Name:_____ **Unit 3 Study Guide** Date:_____

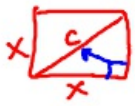
A. Pythagorean Theorem

a. Write the Formula for each version of the Pythagorean Theorem:

Pythagorean Theorem: $a^2+b^2=c^2$

Area of a square on the side of a right Triangle: AREA A + AREA B = AREA C

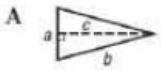
2D Pythagorean Theorem: $a^2+b^2=c^2$, $x^2+x^2=c^2$, $2x^2=c^2$

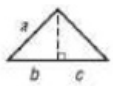


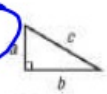
3D Pythagorean Theorem: $a^2+b^2+c^2=d^2$

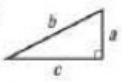
Recognizing the Pythagorean Theorem: EXPLAIN WHY you chose your answer

. Which triangle has sides a, b, and c so that the relationship $a^2 + b^2 = c^2$ is true?

A 

C 

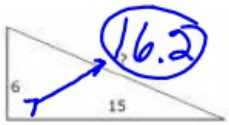
B 

D 

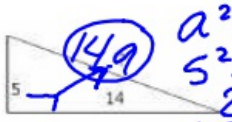
B is the only ANSWER that correctly identifies the hypotenuse as "c"

b. Find the length of the Hypotenuse.

1. $a^2+b^2=c^2$, $6^2+15^2=c^2$, $261=c^2$, $\sqrt{261}=\sqrt{c^2}$, $16.2\approx c$

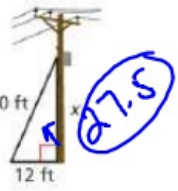


2. $a^2+b^2=c^2$, $5^2+14^2=c^2$, $221=c^2$, $\sqrt{221}=\sqrt{c^2}$, $14.9\approx c$

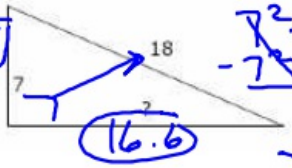


c. Find the length of the leg

1. $a^2+b^2=c^2$, $12^2+b^2=30^2$, $-12^2 \quad -12^2$, $b^2=756$, $\sqrt{b^2}=\sqrt{756}$, $b\approx 27.5$

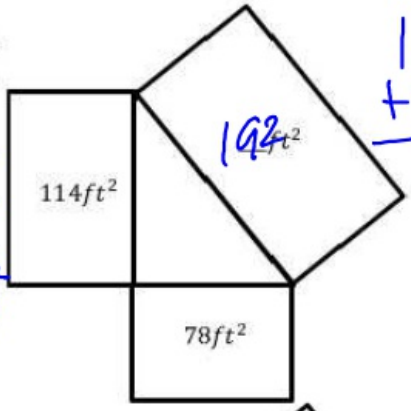


2. $a^2+b^2=c^2$, $7^2+b^2=18^2$, $-7^2 \quad -7^2$, $b^2=275$, $\sqrt{b^2}=\sqrt{275}$, $b\approx 16.6$



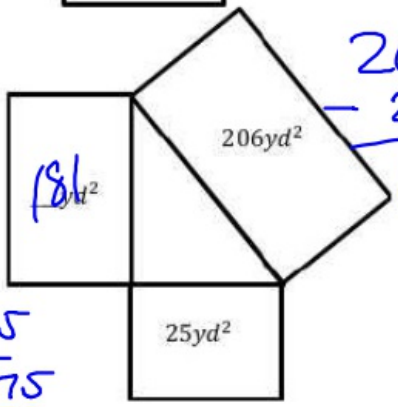
d. Find the area of the squares:

1.



114 + 78 = 192

2.



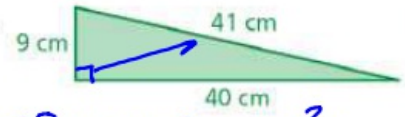
206 − 25 = 181

e. Given three lengths determine if the sides create a right triangle. 9, 41, 40

Does $A^2+B^2=C^2$?

Tell whether the given triangle is a right triangle.

a.

