Helping With Math

Spatial Skill:
Volume of Solid Figures

Suitable for students
aged 9-12

Happy Boxing Day!

This pack is suitable for learners aged 9-12 years old or 5th to 7th graders. The content covers fact files and relevant basic and advanced activities of volume of solid figures topics that aim to develop and strengthen the learners' spatial skills.

Every **26th day of December is Boxing Day**. This is a public Holiday in the United Kingdom and other British Commonwealth countries such as Australia, Canada and New Zealand.

Why do we celebrate Boxing Day?

- This is called the Second Day of Christmas.
- The holiday's name originated from a time when the wealthy used to prepare boxed gifts for the poor.
- Traditionally, Boxing Day was a rest day for servants and a once-in-a-year day when they received a special Christmas box from their masters.
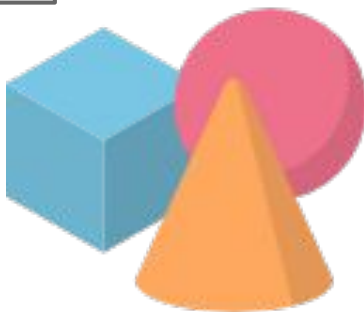
SPATIAL SKILL

Spatial skill is the ability to comprehend, reason, and recall spatial relations among objects or space.
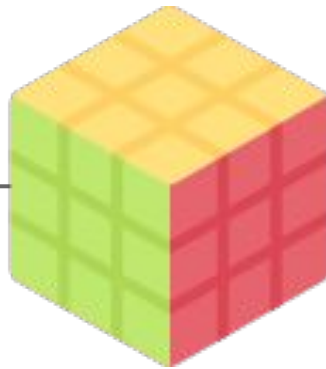
There are four types of spatial skills: spatial perception, spatial visualization, mental folding and mental rotation.

According to experts, children use geometrical strategies to solve math problems, some includes mental number lines, geometric figures, and information about locations in space.

SPATIAL SKILL

Experts also concluded that people who use spatial representation (including spatial relationships) in dealing with math problems are more likely to get better scores.

- Children who have displayed better spatial skills when compared to their peers have better academic achievement in math.
- How do we develop the spatial skills of young learners? Researchers suggest that children must play with building blocks, puzzles, video games, and other spatial materials to help develop their spatial skills.

Which among these items do you play and enjoy the most? Why? Share your answer below.
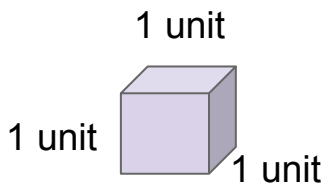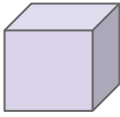
VOLUME OF SOLID FIGURES

SOLID FIGURES

Solid figures are three-dimensional figures that have length, width and height.
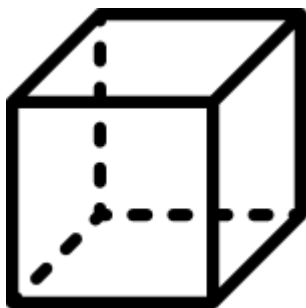
VOLUME

Volume refers to the capacity (amount) of a space occupies with a 3 dimensional objects.

It is measured in "cubic" units. The volume of a figure is equal to the number of cubes required to fill it completely, like blocks in a box.

1 unit

1 unit
1 unit

How many of this ▢ can fit in a cube whose dimensions are 12 ft, 10 ft, and 5 ft?

Cube

A solid object bounded by six square faces, facets or sides, with three meeting at each vertex.

$$V = s^3$$

where s is equal to the measurement of a side of the cube.

VOLUME OF SOLID FIGURES
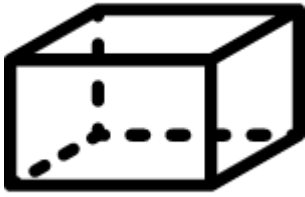
It is a polyhedron with exactly two rectangular faces/bases that are congruent and parallel. Other faces are called lateral faces.

$$V = LWH$$

where L = length, W = width, and H = height.

