NEW JERSEY CENTER
FOR TEACHING & LEARNING

7th Grade Math

3D Geometry

2015-11-20

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Teacher Notes

Vocabulary Words are bolded in the presentation. The text box the word is in is then linked to the page at the end of the presentation with the word defined on it.

3-Dimensional Solids

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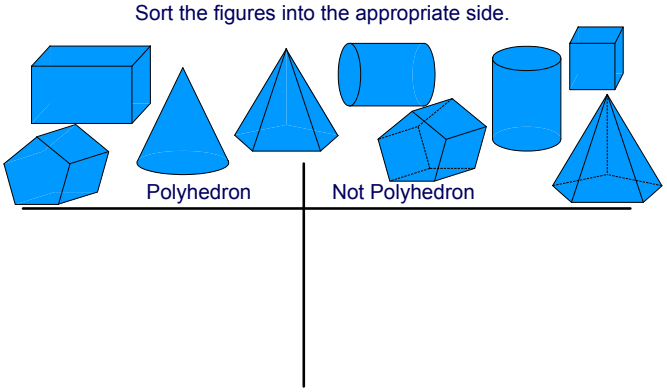
The following link will take you to a site with interactive 3-D figures and nets.

Polyhedrons

Polyhedron A 3-D figure whose faces are *all* polygons

Sort the figures into the appropriate side.



3-Dimensional Solids

Categories & Characteristics of 3-D Solids:

Prisms

click to reveal

Pyramids

click to reveal

3-Dimensional Solids

Categories & Characteristics of 3-D Solids:

Cylinders

click to reveal

Cones

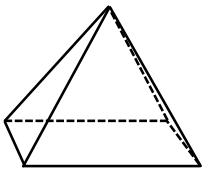
click to reveal

3-Dimensional Solids

Vocabulary Words for 3-D Solids:

Polyhedron	A 3-D figure whose faces are *all* polygons (Prisms & Pyramids)
Face	Flat surface of a Polyhedron
Edge	Line segment formed where 2 faces meet
Vertex	Point where 3 or more faces/edges meet (pl. Vertices)

1 Name the figure.



- A Rectangular Prism
- B Triangular Pyramid
- C Hexagonal Prism
- D Rectangular Pyramid
- E Cylinder
- F Cone

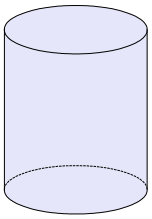
1 Name the figure.

- A Rectangular Prism
- B Triangular Pyramid
- C Hexagonal Prism
- D Rectangular Pyramid
- E Cylinder
- F Cone

Answer

D

2 Name the figure.



- A Rectangular Pyramid
- B Triangular Prism
- C Octagonal Prism
- D Circular Pyramid
- E Cylinder
- F Cone

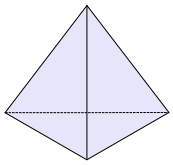
2 Name the figure.

- A Rectangular Pyramid
- B Triangular Prism
- C Octagonal Prism
- D Circular Pyramid
- E Cylinder
- F Cone

Answer

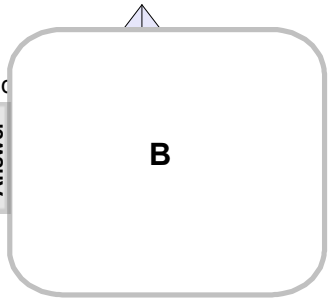
E

3 Name the figure.



- A Rectangular Pyramid
- B Triangular Pyramid
- C Triangular Prism
- D Hexagonal Pyramid
- E Cylinder
- F Cone

3 Name the figure.

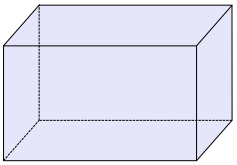


A Rectangular Pyramid
B Triangular Pyramid
C Triangular Prism
D Hexagonal Pyramid
E Cylinder
F Cone

Answer

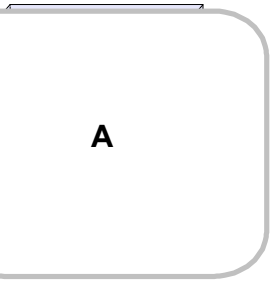
B

4 Name the figure.



A Rectangular Prism
B Triangular Prism
C Square Prism
D Rectangular Pyramid
E Cylinder
F Cone

4 Name the figure.

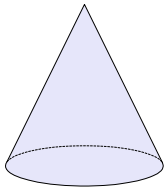


A Rectangular Prism
B Triangular Prism
C Square Prism
D Rectangular Pyramid
E Cylinder
F Cone

Answer

A

5 Name the figure.



- A Rectangular Prism
- B Triangular Pyramid
- C Circular Prism
- D Circular Pyramid
- E Cylinder
- F Cone

5 Name the figure.

- A Rectangular Prism
- B Triangular Pyramid
- C Circular Prism
- D Circular Pyramid
- E Cylinder
- F Cone

Answer

F

Faces, Vertices and Edges

For each figure, find the number of faces, vertices and edges. Can you figure out a relationship between the number of faces, vertices and edges of 3-Dimensional Figures?

Name	Faces	Vertices	Edges
Cube	6	8	12
Rectangular Prism	6	8	12
Triangular Prism	5	6	9
Triangular Pyramid	4	4	6
Square Pyramid	5	5	8
Pentagonal Pyramid	6	6	10
Octagonal Prism	10	16	24

Math Practice

Euler's Formula

Euler's Formula:

click to reveal

6 How many faces does a pentagonal prism have?

6 How many faces does a pentagonal prism have?

Answer

7

7 How many edges does a rectangular pyramid have?

7 How many edges does a rectangular pyramid have?

Answer

8

8 How many vertices does a triangular prism have?

8 How many vertices does a

Answer

6

Cross Sections of Three-Dimensional Figures

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Cross Sections

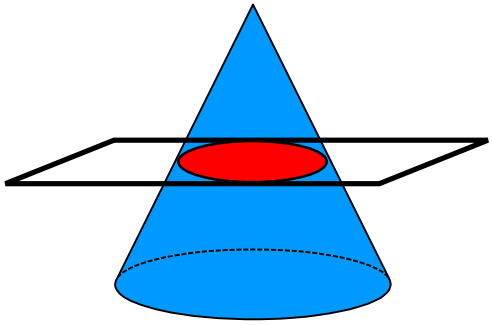
3-Dimensional figures can be cut by planes. When you cut a 3-D figure by a plane, the result is a 2-D figure, called a **cross section**.

These cross sections of 3-D figures are 2 dimensional figures you are familiar with.

Look at the example on the next page to help your understanding.

Cross Sections

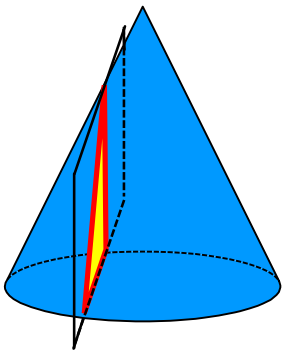
A horizontal cross-section of a cone is a circle.



Can you describe a vertical cross-section of a cone?

Cross Sections

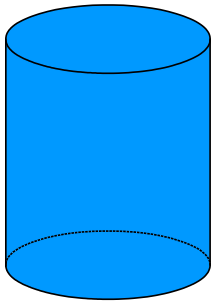
A vertical cross-section of a cone is a triangle.



Cross Sections

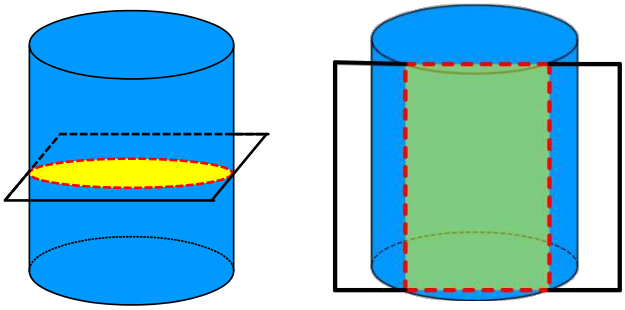
A water tower is built in the shape of a cylinder.

How does the horizontal cross-section compare to the vertical cross-section?

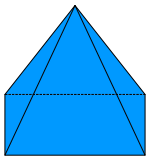


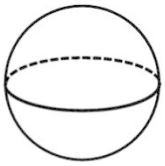
Cross Sections

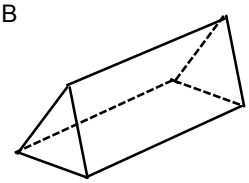
The horizontal cross-section is a circle.
The vertical cross-section is a rectangle

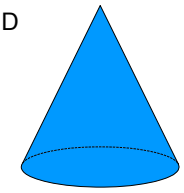


9 Which figure has the same horizontal and vertical cross-sections?

A 

C 

B 

D 

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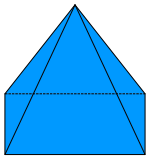
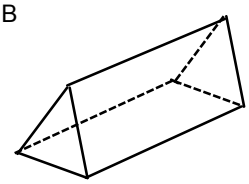
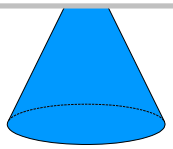
A 

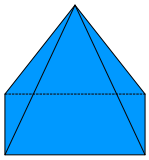
B 

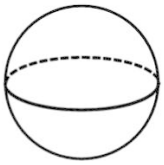
Answer

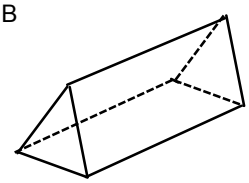
C

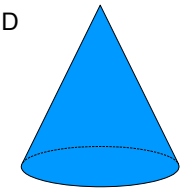


10 Which figure does not have a triangle as one of its cross-sections?

A 

C 

B 

D 

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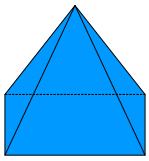
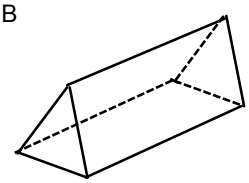
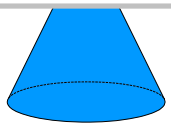
A 