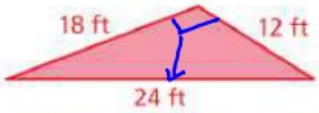


$9^2+40^2=41^2$

$1681=1681$

Yes

b.



$12^2+18^2=24^2$

$468=576$

NO

f. Word problems

1. **SCUBA DIVING** A scuba diver dove 14 feet below the surface. Then, he swam 16 feet toward a coral formation. How far is the diver from his boat?

The diver's distance from the boat is the hypotenuse of a right triangle. Write and solve an equation for x.

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

$14^2+16^2=c^2$

$452=c^2$

$\sqrt{452}=\sqrt{c^2}$

$21.3\approx c$

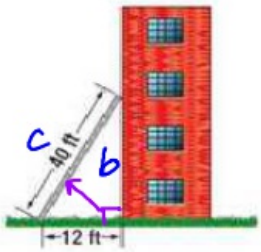
The diver is 21.3 feet from his boat.

2. A painter leans a ladder against the side of a building. How far from the bottom of the building is the top of the ladder?

hypotenuse

F 38.2 ft H 21.8 ft

G 28.0 ft J 20.0 ft



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

$12^2+b^2=40^2$

$-12^2 \quad -12^2$

$b^2=1456$

$\sqrt{b^2}=\sqrt{1456}$

$b\approx 38.2$

3. **MEASUREMENT** A barn door is 10 feet wide and 15 feet tall. A square plank 16 feet on each side must be taken through the doorway. Can the plank fit through the doorway? Justify your answer.

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

$10^2+15^2=c^2$

$325=c^2$

$\sqrt{325}=\sqrt{c^2}$

$18.02\approx c$

18.02

-16.00

2.02

Positive Answer –

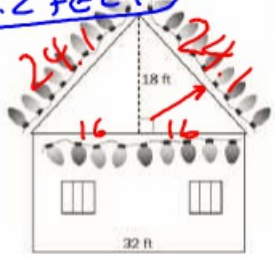
The plank will fit through the door.

4. Jenna wants to string outdoor lights on her house along the roof line and horizontally across the eaves, connecting the ends of the roof line to create a triangle.

What is the approximate total length, in feet, of lights that she needs to create one triangle?

She needs 80.2 feet

24.1
+ 24.1
+ 16.0
+ 16.0
80.2



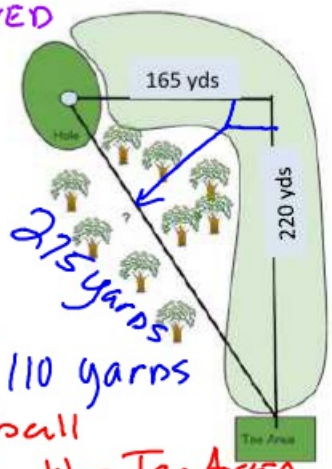
$a^2+b^2=c^2$
$16^2+18^2=c^2$
$580=c^2$
$\sqrt{580}=\sqrt{c^2}$
$24.1\approx c$

Total Distance
− hypotenuse
Distance Saved

Subtraction

5. How much distance would the golfer **SAVE** if he could drive the ball in a straight line from the Tee Area to the Hole? (Hypotenuse)

220
+165
385
− 275
110



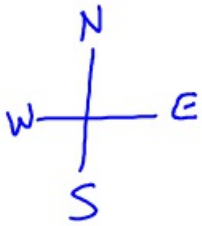
$a^2+b^2=c^2$
$220^2+165^2=c^2$
$75{,}625=c^2$
$\sqrt{75625}=\sqrt{c^2}$
$275=c$

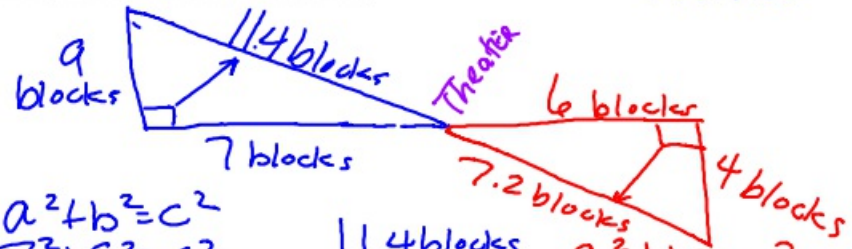
The golfer would save 110 yards hitting the ball Straight from the Tee Area to the hole