Rectangular Prism

$$V = 4/3(\pi r^3)$$

Sphere

It is a figure with a curved surface in which all points on the surface are equidistant from the center.

$$V = \pi r^2 h$$

Cylinder

It is a solid figure that has two congruent or equal circular bases that are parallel.

It is a solid figure that has a circular base connected to a vertex.

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

where r = length of the radius and h = height.

Cone

VOLUME OF SOLID FIGURES

Pyramid

It is a polyhedron in which one face, can be any polygon. The other faces are triangular sides that meet at a common vertex.

$$V = \tfrac{1}{3} BH$$

Where B = area of the base and H = height

ILLUSTRATIVE EXAMPLE
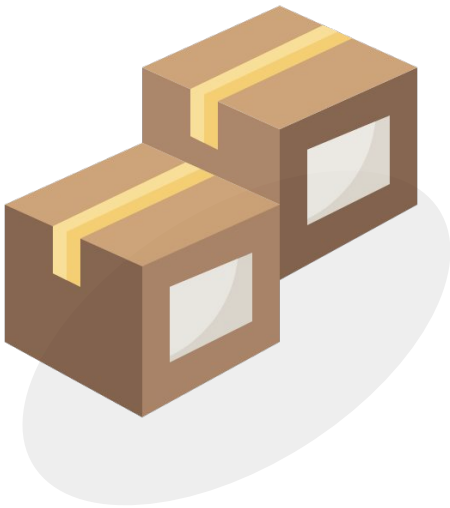
Two boxes will be used for the giving of gifts this Boxing Day. The first one is a cube-shaped box with a side that measures 6 ft. The second one is shaped like a rectangular prism with the following dimensions, 4 ft, 5 ft, 4.5 ft. Sketch the two boxes. Solve for the volume of the two boxes.

A. Sketch the two boxes with their corresponding dimensions.

6 ft.

6 ft.

6 ft.

5 ft.

4.5 ft.

4 ft.
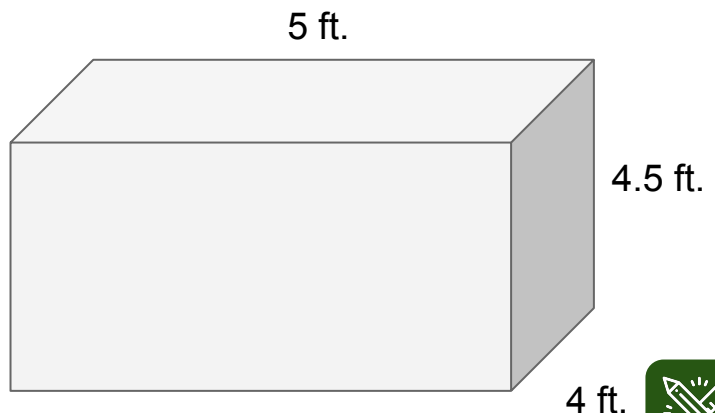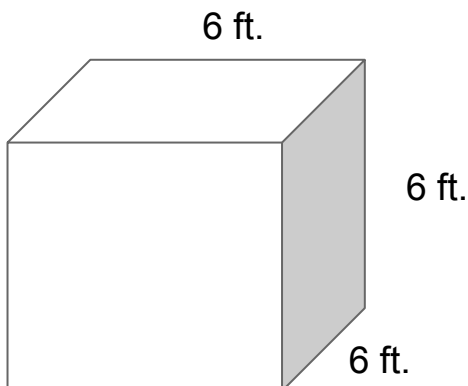
VOLUME OF SOLID FIGURES

B. Solve for the volume of the two boxes.

The first box is a cube so the formula to be used is $V = s \times s \times s$ or s^3

6 ft.

