Solid Geometry

Name:______________________________________

Teacher:______________________________________

Pd: ______
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These formulas are given to you...

**Reference Sheet**

| Volume          | Cylinder                  | \[ V = Bh \]
<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>where ( B ) is the area of the base</td>
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<tr>
<td>Pyramid</td>
<td>[ V = \frac{1}{3}Bh ]</td>
</tr>
<tr>
<td></td>
<td>where ( B ) is the area of the base</td>
</tr>
<tr>
<td>Right Circular Cone</td>
<td>[ V = \frac{1}{3}Bh ]</td>
</tr>
<tr>
<td></td>
<td>where ( B ) is the area of the base</td>
</tr>
<tr>
<td>Sphere</td>
<td>[ V = \frac{4}{3}\pi r^3 ]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lateral Area ((L))</th>
<th>Right Circular Cylinder</th>
<th>[ L = 2\pi rh ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Circular Cone</td>
<td>[ L = \pi rl ]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>where ( l ) is the slant height</td>
<td></td>
</tr>
</tbody>
</table>

| Surface Area | Sphere | \[ SA = 4\pi r^2 \] |

These aren’t given to you…but are very useful!

**Lateral Area for Prism**
\[ L = (\text{Perimeter of the base}) \cdot (\text{Height of the prism}) \quad Or \quad L = Ph \]

**Surface Area for Prisms and Cylinders**
\[ S.A. = L + 2B \]

**Lateral Area for Pyramids**
\[ L = \frac{1}{2} \cdot (\text{Perimeter of the base}) \cdot (\text{Slant Height}) \quad Or \quad L = \frac{1}{2} Pl \]

**Surface Area for Pyramids**
\[ S.A. = L + B \]
Volume of rectangular solids and cylinders – Day 1

Warm Up: Read this section and complete the puzzle on page 2.

Three-dimensional figures, or solids, can be made up of flat or curved surfaces. Each flat surface is called a face. An edge is the segment that is the intersection of two faces. A vertex is the point that is the intersection of three or more faces. Each face of a solid figure is called either a base or a lateral face. Solid figures generally have one or two bases. If it has two, these bases are parallel. If a figure has two parallel bases and lateral faces, such as in a prism, the bases will be perpendicular to the lateral faces.

<table>
<thead>
<tr>
<th>TERM</th>
<th>EXAMPLE</th>
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<tbody>
<tr>
<td>A prism</td>
<td>![Diagram of a prism]</td>
</tr>
<tr>
<td>A cylinder</td>
<td>![Diagram of a cylinder]</td>
</tr>
<tr>
<td>A pyramid</td>
<td>![Diagram of a pyramid]</td>
</tr>
<tr>
<td>A cone</td>
<td>![Diagram of a cone]</td>
</tr>
</tbody>
</table>

A polyhedron is formed by four or more polygons that intersect only at their edges. Prisms and pyramids are polyhedrons, but cylinders and cones are not.
What Did the Taxi Driver Say About His Daughter?

Write the name that best describes each space figure. Then find your answer in the answer column. Write the letter of the answer in the box containing the number of the exercise.

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<thead>
<tr>
<th>Number</th>
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</tbody>
</table>

U triangular pyramid
T hexagonal prism
R cone
T triangular prism
E sphere
M rectangular prism
O pentagonal prism
O cube
U pentagonal pyramid
A cylinder
E hexagonal pyramid
Y rectangular pyramid

The volume of any prism or cylinder is $V = (\text{Area of base})(\text{Height})$

Another way to calculate the **RECTANGULAR PRISM** is: $V = l \cdot w \cdot h$

**VOLUME** = ___________ in.$^3$

---

**VOLUME** of a solid is the number of cubic units of space contained by the solid.

Volume = ___________ un.$^3$

1 cubic unit
### Volume of a Prism

The volume of a prism with base area $B$ and height $h$ is $V = Bh$.

The volume of a right rectangular prism with length $l$, width $w$, and height $h$ is $V = lwh$.

The volume of a cube with edge length $s$ is $V = s^3$.

<table>
<thead>
<tr>
<th>Shape</th>
<th>Name</th>
<th>Formula</th>
<th>Example</th>
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<tbody>
<tr>
<td>2.</td>
<td><img src="image2.png" alt="Image" /> 25 ft</td>
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<tr>
<td>3.</td>
<td><img src="image3.png" alt="Image" /> 5 m, 12 m, 5 m</td>
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<td>4.</td>
<td><img src="image4.png" alt="Image" /> 18, 8</td>
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<td>5.</td>
<td><img src="image5.png" alt="Image" /> 8, 12</td>
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<td>Shape</td>
<td>Name</td>
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<td>9.</td>
<td><img src="image4" alt="Diagram" /></td>
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**Key Concept**

**Volume of a Cylinder**

**Words**
The volume $V$ of a cylinder with radius $r$ is the area of the base $B$ times the height $h$.

**Symbols**
$V = Bh$, where $B = \pi r^2$, or $V = \pi r^2 h$

Calculate the volume of each cylinder. Write your answers in terms of $\pi$ and to the nearest tenth.