6. After watching a movie, Sam and Daisy ride their bikes home from the theater. Sam rides his bike 7 blocks West then turns and rides 9 blocks North to his house. Daisy rides her bike 6 blocks East then turns and rides 4 blocks South to her house. How far apart do Sam and Daisy live?

Round your answer to the nearest tenth

Addition





$a^2+b^2=c^2$
$7^2+9^2=c^2$
$130=c^2$
$\sqrt{130}=\sqrt{c^2}$
$11.4\approx c$

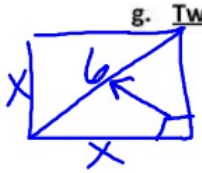
11.4 blocks
+7.2 blocks
18.6 blocks

$a^2+b^2=c^2$
$6^2+4^2=c^2$
$52=c^2$
$\sqrt{52}=\sqrt{c^2}$
$7.2\approx c$

Sam and Daisy live 18.6 blocks Apart.

① Square the hypotenuse
② Divide both sides by 2
③ Take the square root (√)

g. Two Dimensional Pythagorean Theorem $(2x^2 = c^2)$



1. The length of the diagonal of a square rug is 6 feet. What is the approximate measurement of the sides of the rug?

$2x^2 = c^2$
$2x^2 = 6^2$
$\frac{2x^2}{2} = \frac{36}{2}$
$x^2 = 18$

$\sqrt{x^2} = \sqrt{18}$
$x \approx 4.2$

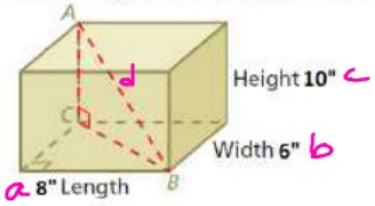
2. The length of the diagonal of a square rug is 5 feet. What is the approximate measurement of the sides of the rug?

$2x^2 = c^2$
$2x^2 = 5^2$
$\frac{2x^2}{2} = \frac{25}{2}$
$x^2 = 12.5$

$\sqrt{x^2} = \sqrt{12.5}$
$x \approx 3.5$

h. Three Dimensional Pythagorean Theorem $a^2+b^2+c^2=d^2$

1. Find the length of the diagonal in the Rectangular Prism shown below



$a^2+b^2+c^2=d^2$
$8^2+6^2+10^2=d^2$
$200 = d^2$
$\sqrt{200} = \sqrt{d^2}$
$14.1 \approx d$

2. Garth wants to send his wife a dozen long stemmed red roses for their anniversary. The roses are 19 inches long. The florist says the roses will fit in a box that measures 4*in.* x 8*in.* x 17*in.* Garth thinks the roses will not fit in the box. Who is right? Justify your answer.

$a^2+b^2+c^2=d^2$
$4^2+8^2+17^2=d^2$
$369 = d^2$
$\sqrt{369} = \sqrt{d^2}$
$19.2 \approx d$

Hypotenuse 19.2
− Rose Length − 19.0
? 0.2 → Positive Answer

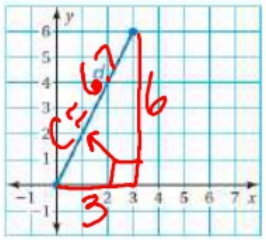
Yes the roses will fit because the diagonal of the box is 0.2 inches longer than the roses.

i. **Distance on the Coordinate plane.**

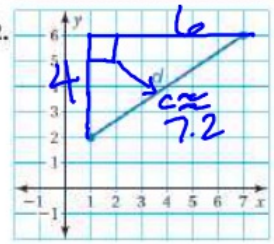
① CREATE A Right triANGLE
② COUNT the lines to get SIDES A & B
③ USE PythagoREAN THEOREM to find the length of the given DIAGONAL LINE.