Since s = 6 ft,

$V = 6 \text{ ft} \times 6 \text{ ft} \times 6 \text{ ft} = 216 \text{ ft}^3$
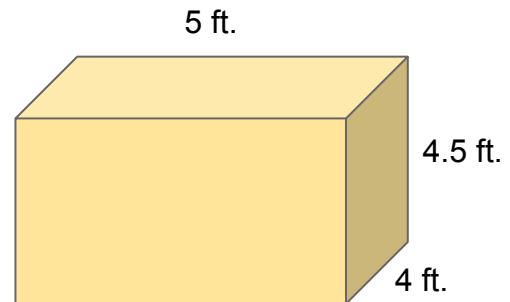
6 ft.

The volume of the box is 216 ft^3.

6 ft.
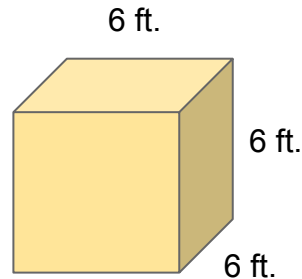
The second box is a rectangular prism so the formula to be used is

$V = L \times W \times H$.

5 ft.

Since L = 5 ft, W = 4 ft, H = 4.5 ft

$V = 5 \text{ ft} \times 4 \text{ ft} \times 4.5 \text{ ft} = 90 \text{ ft}^3$

4.5 ft.

The volume of the box is 90 ft^3.

4 ft.

Other examples:
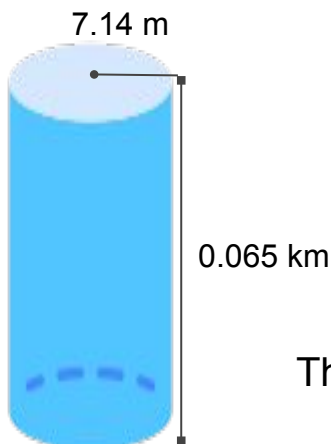
7.14 m

Let r = 7.14 m and h = 0.065 km or 65 m, π = 3.14

$V = \pi r^2 h \longrightarrow V = (3.14)(7.14 \text{ m})^2 (65 \text{ m})$

0.065 km $V = 10,404.94 \text{ m}^3$

The volume of the cylindrical object is **10, 404. 94 m^3.**

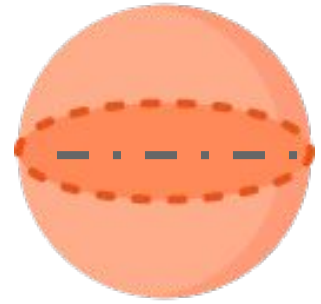## VOLUME OF SOLID FIGURES

The radius of the sphere is 4 ft.

$V = 4/3(\pi r^3)$ $V = 4/3(64\pi)$

$V = 4/3(\pi)(4)^3$ $V = 85.33\pi$ ft^3

$V = 4/3(\pi)(64)$

The radius is 20 in and the height is 50 in.
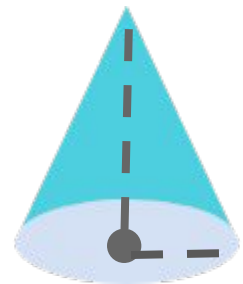
$V = \frac{1}{3}\pi r^2 h$ $V = \frac{1}{3}\pi(20000)$

$V = \frac{1}{3}\pi(20)^2(50)$ $V = 6666.67\pi$ in^3

$V = \frac{1}{3}\pi(400)(50)$

PRACTICE EXERCISES

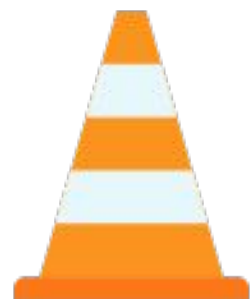The radius of the sphere is 11.25 ft.

The radius is 17 in and the height is 45 in.

TABLE OF ACTIVITIES

	Ages 9-11 (Basic)	G5 - G6
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7	A Trip to New Zealand	
8	Cone Tasks	
9	Volume of Space	
10	Our Gift Offerings	

THE PERFECT BOX

Help Mr. Montgomery look for the perfect box to use this Boxing Day. He will tell you the volume of the box. Which among them is the perfect box that will fit his gift?

1.

