NAME Student
Adv Geo – 7

AMDG

9.8: The Pythagorean Theorem and Space Figures

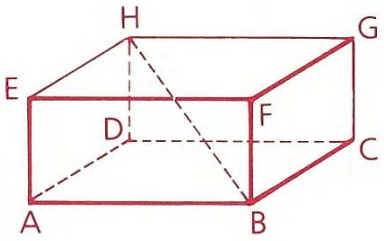
Ms. Kresovic
W 19 Mar 14

Objective

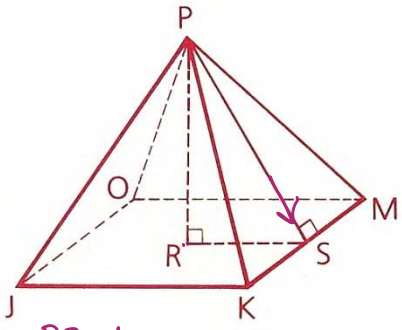
After studying this section, you will be able to

- Apply the Pythagorean Theorem to solid figures

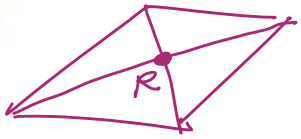
Part One: Introduction



Rectangular Solid



PRalt
Regular Square Pyramid



Many of the problems in this section will involve the two figures shown above.

In the rectangular solid:

ABFE is one of the 6 rectangular ***faces*** flat side

$\overline{AB}$ is one of the 12 ***edges*** lines

$\overline{HB}$ is one of the 4 ***diagonals*** of the solid. (The others are $\overline{AG}$, $\overline{CE}$, and $\overline{DF}$.)

In the regular square pyramid:

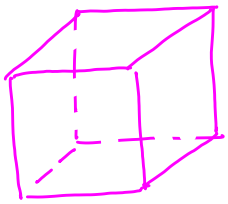
JKMO is a square, and it is called the ***base***

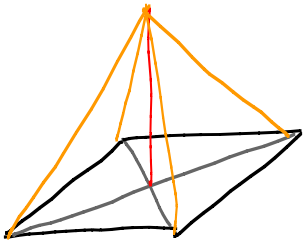
P is the ***vertex***

$\overline{PR}$ is the ***altitude*** of the pyramid and is perpendicular to the base at its center. fall straight

$\overline{PS}$ is called a ***slant height*** and is perpendicular to a side of the base. slide

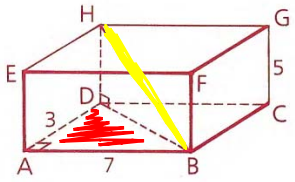
Note A ***cube*** is a rectangular solid in which all edges are congruent.

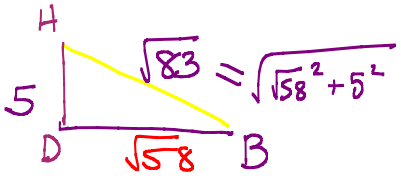




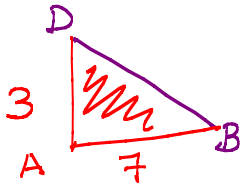
Class Examples

Problem 1 *The dimensions of a rectangular solid are 3, 5, and 7. Find the diagonal.*





Solution It does not matter which edges are given the lengths 3, 5, and 7. Let AD = 3, AB = 7, and HD = 5, and use the Pythagorean Theorem twice.



In △ABD,

$3^2 + 7^2 = (DB)^2$

$9 + 49 = (DB)^2$

$\sqrt{58} = DB$

In △HDB,

$5^2 + (\sqrt{58})^2 = (HB)^2$

$25 + 58 = (HB)^2$

$\sqrt{83} = HB$

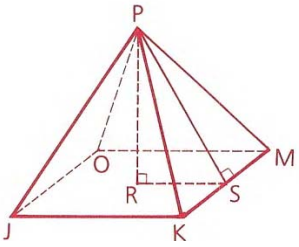
The measure of the diagonal is $\sqrt{83}$.

$\sqrt{3^2 + 7^2} = DB$

$\sqrt{58} = DB$

Problem 2 *Given: The regular square pyramid shown, with altitude* $\overline{PR}$ *and slant height* $\overline{PS}$*, perimeter of* JKMO = 40, PK = 13

Find: **a** JK **b** PS **c** PR



Solution

a $JK = \frac{1}{4}(40) = 10$

b The slant height of the pyramid is the ⊥ bis. of $\overline{MK}$, so PSK is a right △.

$(SK)^2 + (PS)^2 = (PK)^2$

$5^2 + (PS)^2 = 13^2$

$PS = 12$

c The altitude of a regular pyramid is perpendicular to the base at its center. Thus, $RS = \frac{1}{2}(JK) = 5$, and PRS is a right △.

