Section 1: Area, Surface Area, and Volume

This booklet belongs to:_____Block: _____

Section	Due Date	How Did It Go?	Corrections Made and Understood
1.1			
1.2			
1.3			

Self-Assessment Rubric

Category	L-T Score	Learning Target Procedure	Algebraic/Arithmetic Procedure	Communication	Anecdotal Example
Extending	4	Procedural context demonstrates a detailed understanding of the learning targets	Algebraic/Arithmetic process is error free, logic is clear and easy to follow	Written output is clear, easy to follow, and shows depth of understanding	"You could teach this" or "It's an answer key"
	3.5	Procedural context demonstrates a thorough understanding of the learning targets	Algebraic/Arithmetic process contains very minor errors, logic is clear and easy to follow	Written output is clear, easy to follow, and shows depth of understanding	"Almost perfect, one or two little errors"
Proficient	3	Procedural context is clear, demonstrates sound reasoning and thought of the learning targets	Algebraic/Arithmetic process contains minor errors, logic is clear and easy to follow	Written output is clear and organized, and shows depth of understanding	"Good understanding with a few errors"
Developing	2.5	Procedural context is clear, contains errors but demonstrates sound reasoning and thought of the learning targets	Algebraic/Arithmetic process contains errors, logic is clear and easy to follow	Written output is difficult to follow, but shows an understanding of the task	"You know what to do bet not clear how to do it"
Developing	2	Procedural context contains errors. Understanding of the learning targets is developing	Algebraic/Arithmetic process contains numerous errors, difficult to follow	Written output is difficult to follow but shows an understanding of the task	"You are on the right track but key concepts are missing"
Emerging	1	Procedural context is not clear, demonstrates minimal understanding of the learning targets	Algebraic/Arithmetic process contains numerous errors, difficult to follow	Written output is difficult to follow, but shows an understanding of the task	"You have achieved the bare minimum to meet the learning outcome"
Not Yet Meeting Outcomes	IE	Procedural context is not clear, demonstrates minimal understanding of the learning targets	Algebraic/Arithmetic process contains numerous errors, difficult to follow	Written output is difficult to follow or completely absent and lacks clarity	"Learning outcomes are not met at this time"

Learning Targets and Self-Evaluation

L – T	Description	Mark
$1-1$	• Understanding the concept of area with respect to 2D shapes • Can solve 2D images with cut-outs and composite forms	
$1-2$	• Understanding the transfer of 2D shapes to map Surface Area of 3D shapes • Formula manipulation and contextualized problems involving 3D shapes	
$1-3$	• Understanding the transfer of 2D shapes to map Volume of 3D shapes • Formula manipulation and contextualized problems involving 3D shapes	

Comments:

Competency Evaluation

A valuable aspect to the learning process involves self-reflection and efficacy. Research has shown that authentic self-reflection helps improve performance and effort, and can have a direct impact on the growth mindset of the individual. In order to grow and be a life-long learner we need to develop the capacity to monitor, evaluate, and know what and where we need to focus on improvement. Read the following list of Core Competency Outcomes and reflect on your behaviour, attitude, effort, and actions throughout this unit.

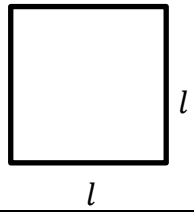
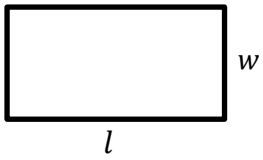
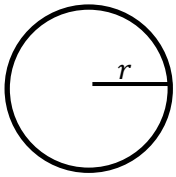
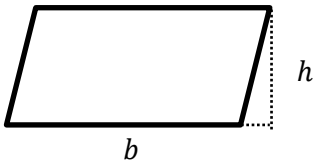
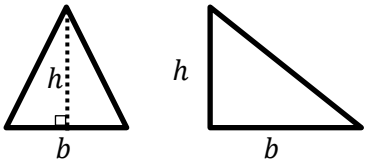
- Rank yourself on the left of each column: 4 (Excellent), 3 (Good), 2 (Satisfactory), 1 (Needs Improvement)

		4	3	2	1
Personal Responsibility	• I **listen** during instruction and come ready to ask questions				
	• I am **on time** for class • I am **fully prepared** for the class, with all the required supplies				
	• I am **fully prepared** for Tests				
	• I **follow** instructions keep my Workbook organized and tidy • I am **on task** during work blocks • I **complete** assignments **on time**				
Self-Regulation	• I keep track of my **Learning Targets**				
	• I take **ownership** over my goals, learning, and behaviour • I can **solve problems** myself and know when to ask for help • I can **persevere** in challenging tasks • I **am actively** engaged in lessons and discussions				
	• I only **use my phone** for school tasks				
Classroom Responsibility and Communication	• I am **focused** on the discussion and lessons • I **ask questions** during the lesson and class • I give **my best effor**t and **encourage** others to work well • I am polite and communicate questions and concerns with my peers and teacher in a timely manner • I clean up after myself and leave the classroom tidy when I leave				
Collaborative Actions	• I can **work with others** to achieve a common goal • I make **contributions** to my group • I **am kind** to others, can work collaboratively and **build relationships** with my peers • I **can identify** when others need support and provide it				
Communication Skills	• I present informative **clearly**, in an organized way • I **ask and respond** to simple direct questions • I am an **active listener**, I support and encourage the speaker • I **recognize** that there are different points of view and can disagree respectfully • I do not interrupt or speak over others				
	Overall				
Goal for next Unit – refer to the above criteria. **Please selec**t (underline/highlight) **two areas** you want to focus on					

Section 1.1 – Area

Area

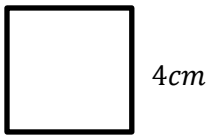
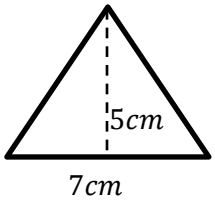
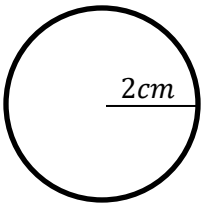
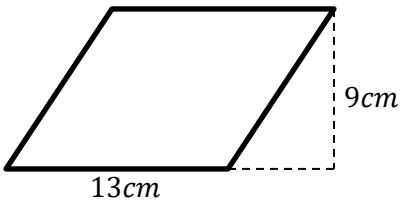
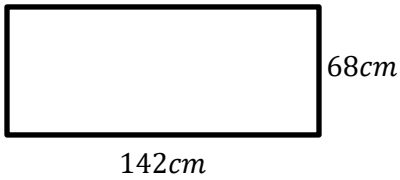
- The amount of space it takes to fill a **2-Dimensional shape**
  - What 2-D shapes can we think of?
    - Square and Rectangles
    - Triangle
    - Circle
    - Parallelograms
  - We have known equations for all of these, let's have a look.

Name	Shape	Equation for Area
Square		$l * l \; or \; l^2$
Rectangle		$l * w \; or \; b * h$
Circle		πr^2
Parallelogram		$b * h$
Triangle		$\frac{b * h}{2}$

- A few of these equations are intuitive
- We don't need to worry about proving them, all we need to know is how they work
- Like **Colour By Numbers** we have to **SUBSTITUTE** the values we have into the equations
- We need to make sure we have enough information to solve the problem

Example:

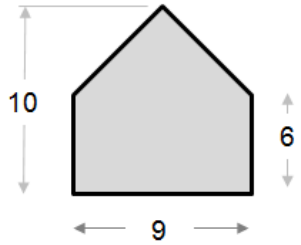
What is the Area of the following Shapes?

a) 	$A = l^2$ $A = 4^2$ $A = 16\ cm^2$
b) 	$A = \frac{bh}{2}$ $A = \frac{5 \cdot 7}{2} \rightarrow \frac{35}{2} \rightarrow 17.5\ cm^2$
c) 	$A = \pi r^2$ $A = \pi 2^2$ $A = 4\pi\ cm^2$
d) 	$A = bh$ $A = 13 \cdot 9$ $A = 117\ cm^2$
e) 	$A = bh$ $A = 142 \cdot 68$ $A = 9656\ cm^2$

Compound Shapes

- Finding the Area of a Compound Shape is a little bit more tricky
- Compound shapes are shapes that involve the breakdown into shapes we know
- Sometimes we have to break a shape into pieces and then add the area's together
- Sometimes we have to subtract a piece of area from another

Example:

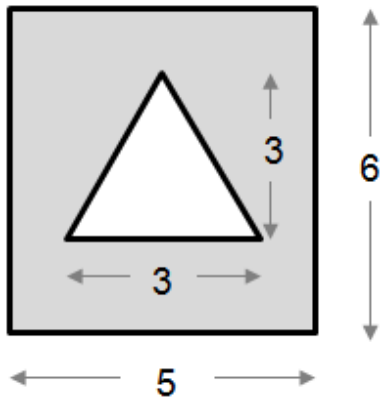


Break it into a triangle and square: Triangle Height of $10 - 6 = 4$

Area of Square	Area of Triangle
$A = 6 \cdot 9 = 54$	$A = \frac{9 \cdot 4}{2} = \frac{36}{2} = 18$

Area Combined

$54 + 18 = 72\ units^2$



Need the triangle and square: Subtract triangle from Square

Area of Square	Area of Triangle
$A = 6 \cdot 5 = 30$	$A = \frac{3 \cdot 3}{2} = \frac{9}{2} = 4.5$

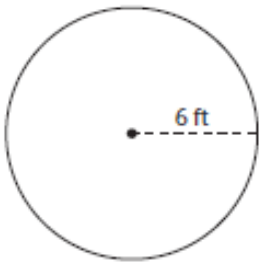
Area Combined

$30 - 4.5 = 25.5\ units^2$

Section 1.1 – Practice Problems

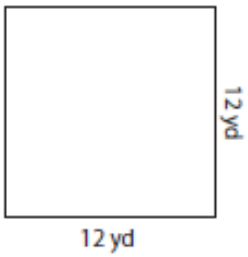
Find the area of each figure.

1)



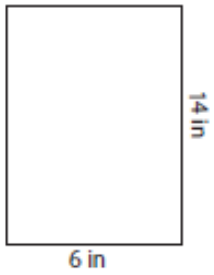
Area = _____

2)



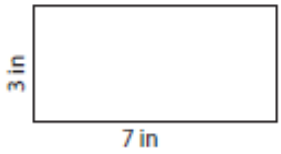
Area = _____

3)



Area = _____

4)

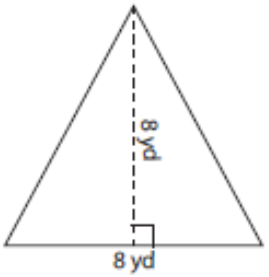


Area = _____

5)

Area = _____

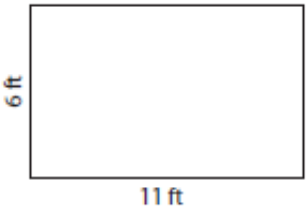
6)



Area = _____

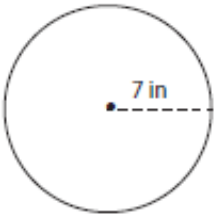
Find the area of each figure.

7)



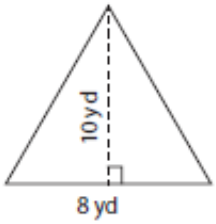
Area = _____

8)



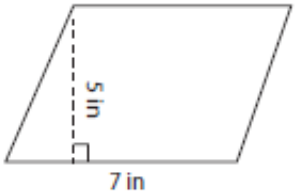
Area = _____

9)



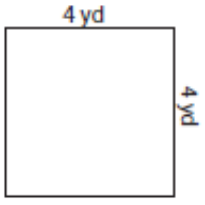
Area = _____

10)



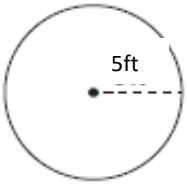
Area = _____

11)



Area = _____

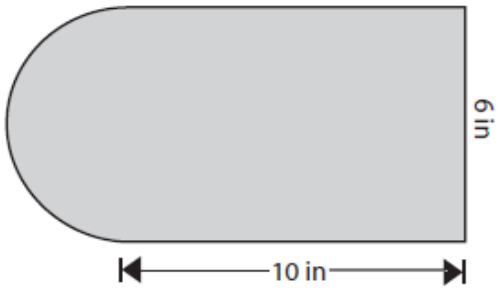
12)



Area = _____

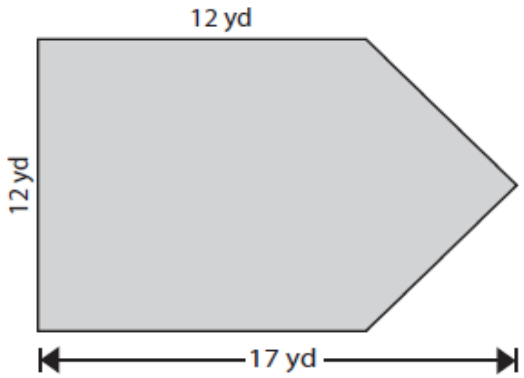
Find the area of each figure. Round the answer to 2 decimal places if necessary.

13)



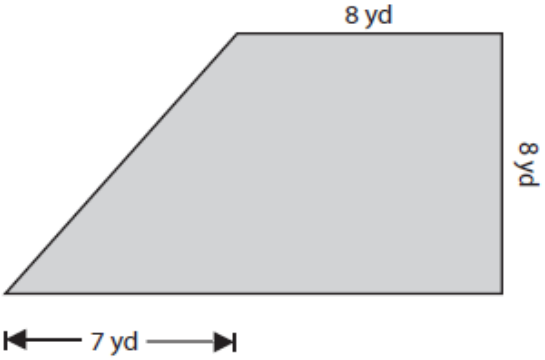
Area = _____

14)



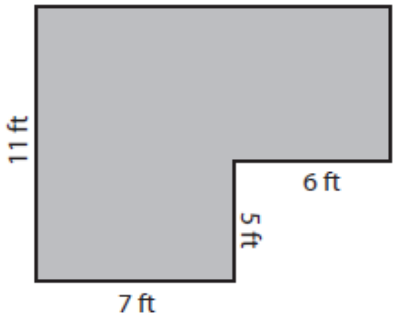
Area = _____

15)



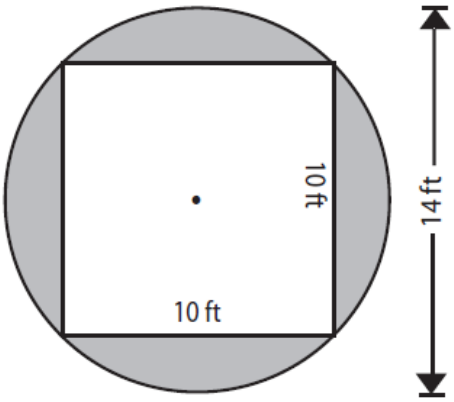
Area = _____

16)



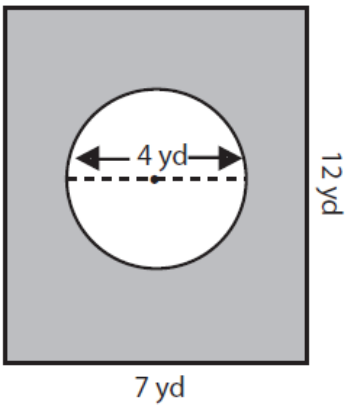
Area = _____

17)



Area = _____

18)



Area = _____

Section 1.2 – Surface Area

Surface Area

- So what about **Surface Area?**
- How does Surface Area differ from Area?

Well it is still 2-Dimensional shapes but it is the **combination of all** the 2-Dimensional sides of a 3-Dimensional figure.

- The Space you can wrap with paper, material, etc.
- The Space you can paint, colour in, etc.
- Requires 2 axes of direction, 2-D

2-D shapes
have units cm^2

So what Shapes do we have know?

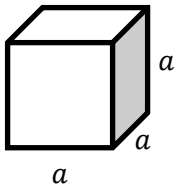
- Cubes
- Rectangular Prisms
- Right Triangular Prisms
- Pyramids
- Cones
- Spheres

✓ See the attached page for all the General Formulas
✓ We will discuss a few in detail

➢ Remember that we just need to take the AREA of each 2-D side and ADD them up!

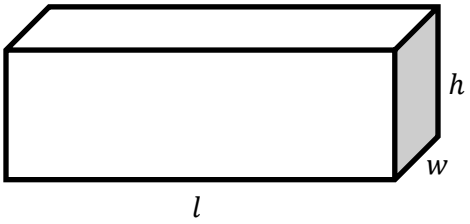
General Formulas

Cube:

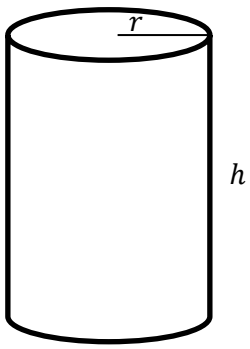


$6a^2$ $\quad$ $where\ a\ is\ the\ side\ length$

Rectangular Prism: $2lw + 2lh + 2wh$



Cylinder:

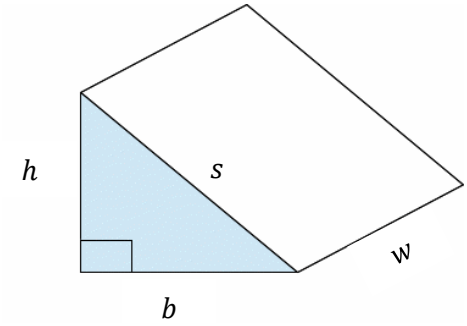


$$2\pi r^2 + 2\pi rh$$

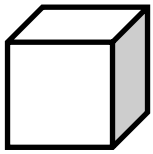
where $\boldsymbol{r}$ *is the* ***radius*** *of the circle*
and $\boldsymbol{h}$ *is the* ***height*** *of the cylinder*

Right Triangular Prism:

$$\frac{\boldsymbol{2(b*h)}}{\boldsymbol{2}} + (w * h) + (b * w) + (w * s)$$



Example: Solve the following using their Equations

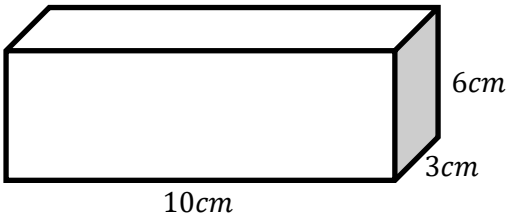


$$SA = 6a^2$$

$$SA = 6(4)^2$$

$$SA = 6(16) = 96\ cm^2$$

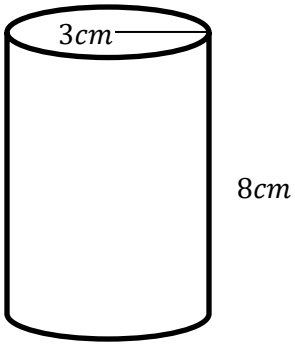
Example:



$$SA = 2lw + 2lh + 2wh$$

$$SA = 2(10)(3) + 2(10)(6) + 2(3)(6)$$

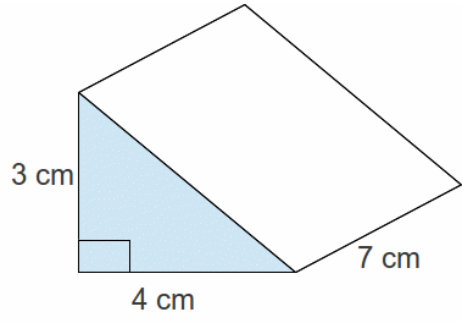
$$SA = 60 + 120 + 36 = 216\ cm^2$$



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

$$SA = 2\pi(3)^2 + 2\pi(3)(8)$$

$$SA = 18\pi\ + 48\pi = 66\pi\ cm^2$$



$$SA = All\ Areas\ Combined$$

$$SA = 2\frac{bh}{2} + bw + wh + ws$$

$$SA = (4)(3) + (4)(7) + (7)(3) + (7)(5)$$

$$SA = 12 + 28 + 21 + 35 = 96\ cm^2$$

- When dealing with Right Prisms we can summon our good old Pythagorean Theorem to solve for unknown lengths on our Right Triangle $a, b, and\ c$
- Except that the Pythagorean Theorem in this case is:

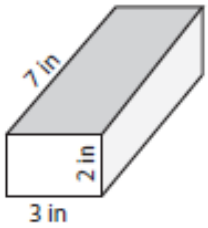
$$b^2 + h^2 = s^2$$

$$base^2 + height^2 = (slant\ height)^2$$

Section 1.2 – Practice Problems

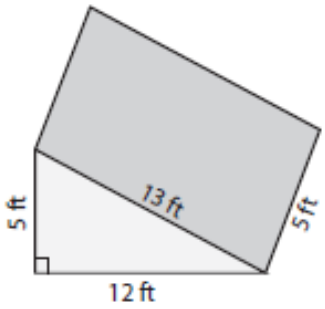
Find the Exact Surface Area of the following shapes. Round to 1 decimal place if necessary.

1)



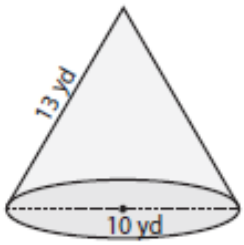
Surface Area = _____

2)



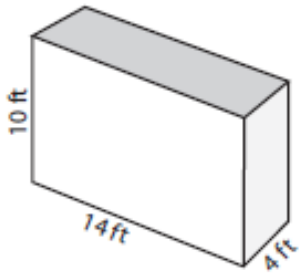
Surface Area = _____

3)



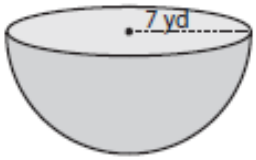
Surface Area = _____

4)



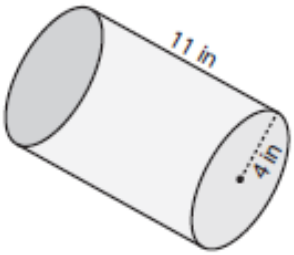
Surface Area = _____

5)



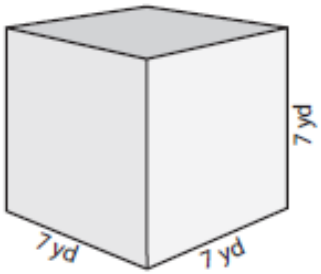
Surface Area = _____

6)



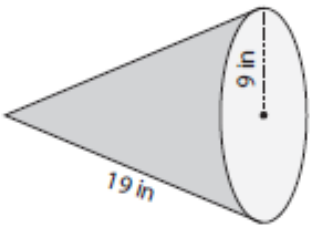
Surface Area = _____

7)



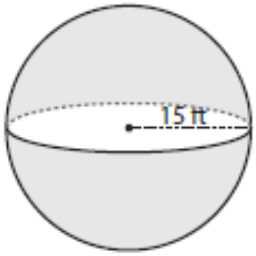
Surface Area = _____

8)



Surface Area = _____

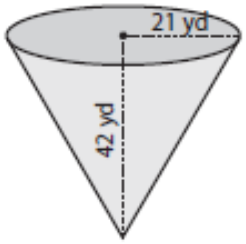
9)



Surface Area = _____

Find the Exact Surface Area of the following shapes. Round to 1 decimal place if necessary.

10)

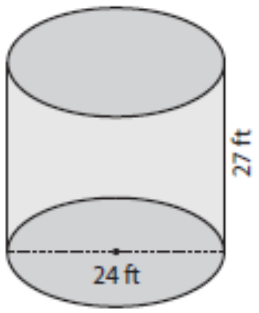


Surface Area = _____

11)

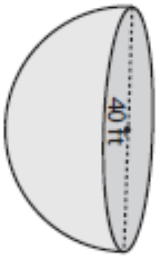
Surface Area = _____

12)



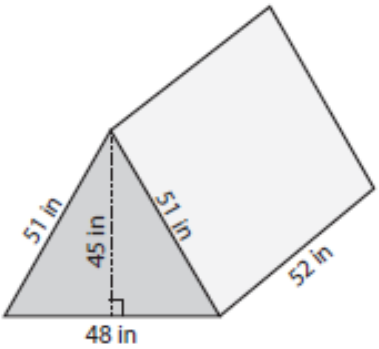
Surface Area = _____

13)



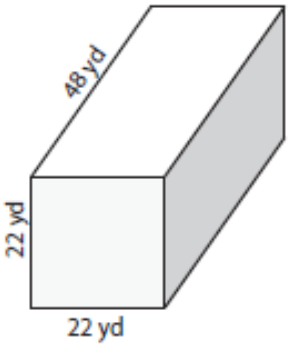
Surface Area = _____

14)



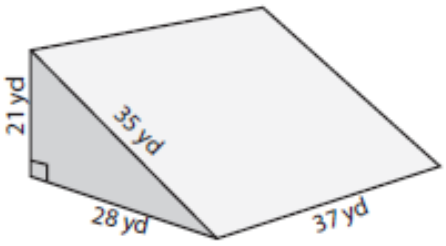
Surface Area = _____

15)



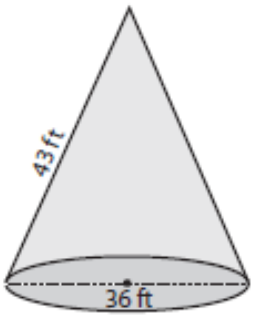
Surface Area = _____

16)



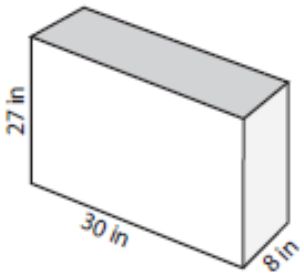
Surface Area = _____

17)



Surface Area = _____

18)



Surface Area = _____

Section 1.3 – Volume

Volume

- Volume is the **space that takes up the inside of a 3D shape**
- Intuitively it is the **AREA of the BASE** of the figure times the **HEIGHT**
- The space you can fill with water, sand, yogurt, air, etc.
- Requires 3-axes of direction, 3D

3-D shapes have units cm^3

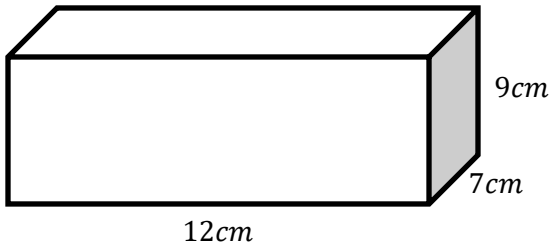
Basic Volume Formulas

- **Cube** a^3 $where\ a\ is\ the\ side\ length\ of\ the\ cube$
- **Rectangular Prism** $l * w * h$
- **Cylinder** $\pi r^2 h$
- **Triangular Prism** $\frac{l*w*h}{2}$

- For Volume it is substituting the numbers into the equations and solving for unknowns
- **See the following list of Surface Area and Volume Equations in the Table provided**

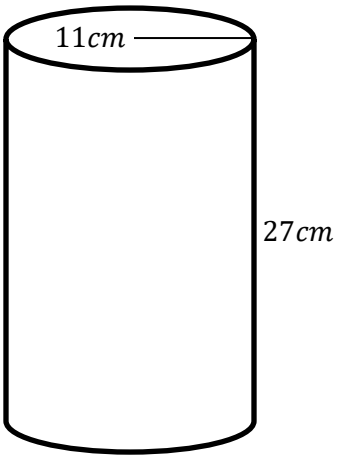
Examples:

Find the Volume of the Following Shapes



$$V = lwh$$

$$V = (12)(7)(9) = 756\ cm^3$$



$$V = (Area\ of\ Base)h$$

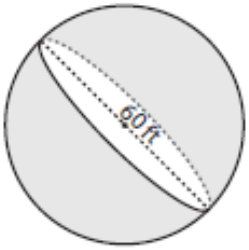
$$V = \pi r^2(h) = \pi(11)^2(27)$$

$$V = \pi(121)(27) = 3267\pi\ cm^3$$

Section 1.3 – Practice Problems

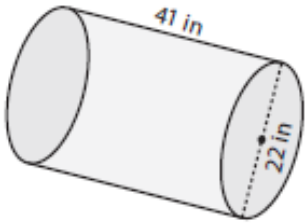
Find the volume of each shape. Round the answer to nearest tenth. (use $\pi = 3.14$)

1)



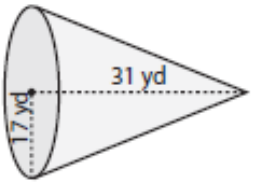
Volume = _____

2)



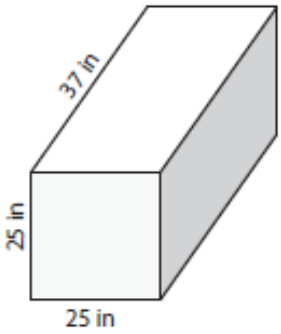
Volume = _____

3)



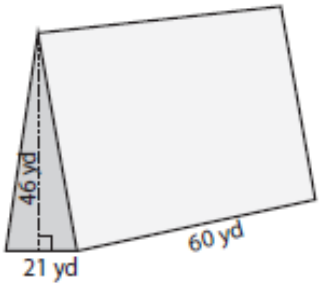
Volume = _____

4)



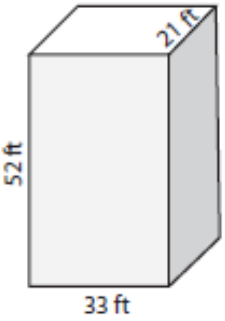
Volume = _____

5)



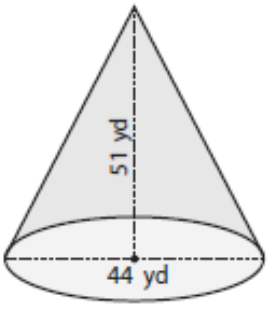
Volume = _____

6)



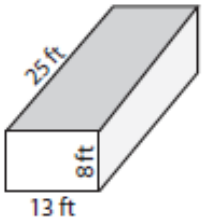
Volume = _____

7)



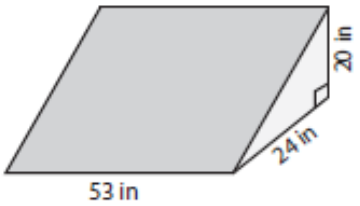
Volume = _____

8)



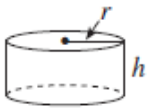
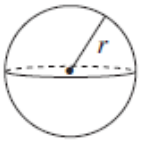
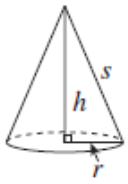
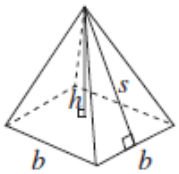
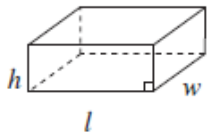
Volume = _____

9)



Volume = _____

Surface Area and Volume General Formula Sheet

Geometric Solid	Surface Area	Volume
Cylinder 	$A_{top} = \pi r^2$ $A_{base} = \pi r^2$ $A_{side} = 2\pi rh$ $SA = 2\pi r^2 + 2\pi rh$	$V = (\text{area of base}) \times h$
Sphere 	$SA = 4\pi r^2$ **or** $SA = \pi d^2$	$V = \frac{4}{3}\pi r^3$
Cone 	$A_{side} = \pi rs$ $A_{base} = \pi r^2$ $SA = \pi r^2 + \pi rs$	$V = \frac{1}{3} \times (\text{area of base}) \times h$
Square-Based Pyramid 	$A_{triangle} = \frac{1}{2}bs$ (for each triangle) $A_{base} = b^2$ $SA = 2bs + b^2$	$V = \frac{1}{3} \times (\text{area of base}) \times h$
Rectangular Prism 	$SA = wh + wh + lw + lw + lh + lh$ **or** $SA = 2(wh + lw + lh)$	$V = (\text{area of base}) \times h$
General Right Prism	$SA =$ the sum of the areas of all the faces	$V = (\text{area of base}) \times h$
General Right Pyramid	$SA =$ the sum of the areas of all the faces	$V = \frac{1}{3} \times (\text{area of base}) \times h$

Answer Key

Section 1.1

1. $113.1ft^2$
2. $144yd^2$
3. $84in^2$
4. $21in^2$
5. $50.3ft^2$
6. $32yd^2$
7. $66ft^2$
8. $153.9in^2$
9. $40yd^2$
10. $35in^2$
11. $16yd^2$
12. $78.5ft^2$
13. $74.1in^2$
14. $174yd^2$
15. $92yd^2$
16. $113ft^2$
17. $53.9ft^2$
18. $71.4yd^2$

Section 1.2

1. $82in^2$
2. $210ft^2$
3. $282.7yd^2$
4. $472ft^2$
5. $461.8yd^2$
6. $377.0in^2$
7. $294.0yd^2$
8. $791.7in^2$
9. $2827.4ft^2$
10. $4486.2yd^2$
11. $2770in^2$
12. $2940.5ft^2$
13. $3769.9ft^2$
14. $9960in^2$
15. $5192yd^2$
16. $3696yd^2$
17. $3499.5ft^2$
18. $2532in^2$

Section 1.3

1. $113\ 097.3ft^3$
2. $15\ 585.4in^3$
3. $9381.8yd^3$
4. $23\ 125in^3$
5. $28\ 980yd^3$
6. $36\ 036ft^3$
7. $25\ 849.0yd^3$
8. $2600ft^3$
9. $12\ 720in^3$