Find the distance d. Round your answer to the nearest tenth.

1.



2.



Work for # 1

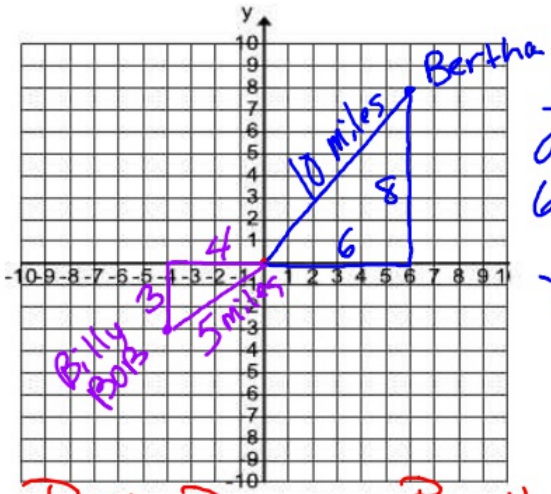
$a^2+b^2=c^2$
$3^2+6^2=c^2$
$45=c^2$
$\sqrt{45}=\sqrt{c^2}$
$6.7\approx c$

Work for # 2

$a^2+b^2=c^2$
$4^2+6^2=c^2$
$52=c^2$
$\sqrt{52}=\sqrt{c^2}$
$7.2\approx c$

3. Billy Bob and Bertha decided to go skydiving on their 24th anniversary. After they jumped from the plane, Billy Bob landed 4 miles west and 3 miles south of the landing target. Bertha landed 8 miles east and 6 miles north of the landing target. If the landing target is the point of origin (0, 0), how far apart are Billy Bob and Bertha after they landed?

Plot Billy Bob and Bertha's location on the coordinate plane to determine how far apart they are.



Show your work here

Bertha

$a^2+b^2=c^2$
$6^2+8^2=c^2$
$100=c^2$
$\sqrt{100}=\sqrt{c^2}$
$10=c$

Billy BOB

$a^2+b^2=c^2$
$3^2+4^2=c^2$
$25=c^2$
$\sqrt{25}=\sqrt{c^2}$
$5=c$

Billy BOB AND Bertha LANDED 15 miles Apart.

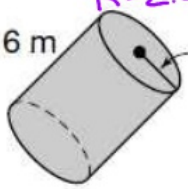
Bertha to Billy BOB
10 miles
+ 5miles
15 miles

B. Volume

a. Cylinder

1. Formula: $V = \pi r^2 h$

2. Find the volume of the cylinder. **Be sure to provide three answers.**



R=2.5 h=6

Terms of π
$V = \pi r^2 h$
$V = \pi(2.5^2)(6)$
$V = 37.5\pi m^3$

Using π button
$V = \pi r^2 h$
$V = \pi(2.5^2)(6)$
$V = 117.8 m^3$

Using 3.14 for π
$V = \pi r^2 h$
$V = (3.14)(2.5^2)(6)$
$V = 117.75 m^3$ or $117.8 m^3$

3. Find the volume of the cylinder. **Be sure to provide three answers.**

D=10 R=5 h=12

Terms of π
$V = \pi r^2 h$
$V = (\pi)(5^2)(12)$
$V = 300\pi cm^3$

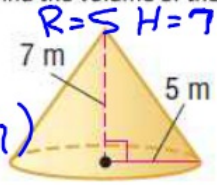
Use π button
$V = \pi r^2 h$
$V = (\pi)(5^2)(12)$
$V = 942.5 cm^3$

Use 3.14 for π
$V = \pi r^2 h$
$V = (3.14)(5^2)(12)$
$V = 942 cm^3$

b. Cone

1. Formula: $V = \frac{1}{3}\pi r^2 h$

2. Find the volume of the cone. **Be sure to provide three answers.**



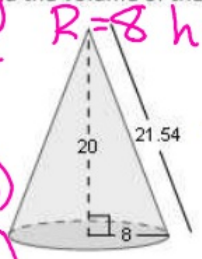
R=5 H=7

Terms of π
$V = \frac{1}{3}\pi r^2 h$
$V = (\frac{1}{3})(\pi)(5^2)(7)$
$V = \frac{175}{3}\pi m^3$ or $V = 58.3\pi cm^3$

