GreatHearts®

Euclidean Geometry

April 14 – April 17

Time Allotment: 40 minutes per day

Student Name: ________________________________

Teacher Name: ________________________________

Euclidean Geometry
April 14 – April 17

Packet Overview

Date	Objective(s)	Page Number
Monday, April 6	1. Identify the parts of prisms	2
Tuesday, April 7	1. Calculate the lateral area, and surface area of pyramids	4
Wednesday, April 8	1. Calculate the volume of a pyramid	6
Thursday, April 9	1. Minor assessment on pyramids	8

Additional Notes: Hello students!,

This week we will be working with Pyramids!!!

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

Do all of your work on sheet of notebook paper. You can keep your packet, but you will need to turn in the work you do on a piece of notebook paper.
Mr. Bernstein will have office hours at the following times

- 1st Period 10:00-10:50am Mondays & Wednesdays
- 5th Period 11:00- 11:50 am Tuesdays & Thursdays

Miss McCafferty will hold office hours at the following times:

- 1st Period 10:00-10:50 am Mondays & Wednesdays
- 3rd Period 1:00- 1:50 pm Mondays & Wednesdays
- 4th Period 10:00-10:50 am Tuesdays & Thursdays
- 6th Period 1:00- 1:50 pm Tuesdays & Thursdays

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:

____

Euclidean Geometry
April 14 – April 17

Tuesday, April 14

Geometry Unit: 3-D Figures
Lesson 1: Pyramids

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

1. Identify the parts of pyramids

Lesson 1

Hello! Today we are starting with PYRAMIDS.
Not all pyramids look like this:

Pyramids can be constructed with any shaped base!

NOTES

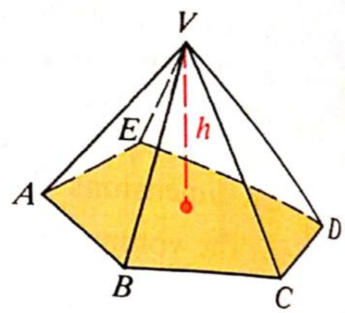
12-2 *Pyramids*

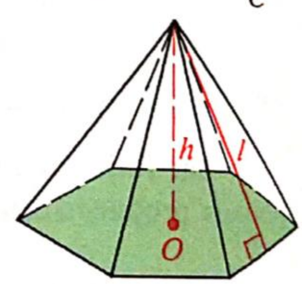
The diagram shows the pentagonal **pyramid** $V\text{-}ABCDE$. Point V is the **vertex** of the pyramid and pentagon $ABCDE$ is the **base.** The segment from the vertex perpendicular to the base is the **altitude** and its length is the *height*, h, of the pyramid.

The five triangular faces with V in common, such as $\triangle VAB$, are **lateral faces.** These faces intersect in segments called **lateral edges.**

Most of the pyramids you'll study will be **regular pyramids.** These are pyramids with the following properties:

(1) The base is a regular polygon.
(2) All lateral edges are congruent.
(3) All lateral faces are congruent isosceles triangles. The height of a lateral face is called the **slant height** of the pyramid. It is denoted by l.
(4) The altitude meets the base at its center, O.





Regular hexagonal pyramid

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Write your answer on a separate sheet of paper titled: "April 14, Lesson 1, pg. 3"

1. **What is the vertex of a pyramid? (Answer in a complete sentence.)**

2. **The perpendicular line segment from the vertex to the base is called the**

   __________?______________.

3. **The length of the altitude is the ________?_____________ of the pyramid.**

4. **Which type of rectilinear figure makes up the lateral faces of a pyramid?**

5. **What is a lateral edge? (answer in a complete sentence)**

6. **List the four properties of a regular pyramid.**

7. **What is slant height? (Use the notes on page 2. Answer in a complete sentence)**

8. **What is an isosceles triangle? (think back to the Euclidean Pillars or use your definitions from Book I of Euclid's Elements)**