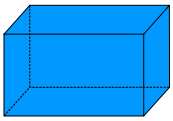
B 

Answer

C



11 Which is the vertical cross-section of the figure shown?



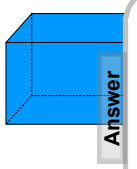
A Triangle

B Circle

C Rectangle

D Trapezoid

11 Which is the vertical cross-section of the figure shown?

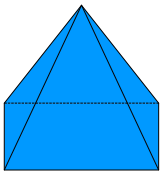


Answer

C

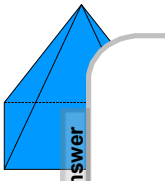
- A Triangle
- B Circle
- C Rectangle
- D Trapezoid

12 Which is the horizontal cross-section of the figure shown?



- A Triangle
- B Circle
- C Rectangle
- D Trapezoid

12 Which is the horizontal cross-section of the figure shown?

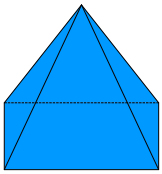


Answer

C

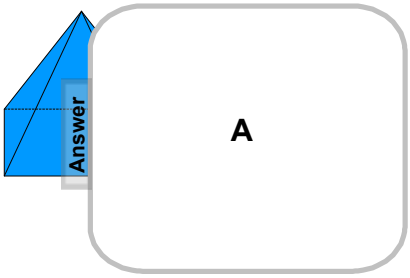
- A Triangle
- B Circle
- C Rectangle
- D Trapezoid

13 Which is the vertical cross-section of the figure shown?



- ❍ A Triangle
- ❍ B Circle
- ❍ C Square
- ❍ D Trapezoid

13 Which is the vertical cross-section of the figure shown?



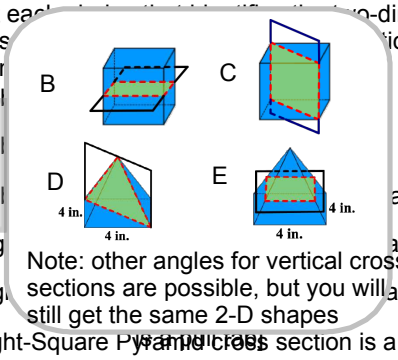
- ❍ A Triangle
- ❍ B Circle
- ❍ C Square
- ❍ D Trapezoid

14 Misha has a cube and a right-square pyramid that are made of clay. She placed both clay figures on a flat surface.
Select each choice that identifies the two-dimensional plane sections that could result from a vertical or horizontal slice through each clay figure.

- ❑ Cube cross section is a Triangle
- ❑ Cube cross section is a Square
- ❑ Cube cross section is a Rectangle (not a square)
- ❑ Right-Square Pyramid cross section is a Triangle
- ❑ Right-Square Pyramid cross section is a Square
- ❑ Right-Square Pyramid cross section is a Rectangle (not a square)

From PARCC EOY sample test calculator #11

14 Misha has a cube and a right-square pyramid that are made of clay. She placed both clay figures on a flat surface.
Select eac[illegible]-dimensional plane s[illegible]ical or horizon[illegible]



Note: other angles for vertical cross sections are possible, but you will still get the same 2-D shapes

- ❑ Cu[illegible]
- ❑ C[illegible]
- ❑ C[illegible] a square)
- ❑ Rig[illegible] a Triangle
- ❑ Rig[illegible] a Square
- ❑ Right-Square Pyramid cross section is a Rectangle (not a square)

Answer

From PARCC EOY sample test calculator #11

Volume

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Volume

Volume

click to reveal

Label

click to reveal

Volume

Volume

Math Practice

MP6: Attend to precision.

Continuously emphasize the units used to label the answers.

Ask: What labels should we use?

Label

click to reveal

Volume Activity

Click the link below for the activity

Lab #1: Volume Activity

Volume Activity

Math Practice

This lab addresses

MP7: Look for and make use of structure

MP8: Look for and express regularity in repeated reasoning.

Ask: Do you see a pattern? Can you explain it? (MP7 & MP8)

Can you predict the next one? (MP7 & MP8)

Volume of Prisms & Cylinders

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Volume

Volume of Prisms & **Cylinders**:

click _____

Area Formulas:

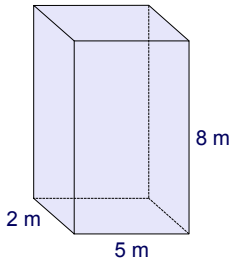
Rectangle = click _____

Triangle = click _____

Circle = click _____

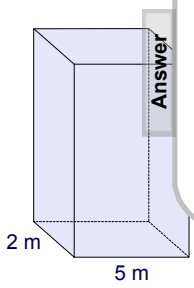
Volume

Find the Volume.



Volume

Find the Volume.

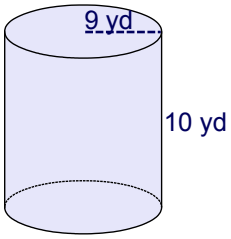


VOLUME:
2
x 5
10 (Area of Base)
x 8 (Height)
80 m^3

VOLUME:
V = B h
V = l w h
V = 5 2 8
V = 10 8
V = 80 m^3

Volume

Find the Volume. Use 3.14 as your value of π.



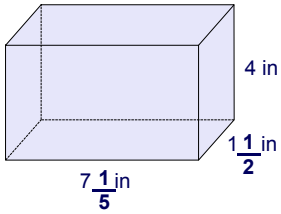
Volume

Find the Volume

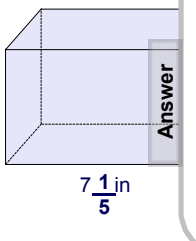
VOLUME:
9
x 9
81
x 3.14
254.34 (Area of Base)
x 10 (Height)
2543.4 yd^3

VOLUME:
V = B h
V = πr^2 h
V = 3.14 9^2 10
V = 3.14 81 10
V = 254.34 10
V = 2543.4 yd^3

15 Find the volume.



15 Find the volume.



VOLUME:
7.2
x 1.5
10.8 (Area of Base)
x 4 (Height)
43.2 in^3

VOLUME:
$V = B \cdot h$
$V = 7.2(1.5)(4)$
$V = 43.2\ in^3$

16 Find the volume of a rectangular prism with length 2 cm, width 3.3 cm and height 5.1 cm.

16 Find the volume of a rectangular prism with length 2 cm, width 3.3 cm and height 5.1 cm.

Answer

VOLUME:
V = B h
V =2(3.3)(5.1)
V = (6.6)(5.1)
V = 33.66 cm^3

17 Which is a possible length, width and height for a rectangular prism whose volume = 18 cm^3?

- A 1 x 2 x 18
- B 6 x 3 x 3
- C 2 x 3 x 3
- D 3 x 3 x 3

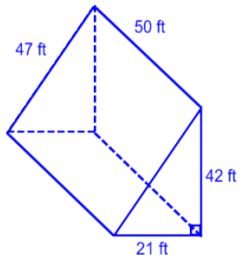
17 Which is a possible length, width and height for a rectangular prism whose vo

- A 1 x 2 x 18
- B 6 x 3 x 3
- C 2 x 3 x 3
- D 3 x 3 x 3

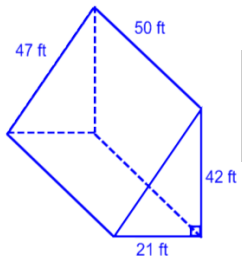
Answer

C

18 Find the volume.



18 Find the volume.



Answer

$V = Bh$

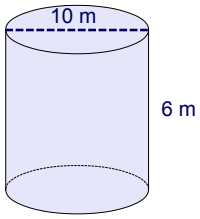
$V = \frac{1}{2}(21)(42)(50)$

$V = \frac{1}{2}(882)(50)$

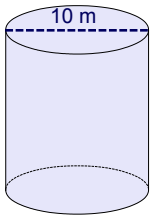
$V = (441)(50)$

$V = 22050\, ft^3$

19 Find the volume. Use 3.14 as your value of π.



19 Find the volume. Use 3.14 as your value of π.



Answer

$V = Bh$

$V = \pi(5)^2\ (6)$

$V = \pi(25)(6)$

$V = 150\pi$

$V = 471 m^3$

Teachers:

Use this Mathematical Practice Pull Tab for the next 3 SMART Response slides.

Teachers

Use this

SMART

Math Practice

The next 4 slides address MP4 & MP5

Ask: What connections do you see between the volume of a prism/cylinder and this problem? (MP4)

Could you use a drawing to show your thinking? (MP5)

Why do the results make sense? (MP4)

20 A box-shaped refrigerator measures 12 by 10 by 7 on the outside. All six sides of the refrigerator are 1 unit thick. What is the inside volume of the refrigerator in cubic units?

HINT: You may want to draw a picture!

20 A box-shaped refrigerator measures 12 by 10 by 7 on the outside. All six sides of the refrigerator are 1 unit thick. What is the inside volume of the refrigerator in cubic units?

HINT: You may want to draw a picture!

Answer

$V = Bh$

$V = (10)(8)(5)$

$V = (80)(5)$

$V = 400u^3$

21 What is the volume of the largest cylinder that can be placed into a cube that measures 10 feet on an edge? Use 3.14 as your value of π.

21 What is the volume of the largest cylinder that can be placed into a cube that measures 10 feet on an edge? Use 3.14 as your value ofπ.