Use π Button
$V = \frac{1}{3}\pi r^2 h$
$V = (\frac{1}{3})(\pi)(5^2)(7)$
$V = \frac{175}{3}\pi m^3$
$V = 183.3 m^3$

Use 3.14 for π
$V = \frac{1}{3}\pi r^2 h$
$V = (\frac{1}{3})(3.14)(5^2)(7)$
$V = 183.2 m^3$

3. Find the volume of the cone. **Be sure to provide three answers.**



R=8 h=20

Terms of π
$V = \frac{1}{3}\pi r^2 h$
$V = (\frac{1}{3})(\pi)(8^2)(20)$
$V = \frac{1280}{3}\pi u^3$ or $V = 426.7 u^3$

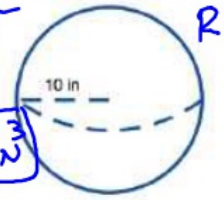
Use π Button
$V = \frac{1}{3}\pi r^2 h$
$V = (\frac{1}{3})(\pi)(8^2)(20)$
$V = \frac{1280\pi}{3} u^3$
$V = 1340.4 u^3$

Use 3.14 for π
$V = \frac{1}{3}\pi r^2 h$
$V = \frac{1}{3}(3.14)(8^2)(20)$
$V = 1339.7 u^3$

c. **Sphere**

1. Formula: $V = \frac{4}{3}\pi r^3$ → Remember to cube the radius INSTEAD of squaring it.

2. Find the volume of the sphere. **Provide three answers.**



TERMS of π

$V = \frac{4}{3}(\pi)(10^3)$

$V = 1333.3\pi\ in^3$

$R = 10$

use π button

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

$V = \frac{4}{3}\pi 10^3$

$V = 4188.8\ in^3$

use 3.14 for π

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

$V = (\frac{4}{3})(3.14)(10^3)$

$V = 4186.7\ in^3$

3. Find the volume of the sphere. **Provide three answers.**

TERMS of π.

~~$D = 8$~~ $R = 4$

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

$V = (\frac{4}{3})(\pi)(4^3)$

$V = \frac{256}{3}\pi\ in^3$

or

$V = 85.3\pi\ in^3$

use π button

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

$V = \frac{4}{3}(\pi)(4^3)$

$V = \frac{256\pi}{3}\ in^3$

$V = 268.1\ in^3$

use 3.14 for π

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

$V = (\frac{4}{3})(3.14)(4^3)$

$V = 267.9\ in^3$

C. Comparing Volumes

1. Find the volumes of Cylinder A and Cylinder B using the π button on the calculator.

Cylinder A

~~$D = 10$~~

$R = 5$

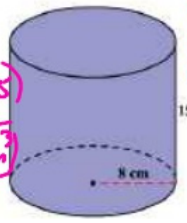
$h = 15$

$V = \pi r^2 h$

$V = (\pi)(5^2)(15)$

$V = 375\pi\ cm^3$

Cylinder B



$R = 8$

$h = 15$

$V = \pi r^2 h$

$V = (\pi)(8^2)(15)$

$V = 960\pi\ cm^3$

a. Which cylinder is larger? Cylinder B

b. Which cylinder is smaller? Cylinder A

c. What is the numerical difference between the two cylinders? Cylinder B holds $585\pi cm^3$ more than Cylinder A

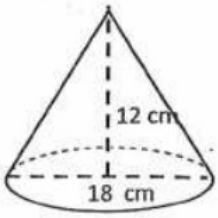
d. If the volume of both cylinders were combined, how much would it measure? $1335\ cm^3$

(c) Cylinder B $960\pi cm^3$ − Cylinder A $375\pi cm^3$ = Difference $585\pi cm^3$