18 in

1 ft

13 in

2.

1.5 ft

6 in

11 in

3.

1.2 ft

6 in

10 in
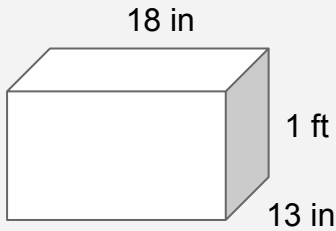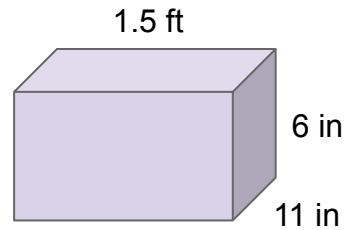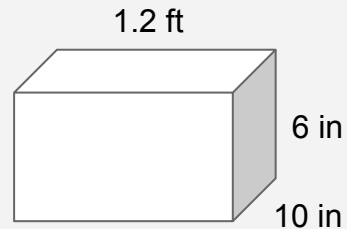
The volume of my box is 2808 in ^{3} .

BOXES' CUBIC UNITS

These are the boxes that will be used by McGregor Family to give away this 2nd day of Christmas. Can you calculate its volume?
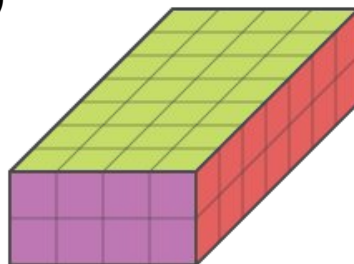
1.)
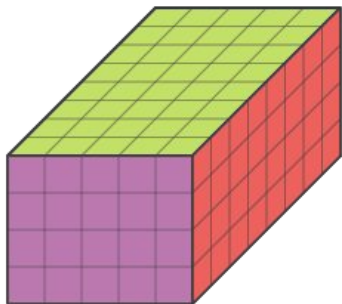
L = _____   W = _____

H = _____   V = _____

2.)

L = _____   W = _____

H = _____   V = _____

3.)
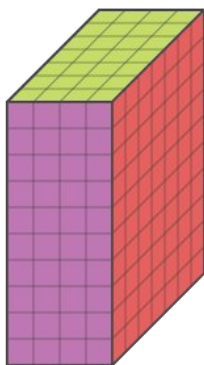
L = _____   W = _____

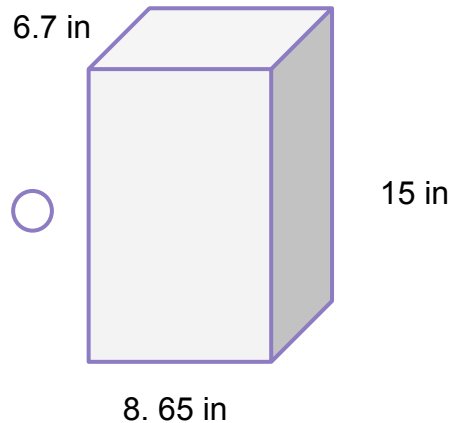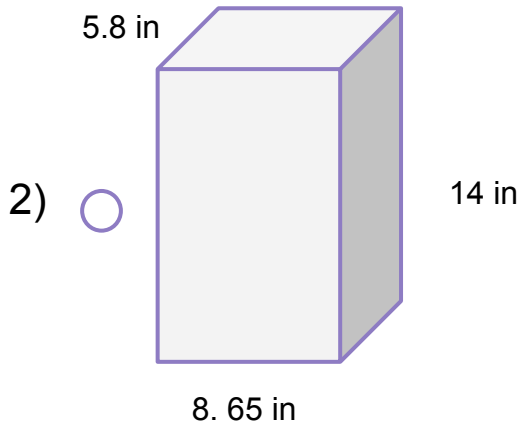H = _____   V = _____

4.)
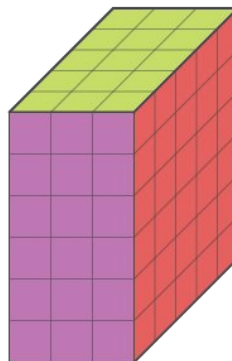
L = _____   W = _____

H = _____   V = _____

SELECTING THE LARGER BOX

In the spirit of giving gifts to others, the Smith family would like to extend their gratitude to their servants by handing them large gift boxes. Put a check on which box is larger in terms of its volume. Note: the shapes' drawings are not their actual size.