Answer

$$V = Bh$$
$$V = \pi(\frac{10}{2})^2(10)$$
$$V = \pi(5)^2(10)$$
$$V = \pi(25)(10)$$
$$V = 785\,ft^3$$

Slide 46 (Answer) / 159

22 A circular garden has a diameter of 20 feet and is surrounded by a concrete border that has a width of three feet and a depth of 6 inches. What is the volume of concrete in the path? Use 3.14 as your value of π.

Slide 47 / 159

22 A circular garden has a diameter of 20 feet and is surrounded by a concrete border that has a width of three feet and a depth of 6 inches. What is the volume of concrete in the path? Us

Answer

$$V = Bh$$
$$V = [\pi(\frac{26}{2})^2 - \pi(\frac{20}{2})^2](0.5)$$
$$V = (169\pi - 100\pi)(0.5)$$
$$V = (216.66)(0.5)$$
$$V = 108.33\,ft^3$$

Slide 47 (Answer) / 159

Teachers:

Use this Mathematical Practice Pull Tab for the next SMART Response slide.

Teachers:

Use this M
SMART Re

Math Practice

The next slide addresses MP3

Ask: What math language will help you prove your answer?

Why is it true?

23 Which circular glass holds more water? Use 3.14 as your value of π. Before revealing your answer, make sure that you can prove that your answer is correct.

A Glass A having a 7.5 cm diameter and standing 12 cm high

B Glass B having a 4 cm radius and a height of 11.5 cm

23 Which circular glass holds more water? Use 3.14 as your valu revealing your answe can prove that your a

- A Glass A having standing 12 cm
- B Glass B having a of 11.5 cm

Answer

Glass A	Glass B
$V = Bh$	$V = Bh$
$V = \pi(\frac{7.5}{2})^2\ (12)$	$V = \pi(4)^2\ (11.5)$
$V = \pi(3.75)^2(12)$	$V = \pi(16)(11.5)$
$V = \pi(14.0625)(12)$	$V = \pi(184)$
$V = 529.875cm^3$	$V = 577.76cm^3$

Volume of Pyramids, Cones & Spheres

Return to Table of Contents

Demonstration Comparing Volume of Cones & Spheres with Volume of Cylinders

click to go to web site

Volume of a Cone

The **Volume of a Cone** is 1/3 the volume of a cylinder with the same base area (*B*) and height (*h*).

click to reveal

Volume of a Sphere

The **Volume of a Sphere** is 2/3 the volume of a cylinder with the same base area (*B*) and height (*h*).

click to reveal

Slide 54 / 159

Volume

How much ice cream can a Friendly's Waffle cone hold if it has a diameter of 6 in and its height is 10 in?

(Just Ice Cream within Cone. Not on Top)

Slide 55 / 159

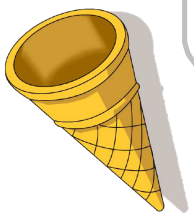
Volume

How much ice crea d if it has a diameter

(Just Ice Cream

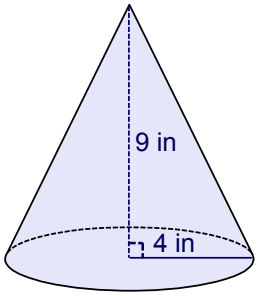
Answer

3.14
x 9
28.26 (Area of Base)
x 10 (Height)
282.6
3 (cone)
= 94.2 in^3

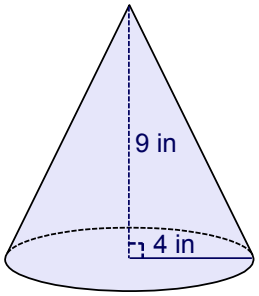


Slide 55 (Answer) / 159

24 Find the volume.



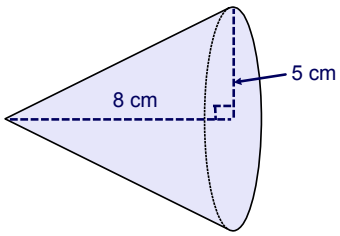
24 Find the volume.



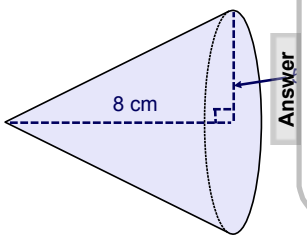
Answer

$$V = \frac{1}{3}Bh$$
$$V = \frac{1}{3}(\pi 4^2)(9)$$
$$V = \frac{1}{3}(16\pi)(9)$$
$$V = 3(50.24)$$
$$V = 150.72 in^3$$

25 Find the volume.



25 Find the volume.



Answer

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

$$V = \frac{1}{3}(\pi 5^2)(8)$$

$$V = \frac{1}{3}(25\pi)(8)$$

$$V = \frac{1}{3}(200\pi)$$

$$V = 209\frac{1}{3}cm^3$$

26 What is the volume of a sphere with a radius of 8 ft?

26 What is the volume of a sphere with a radius of 8 ft?

Answer

$$V = \frac{4}{3}\pi r^3$$
$$V = \frac{4}{3}(3.14)(8)^3$$
$$V = 2143.57\,ft^3$$

27 What is the volume of a sphere with a diameter of 4.25 in?

27 What is the volume of a sphere with a diameter of 4.25 in?

Answer

$$V = \frac{4}{3}\pi r^3$$
$$V = \frac{4}{3}(3.14)(\frac{4.25}{2})^3$$
$$V = \frac{4}{3}(3.14)(2.125)^3$$
$$V \approx 40.17 in^3$$

Volume of a Pyramid

The **Volume of a Pyramid** is 1/3 the volume of a prism with the same base area (*B*) and height (*h*).

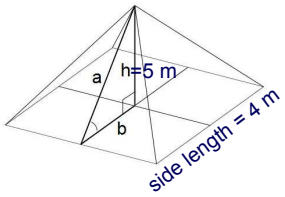
click to reveal

Note: Pyramids are named by the shape of their base.

Volume

Example: Find the volume of the pyramid shown below.

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



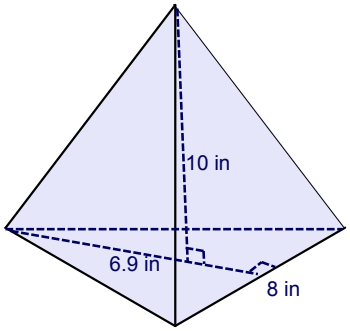
$V = \frac{1}{3}Bh$

$V = \frac{1}{3}(4 \times 4)(5)$

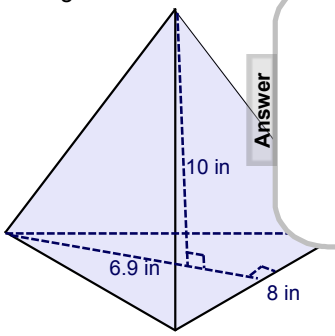
$V = \frac{1}{3}(80)$

$V = 26\frac{2}{3}m^3$

28 Find the Volume of a triangular pyramid with base edges of 8 in, base height of 6.9 in and a pyramid height of 10 in.



28 Find the Volume of a triangular pyramid with base edges of 8 in, base height of 6.9 in and a pyramid height of 10 in.



Answer

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

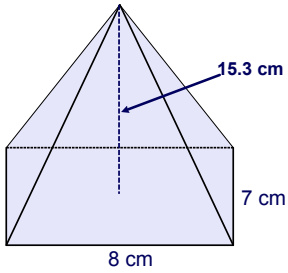
$V = \frac{1}{3}\left[\frac{1}{2}(8)(6.9)\right](10)$

$V = \frac{1}{3}[27.6](10)$

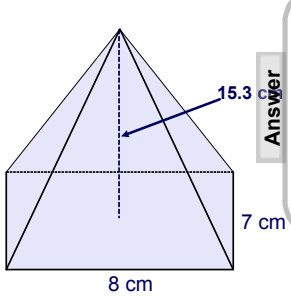
$V = \frac{1}{3}(276)$

$V = 92\ in^3$

29 Find the volume.



29 Find the volume.



Answer

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

$V = \frac{1}{3}(8)(7)(15.3)$

$V = \frac{1}{3}(56)(15.3)$

$V = 285.6cm^3$

Surface Area

Return to Table of Contents

Surface Area of Prisms

Return to Table of Contents

Surface Area

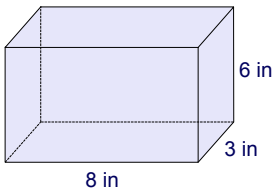
Surface Area is the sum of the areas of *all* outside surfaces of a 3-D figure.

To find surface area, you must find the area of each surface of the figure then add them together.

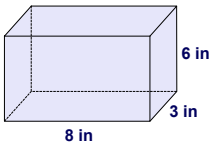
What type of figure is pictured?

How many surfaces are there?

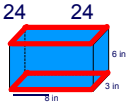
How do you find the area of each surface?

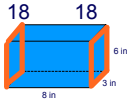


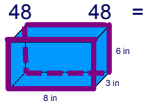
Surface Area



Bottom	Top	Left	Right	Front	Back	SUM
8	8	6	6	8	8	
x 3	x 3	x 3	x 3	x 6	x 6	
24	24	18	18	48	48	= 180 in^2







180 in^2

Slide 68 / 159

Slide 69 / 159

Slide 70 / 159

Arrangement of Unit Cubes

Surface Area Activity

Click the link below for the activity

Lab #2: Surface Area Activity

Teachers:

Use this Mathematical Practice Pull Tab for the next 4 SMART Response slides.

Teachers:

Use this Ma
SMART Re

Math Practice

The next 4 slides address MP2

Ask: How can you represent the problem w/ symbols and numbers?

What do you think the answer/result will be?