(d) Cylinder B = $960\pi cm^3$ + Cylinder A $375\pi cm^3$ = Combined Total $1335\pi cm^3$

2. What is the volume of the cone?

Radius= 9
Height= 12
Diameter = 18



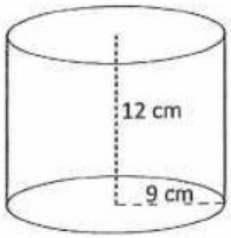
Show work Below:

$V = \frac{1}{3}\pi r^2 h$
$V = \frac{1}{3}\pi (9)^2 (12)$
$V_1 = 324\pi \text{ cm}^3$
$\frac{1}{3}(\pi)(9)^2(12)$ $V_2 = 1017.88 \text{ cm}^3$
$\frac{1}{3}(3.14)(9)^2(12)$ $V_3 = 1017.36 \text{ cm}^3$

In terms of pi $324\pi \text{ cm}^3$
using π on calculator 1017.9 cm^3
substituting 3.14 on calculator 1017.4 cm^3

What is the volume of the cylinder?

Radius= 9
Height= 12
Diameter = 18



Show work below:

$V = \pi r^2 h$
$V = \pi (9)^2 (12)$
$V_1 = 972\pi \text{ cm}^3$
$(\pi)(9)^2(12)$ $V_2 = 3053.6 \text{ cm}^3$
$(3.14)(9)^2(12)$ $V_3 = 3052.08 \text{ cm}^3$

In terms of pi $972\pi \text{ cm}^3$
using π on calculator 3053.6 cm^3
substituting 3.14 on calculator 3052.08 cm^3

a. What is similar between the cone and cylinder above?
They have the same dimensions (Diameter, Radius, Height)

b. Looking at the cylinder and the cone above, how do the measurements of the two compare when looking at the volume?
The volume of the cylinder is 3 times the volume of the cone ($972\pi \div 3 = 324\pi$)

c. How many cones will fill up the cylinder? How do you know?
3 Cones fill 1 Cylinder. $324\pi \times 3 = 972\pi$

D. Finding Height or Radius of Cones, Cylinders, and Spheres

1. Find the height of a cylinder with the volume of 11309.73 and a radius of 15.

$V = \pi r^2 h$

$11309.73 = \pi 15^2 h$

$\frac{11309.73}{\pi 225} = \frac{\pi 225 h}{\pi 225}$

$16 = h$

$h = 16$

2. Find radius of a cylinder with the volume of 3150π and height of 14.

$V = \pi r^2 h$

$\frac{3150\pi}{\pi 14} = \frac{\pi r^2 14}{\pi 14}$

$\sqrt{225} = \sqrt{r^2}$

$15 = r$

$R = 15$

3. Find the height of a cone with the volume of 565.49 and a radius of 6.

$V = \frac{1}{3}\pi r^2 h$

$565.49 = \frac{1}{3}\pi (6)^2 h$

$\frac{565.49}{12\pi} = \frac{12\pi h}{12\pi}$

$15 = h$

$h = 15$

4. Find the radius of a cone with the volume of 8143 and height of 24.

$V = \frac{1}{3}\pi r^2 h$

$8143 = \frac{1}{3}\pi r^2 24$

$\frac{8143}{8\pi} = \frac{8\pi r^2}{8\pi}$

$\sqrt{324} = \sqrt{r^2}$

$18 = r$

5. Find the radius of a sphere with a volume of $\frac{256}{3}\pi$. $\rightarrow 268.1$

$\frac{4}{3}\pi = 4.2$

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

$\frac{256}{3}\pi = \frac{4}{3}\pi r^3$

$\frac{\frac{256}{3}\pi}{\frac{4}{3}\pi} = \frac{\frac{4}{3}\pi r^3}{\frac{4}{3}\pi}$

$64 = r^3$

$\sqrt[3]{64} = \sqrt[3]{r^3}$

$4 = r$

or

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

$\frac{268.1}{4.2} = \frac{4.2 r^3}{4.2}$

$63.8 = r^3$

$\sqrt[3]{63.8} = \sqrt[3]{r^3}$

$4 = r$