= 2L + 2w$$

Fill in the blank, or write out the answers in your notebook labeled: Lesson 1, pg. 3:

Practice Problem: Show your work

2. In a rectangle L = 8 & W= 4. What is the perimeter?

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The perimeter of a rhombus:

To find the perimeter of a rhombus, just add up all the lengths of the sides:

Fill in the blank, or write out the answers in your notebook labeled: Lesson 1, pg. 4: (answer in complete sentences):

Euclid Review

3. What is Euclid's definition of a Rhombus?

____

____

The perimeter of a square:

To find the perimeter of a square, just add up all the lengths of the sides:

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Fill in the blank, or write out the answers in your notebook labeled: Lesson 1, pg. 5:

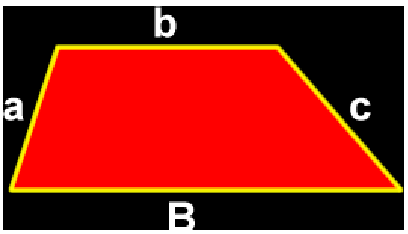
Euclid Short answer:

4. What is the difference between a rhombus and a square? (answer in 1-2 complete sentences)

____

____

The perimeter of a trapezoid:



To find the perimeter of a trapezoid, just add up all the lengths of the sides:

$$\textbf{Perimeter} = a + b + c + B$$

Fill in the blank, or write out the answers in your notebook labeled: Lesson 1, pg. 5:

Euclid Short answer:

5. A Trapezoid is the singular form of the noun Trapezia. Where does Euclid use the word trapezia? (answer in complete sentences)

____

____

6. Write your own definition of Trapezoid. (complete sentences)

____

____

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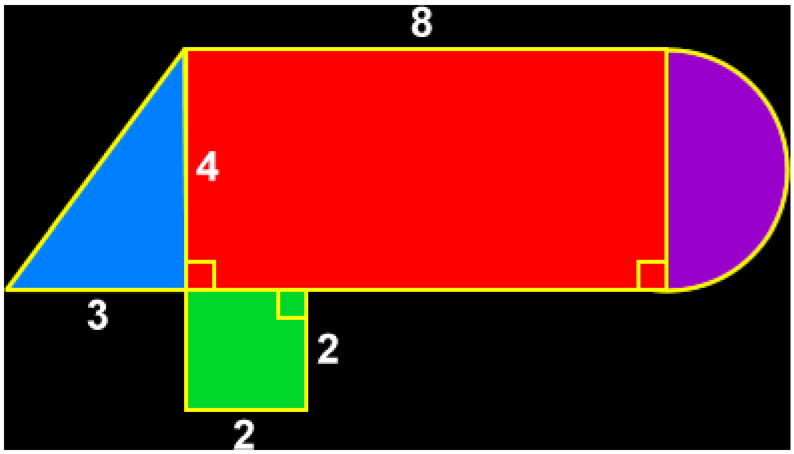
How to find the perimeter of strangely shaped objects:

Let's find the perimeter of this shape. We need to add up all the outside edges. And we'll just have to do that piece by piece!



Fill in the blank, or write out the answers in your notebook labeled: Lesson 1, pg. 6:

Practice Problem: Show your work.

7. What is the perimeter or the above figure? (Hint: Use the Pythagorean Theorem)

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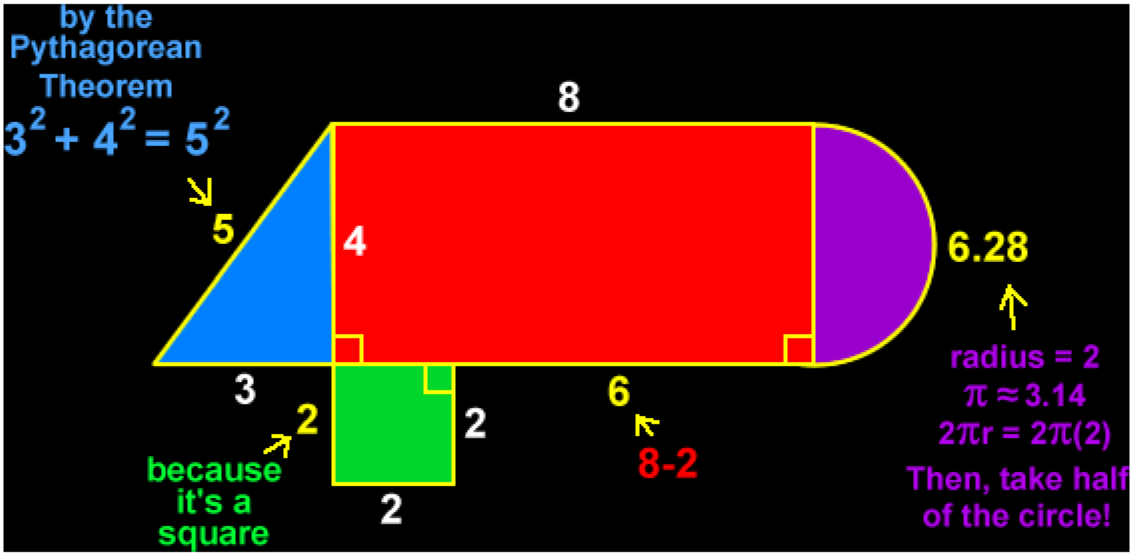
Answers for Lesson 1:

1. Book I Prop 34 tells us that "In parallelogrammic areas *opposite* sides and areas are equal to one another"
2. Area = 24
3. A rhombus that which is equilateral but not right-angled.

7. Here are all the missing pieces:



Now, add them all up!

$$5 + 8 + 6.28 + 6 + 2 + 2 + 2 + 3 = 34.28$$

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Tuesday, March 31

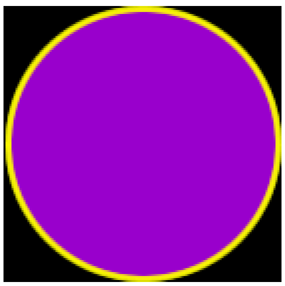
Objective: Be able to do this by the end of this lesson.

1. Calculate Area of different shapes given formulas

Geometry Unit: 3-D Figures

Lesson 2: Area

The area of a circle:

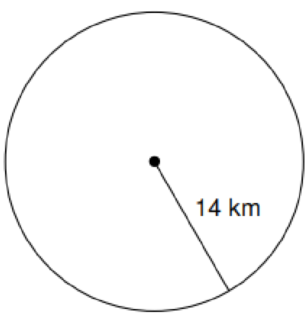


Area = πr^2
where r = the radius of the circle
and pi = 3.141592...

Fill in the blank, or write out the answers in your notebook labeled: Lesson 2, pg. 8:

Practice Problem:
Find the area of the circle. Use your calculator's value of π. Round your answer to the nearest tenth. Show your work.

1.



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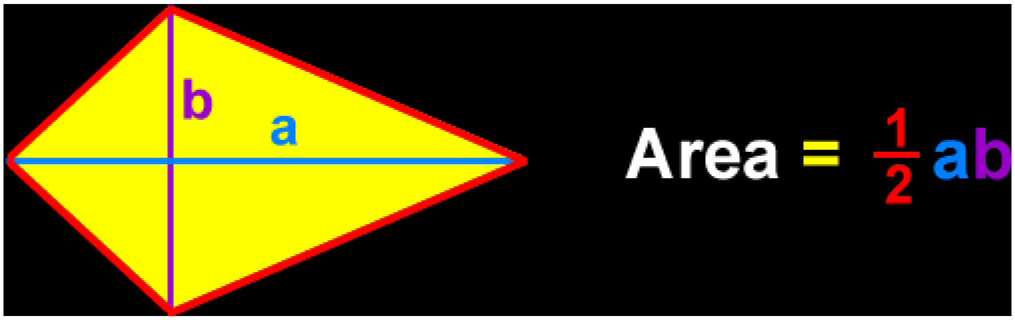
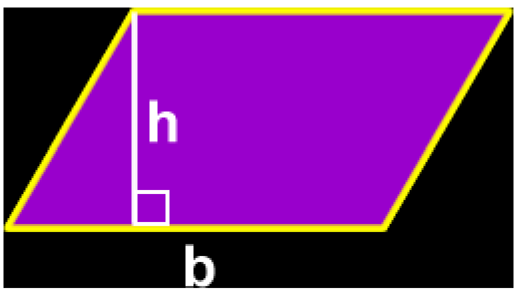
The area of a kite:

To find the area of a kite, multiply the lengths of the two diagonals and divide by 2 (same as multiplying by 1/2):



The area of a parallelogram:

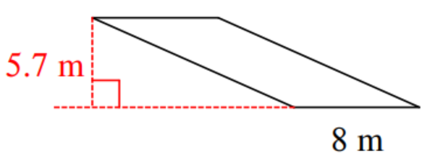


To find the area of a parallelogram, just multiply the base length (b) times the height (h):
Area = b x h