30 Which arrangement of 27 cubes has the *least* surface area?

- A 1 x 1 x 27
- B 3 x 3 x 3
- C 9 x 3 x 1

30 Which arrangement of 27 cubes has the *least* surface area?

- A 1 x 1 x 27
- B 3 x 3 x 3
- C 9 x 3 x 1

Answer

B

31 Which arrangement of 12 cubes has the *least* surface area?

- A 2 x 2 x 3
- B 4 x 3 x 1
- C 2 x 6 x 1
- D 1 x 1 x 12

31 Which arrangement of 12 cubes has the *least* surface area?

- A 2 x 2 x 3
- B 4 x 3 x 1
- C 2 x 6 x 1
- D 1 x 1 x 12

Answer

A

32 Which arrangement of 25 cubes has the *greatest* surface area?

- A 1 x 1 x 25
- B 1 x 5 x 5

32 Which arrangement of 25 cubes has the *greatest* surface area?

- A 1 x 1 x 25
- B 1 x 5 x 5

Answer

A

33 Which arrangement of 48 cubes has the least surface area?

- A 4 x 12 x 1
- B 2 x 2 x 12
- C 1 x 1 x 48
- D 3 x 8 x 2
- E 4 x 2 x 6
- F 4 x 3 x 4

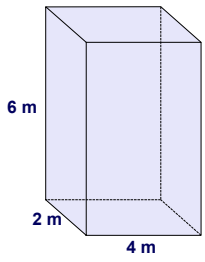
33 Which arrangement of 48 cubes has the least surface area?

- A 4 x 12 x 1
- B 2 x 2 x 12
- C 1 x 1 x 48
- D 3 x 8 x 2
- E 4 x 2 x 6
- F 4 x 3 x 4

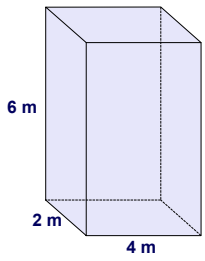
Answer

F

34 How many faces does the figure have?



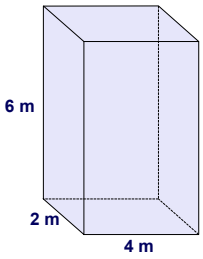
34 How many faces does the figure have?



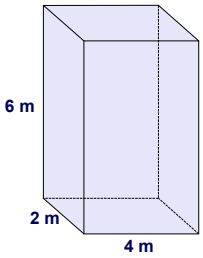
Answer

6

35 How many area problems must you complete when finding the surface area?



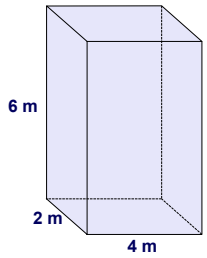
35 How many area problems must you complete when finding the surface area?



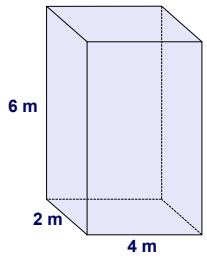
Answer

6
3 **(if you double)**

36 What is the area of the top or bottom face?



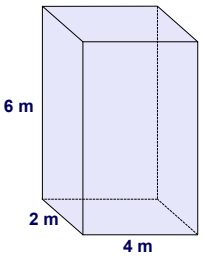
36 What is the area of the top or bottom face?



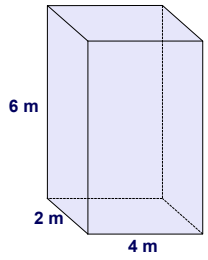
Answer

(2)(4)
8 m^2

37 What is the area of the left or right face?



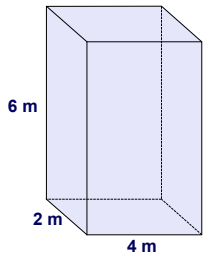
37 What is the area of the left or right face?



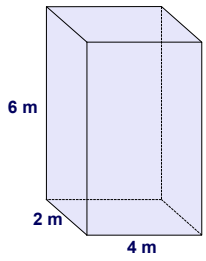
Answer

(2)(6)
12 m^2

38 What is the area of the front or back face?



38 What is the area of the front or back face?

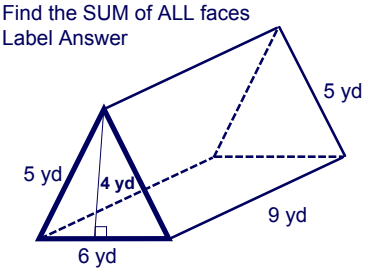


Answer

(6)(4)
24 m^2

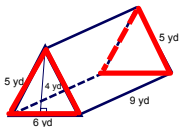
Find the Surface Area

1. Draw and label ALL faces; use the net, if it's helpful
2. Find the correct dimensions for each face
3. Calculate the AREA of EACH face
4. Find the SUM of ALL faces
5. Label Answer

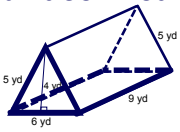


go on to see steps

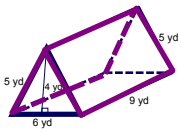
Surface Area



CLICK TO REVEAL



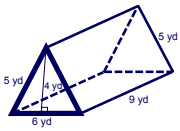
CLICK TO REVEAL

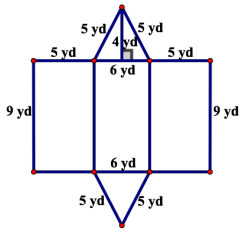


CLICK TO REVEAL

CLICK TO REVEAL

Find the Surface Area Using the Net





CLICK TO REVEAL

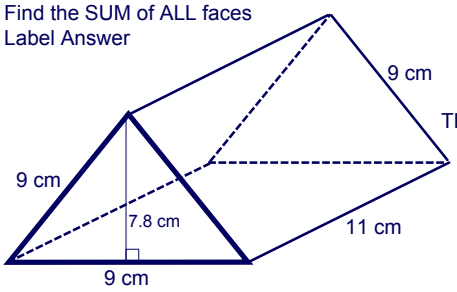
CLICK TO REVEAL

CLICK TO REVEAL

CLICK TO REVEAL

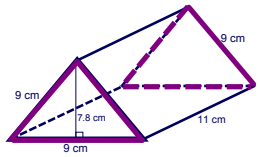
Find the Surface Area

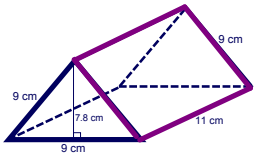
1. Draw and label ALL faces; use the net if it's helpful
2. Find the correct dimensions for each face
3. Calculate the AREA of EACH face
4. Find the SUM of ALL faces
5. Label Answer



TRY THIS ONE

Surface Area





Triangles

$A = \frac{7.8 \times 9}{2}$

$A = 35.1$ cm²

$\times 2$

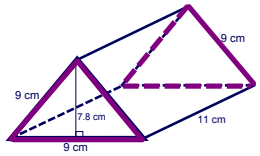
70.2 cm²

Rectangles

$A = 9(11) = 99$ cm²

$A = 99 \times 3 = 297$ cm²

Surface Area



Answer

367.2 cm²

Triangles

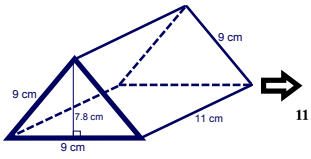
$A = \frac{7.8 \times 9}{2}$

$A = 35.1$ cm²

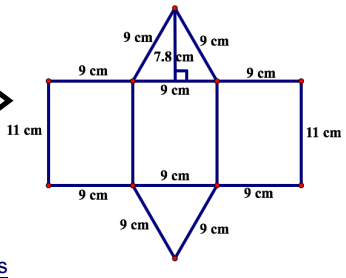
$\times 2$

70.2 cm²

Surface Area



Triangles

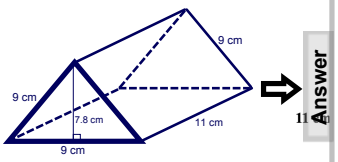


Rectangles

click to reveal

click to reveal

Surface Area



Triangles

Rectangles

click to reveal

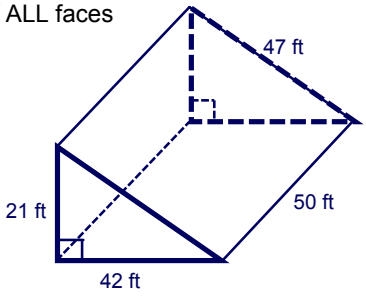
click to reveal

Answer

367.2 cm²

40 Find the surface area of the shape below.

1. Draw and label ALL faces; use the net if it's helpful
2. Find the correct dimensions for each face
3. Calculate the AREA of EACH face
4. Find the SUM of ALL faces
5. Label Answer

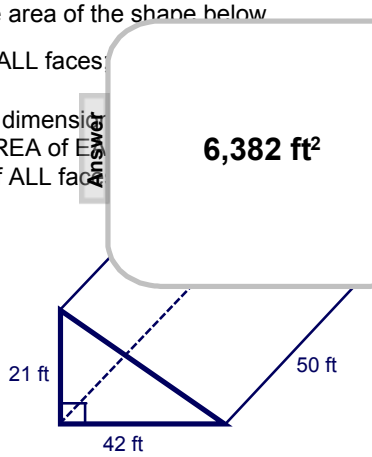


40 Find the surface area of the shape below.

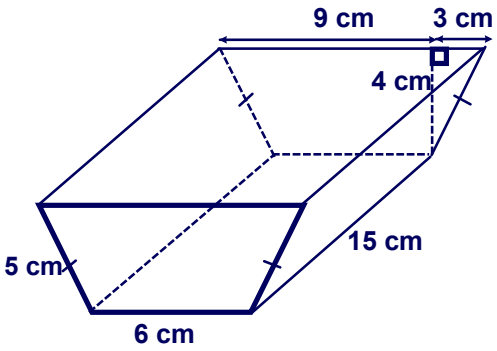
1. Draw and label ALL faces; use the net if it's helpful
2. Find the correct dimensions for each face
3. Calculate the AREA of EACH face
4. Find the SUM of ALL faces
5. Label Answer

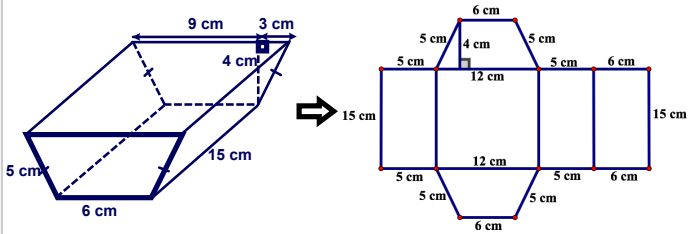
Answer

6,382 ft²



Find the Surface Area.