$(RS)^2 + (PR)^2 = (PS)^2$

$5^2 + (PR)^2 = 12^2$

$25 + (PR)^2 = 144$

$PR = \sqrt{119}$

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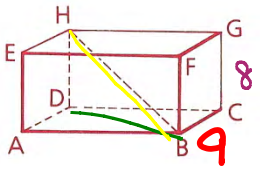
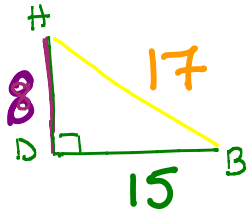
4 Given: The rectangular solid shown,
GC = 8, HG = 12, BC = 9

Find: **a** HB, a diagonal of the solid

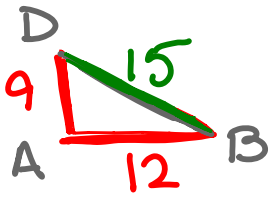
b AG, another diagonal of the solid





$8^2+15^2=17^2$

$64+225=289$

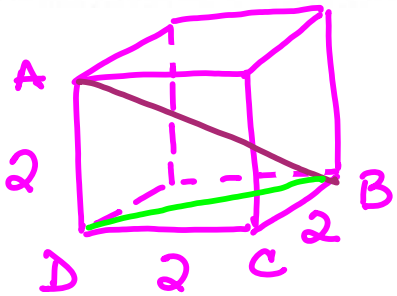


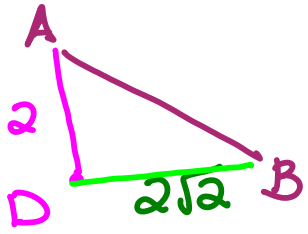
9, 12, DB

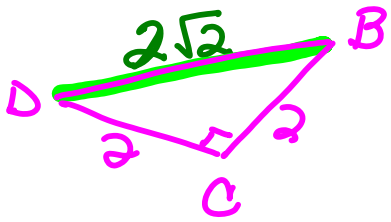
3(3, 4, 5)

HB = AG

15 Find the diagonal of a cube if each edge is 2.







$\sqrt{AD^2+DB^2}=AB$

$\sqrt{2^2+(2\sqrt{2})^2}=$

$\sqrt{4+4\cdot2}=$

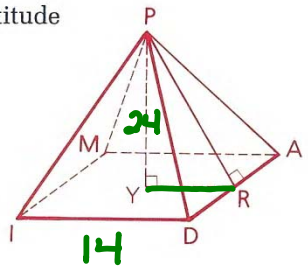
$\sqrt{4+8}$

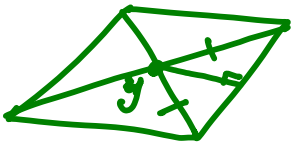
$\sqrt{12}$

$\sqrt{4\cdot3}$

$2\sqrt{3}=AB$

5 Given: The regular square pyramid shown, with altitude $\overline{PY}$ and slant height $\overline{PR}$,
ID = 14, PY = 24



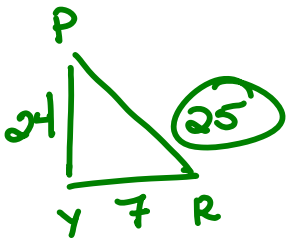


Find: **a** AD

sq base → 4 ≅ sds → AD = 14

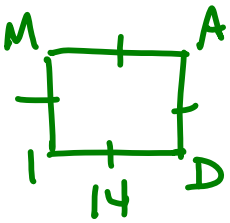
b YR 7

c PR



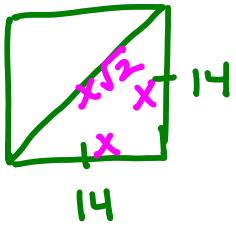
d The perimeter of base AMID

Sum of sides
4s



4(10 + 4) = 40 + 16
= 56

e A diagonal of the base (not shown in the diagram)



$14\sqrt{2}$

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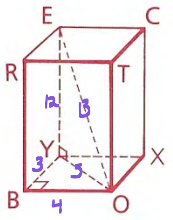
Homework

1 Given: The rectangular solid shown,
BY = 3, OB = 4, EY = 12

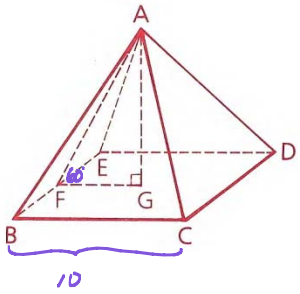
Find: **a** YO, a diagonal of face BOXY 5

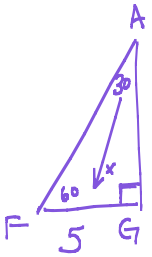
b EO, a diagonal of the solid 13



3 Given: Regular square pyramid ABCDE, with slant height $\overline{AF}$, altitude $\overline{AG}$, and base BCDE;
perimeter of BCDE = 40,
$\angle AFG = 60°$

Find: The altitude and the slant height





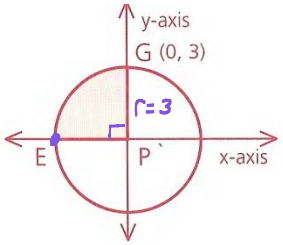
30	60	90
x	$x\sqrt{3}$	2x
5	$5\sqrt{3}$	10
FG	AG	AF
	alt	slant

11 Given: ⊙P as shown

Find: **a** The coordinates of point E (−3, 0)

b The area of sector EPG ~~to the nearest tenth~~

c The length of $\overset{\frown}{GE}$ ~~to the nearest tenth~~



b $A_{sector} = \frac{\angle}{360}(\pi r^2)$

$= \frac{90}{360}(\pi 3^2)$

$= \frac{9}{4}\pi$

c Length Arc $= \frac{\angle}{360}\pi d$

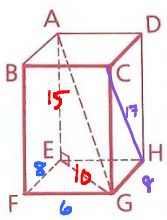
$= \frac{90}{360} 6\pi$

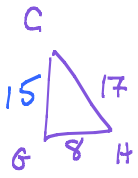
$= \frac{3}{2}\pi$

13 ABCDEFGH is a rectangular solid.

a If face diagonal $\overline{CH}$ measures 17, edge $\overline{GH}$ measures 8, and edge $\overline{FG}$ measures 6, how long is diagonal $\overline{AG}$?

b If diagonal $\overline{AG}$ measures 50, edge $\overline{AE}$ measures 40, and edge $\overline{EF}$ measures 3, how long is edge $\overline{FG}$?





$\Delta EFG = 2(3,4,-)$

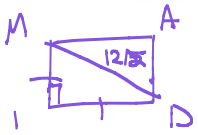
$EG = 10$

$\Delta AEG = 10, 15, AG$

$5(2,3,-) \rightarrow \sqrt{2^2+3^2} = \sqrt{13} \rightarrow AG = 5\sqrt{13}$

14 PADIM is a regular square pyramid. Slant height $\overline{PR}$ measures 10, and the base diagonals measure $12\sqrt{2}$.

a Find ID.

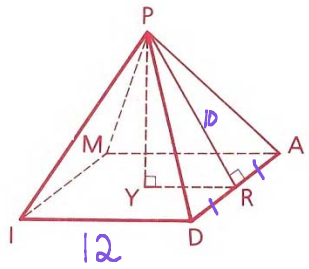


45 45 90

x x x√2

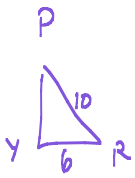
12√2

12



b Find the altitude of the pyramid.

PY = 8



2(3 4 5)

c Find RD.

6

6 10 $PD = 2\sqrt{34}$

d Find PD (length of a lateral edge).

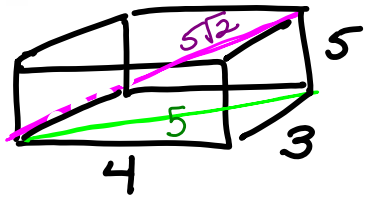
$2(3,5,-)$

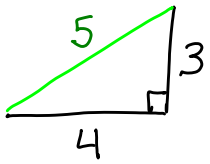
$\sqrt{3^2+5^2}$

$\sqrt{34}$

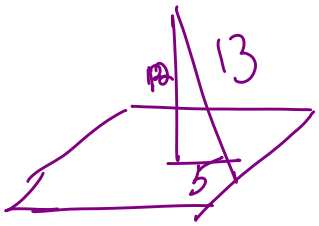
Class Work

2 Find the diagonal of a rectangular solid whose dimensions are 3, 4, and 5.

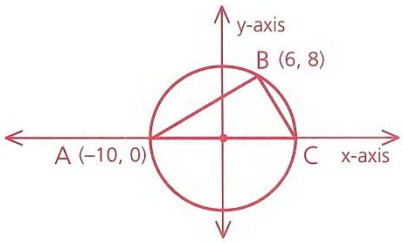




6 Find the slant height of a regular square pyramid if the altitude is 12 and one of the sides of the square base is 10.



12 Given: Diagram as marked
Find: AB (the length of $\overline{AB}$)



$$AB = \sqrt{\Delta x^2 + \Delta y^2}$$

$$\sqrt{(-10-6)^2 + (0-8)^2}$$

$$\sqrt{(-16)^2 + (-8)^2}$$

$$\sqrt{16^2 + 8^2}$$

$8(1, 2, \_\_)$

$$8\sqrt{1^2+2^2}$$

$$\boxed{8\sqrt{5}}$$