1) ◯

10 cm

5.5 cm

8 cm

◯

9 cm

7 cm

5 cm

Solution:

2) ◯
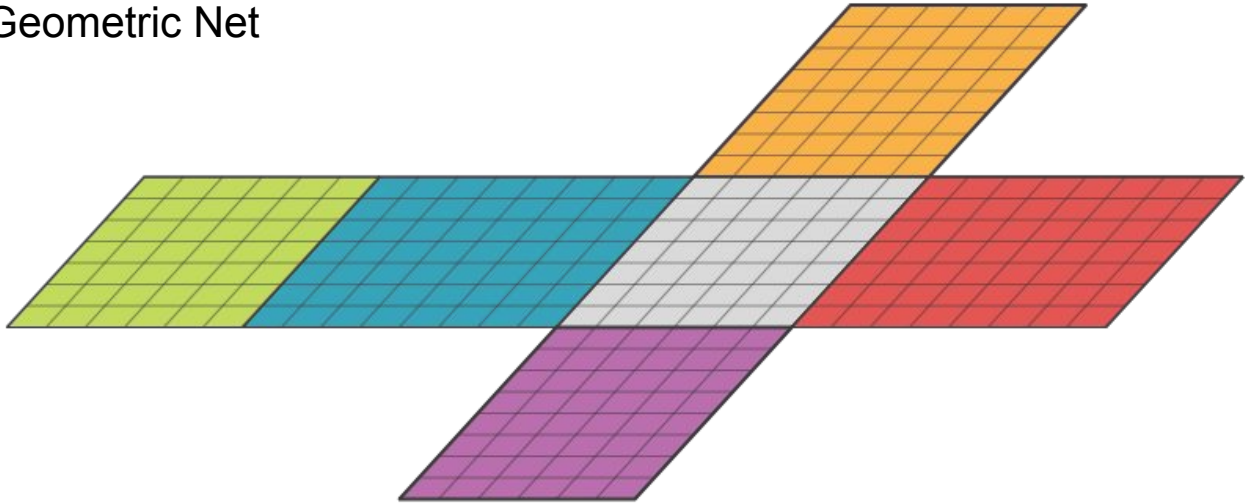
5.8 in

14 in

8. 65 in

◯

6.7 in

15 in
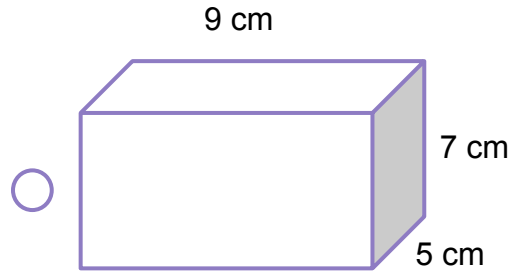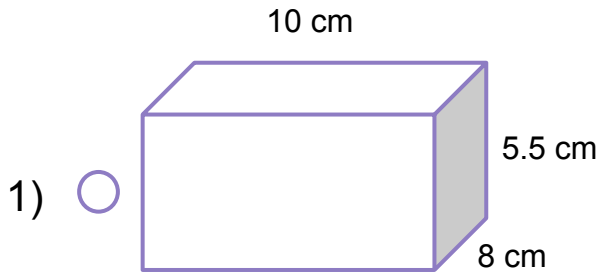
8. 65 in

Solution:

GIFT WRAPPING

This Boxing Day, it's nice to cover our gifts with amazing gift wrapper. Given the geometric net of the gift wrapper below, can you calculate the volume of the gift box?

Geometric Net

Sketch the solid figure and calculate its volume

Boxing Day is considered the second day of Christmas, where traditionally, the wealthy give alms to the poor. Consider the gift boxes below and use your understanding of volume to solve it.