9. **What is the Pythagorean Therem?**

Wednesday, April 15

Geometry Unit: 3-D Figures
Lesson 2: Pyramids

Objective: Be able to do this by the end of this lesson:
Calculate the lateral area of a Pyramid

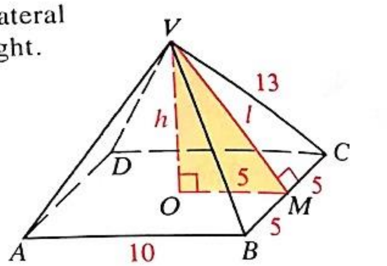
NOTES

Example 1 A regular square pyramid has base edges 10 and lateral edges 13. Find **(a)** its slant height and **(b)** its height.

Solution Use the Pythagorean Theorem.

a. In rt. $\triangle VMC$,
$$l = \sqrt{13^2 - 5^2} = 12.$$

b. In rt. $\triangle VOM$,
$$h = \sqrt{12^2 - 5^2} = \sqrt{119}.$$



Notice in the above example that we need to use TWO different right triangles: VMC & VMO

Remember the HYPOTENUSE is the side that SUBTENDS the right angle.

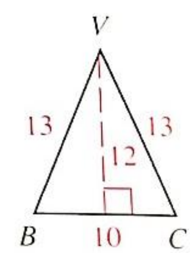
The Pythagorean Theorem is $a^2 + b^2 = c^2$ *a= leg* *b = leg* *c= hypotenuse*

Example 2 Find the lateral area of the pyramid in Example 1.

Solution The four lateral faces are congruent.

area of $\triangle VBC = \frac{1}{2} \cdot 10 \cdot 12 = 60$

lateral area = area of 4 lateral faces
$= 4 \cdot$ area of $\triangle VBC$
$= 4 \cdot 60 = 240$



Example 2 illustrates a simple method for finding the lateral area of a regular pyramid. It is Method 1, summarized below.

To find the lateral area of a **regular** pyramid with n lateral faces:

Method 1 Find the area of one lateral face and multiply by n.

Method 2 Use the formula L.A. $= \frac{1}{2}pl$, stated as the next theorem.

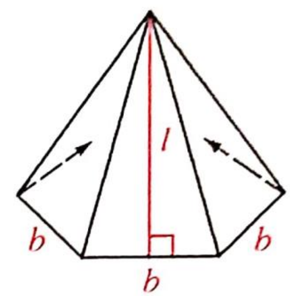
Theorem 12-3

The lateral area of a regular pyramid equals half the perimeter of the base times the slant height. (L.A. $= \frac{1}{2}pl$)

This formula is developed using Method 1 on the previous page. The area of one lateral face is $\frac{1}{2}bl$. Then:

$$\text{L.A.} = (\tfrac{1}{2}bl)n = \tfrac{1}{2}(nb)l$$

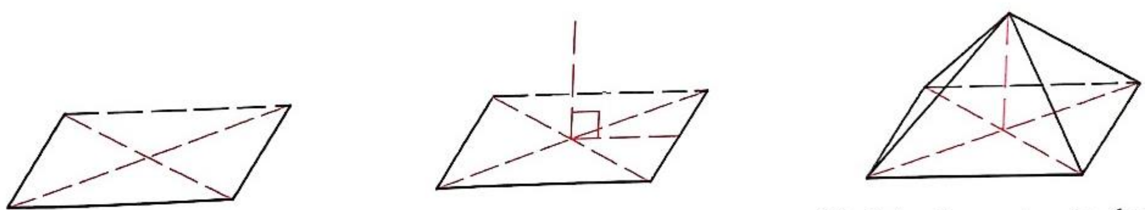
Since $nb = p$, $\quad \text{L.A.} = \frac{1}{2}pl$



b = the length of one side of the base
n = the number of sides of the base
l = slant height
p = perimeter

Do the odd numbered problems below title your page : "April 15, Lesson 2, pg. 5"
Write your answers on a separate sheet of paper and show your work

You can use the following three steps to sketch a square pyramid.