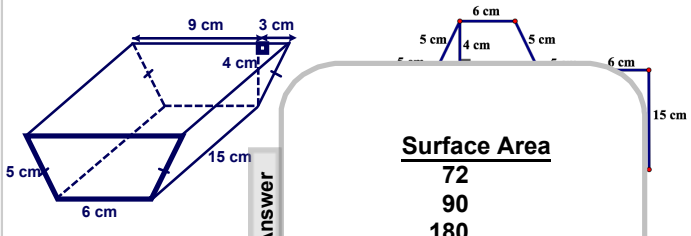
Trapezoids Bottom Rectangle Top Rectangle Side Rectangles

click to reveal

click to reveal

click to reveal

click to reveal



Trapezoids Bottom Rect

Answer

Surface Area

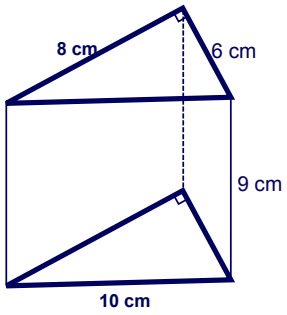
72
90
180
+ 150
492 cm²

click to reveal

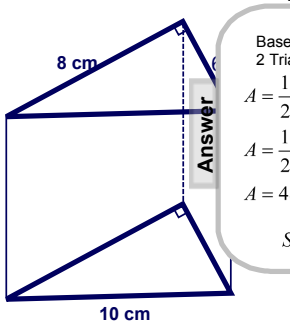
click to reveal

click to reveal

41 Find the surface area of the shape below.



41 Find the surface area of the shape below.



Answer

Bases Sides
2 Triangles3 Rectangles

$A = \frac{1}{2}bh \bullet 2$ $\quad 10 \bullet 9 = 90$

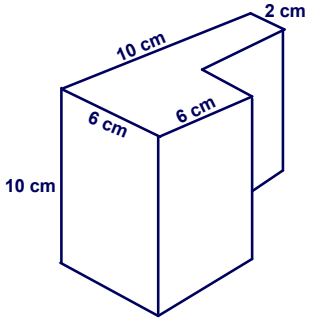
$6 \bullet 9 = 54$

$A = \frac{1}{2}(8)(6) \bullet 2$ $\quad 8 \bullet 9 = 72$

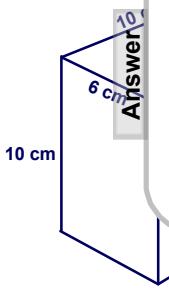
$A = 48cm^2$ $\quad sum = 216cm^2$

$SurfaceArea = 264cm^2$

42 Find the surface area of the shape below.



42 Find the surface



Answer

Bases Sides

Square & Rectangle	6 Rectangles
$A = s^2 + lw$	$6 \bullet 10 = 60$
$A = 6^2 + 4 \bullet 2$	$6 \bullet 10 = 60$
$A = 36 + 8$	$4 \bullet 10 = 40$
$A = 44cm^2$	$4 \bullet 10 = 40$
$A = 44 \bullet 2$	$2 \bullet 10 = 20$
$(top + bottom)$	$10 \bullet 10 = 100$
$A = 88cm^2$	$sum = 320cm^2$

$SurfaceArea = 408cm^2$

Surface Area of Pyramids

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Surface Area of Pyramids

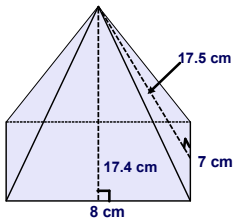
What is a pyramid?

click to reveal

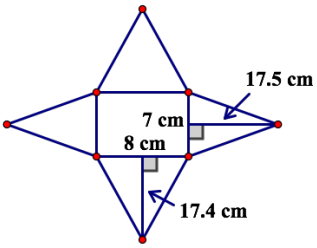
How do you find Surface Area?

click to reveal

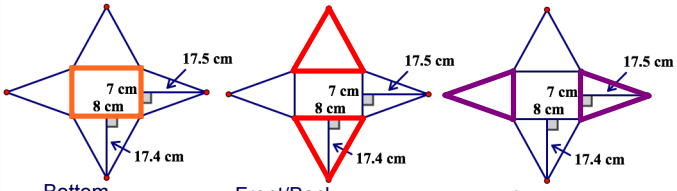
Find the Surface Area.



go on to see steps



Find the Surface Area.



Bottom
Rectangle
8
x 7
56 cm²

Front/Back
Triangles

$A = \frac{1}{2}bh(2)$

$A = \frac{1}{2}(8)(17.4)(2)$

$A = 139.2$ cm²

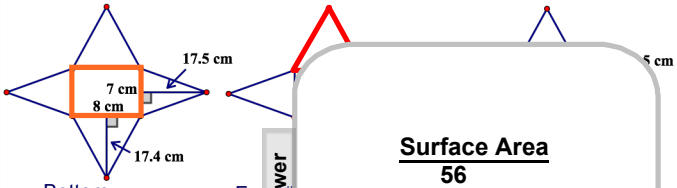
Left/Right
Triangles

$A = \frac{1}{2}bh(2)$

$A = \frac{1}{2}(7)(17.5)(2)$

$A = 122.5$ cm²

Find the Surface Area.



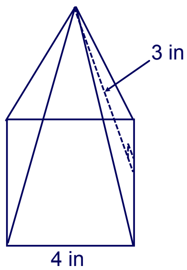
Bottom
Rectangle
8
x 7
56 cm²

Answer

Surface Area
56
139.2
+ 122.5
317.7 cm²

Surface Area

Find the surface area of a square pyramid with base edge of 4 inches and triangle height of 3 inches.



Base

4 Triangles

Surface Area

click to reveal

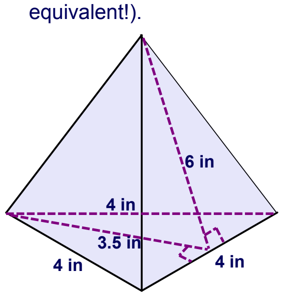
click to reveal

click to reveal

Slide 100 / 159

Surface Area

Find the surface area. Be sure to look at the base to see if it is an equilateral or isosceles triangle (making all or two of the side triangles equivalent!).



Base

Remaining Triangles (all equal)

click to reveal

click to reveal

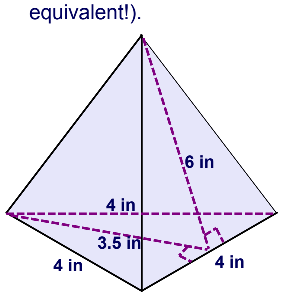
Surface Area

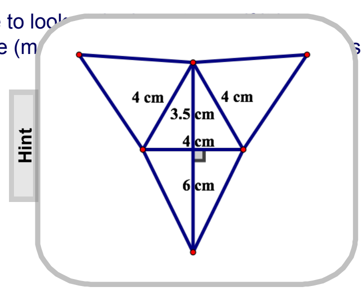
click to reveal

Slide 101 / 159

Surface Area

Find the surface area. Be sure to look
equilateral or isosceles triangle (m
equivalent!).





Surface Area

click to reveal

Slide 101 (Answer) / 159

43 Which has a greater Surface Area, a square pyramid with a base edge of 8 in and a height of 4 in or a cube with an edge of 5 in?

- A Square Pyramid
- B Cube

43 Which has a greater Surface Area, a square pyramid with a base edge of 8 in and a height of 4 in or a cube with an edge of 5 in?

- A Square Pyramid
- B Cube

Answer

Square Pyramid

Base: $A = s^2$, $A = 8^2$, $A = 64in^2$

4 Triangles: $A = \frac{1}{2}bh \cdot 4$, $A = \frac{1}{2}(8)(4) \cdot 4$, $A = 64in^2$

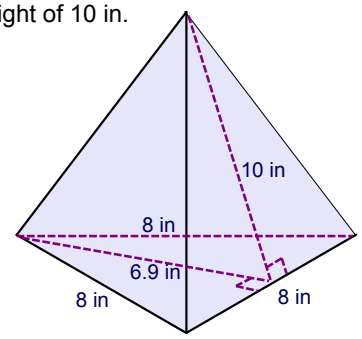
$SA = 128\ in^2$

Cube

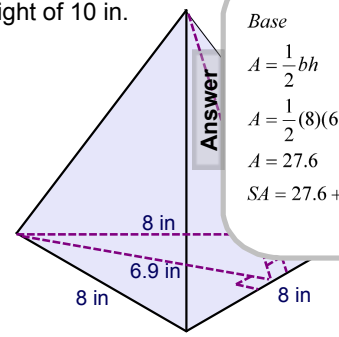
6 faces: $A = s^2 \cdot 6$, $A = 5^2 \cdot 6$, $A = 150in^2$

B

44 Find the Surface Area of a triangular pyramid with base edges of 8 in, base height of 4 in and a slant height of 10 in.