10.  

![Cylinder 10](image)

11.  

![Cylinder 11](image)

**Working Backwards**

12. A fish tank with a rectangular base has a volume of 3,360 cubic inches. The length and width of the tank are 14 inches and 12 inches, respectively. Find the height, in inches, of the tank.

13. A cube has a volume of 3375 cubic units. Calculate the length of one side of the cube.
14. The volume of a cylinder is $441\pi\text{ in}^3$. The height of the cylinder is 9 in. Calculate the radius of the cylinder to the nearest tenth of a centimeter.

15. The volume of a cylinder is $794.3\text{ cm}^3$. The height of the cylinder is 7 cm. Calculate the radius of the cylinder to the nearest tenth of a centimeter.

**Challenge**
Find the volume of each composite figure.
Summary:

Find the volume of each solid.

3. \[ V = \frac{1}{2} \cdot 8 \cdot 4 \cdot 18 = 288 \text{ in}^3 \]

4. \[ B = \frac{1}{2} (8+4) \cdot 2 = 10 \]
   \[ V = 10 \cdot 17 = 170 \text{ m}^3 \]

5. \[ V = \pi r^2 h \]
   \[ V = \pi (7^2) \times 5 \frac{1}{2} = \frac{539}{2} \pi \text{ in}^3 \]

6. \[ V = B \cdot h \]
   \[ V = 50 \cdot 6 \frac{1}{2} = 325 \text{ in}^3 \]

Exit Ticket:

What is the volume, in cubic centimeters, of a cylinder that has a height of 15 cm and a diameter of 12 cm?

1) \(180\pi\)  
2) \(540\pi\)  
3) \(675\pi\)  
4) \(2,160\pi\)
Homework - Volume of Prisms and cylinders – Day 1

Calculate the volume of each.

1. \( \text{Volume} = \text{base area} \times \text{height} \)

2. \( \text{Volume} = \frac{1}{2} \times \text{base area} \times \text{height} \)

3. \( \text{Volume} = \frac{1}{3} \times \text{base area} \times \text{height} \)

4. \( \text{Volume} = \text{base area} \times \text{height} \)

5. \( \text{Volume} = \text{base area} \times \text{height} \)

6. Round your answers to the nearest tenth.
7. Round your answers to the nearest hundredth.

8. Leave your answer in terms of $\pi$.

[Images of cylinders with dimensions]

**Word Problems**

9. The volume of a cube is 216 cubic yards. Find the side length.

10. Julia has a rectangular prism with a length of 10 centimeters, a width of 2 centimeters, and an unknown height. He needs to build another rectangular prism with a length of 5 centimeters and the same height as the original prism. The volume of the two prisms will be the same. Find the width, in centimeters, of the new prism.

11. $V = 1440 \, m^3$

12. $V = 360 \, ft^3$
13. The volume of a right cylinder is $3600\pi$ cubic centimeters and the height is 16 centimeters. Find the radius.

14. A right circular cylinder has a volume of 2,000 cubic inches and a height of 4 inches. What is the radius of the cylinder to the nearest tenth of an inch?

15. The cylindrical glass is full of water, which is poured into the rectangular pan. Will the pan overflow? If yes, by how much? All measurements are in cm.
SWBAT: Calculate the Volume of Pyramids and Cones

Warm - Up
Calculate the volume of the prism below.

Describe the effect of each change on the volume of the given figure.

a) If the dimensions are doubled.

b) If the dimensions are divided by 5.

Volume of a Pyramids and Cones

The cones and the cylinder have the same base and height.
It takes three cones full of rice to fill the cylinder.

Volume of Cones

The volume of a cone with base area $B$, radius $r$, and height $h$ is $V = \frac{1}{3}Bh$,
or $V = \frac{1}{3} \pi r^2 h$. 
**Volume of a Pyramid**

The volume of a pyramid with base area $B$ and height $h$ is $V = \frac{1}{3}Bh$.

<table>
<thead>
<tr>
<th>Shape</th>
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<th>Formula</th>
<th>Example</th>
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<tbody>
<tr>
<td>1.</td>
<td><img src="image1.png" alt="Pyramid 1" /></td>
<td><img src="image2.png" alt="Formula" /></td>
<td><img src="image3.png" alt="Example 1" /></td>
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<td>2.</td>
<td><img src="image4.png" alt="Pyramid 2" /></td>
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<tr>
<td>3.</td>
<td><img src="image7.png" alt="Pyramid 3" /></td>
<td><img src="image8.png" alt="Formula" /></td>
<td><img src="image9.png" alt="Example 3" /></td>
</tr>
</tbody>
</table>
Word - Problems

9. The Volume of a square pyramid is 507 meter cubed. If the height is 9 meters, then find the dimensions of the base?

10. A cube with sides 5 inches, and a pyramid with base edges 5 inches. What is the height, so that the volume of the cube and the pyramid are equal?

11. A right cone has a height of 6 feet and a volume of $32\pi$ cubic feet. What is its radius?

12. Sand is piled in the shape of a cone. If a pile of sand has a diameter of 20 feet and a volume of $610\pi$ feet cubed, then what is the height of the pile?
**Challenge**
Calculate the volume of the composite figure.

![Composite figure diagram]

**Summary**
Calculate the volume of each shape.

a. 

![Triangle with height 6 cm and base 6 cm]

\[ V = \frac{1}{3} B h \]

\[ B = 6 \times 6 = 36 \]

\[ V = \frac{1}{3} (36)(5) = 60 \text{ cm}^3 \]

b. 

![Right circular cone with radius 12 in and height 15 in]

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

\[ V = \frac{1}{3} \pi (12^2)(15) \]

\[ V = 324 \pi \text{ in}^3 \]

**Exit Ticket**
In the diagram below, a right circular cone has a diameter of 8 inches and a height of 12 inches.

![Right circular cone diagram]

What is the volume of the cone to the nearest cubic inch?

1) 201
2) 481
3) 603
4) 804
Calculate the volume of each.

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<td><img src="image13.png" alt="Diagram" /></td>
<td><img src="image14.png" alt="Diagram" /></td>
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</tbody>
</table>
**Word Problems**

9. The volume of a square pyramid is $605 \, m^3$. Calculate the dimensions of the base of the square if the pyramid has a height of $15m$.

10. The Volume of square pyramid is $784 \, cm^3$. If the base edge is 14 centimeters, then how tall is the pyramid?

11. A cone has a volume of $432\pi \, cm^3$ and a height of $9$ cm.
   a) Calculate the radius of the cone
   b) Calculate the slant height of the cone.

12. If the volume of a cone is $10 \, m^3$ what is its height if the area of the base is $10 \, m^2$?
**Surface area of rectangular prisms and cylinders – Day 3**

**Warm – Up**

A gazebo (garden house) has a pentagonal base with an area of 50 m². The total height to the peak is 16 m. The height of the pyramidal roof is 6 m. Find the gazebo's total volume.

---

**Surface Area of a Prism**

- Top
- Front
- Left
- Bottom
- Back
- Right

**Prism Surface Area Formula**

<table>
<thead>
<tr>
<th>Top</th>
<th>lw</th>
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</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>lw</td>
</tr>
<tr>
<td>Front</td>
<td>hl</td>
</tr>
<tr>
<td>Back</td>
<td>hl</td>
</tr>
<tr>
<td>Left</td>
<td>hw</td>
</tr>
<tr>
<td>Right</td>
<td>hw</td>
</tr>
<tr>
<td>Total</td>
<td>lw + lw + hl + hl + hw + hw</td>
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<tr>
<td></td>
<td>2lw + 2hl + 2hw</td>
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</tbody>
</table>

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**Rectangular Prism**

\[ SA = 2lh + 2hw + 2lw \]

This formula assumes a "closed box", with all 6 sides
Example 1:
Calculate the surface area of the prism below.

Example 2:
Rashid needs to buy some wood to build a box. He must calculate the surface area of the box to determine how much wood to buy. A diagram of the box is shown below. How much wood does Rashid need to buy to build the box?

Example 3: The surface area of the prism below is 102 cm$^2$. Find x
The net of a cube is always made up of 6 squares. Each square has an area of $x^2$ if the length of the side of the cube is $x$.

Example 4:
Calculate the surface area of a cube with a side that measures 5 in.

Example 5:
The surface area of a cube is 24 cm$^2$. Find the length of each side of the cube.
A **cylinder** is a solid with congruent circular bases that lie in parallel planes. The *altitude*, or *height*, of a cylinder is the perpendicular distance between its bases. The radius of the base is also called the *radius* of the cylinder. A cylinder is called a **right cylinder** if the segment joining the centers of the bases is perpendicular to the bases.

**Surface Area of a Cylinder**

\[
\text{Surface Area of a Cylinder} = \pi r^2 + 2\pi rh
\]

**Example 6:**

Find the surface area, to the *nearest tenth of a square foot*.
7. Calculate the surface area, to the *nearest tenth of a square foot*.

![Cylinder Diagram]

8. A cylinder has a surface area of $200\pi \text{ ft}^2$.
   
a) Calculate the radius of the cylinder if the height is 15 feet.
   
b) Calculate the Lateral Area of the cylinder.

9. Solve for $x$ given the surface area $S$ of the right cylinder. Round your answer to two decimal places.

![Cylinder Diagram]
**Challenge Problem:** What is the surface area of the composite figure below?

![Composite Figure](image)

**Summary:**

- **Cube**
  - Total Surface Area: $6s^2$
  - Volume: $s^3$

- **Right Circular Cylinder**
  - Total Surface Area: $2\pi rh + 2\pi r^2$
  - Volume: $\pi r^2h$

- **Right Rectangular Prism**
  - Total Surface Area: $2lw + 2lh + 2wh$
  - Volume: $lwh$

**Exit Ticket**

A right circular cylinder has an altitude of 11 feet and a radius of 5 feet. What is the lateral area, in square feet, of the cylinder, to the nearest tenth?

1) 172.7  
2) 172.8  
3) 345.4  
4) 345.6
Homework - Surface area of rectangular prisms and cylinders – Day 3

1. Find the surface area, to the nearest tenth of a square foot, of this container assuming it has a closed top and bottom.

![Cylinder diagram](image)

2. Find the surface area of the prism below.

![Prism diagram](image)

3. Find the surface area of the cylinder below.

![Cylinder diagram](image)

4. Calculate the surface area of a cube with a side of 6 inches.
5. Solve for \( x \) given the surface area.

\[
S = 298 \text{ ft}^2
\]

6. A cube has a surface area of 486 cm\(^2\). Calculate the length of one side of the cube.

7. The surface area of a cylinder is \( 48\pi \) square feet. The radius of the cylinder is 3 feet. What is the height of the cylinder?

8. Solve for \( z \) given the surface area.

\[
S = 1202 \text{ in.}^2
\]
Warm-Up

Calculate the surface area of the cube below.

\[ \text{10 inches} \]

Describe the effect of each change on the surface of the given figure.

\( a \) If the dimensions are doubled.

\( b \) If the dimensions are divided by 5.

The lateral area of a prism is the sum of the areas of all the lateral faces. A lateral face is not a base. The surface area is the total area of all faces.

<table>
<thead>
<tr>
<th>Lateral Area</th>
<th>The lateral area of a right prism with base perimeter ( P ) and height ( h ) is [ L = Ph ].</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Area</td>
<td>The surface area of a right prism with lateral area ( L ) and base area ( B ) is [ S = L + 2B, \text{ or } S = Ph + 2B ].</td>
</tr>
<tr>
<td>Shape</td>
<td>Procedure for Calculating Surface Area</td>
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<tr>
<td>1. Name _________________________</td>
<td>Area of Base: ________________________</td>
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<td>Perimeter of Base: ____________________</td>
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<td>Height of Prism: _____________________</td>
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<th>Area of Base: ______________________</th>
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<td>Height of Prism: ____________________</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LA: ________________________________</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SA: ________________________________</td>
</tr>
</tbody>
</table>
7. Find the width of a rectangular solid with length 15 cm, height 8 cm, and lateral area 400 cm².

8. Find the value of \( x \).

\[ S = 200 \text{ ft}^2 \]

9. Long Tall Tent Company makes tents in the shape of triangular prisms. Tent model 7T (pictured below) has a length of 7 feet, width of 6 feet, and a height of 4 feet. You Buy It store has just ordered 40 tents to sell in their camping stores. How much material will Long Tall Tent Company need to complete this order?
Challenge
A builder drills a hole through a cube of concrete, as shown in the figure. This cube will be an outlet for a water tap on the side of a house.

Find the surface area of the figure.

EXIT TICKET
Calculate the surface area of the triangular prism to the nearest hundredth.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>30.5</td>
<td>B</td>
</tr>
<tr>
<td>C</td>
<td>49.45</td>
<td>D</td>
</tr>
</tbody>
</table>
# Homework – Day 4

**Calculate the Lateral and Surface area of each.**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><img src="image1.png" alt="Diagram 1" /></td>
</tr>
<tr>
<td>2.</td>
<td><img src="image2.png" alt="Diagram 2" /></td>
</tr>
<tr>
<td>3.</td>
<td><img src="image3.png" alt="Diagram 3" /></td>
</tr>
<tr>
<td>4.</td>
<td><img src="image4.png" alt="Diagram 4" /></td>
</tr>
</tbody>
</table>

Show your work here!
Word Problems

5. The lateral area for a hexagonal prism measures 432 inches$^2$. Calculate the surface area of the prism if the height of the prism measures 9 inches.

6. The lateral area for a regular triangular prism measures 462 inches$^2$. Calculate the surface area of the prism if the height of the prism measures 11 inches.

7. The surface area for a right triangular prism measures 864 cm$^2$. The legs of the triangle measure 12 and 16 cm respectively. Calculate the height and Lateral Area of the prism. (Draw a picture to help you!)
Surface Area of Pyramids and Cones – Day 5

Warm-Up

1. The surface area of a cube is increased so that it is 9 times its original surface area. How did the length of the cube change?
   A The length was doubled.
   B The length was tripled.
   C The length was quadrupled.
   D The length was multiplied by 9.

2. A cylinder has a volume of $4\pi$ cm$^3$. If the radius and height are each tripled, what will be the new volume of the cylinder?
   F $12\pi$ cm$^3$
   H $64\pi$ cm$^3$
   G $36\pi$ cm$^3$
   J $108\pi$ cm$^3$

Pyramids

The lateral area of a pyramid is the sum of the areas of the congruent lateral faces. You can find a formula for the lateral area of a pyramid by looking at its net.

\[
L.A. = \text{The area of each lateral face is}\]
\[
\text{Commutative and Associative Properties of Multiplication}\]
\[
\text{The perimeter } p \text{ of the base is } 4s.\]

To find the surface area of a pyramid, add the area of its base to its lateral area.

Theorem 10-3 Lateral and Surface Areas of a Regular Pyramid

The lateral area of a regular pyramid is half the product of the perimeter of the base and the slant height.

\[
L.A. = \]

The surface area of a regular pyramid is the sum of the lateral area and the area of the base.

\[
S.A. =\]
Example 1: Find the L.A. and S.A.

Name ____________________________

Area of the base: __________________

Perimeter of the base: ______________

Slant Height: _____________________

L.A. ______________________________

Surface Area: _____________________

Example 2:

Name ____________________________

Area of the base: __________________

Perimeter of the base: ______________

Slant Height: _____________________

L.A. ______________________________

Surface Area: _____________________

Example 3: **Challenge***

Name ____________________________

Area of the base: __________________

Perimeter of the base: ______________

Slant Height: _____________________

L.A. ______________________________

Surface Area: _____________________
Example 4:

Cones

By cutting a cone and laying it out flat, you can see how the formula for lateral area of a cone \( L.A. = \frac{1}{2} \cdot C_{\text{base}} \cdot \ell \) resembles that for the area of a triangle \( A = \frac{1}{2}bh \).

Theorem 10-4: Lateral and Surface Areas of a Cone

The lateral area of a right cone is half the product of the circumference of the base and the slant height.

\[ L.A. = \frac{1}{2} C_{\text{base}} \ell, \text{ or } L.A. = \]

The surface area of a right cone is the sum of the lateral area and the area of the base.

\[ S.A. = \]
Example 5: Calculate the lateral area and surface area.

Example 6: Calculate the lateral area and surface area.

**Word Problems**

7. Find the surface area of a regular square pyramid with slant height 7 in, if its lateral area is 70 sq. in.

8. Find the slant height of a regular hexagonal pyramid with base edge length 6 cm, and lateral area 198 cm$^2$. 
9. A cone has a lateral area of $72\pi$ and a total surface area of $121\pi$. Find its radius.

10. A cone has a lateral area of $34\pi$ and a total surface area of $203\pi$. Find its radius.

**Challenge**

Find the total surface area of the rectangular right pyramid (measurements in cm):

**Summary**

Find the lateral area and total surface area of the cone.

Use the Pythagorean Theorem (or a Pythagorean triple) to find $r$.

\[
\begin{align*}
12^2 + r^2 &= 13^2 \\
144 + r^2 &= 169 \\
r^2 &= 25 \\
r &= 5.
\end{align*}
\]

\[
\begin{align*}
LA &= \pi rl = \pi (5)(13) = 65\pi \\
S &= \pi r^2 + \pi rl \text{ or } \pi r^2 + LA \\
&= \pi (5)^2 + 65\pi = 90\pi \text{ units}^2.
\end{align*}
\]

**Exit Ticket**

Choose the correct formula for the surface area of a cone.

- F $S = Ph + 2B$
- H $S = \frac{1}{2}P\ell + B$
- G $S = \pi r\ell + \pi r^2$
- J $S = \pi r\ell + 2\pi r$
Day 5 - Homework
Find the Lateral Area and Surface Area of each Prism, Pyramid, and Cone.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2.</td>
</tr>
<tr>
<td><img src="Image" alt="Triangle Diagram" /></td>
<td><img src="Image" alt="Pyramid Diagram" /></td>
</tr>
<tr>
<td><img src="Image" alt="11 in." /></td>
<td><img src="Image" alt="12 in." /></td>
</tr>
<tr>
<td>3.</td>
<td>4.</td>
</tr>
<tr>
<td><img src="Image" alt="Rectangle Diagram" /></td>
<td><img src="Image" alt="Cylinder Diagram" /></td>
</tr>
<tr>
<td><img src="Image" alt="14 cm" /></td>
<td><img src="Image" alt="8 cm" /></td>
</tr>
<tr>
<td>5.</td>
<td>6.</td>
</tr>
<tr>
<td><img src="Image" alt="Octahedron Diagram" /></td>
<td><img src="Image" alt="Cone Diagram" /></td>
</tr>
<tr>
<td><img src="Image" alt="8 cm" /></td>
<td><img src="Image" alt="24 cm" /></td>
</tr>
<tr>
<td><img src="Image" alt="15 cm" /></td>
<td><img src="Image" alt="10 cm" /></td>
</tr>
</tbody>
</table>
Word Problems

7. **Gazebo** The roof of a gazebo is shaped like a regular square pyramid with base edge length of 10 feet as shown. Its lateral area is 120 square feet. Find the slant height.

8. Mr. Fixit built a building in the shape of a square pyramid. He wanted to paint every other side red and the other two sides blue. The pyramid has a height of 8 feet and the base is 12 feet long. The red paint only covers 32 square feet per gallon, and the blue covers 46 square feet per gallon. How much paint of each color will he need to paint the sides of the pyramid?

9. Find the slant height of a regular square pyramid with base edge length 4 cm, if its lateral area is 72 cm².

10. A cone has lateral area $100\pi$ and total surface area $136\pi$. Find its radius.
Day 6 – Spheres

Warm – Up

What is the surface area of the cone?
A $225\pi \text{ in}^2$
B $375\pi \text{ in}^2$
C $600\pi \text{ in}^2$
D $1000\pi \text{ in}^2$

A **sphere** is the set of all points in space equidistant from a given point called the **center**. A **radius** is a segment that has one endpoint at the center and the other endpoint on the sphere. A **diameter** is a segment passing through the center with endpoints on the sphere.

---

**Theorem 10-10** **Surface Area of a Sphere**

The surface area of a sphere is four times the product of $\pi$ and the square of the radius of the sphere.

$$S.A. = 4\pi r^2$$
Find the surface area of each sphere. Leave your answers in terms of $\pi$.

1. 

![Diagram](image)

2. 

![Diagram](image)

**Example 3:** Find the surface area of a sphere with a great circle that has an area of $49\pi \text{ mi}^2$.

![Diagram](image)

**Example 4:** Find the radius of a sphere with a surface area of $1024\pi \text{ u}^2$.

![Diagram](image)
Example 5: Find the volume of the sphere. Give your answer in terms of $\pi$.

Example 6: Find the radius of a sphere with volume $7776\pi \text{ ft}^3$.

Example 7: Find the volume of the sphere if the surface area is represented by $196\pi$. Leave your answer in terms of $\pi$. 

Challenge

Given a cone and a hemisphere as marked, find

a. The total volume of the solid
b. the total surface area of the solid

SUMMARY

Example

Find the surface area and volume of the sphere.

Substitute \( r = 5 \) into each formula and simplify.

\[
\text{S.A.} = 4\pi r^2 \\
= 4\pi(5)^2 \\
= 100\pi \\
= 314.2
\]

\[
V = \frac{4}{3}\pi r^3 \\
= \frac{4}{3}\pi(5)^3 \\
= \frac{500\pi}{3} \\
= 523.6
\]

The surface area of the sphere is 314.2 in\(^2\). The volume of the sphere is 523.6 in\(^3\).

Exit Ticket

If the surface area of a sphere is represented by \(900\pi\),
What is the volume in terms of \(\pi\)?

1) \(300\pi\)
2) \(3000\pi\)
3) \(4500\pi\)
4) \(36000\pi\)
Day 6 – Homework

Calculate the Surface Area of each. Leave your answers in terms of $\pi$.

1. The circumference of a great circle of a sphere is $8\pi$ meters. What is the surface area of the sphere?

2. The area of a great circle of a sphere is $36\pi$ meters. What is the surface area of the sphere?

3. $S = 324\pi \text{ cm}^2$

4. $S = 4\pi \text{ ft}^2$

---

Find the radius of a sphere with the given surface area $S$.

5. The circumference of a great circle of a sphere is $8\pi$ meters. What is the surface area of the sphere?
Calculate the Volume of each. Round your answers to 2 decimal places.

7.

8.

Find the radius of a sphere with the given volume \( V \).

9. \( V = 2304\pi \text{ yd}^3 \)

10. \( V = 36\pi \text{ in.}^3 \)

11. Calculate the surface area of a sphere given a volume of \( 26,244\pi \) cubic meters.

12. Calculate the volume of a sphere given a surface area of \( 100\pi \) square meters. Round your answer to the nearest tenth.
### Day 7 – Review

<table>
<thead>
<tr>
<th>3-D Shape</th>
<th>Lateral Area</th>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram 1" /></td>
<td><img src="image2.png" alt="Diagram 2" /></td>
<td><img src="image3.png" alt="Diagram 3" /></td>
<td><img src="image4.png" alt="Diagram 4" /></td>
</tr>
</tbody>
</table>

1. 3-D Shape: Rectangular Prism
   - Length: 5 cm
   - Width: 8 cm
   - Height: 7 cm

2. 3-D Shape: Rectangular Prism
   - Length: 10 m
   - Width: 10 m
   - Height: 6 m

3. 3-D Shape: Hexagonal Prism
   - Base Side: 8 cm
   - Height: 6 cm

4. 3-D Shape: Cube
   - Edge: 6 inches
<table>
<thead>
<tr>
<th>3-D Shape</th>
<th>Lateral Area</th>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td><img src="cylinder.png" alt="Cylinder" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td><img src="triangular_prism.png" alt="Triangular Prism" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td><img src="triangular_pyramid.png" alt="Triangular Pyramid" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td><img src="cone.png" alt="Cone" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td><img src="sphere.png" alt="Sphere" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Day 8 – Word Problems**

1. A cube has a volume of 729 cubic units. Calculate the length of one side of the cube.

   Ans: $s = 9$ units

2. The volume of a cylinder is $600\pi$ in$^3$. The height of the cylinder is 6 in. Calculate the radius of the cylinder to the nearest tenth of a centimeter.

   Ans: $r = 10$ in

3. The volume of a cylinder is 5428.7 in$^3$. The height of the cylinder is 3 in. Calculate the radius of the cylinder to the nearest tenth of a centimeter.

   Ans: $r \approx 24$ in

4. Mrs. Claus is taking a art class. Her art project is to make an cone vase. If the vase has a volume of 157 inches cubed, and a diameter of 10 inches. What is the height to the nearest inch?

   Ans: $h \approx 6$ in

5. Prisms $A$ and $B$ have the same length and width, but different heights. If the volume of Prism $B$ is 150 cubic inches greater than the volume of Prism $A$, what is the length of each prism?

   Ans: length = 12.5 in
6. Which statement best describes how the volume of a cube changes when the edge length is doubled to form a new cube?

A  The volume of the new cube is \( \frac{1}{2} \) the volume of the original cube.

B  The volume of the new cube is \( \frac{1}{4} \) the volume of the original cube.

C  The volume of the new cube is 8 times the volume of the original cube.

D  The volume of the new cube is 4 times the volume of the original cube.

Explain your answer below.

Ans: “C” \( \rightarrow (2)^3 = 8 \)

7. Two cylinders are shown below. The dimensions of one of them are labeled.

When each dimension of the smaller cylinder is changed by a scale factor of 3, the larger cylinder is created. Which is closest to the volume of the larger cylinder?

A  2,714 in.\(^3\)

B  402 in.\(^3\)

C  10,857 in.\(^3\)

Ans: “A” \( \rightarrow 100.53 \cdot (3)^3 = 2714.34 \)
8. The base of a pyramid is a rectangle with a width of 8 cm and a length of 9 cm. Find, in centimeters, the height of the pyramid if the volume is 264 cm$^3$.

\[
\text{Ans: } h = 11 \text{ cm}
\]

9. The volume of a sphere is $12348\pi$ in$^3$. Calculate the radius of the sphere and the surface area of the sphere.

\[
\text{Ans: } r = 21 \text{ in}
\]

<table>
<thead>
<tr>
<th>Ans: $V \approx 1206.4$ cu</th>
</tr>
</thead>
</table>

10. The volume of a cylinder is $375\pi$. If $h = 15$, find the lateral area.

\[
\text{Ans: } LA \approx 471.2 \text{ squ}
\]

11. The lateral area of a cylinder is $96\pi$. If $r = 8$, find the volume.

\[
\text{Ans: } V \approx 1206.4 \text{ cu}
\]
12. A cone has a volume of $432\pi$ cm$^3$ and height of 9cm. Calculate the surface area of the cone.

Ans: $SA \approx 1017.9$ cm$^2$

13. The total surface area of a cylinder is $256\pi$ cm$^2$. If $r = h$, find $r$ and $LA$.

Ans: $LA \approx 402.1$ cm$^2$

14. A cone has lateral area $100\pi$ and total surface area $136\pi$. Find its radius.

Ans: $r = 6$

15. The surface area of a plastic ball is $196\pi$. A sponge ball has a radius twice that of the plastic ball. What is the surface area of the sponge ball?

<table>
<thead>
<tr>
<th>Option</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$9,604\pi$</td>
</tr>
<tr>
<td>B</td>
<td>$993\pi$</td>
</tr>
<tr>
<td>C</td>
<td>$784\pi$</td>
</tr>
<tr>
<td>D</td>
<td>$546\pi$</td>
</tr>
</tbody>
</table>

Explain Your Answer!

Ans: “C” → $196\pi \cdot (2)^2 = 784\pi$
**SUMMARY**

Formulas for the lateral area $LA$, total surface area $S$ and volume $V$ of the more common solids are given below.

<table>
<thead>
<tr>
<th>PRISM</th>
<th>CYLINDER</th>
<th>PYRAMID</th>
<th>CONE</th>
<th>SPHERE</th>
</tr>
</thead>
<tbody>
<tr>
<td>perimeter of base $P$, height $h$, Area of Base $B$, length $l$ and width $w$</td>
<td>radius $r$ and height $h$</td>
<td>perimeter of base $P$, slant height $l$, Area of Base $B$, and height $h$</td>
<td>radius $r$, slant height $l$, and height $h$</td>
<td>radius $r$</td>
</tr>
<tr>
<td>$LA = Ph$</td>
<td>$LA = 2\pi rh$</td>
<td>$LA = \frac{1}{2} P l$</td>
<td>$LA = \pi rl$</td>
<td></td>
</tr>
<tr>
<td>$S = 2B + Ph$</td>
<td>$S = 2\pi r^2 + 2\pi rh$</td>
<td>$S = B + \frac{1}{2} P l$</td>
<td>$S = \pi r^2 + \pi rl$</td>
<td>$S = 4\pi r^2$</td>
</tr>
<tr>
<td><strong>Rectangular Prism:</strong></td>
<td></td>
<td><strong>Rectangular Prism:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$S = lwh + 2lh + 2wh$</td>
<td></td>
<td>$V = \frac{1}{3} Bh$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cube:</strong></td>
<td></td>
<td>$V = \frac{1}{3} \pi r^3$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$S = 6s^2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V = Bh$</td>
<td></td>
<td>$V = \frac{1}{3} Bh$</td>
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<td></td>
</tr>
<tr>
<td><strong>Rectangular Prism:</strong></td>
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<td></td>
</tr>
<tr>
<td>$V = lwh$</td>
<td></td>
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</tr>
<tr>
<td><strong>Cube:</strong></td>
<td></td>
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</tr>
<tr>
<td>$V = s^3$</td>
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</tbody>
</table>

In a PRISM or PYRAMID: Area of Base ($B$)... will be replaced with the appropriate area formula, to match the shape of the base.

<table>
<thead>
<tr>
<th>SQUARE</th>
<th>$A = s^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECTANGLE</td>
<td>$A = bh$</td>
</tr>
<tr>
<td>TRIANGLE</td>
<td>$A = \frac{1}{2} bh$</td>
</tr>
<tr>
<td>PARALLELOGRAM</td>
<td>$A = bh$</td>
</tr>
<tr>
<td>TRAPEZOID</td>
<td>$A = \frac{1}{2} h(a + b_2)$</td>
</tr>
<tr>
<td>RHOMBUS/KITE</td>
<td>$A = \frac{1}{2} d_1d_2$</td>
</tr>
<tr>
<td>EQUILATERAL TRIANGLE</td>
<td>$A = \frac{1}{4} s^2\sqrt{3}$</td>
</tr>
<tr>
<td>REGULAR POLYGON</td>
<td>$A = \frac{1}{2} aP$</td>
</tr>
</tbody>
</table>
Extra Credit

Find the total volume of the castle, including the towers.