Fill in the blank, or write out the answers in your notebook labeled: Lesson 2, pg. 9:

Practice Problem

2. **Find the area of the parallelogram. Show your work**



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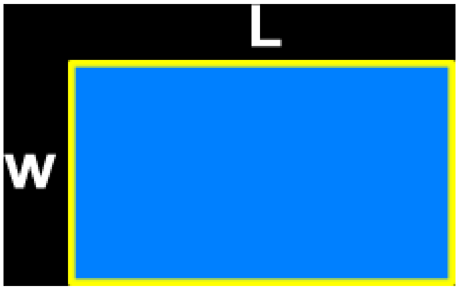
The area of a rectangle:

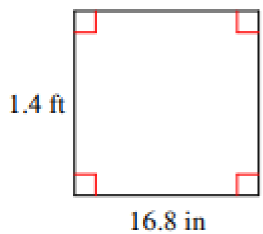


To find the area of a rectangle, just multiply the length times the width:
Area = L x W

Fill in the blank, or write out the answers in your notebook labeled: Lesson 2, pg. 10:

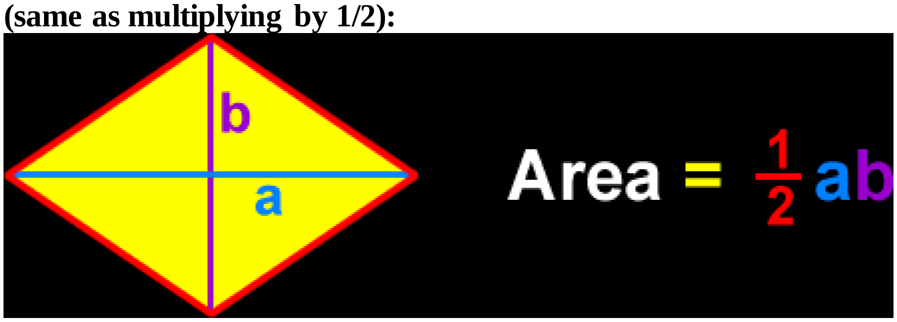
Practice Problem

3. **Find the area of the rectangle. Show your work.**



The area of a rhombus:

To find the area of a rhombus, multiply the lengths of the two diagonals and divide by 2 (same as multiplying by 1/2):



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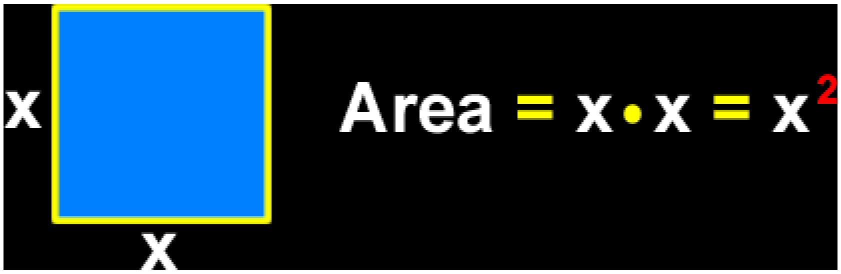
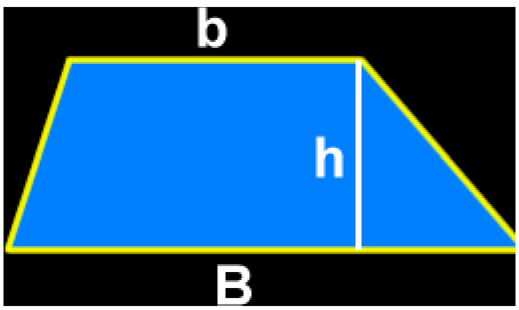
The area of a square:

To find the area of a square, multiply the lengths of two sides together



The area of a trapezoid:



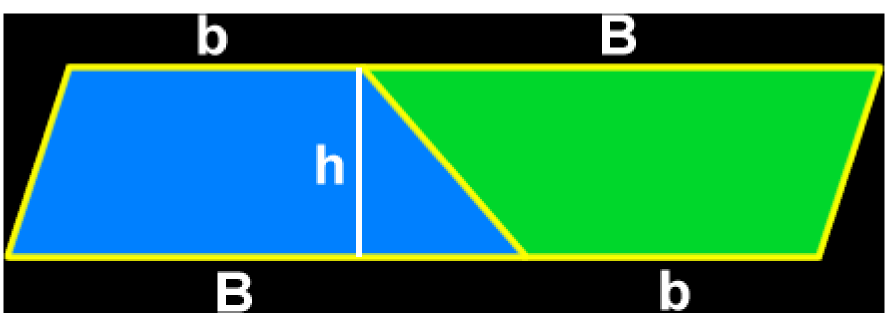
To find the area of a trapezoid... The longer base (the bottom) is big B and the smaller base (the top) is little b...

$$\text{Area} = \frac{1}{2}h(B+b)$$

Take two copies of the trapezoid (one blue trapezoid and one green trapezoid)... Tip one upside down and stick them together... Now, you've got a parallelogram.

Area of a parallelogram = base x height
= (B + b) x h

But, this is double of what we need... So, multiply by 1/2!



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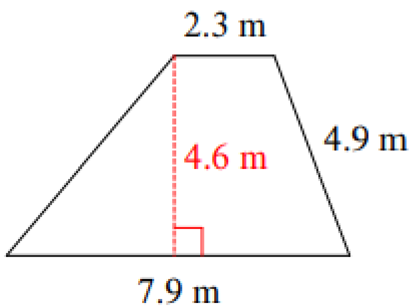
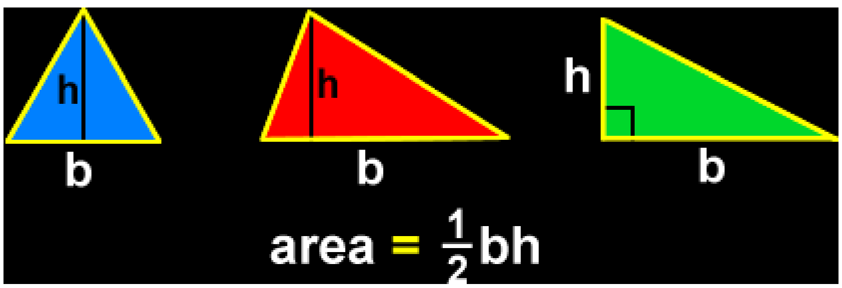
Do your work in the packet, or write out the answers in your notebook labeled: Lesson 2, pg. 12:

4. **Find the area of the trapezoid. Show your work.**

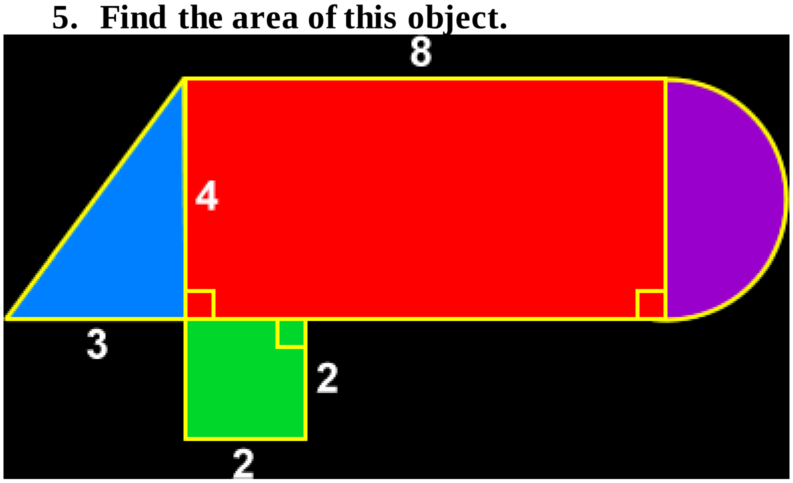


The area of Triangles:



Do your work in the packet, or write out the answers in your notebook labeled: Lesson 2, pg. 12:

5. **Find the area of this object.**



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Critical Thinking Questions

Sketch your answer here, or sketch the answers in your notebook labeled: Lesson 2, pg. 13:

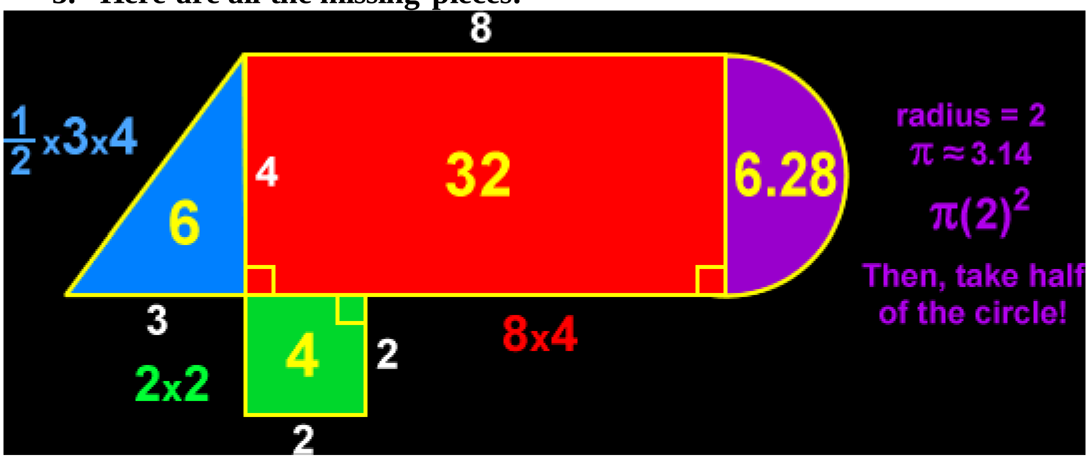
6. **Sketch and label a trapezoid that has an area of 100 cm^2**

7. **Change one number in the diagram you drew for the last question so that the area is now 200 cm^2**

Answers to Lesson 2:

1. **615.8 km^2**
2. **45.6 m^2**
3. **1.96 ft^2**
4. **23.46 m^2**

5. **Here are all the missing pieces:**



Now, add them all up!
6 + 4 + 32 + 6.28 = 48.28

6. **Many answers**
7. **Double the height**

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Wednesday, April 1

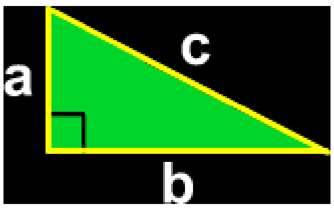
Objective: Be able to do this by the end of this lesson.

1. Use the Pythagorean Theorem to find missing lengths of right triangles

Lesson 3: Review of the Pythagorean Theorem

This lesson is a review. All of the practice problems are here to refresh your memory and shake some of the dust off.

The Pythagorean Theorem:



This formula is for right triangles only!
The sides, a and b, of a right triangle are called the legs, and the side that is opposite to the right (90 degree) angle, c, is called the hypotenuse. This formula will help you find the length of either a, b or c, if you are given the lengths of the other two.

$$a^2 + b^2 = c^2$$

Do your work in the packet, or write out the answers in your notebook labeled: Lesson 3, pg. 14:

Euclid Review:

1. **Draw out the diagram for Book I. Proposition 47 from memory. Hint: this is the mural in the downstairs hallway next to Mr. Austin's room.**

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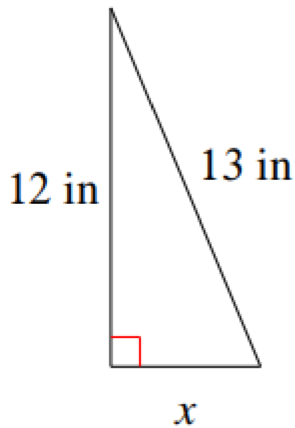
Do your work in the packet, or write out the answers in your notebook labeled: Lesson 3, pg. 15:

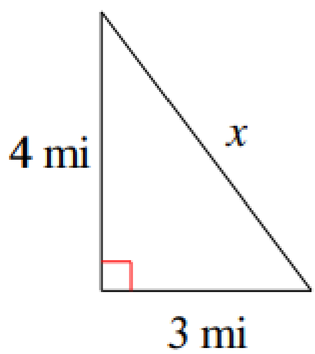
Practice Problems:

Find the missing side of each triangle. Round your answers to the nearest tenth if necessary. Show your work.

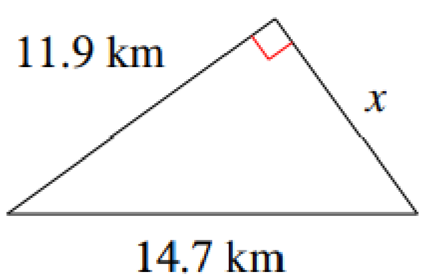
1.



2.



3.



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Do your work in the packet, or write out the answers in your notebook labeled: Lesson 3, pg. 16:

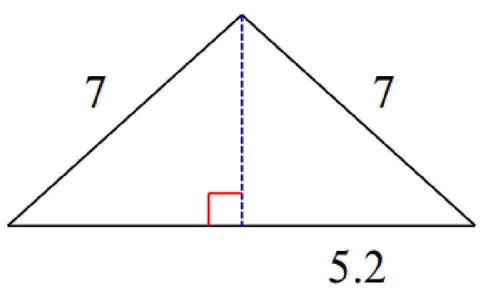
State if the three sides lengths form a right triangle. Show your work.

4. 10 cm, 49.5 cm, 50.5 cm

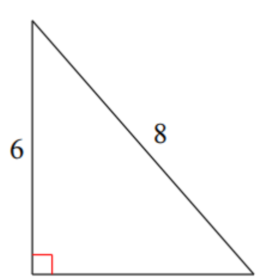
5. 9 in, 12 in, 15 in

Find the area of each triangle. Round intermediate values to the nearest tenth. Use the rounded values to calculate the next value. Round your final answer to the nearest tenth. Show your work.

6.



7.



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Answers to Lesson 3

1. 5 in
2. 5 mi
3. 8.6 in
4. Yes
5. Yes
6. 24.4
7. 15.9

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Thursday, April 2

Objective: Be able to do this by the end of this lesson.

1. Name Polygons
2. Calculate interior angles sums

Lesson 4: POLYGONS

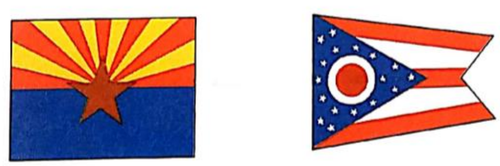
The word **polygon** means ''many angles.'' Look at the figures at the left below and note that each polygon is formed by coplanar segments (called *sides*) such that:

(1) Each segment intersects exactly two other segments, one at each endpoint.

(2) No two segments with a common endpoint are collinear.

Can you explain why each of the figures at the right above is *not* a polygon?

A **convex polygon** is a polygon such that no line containing a side of the polygon contains a point in the interior of the polygon. The outline of the state flag of Arizona, shown at the left below, is a convex polygon. At the right below is the state flag of Ohio, whose outline is a nonconvex polygon.



When we refer to a polygon in this book we will mean a convex polygon.

Polygons are classified according to the number of sides they have. Listed below are some of the special names for polygons you will see in this book.

Number of Sides	*Name*
3	triangle
4	quadrilateral
5	pentagon
6	hexagon
8	octagon
10	decagon
n	n-gon

A triangle is the simplest polygon. The terms that we applied to triangles (such as *vertex* and *exterior angle*) also apply to other polygons.

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Do your work in the packet, or write out the answers in your notebook labeled: Lesson 4, pg. 19:

Practice Problems:

1. Draw a triangle

2. Draw a Convex Quadrilateral

3. Draw a nonconvex Quadrilateral.

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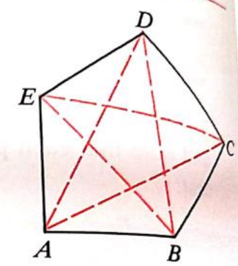
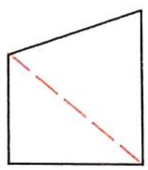
When referring to a polygon, we list its consecutive vertices in order. Pentagon *ABCDE* and pentagon *BAEDC* are two of the many correct names for the polygon shown at the right.

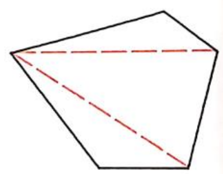


A segment joining two nonconsecutive vertices is a **diagonal** of the polygon. The diagonals of the pentagon at the right are indicated by dashes.

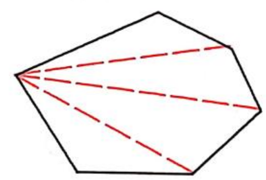
To find the sum of the measures of the angles of a polygon draw all the diagonals from just *one* vertex of the polygon to divide the polygon into triangles.



4 sides, 2 triangles
Angle sum = 2(180)



5 sides, 3 triangles
Angle sum = 3(180)



6 sides, 4 triangles
Angle sum = 4(180)

Note that the number of triangles formed in each polygon is two less than the number of sides. This result suggests the following theorem.

Theorem 3-13

The sum of the measures of the angles of a convex polygon with n sides is $(n - 2)180$.

Since the sum of the measures of the *interior* angles of a polygon depends on the number of sides, n, of the polygon, you would think that the same is true for the sum of the exterior angles. This is *not* true, as Theorem 3-14 reveals. The experiment suggested in Exercise 7 should help convince you of the truth of Theorem 3-14.

Theorem 3-14

The sum of the measures of the exterior angles of any convex polygon, one angle at each vertex, is 360.

Example 1 A polygon has 32 sides. Find (a) the sum of the measures of the interior angles and (b) the sum of the measures of the exterior angles, one angle at each vertex.

Solution (a) Interior angle sum = $(32 - 2)180 = 5400$ (Theorem 3-13)
(b) Exterior angle sum = 360 (Theorem 3-14)

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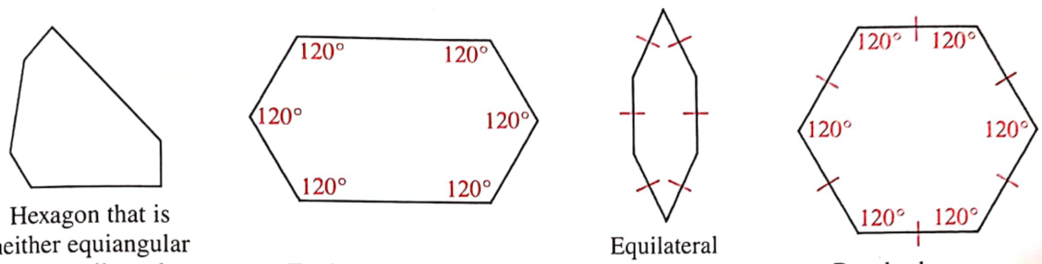
Polygons can be equiangular or equilateral. If a polygon is both equiangular and equilateral, it is called a **regular polygon.**



Hexagon that is neither equiangular nor equilateral

Equiangular hexagon

Equilateral hexagon

Regular hexagon

Example 2 A regular polygon has 12 sides. Find the measure of each interior angle.

Solution 1 Interior angle sum = (12 − 2)180 = 1800
Each of the 12 congruent interior angles has measure 1800 ÷ 12, or 150.

Solution 2 Each exterior angle has measure 360 ÷ 12, or 30.
Each interior angle has measure 180 − 30, or 150.

Do your work in the packet, or write out the answers in your notebook labeled: Lesson 4, pg. 21:

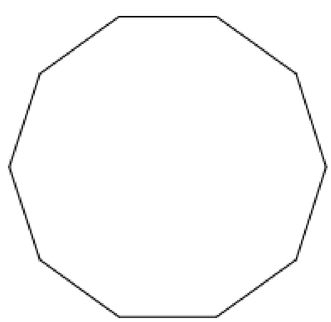
Practice Problems:

- Write the name of each polygon.
- Calculate the sum of its interior angles.
- Show your work

4. Name: _____________

Sum of the interior

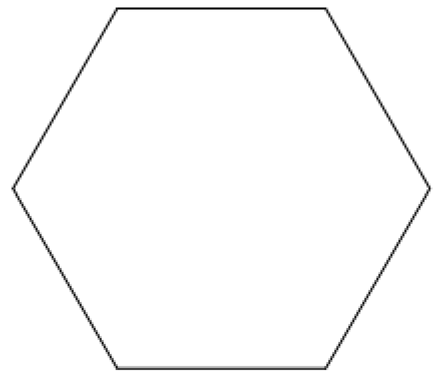
angles: ____________



5. Name: _____________

   Sum of the interior

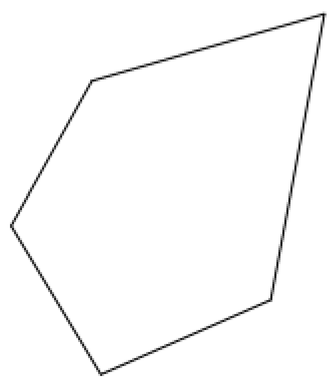
   angles: ____________



6. Name: _____________

   Sum of the interior

   angles: ____________



Answers for Lesson 4

4. Name: Decagon
   Sum of Interior Angles: 1440 degrees

5. Name: hexagon
   Sum of Interior Angles: 720 degrees

6. Name: Pentagon
   Sum of Interior Angles: 540

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Friday, April 3

Objective: Be able to do this by the end of this lesson.

1. Name Polygons
2. Calculate interior angles sums

Lesson 5: POLYGONS practice

Do the odd numbered exercises in your notebook. Show your work. Title your work **Lesson 5, pg. 23:**

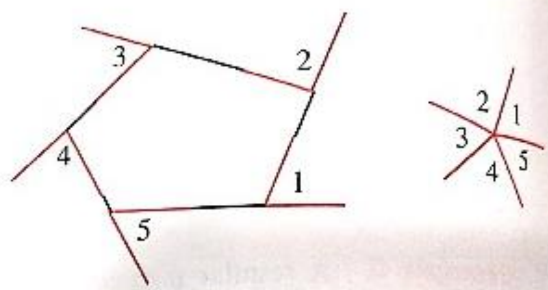
Make sure to do number 7! It should be fun! Use the notes from Lesson 4 if you get confused.

Written Exercises

For each polygon, find (a) the interior angle sum and (b) the exterior angle sum.

A

1. Quadrilateral
2. Pentagon
3. Hexagon
4. Octagon
5. Decagon
6. n-gon
7. Draw a pentagon with one exterior angle at each vertex. Cut out the exterior angles and arrange them so that they all have a common vertex, as shown at the far right. What is the sum of the measures of the exterior angles? Repeat the experiment with a hexagon. Do your results support Theorem 3-14?



8. Complete the table for regular polygons.

Number of sides	9	15	30	?	?	?	?
Measure of each ext. ∠	?	?	?	6	8	?	?
Measure of each int. ∠	?	?	?	?	?	165	178

9. A baseball diamond's home plate has three right angles. The other two angles are congruent. Find their measure.

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Do the odd numbered exercises in your notebook. Show your work. Title your work: **Lesson 5, pg. 23:**

10. Four of the angles of a pentagon have measures 40, 80, 115, and 165. Find the measure of the fifth angle.

11. The face of a honeycomb consists of interlocking regular hexagons. What is the measure of each angle of these hexagons?

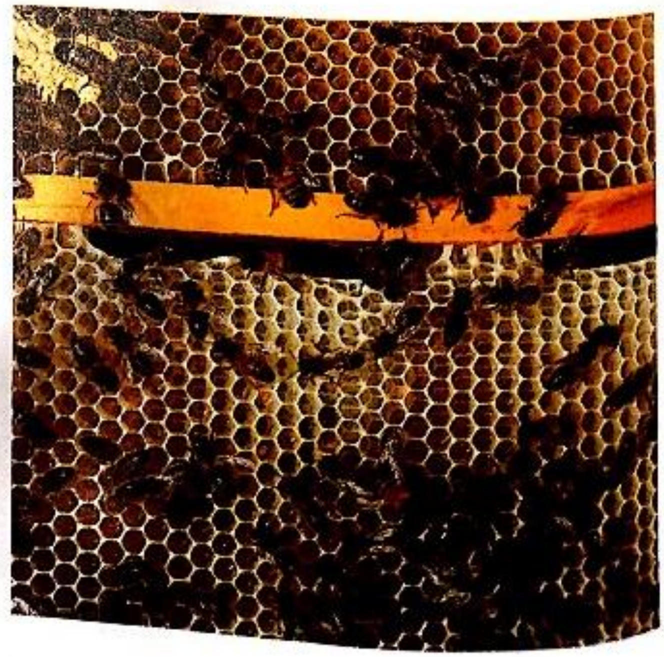
Sketch the polygon described. If no such polygon exists, write *not possible*.

12. A quadrilateral that is equiangular but not equilateral

13. A quadrilateral that is equilateral but not equiangular

14. A regular pentagon, one of whose angles has measure 120

15. A regular polygon, one of whose angles has measure 130



Answers to Lesson 5

1. 360; 360
3. 720; 360
5. 1440; 360
7. 360; yes
9. 135
11. 120
13. Many answers
15. Not possible

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Afterward

As I was thinking about all of you, I remembered a passage from The Voyage of the Dawn Treader by C. S. Lewis that Mrs. Williams quotes at times and I wanted to share it with you:

"Lucy looked along the beam and presently saw something in it. At first it looked like a cross, then it looked like an aeroplane, then it looked like a kite, and at last with a whirring of wings it was right overhead and was an albatross. It circled three times round the mast and then perched for an instant on the crest of the gilded dragon at the prow. It called out in a strong sweet voice what seemed to be words though no one understood them. After that it spread its wings, rose, and began to fly slowly ahead, bearing a little to starboard. Drinian steered after it not doubting that it offered good guidance. But no one except Lucy knew that as it circled the mast it had whispered to her, "Courage, dear heart," and the voice, she felt sure, was Aslan's, and with the voice a delicious smell breathed in her face.

In a few moments the darkness turned into a greyness ahead, and then, almost before they dared to begin hoping, they had shot out into the sunlight and were in the warm, blue world again. And all at once everybody realized that there was nothing to be afraid of and never had been. They blinked their eyes and looked about them. The brightness of the ship herself astonished them: they had half expected to find that the darkness would cling to the white and the green and the gold in the form of some grime or scum. And then first one, and then another, began laughing."

Courage dear hearts! All of you are in our thoughts and prayers.

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