44 Find the Surface Area of a triangular pyramid with base edges of 8 in, base
height of 10 in.



Answer

Base

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(8)(6.9)$

$A = 27.6$

3Triangles

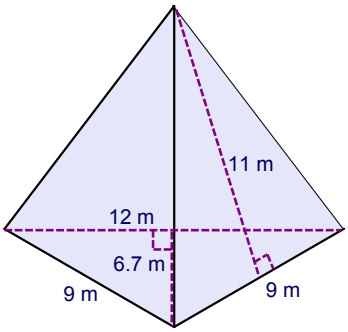
$A = \frac{1}{2}bh \cdot 3$

$A = \frac{1}{2}(8)(10) \cdot 3$

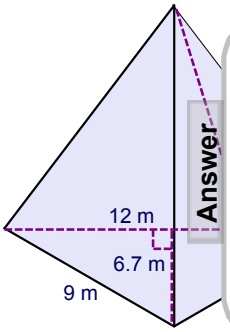
$A = 120$

$SA = 27.6 + 120 = 147.6 in^2$

45 Find the Surface Area.



45 Find the Surface Area.



Answer

Base

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(12)(6.7)$

$A = 40.2$

3Triangles

$A = \frac{1}{2}bh \cdot 2 + \frac{1}{2}bh$

$A = \frac{1}{2}(9)(11) \cdot 2 + \frac{1}{2}(12)(11)$

$A = 99 + 66$

$A = 165$

$SA = 40.2 + 165 = 205.2 in^2$

Surface Area of Cylinders

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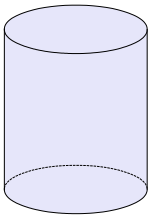
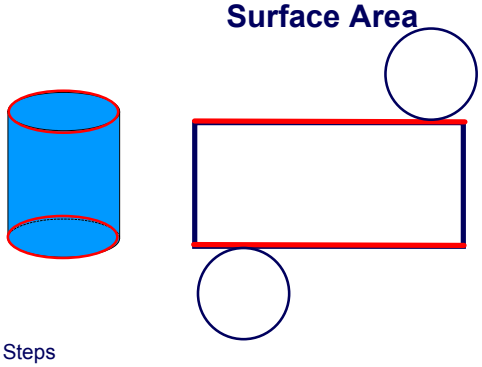
Surface Area

How would you find the surface area of a cylinder?



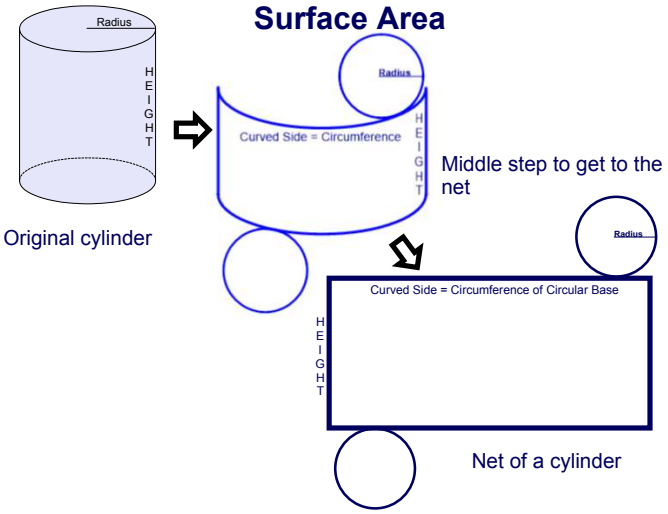
Surface Area



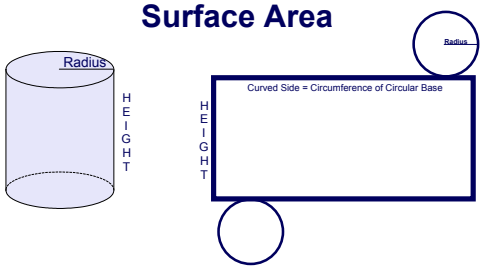
Notice the length of the rectangle is actually the circumference of the circular base.

Steps
1. Find the area of the 2 circular bases.
2. Find the area of the curved surface (actually, a rectangle).
3. Add the two areas.
4. Label answer.

Surface Area



Surface Area



Area of Circles = 2 (πr^2)

Area of Curved Surface = Circumference Height

$= \pi d h$

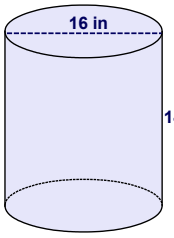
$2\pi r^2 + \pi dh$

-or-

$2\pi r^2 + 2\pi rh$

Surface Area

Find the surface area of a cylinder whose height is 14 inches and whose base has a diameter of 16 inches. Use 3.14 as your value of π.



Area of Circles = 2 (πr^2)
$= 2 \quad (\pi 8^2)$
$= 2 \quad (64\pi)$
$= 128\pi$
$= 401.92 \text{ in}^2$

Area of Curved Surface = Circumference Height
$= \pi \quad d$ Height
$= \pi(16)(14)$
$= 224\pi$
$= 703.36 \text{ in}^2$

Surface Area = 401.92 + 703.36 = 1,105.28 in²

46 Find the surface area of a cylinder whose height is 8 inches and whose base has a diameter of 6 inches. Use 3.14 as your value of π.

46 Find the surface area of a cylinder whose height is 8 inches and whose base h
inches. Use 3.14 as you

Answer

Circles	*Side*
$A = \pi r^2 \cdot 2$	$A = \pi dh$
$A = \pi 3^2 \cdot 2$	$A = \pi(6)(8)$
$A = 56.52in^2$	$A = 150.72in^2$

$SA = 56.52 + 150.72 = 207.24in^2$

47 Find the surface area of a cylinder whose height is 14 inches and whose base has a diameter of 20 inches. Use 3.14 as your value of π.

47 Find the surface area of a cylinder whose height is 14 inches and whose base has a diameter of 20 inches. Use 3.14 as you

Answer

Circles	Side
$A = \pi r^2(2)$	$A = \pi dh$
$A = \pi(10)^2(2)$	$A = \pi(20)(14)$
$A = 628\ in^2$	$A = 879.2\ in^2$

$SA = 628 + 879.2 = 1{,}507.2\ in^2$

48 How much material is needed to make a cylindrical orange juice can that is 15 cm high and has a diameter of 10 cm? Use 3.14 as your value of π.

48 How much material is needed to make a cylindrical orange juice can that is 15 [illegible] of 10 cm? Use 3.14 as y

Answer

Circles	*Side*
$A = \pi r^2 \cdot 2$	$A = \pi dh$
$A = \pi 5^2 \cdot 2$	$A = \pi(10)(15)$
$A = 157 in^2$	$A = 471 in^2$

$SA = 157 + 471 = 628 in^2$

49 Find the surface area of a cylinder with a height of 14 inches and a base radius of 8 inches. Use 3.14 as your value of π.

49 Find the surface area of a cylinder with a height of 14 inches and a base radius of 8 inches. Use 3.14 as your value of π.

Answer

Circles	*Side*
$A = \pi r^2 \cdot 2$	$A = \pi dh$
$A = \pi 8^2 \cdot 2$	$A = \pi(16)(14)$
$A = 401.92 in^2$	$A = 703.36 in^2$

$SA = 401.92 + 703.36 = 1105.28 in^2$

50 A cylindrical feed tank on a farm needs to be painted. The tank has a diameter 7.5 feet and a height of 11 ft. One gallon of paint covers 325 square feet. Do you have enough paint? Explain. Note: Use 3.14 as your value of π.

- Yes
- No

50 A cylindrical feed tank on a farm needs to be painted. The tank has a diameter 7.5 feet and a height of 11 ft. One gallon of paint covers [illegible] have enough paint? Expl[illegible] value of π.

- Yes
- No

Answer

Circles $A = \pi r^2 \cdot 2$

$A = \pi 3.75^2 \cdot 2$

$A = 88.3125 in^2$

Side $A = \pi dh$

$A = \pi(7.5)(11)$

$A = 259.05 in^2$

$SA = 88.3125 + 259.05 = 347.3625 ft^2$

NO

Surface Area of Spheres

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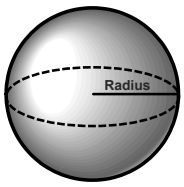
Surface Area

A sphere is the set of all points that are the same distance from the center point.

Like a circle, a sphere has a radius and a diameter.

You will see that like a circle, the formula for surface area of a sphere also includes π.

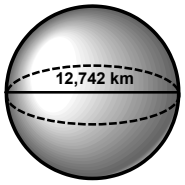


Surface Area of a Sphere

click to reveal

Surface Area

If the diameter of the Earth is 12,742 km, what is its surface area? Use 3.14 as your value of π. Round your answer to the nearest whole number.



$$SA = 4\pi r^2$$

$$SA = 4\pi\left(\frac{12742}{2}\right)^2$$

$$SA = 4\pi(6371)^2$$

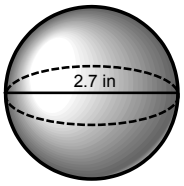
$$SA = 509,805,891 km^2$$

Surface Area

Try This:

Find the surface area of a tennis ball whose diameter is 2.7 inches. Use 3.14 as your value of π.

$$SA = 4\pi r^2$$



click to reveal

51 Find the surface area of a softball with a diameter 3.8 inches. Use 3.14 as your value of π.

51 Find the surface area of a sphere with radius 3.8 inches. Use 3.14 as y

Answer

$$SA = 4\pi r^2$$
$$SA = 4\pi\left(\frac{3.8}{2}\right)^2$$
$$SA = 4\pi(1.9)^2$$
$$SA = 45.3416in^2$$

52 How much leather is needed to make a basketball with a radius of 4.7 inches? Use 3.14 as your value of π.

52 How much leather is needed to make a basketball with a radius of 4.7 inches? Use 3.14 as your value of π.

Answer

$$SA = 4\pi r^2$$
$$SA = 4\pi(4.7)^2$$
$$SA = 277.4504in^2$$

53 How much rubber is needed to make 6 racquet balls with a diameter of 5.7 inches? Use 3.14 as your value of π.

53 How much rubber is needed to make 6 racquet balls with a diame
Use 3.14 as your value

Answer

$$SA = 4\pi r^2$$
$$SA = 4\pi\left(\frac{5.7}{2}\right)^2$$
$$SA = 4\pi(2.85)^2$$
$$SA = 102.0186 \bullet 6balls$$
$$SA = 612.1116in^2$$

More Practice / Review

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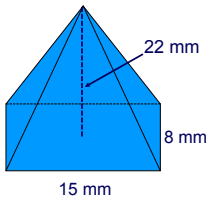
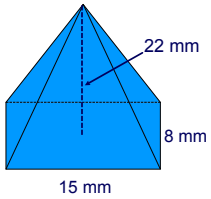
54 Find the volume.