1. One out of three boxes for the celebration of Boxing Day can hold 4096 cubic inches. This box has a shape of cube. What are its dimensions?

2. If a cube box has a volume of 1728 cm cubic units, how many blocks of a smaller cube, whose length is 2 cm, can fit on the bigger box?
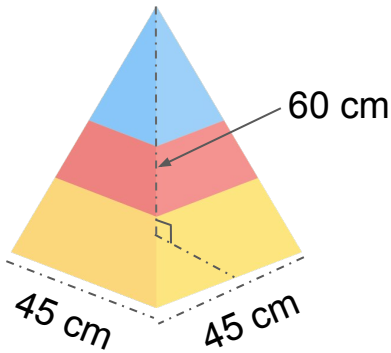
3. A storage box in cube shape can hold approximately 150 blocks of smaller cubes whose length is 3 cm. Given this, estimate the volume of the storage box.
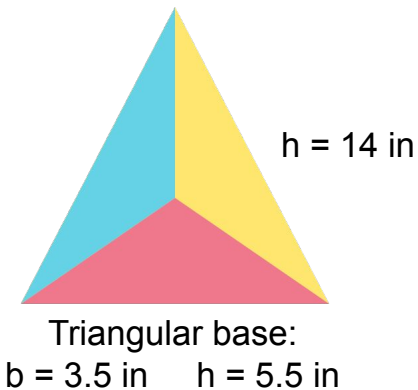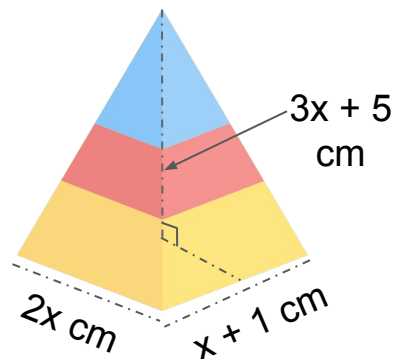
THE PYRAMID GIFTS

Get these amazing pyramid-shaped gifts in celebration of Boxing Day. All you need to do is calculate for its volume.

60 cm

45 cm   45 cm

h = 14 in

Triangular base:
b = 3.5 in   h = 5.5 in

3x + 5 cm

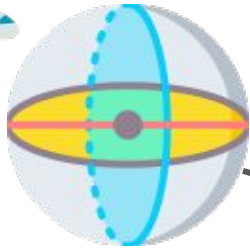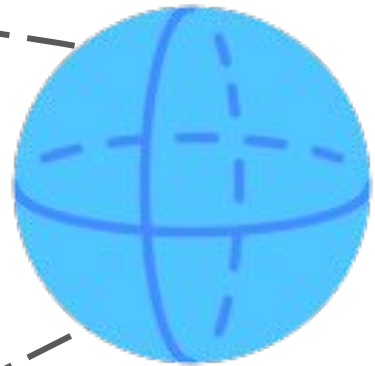2x cm   x + 1 cm

Win this Boxing Day promo! A trip to New Zealand is at stake by answering these sphere-related questions. Hurry and grab your chance! Let π = 3.14. Round off your answer to the nearest tenths.
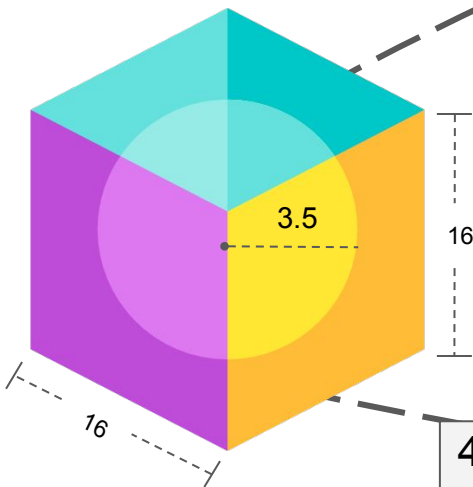
1. Solve for the volume of this sphere.

d = 7 yd

9 yd

2. Solve for the volume of this sphere.

3. What is the volume of the hollow space?

3.5

16

16

r = 2 ¼ in

4. Solve for the V of the billiard ball.
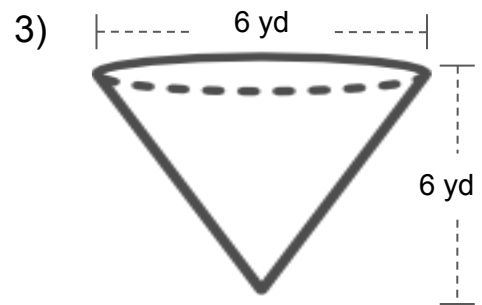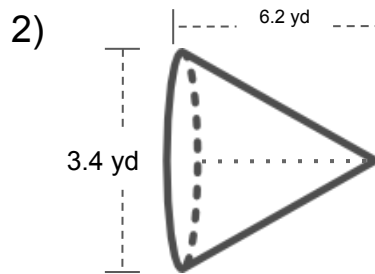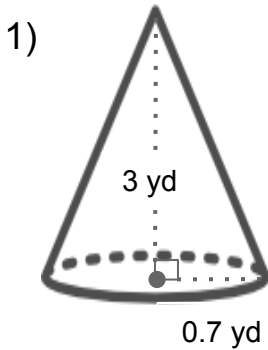
CONE TASKS

Look at these cones, are they not beautiful? This Boxing Day, can you compute for their volume? Show your solutions below.

1)

3 yd

0.7 yd

2)

6.2 yd

3.4 yd

3)

6 yd

6 yd

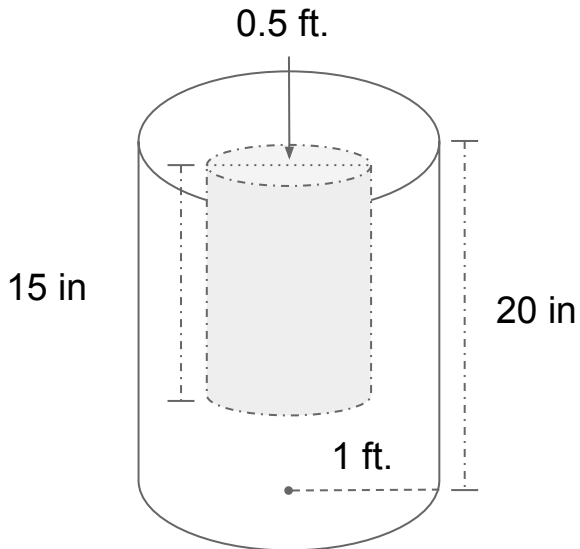| 1)	2)	3)

4) r = 5.85 m   h = 10 m

5) d = 300 cm   h = 55 m

6) circumference = 10π units   h = 25 units
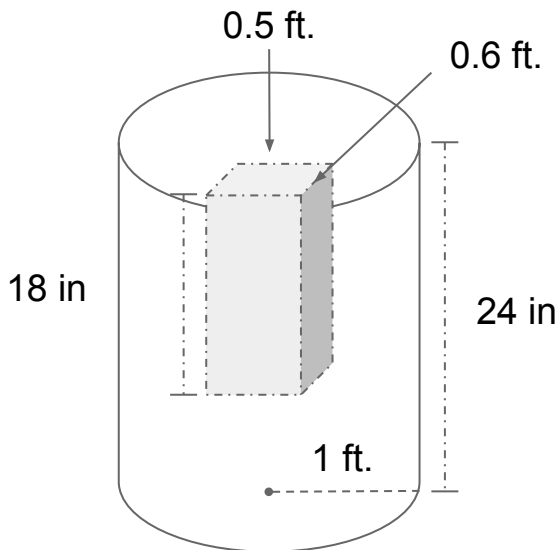
Milly would like to wrap her gifts in cylindrical shape. The outline are given below. What is the volume of the free space?

0.5 ft.

15 in

20 in

1 ft.

Solution:

0.5 ft.

0.6 ft.

18 in

24 in

1 ft.
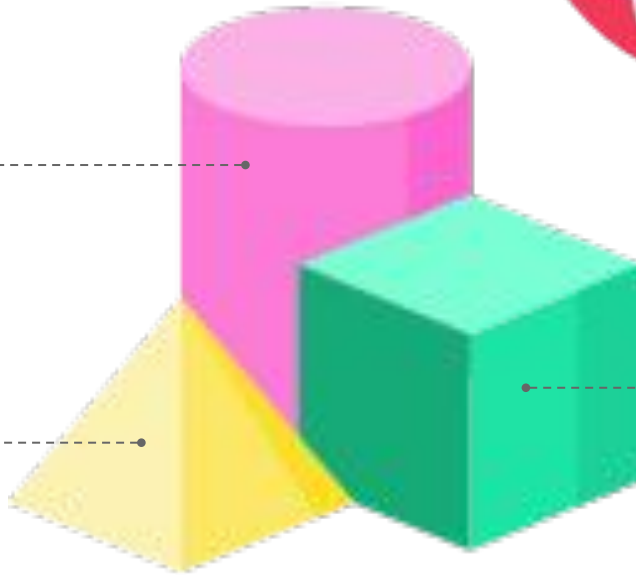
Solution:

OUR GIFT OFFERINGS

This Boxing Day, look around your house and find some objects that are cube, pyramid, and cylinder in shape. Measure their dimensions and calculate their volume.

ANSWER GUIDE

Activity 1

1. 2808 cubic in   2. 1188 cubic in   3. 720 cubic in
The answer is the first box.

Activity 2

1. L = 8 units   W = 5 units   H = 4 units   V = 160 cu. units
2. L = 7 units   W = 4 units   H = 2 units   V = 58 cu. units
3. L = 7 units   W = 4 units   H = 10 units   V = 280 cu. units
4. L = 5 units   W = 3 units   H = 6 units   V = 90 cu. units

Activity 3

1. 440 cu. cm vs 315 cu. cm -- the larger box is the first one.
2. 702.38 cu. in vs 869.33 cu. in --- the larger box is the second one.

Activity 4
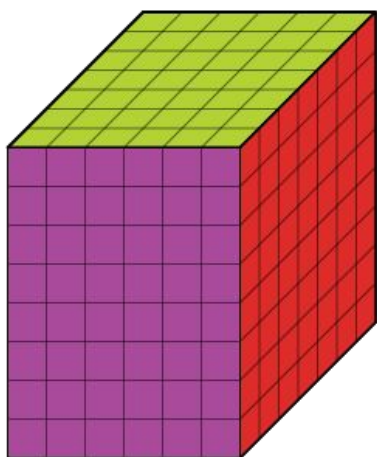
Volume is 336 cu. units

Activity 5

1. The dimensions of the cube are all equal to 16 in.
2. 216 smaller cubes
3. The volume of the storage box is 4050 cu. cm. Just multiply 150 to the volume of the smaller cube (27 cu. cm).

ANSWER GUIDE

Activity 6

1. 40500 cu. cm
2. 44.92 cu. In

3. $\dfrac{6x^3 + 16x^2 + 10x}{3}$ cu.cm

Activity 7

1. 1436.0 cu. yd
2. 3052.1 cu. yd
3. Sphere = 179.5 Cube = 4096
V of cube - V of sphere = 4096 -
179.5 = 3916.5 cu. units
4. 47.7 cu. in

Activity 8

1. V = 1.54 cu.yd
2. 18.76 cu.yd
3. 226.19 cu.yd
4. 358.38 cu. m
5. 129.59 cu. m
6. 654.5 cu. units

Activity 9

1. Larger cylinder = 9047.79
   Smaller cylinder = 424.12
   Space' volume = 8623.67
2. Cylinder = 2714.34
   Rectangular prism = 777.6
   Space' volume = 1936.74

Activity 10

Answers may vary.

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