(1) Draw a parallelogram for the base and sketch the diagonals.
(2) Draw a vertical segment at the point where the diagonals intersect.
(3) Join the vertex to the base vertices.

Sketch each pyramid, as shown above. Then find its lateral area.

7. A regular triangular pyramid with base edge 4 and slant height 6
8. A regular pentagonal pyramid with base edge 1.5 and slant height 9
9. A regular square pyramid with base edge 12 and lateral edge 10
10. A regular hexagonal pyramid with base edge 10 and lateral edge 13

Answer Key for pg. 5

7. 36
9. 192

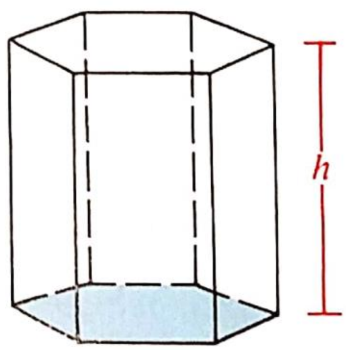
Thursday, April 16

Geometry Unit: 3-D Figures
Lesson 3: Pyramids

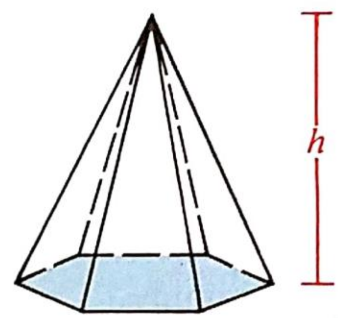
Objective: Be able to do this by the end of this lesson.
Calculate the volume of a pyramid

NOTES

The prism and pyramid below have congruent bases and equal heights. Since the volume of the prism is Bh, the volume of the pyramid must be less than Bh. In fact, it is exactly $\frac{1}{3}Bh$. This result is stated as Theorem 12-4. Although no proof will be given, Classroom Exercise 1 and the Computer Key-In on pages 488–489 help justify the formula.



$V = Bh$



$V = \frac{1}{3}Bh$

Theorem 12-4

The volume of a pyramid equals one third the area of the base times the height of the pyramid. ($V = \frac{1}{3}Bh$)

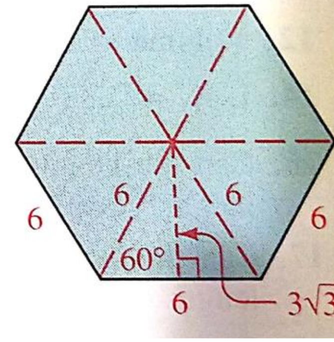
Example 3 Suppose the regular hexagonal pyramid shown at the right above Theorem 12-4 has base edges 6 and height 12. Find its volume.

Solution Find the area of the hexagonal base.

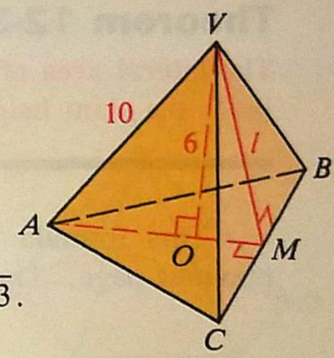
Divide the base into six equilateral triangles.
Find the area of one triangle and multiply by 6.

Base area $= B = 6(\frac{1}{2} \cdot 6 \cdot 3\sqrt{3}) = 54\sqrt{3}$

Then $V = \frac{1}{3}Bh = \frac{1}{3} \cdot 54\sqrt{3} \cdot 12 = 216\sqrt{3}$



Example 4 A regular triangular pyramid has lateral edge 10 and height 6. Find the (**a**) lateral area and (**b**) volume.



Solution **a.** In rt. $\triangle VOA$, $AO = \sqrt{10^2 - 6^2} = \sqrt{64} = 8$.

Since $AO = \frac{2}{3}AM$ (why?), $\frac{2}{3}AM = 8$, $AM = 12$, and $OM = 4$.

$l = \sqrt{6^2 + 4^2} = \sqrt{52} = 2\sqrt{13}$

In 30°-60°-90° $\triangle AMC$, $CM = \frac{12}{\sqrt{3}} = \frac{12\sqrt{3}}{3} = 4\sqrt{3}$.

Base edge $= BC = 2 \cdot 4\sqrt{3} = 8\sqrt{3}$

L.A. $= \frac{1}{2}pl = \frac{1}{2}(3 \cdot 8\sqrt{3}) \cdot 2\sqrt{13} = 24\sqrt{39}$

b. Area of base $= B = \frac{1}{2} \cdot BC \cdot AM = \frac{1}{2} \cdot 8\sqrt{3} \cdot 12 = 48\sqrt{3}$

$V = \frac{1}{3}Bh = \frac{1}{3} \cdot 48\sqrt{3} \cdot 6 = 96\sqrt{3}$

Do the odd problems for #11 - 15.

Write out your answers on a separate sheet of paper titled: **"April 16, Lesson 3, pg. 7"**

For Exercises 11–14 sketch each square pyramid described. Then find its lateral area, total area, and volume.

11. base edge = 6, height = 4

12. base edge = 16, slant height = 10

13. height = 12, slant height = 13

14. base edge = 16, lateral edge = 17

15. A pyramid has a base area of 16 cm² and a volume of 32 cm³. Find its height.

Answer Key

11. 60; 96; 48

13. 260; 360; 400

15. 6 cm

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Friday, April 17

Geometry Unit: 3-D Figures

Lesson 3: Minor assessment on Pyramids

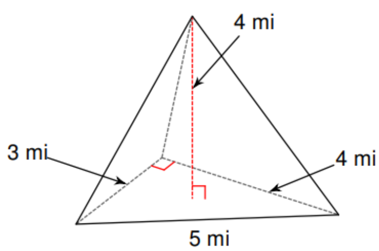
Objective: Be able to do this by the end of this lesson.

1. Take minor assessment

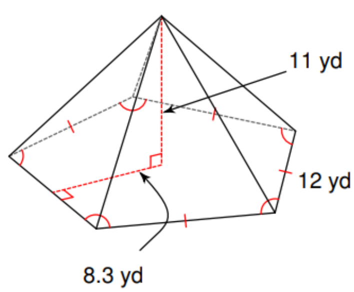
Do your work on a separate sheet of paper titled: "April 17, Minor Assessment, pg. 8"

Find the volume of the figures in 1 & 2. Round your answers to the nearest tenth, if necessary.

1.



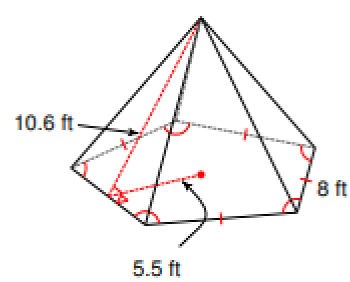
2.



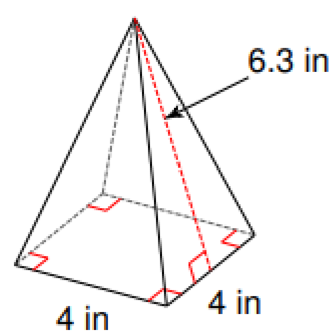
3. A square pyramid measuring 10 yd along each edge of the base has a height of 6 yd. Draw the pyramid and calculate its volume.

Find the lateral area and surface area of figures 4 & 5. Round your answers to the nearest tenth, if necessary

4.



5.



6. A pyramid with slant height 6.8 mi whose triangular base measures 11 mi on each side. Each altitude of the base measures 9.5 mi. Draw the pyramid and calculate its lateral area and surface area.