54 Find the volume.



Answer

880 mm^3

55 Find the volume of a rectangular pyramid with a base length of 2.7 meters and a base width of 1.3 meters, and the height of the pyramid is 2.4 meters.

HINT: Drawing a diagram will help!

55 Find the volume of a rectangular pyramid with a base length of 2.7 meters and a [illegible] and the height of the pyr[illegible]

HINT: Drawing a diagra[illegible]

Answer

2.808 m^3

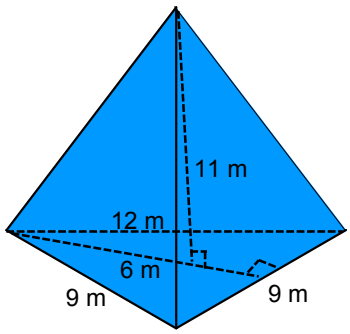
56 Find the volume of a square pyramid with base edge of 4 inches and pyramid height of 3 inches.

56 Find the volume of a square pyramid with base edge of 4 inches and pyramid [illegible]

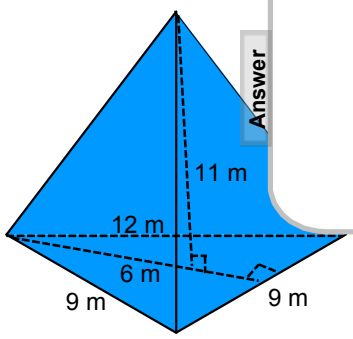
Answer

16 in^3

57 Find the Volume.



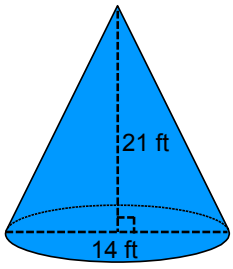
57 Find the Volume.



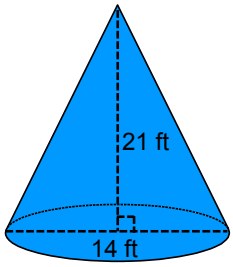
Answer

148.5 m^3

58 Find the Volume. Use 3.14 as your value of π.



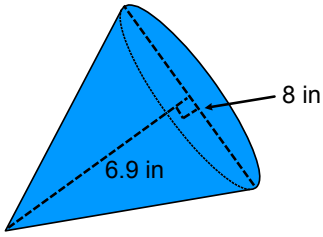
58 Find the Volume. Use 3.14 as your value of π.



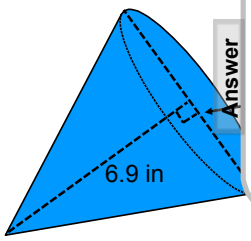
Answer

1077.02 ft³

59 Find the Volume. Use 3.14 as your value of π.



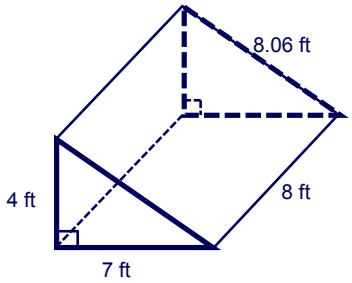
59 Find the Volume. Use 3.14 as your value of π.



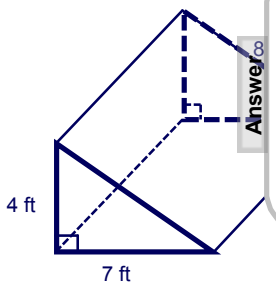
Answer

115.552 in³

60 Find the volume.



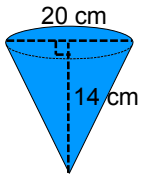
60 Find the volume.

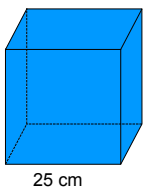


Answer

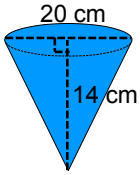
112 ft³

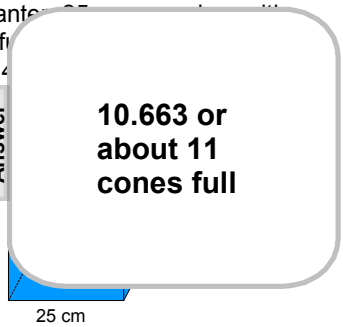
61 A cone 20 cm in diameter and 14 cm high was used to fill a cubical planter, 25 cm per edge, with soil. How many cones full of soil were needed to fill the planter? Use 3.14 as your value of π.





61 A cone 20 cm in diameter and 14 cm high was used to fill a cubical plante soil. How many cones f fill the planter? Use 3.14



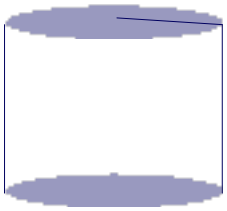


Answer

10.663 or about 11 cones full

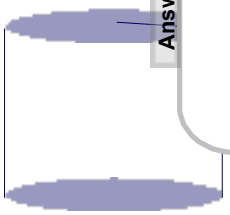
62 Find the surface area of the cylinder. Use 3.14 as your value of π.

Radius = 6 cm and Height = 7 cm



62 Find the surface area of as your value of π.

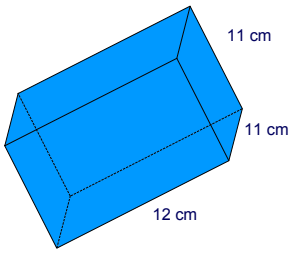
Radius = 6 cm and He



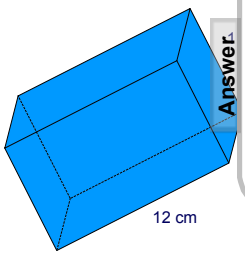
Answer

489.84 cm²

63 Find the Surface Area.



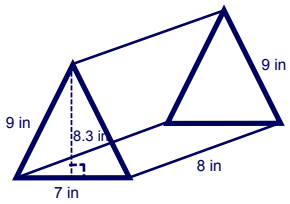
63 Find the Surface Area.



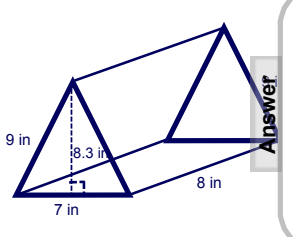
Answer

770 cm²

64 Find the Surface Area.



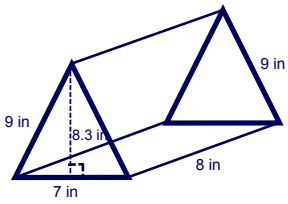
64 Find the Surface Area.



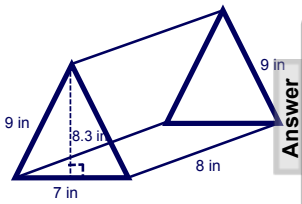
Answer

258.1 in^2

65 Find the volume.



65 Find the volume.



Answer

232.4 in^3

66 A rectangular storage box is 12 in wide, 15 in long and 9 in high. How many square inches of colored paper are needed to cover the surface area of the box?

66 A rectangular storage box is 12 in wide, 15 in long and 9 in high. How many square inches of colored paper are needed to cover the s

Answer

846 in^2

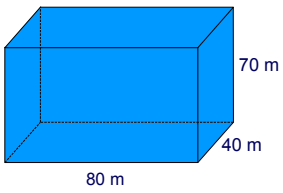
67 Find the surface area of a square pyramid with a base length of 4 inches and slant height of 5 inches.

67 Find the surface area of a square pyramid with a base length of 4 inches and a height of 7 inches.

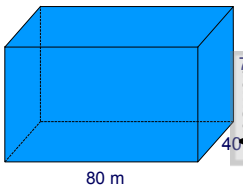
Answer

56 in^2

68 Find the volume.



68 Find the volume.



Answer

224,000 m^3

69 A teacher made 2 foam dice to use in math games. Each cube measured 10 in on each side. How many square inches of fabric were needed to cover the 2 cubes?

69 A teacher made 2 foam dice to use in math games. Each cube measu
How many square inches
cover the 2 cubes?

Answer

1,200 in^2

Glossary & Standards

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Glo

Teacher Notes

Vocabulary Words are bolded in the presentation. The text box the word is in is then linked to the page at the end of the presentation with the word defined on it.

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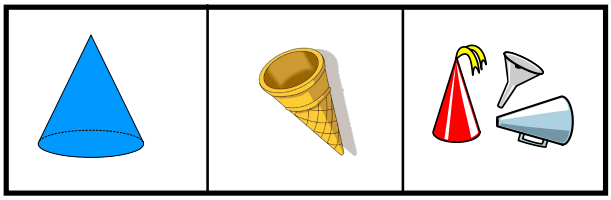
Cone

A 3-D solid that has 1 circular base with a vertex opposite it. The sides are curved.



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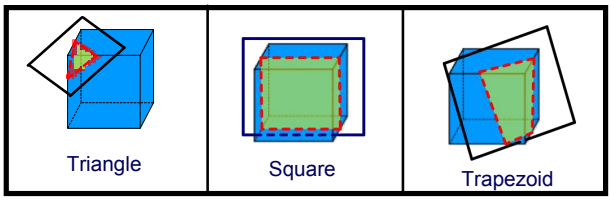
Cross Section

The shape formed when cutting straight through an object.



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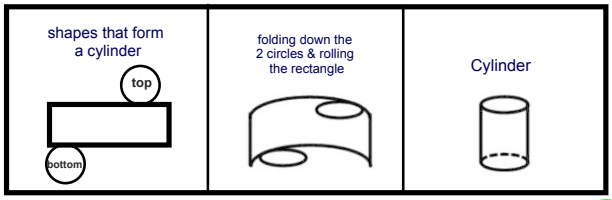
Cylinder

A solid that has 2 congruent, circular bases which are parallel to one another.
The side joining the 2 circular bases is a curved rectangle.



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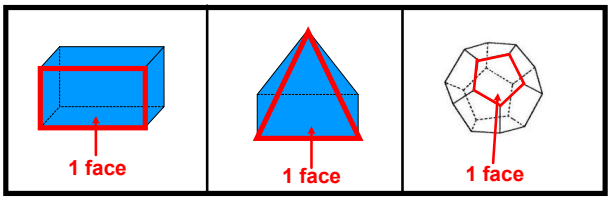
Face

Flat surface of a Polyhedron.



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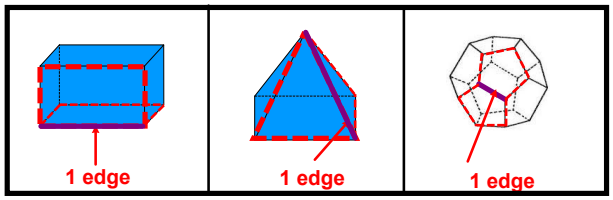
Edge

Line segment formed where 2 faces meet.



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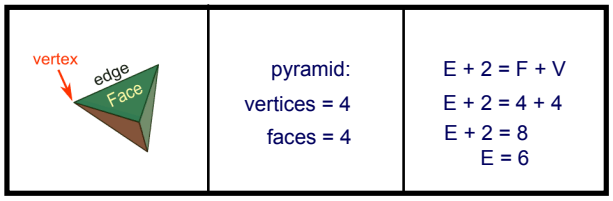
Euler's Formula

The sum of the edges and 2 is equal to the sum of the faces and vertices.
E + 2 = F + V



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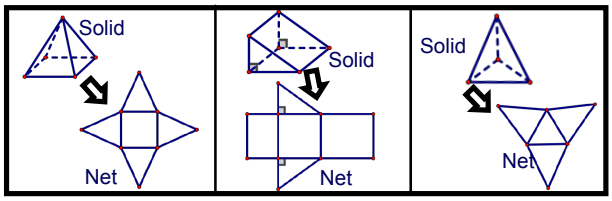
Net

A 2-D pattern of a 3-D solid that can be folded to form the figure. An unfolded geometric solid.



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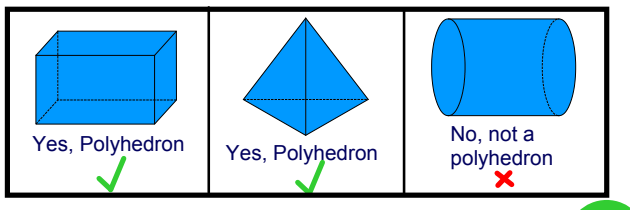
Polyhedron

A 3-D figure whose faces are *all* polygons.
A Polyhedron has NO curved surfaces.
Plural: Polyhedra



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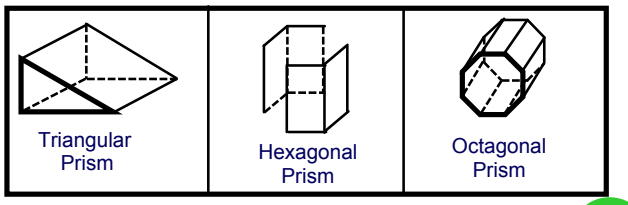
Prism

A polyhedron that has 2 congruent, polygon bases which are parallel to one another. Remaining sides are rectangular (parallelograms). Named by the shape of the base.



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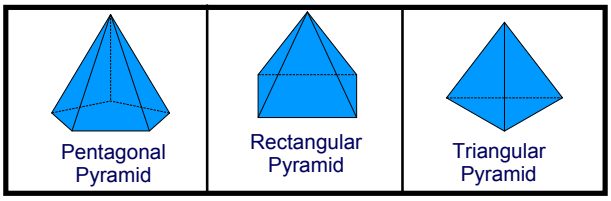
Pyramid

A polyhedron that has 1 polygon base with a vertex opposite it. Remaining sides are triangular. Named by the shape of their base



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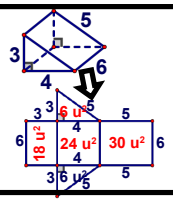
Surface Area

The sum of the areas of *all* outside surfaces of a 3-D figure.

1. Find the area of each surface of the figure
2. Add all of the areas together



18
24
30
6
+ 6
SA = 84 units²

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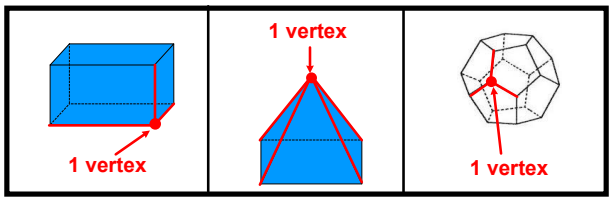
Vertex

Point where 3 or more faces/edges meet
Plural: Vertices



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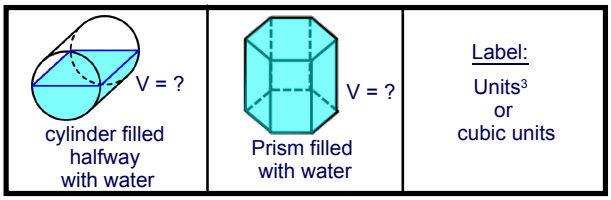
Volume

The amount of space occupied by a 3-D Figure. The number of cubic units needed to FILL a 3-D Figure (layering).



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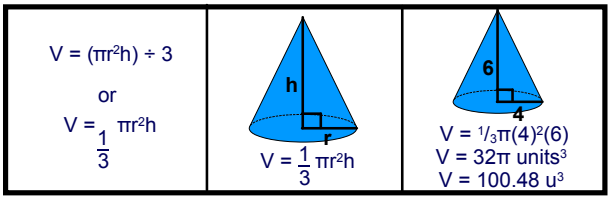
Volume of a Cone

A cone is 1/3 the volume of a cylinder with the same base area ($B = \pi r^2$) and height (h).



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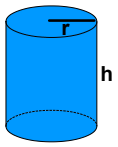
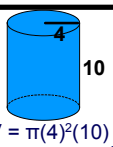
Volume of a Cylinder

Found by multiplying the Area of the base (B) and the height (h).

Since your base is always a circle, your volume formula for a cylinder is V = Bh $V = \pi r^2 h$	 $V = \pi r^2 h$	 $V = \pi(4)^2(10)$ $V = 160\pi$ units^3 $V = 502.4$ u^3

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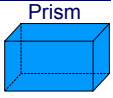
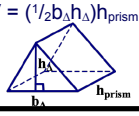
Volume of a Prism

Found by multiplying the Area of the base (B) and the height (h).
V = Bh

The shape of your base matches the name of the prism	Rectangular Prism  V = Bh V = (lw)h	Triangular Prism V = Bh $V = (\frac{1}{2}b_\Delta h_\Delta)h_{prism}$ 

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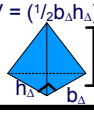
Volume of a Pyramid

A pyramid is 1/3 the volume of a prism with the same base area (*B*) and height (*h*).

$V = (Bh) \div 3$ or $V = \frac{1}{3}(Bh)$

The shape of your base matches the name of the pyramid	Rectangular Pyramid  $V = \frac{1}{3}Bh$ $V = \frac{1}{3}(lw)h$	Triangular Pyramid $V = \frac{1}{3}Bh$ $V = (\frac{1}{2}b_\Delta h_\Delta)h_{pyramid}$ 

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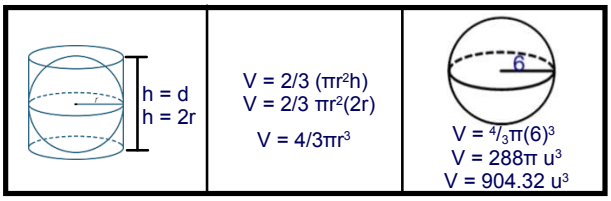
Volume of a Sphere

A sphere is 2/3 the volume of a cylinder with the same base area ($B = \pi r^2$) and height (h = d = 2r).



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Standards for Mathematical Practices

MP1 Make sense of problems and persevere in solving them.

MP2 Reason abstractly and quantitatively.

MP3 Construct viable arguments and critique the reasoning of others.

MP4 Model with mathematics.

MP5 Use appropriate tools strategically.

MP6 Attend to precision.

MP7 Look for and make use of structure.

MP8 Look for and express regularity in repeated reasoning.

Click on each standard to bring you to an example of how to meet this standard within the unit.

COMMON CORE STATE STANDARDS INITIATIVE
PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER