

Important Concepts . . .

Preview Review



Mathematics Grade 9
W2 - Lesson 10: Surface Area of 3D
Objects

Important Concepts of Grade 9 Mathematics	Materials Required
W1 - Lesson 1 Powers W1 - Lesson 2 Exponents W1 - Lesson 3 Rational Numbers W1 - Lesson 4 Order of Operations W1 - Lesson 5 Square Roots of Rational Numbers W1 - Review W1 - Quiz	Paper Pencil Grid Paper Calculator 3D Solids
W2 - Lesson 6 Graphing Linear Relations W2 - Lesson 7 Solving Linear Relations W2 - Lesson 8 Linear Inequalities W2 - Lesson 9 Polynomials W2 - Lesson 10 Surface Area of 3D Objects W2 - Review W2 - Quiz	No Textbook Required This is a stand-alone course.
W3 - Lesson 11 Properties of Circles W3 - Lesson 12 Polygons and Scale Diagrams W3 - Lesson 13 Rotational Symmetry W3 - Lesson 14 Representing Data W3 - Lesson 15 Probability W3 - Review W3 - Quiz	

Mathematics Grade 9
Version 6
Preview/Review W2 - Lesson 10
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Preview/Review Concepts for Grade Nine Mathematics



W2 – Lesson 10:

Surface Area of 3D Objects

OBJECTIVES

By the end of this lesson, you will be able to:

- Determine the surface area of a given composite 3-D object.
- Solve a given problem involving surface area.

GLOSSARY

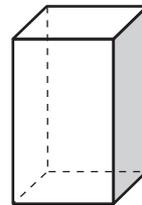
Surface Area: Surface area is the total area of all faces, or surfaces, of a three-dimensional figure. It is the total number of square units needed to cover the outside a three-dimensional figure.

3D Object: A three-dimensional object is a figure that has length, width and depth.

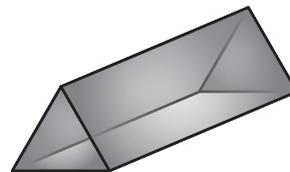
Cylinder: A cylinder is a 3D object having two congruent (identical) circular bases that are parallel.



Rectangular Prism: A solid (3-dimensional) object which has six faces that are rectangles.



Triangular Prism: A solid (3-dimensional) with two bases that are congruent (identical), parallel triangles and all other faces are rectangles.



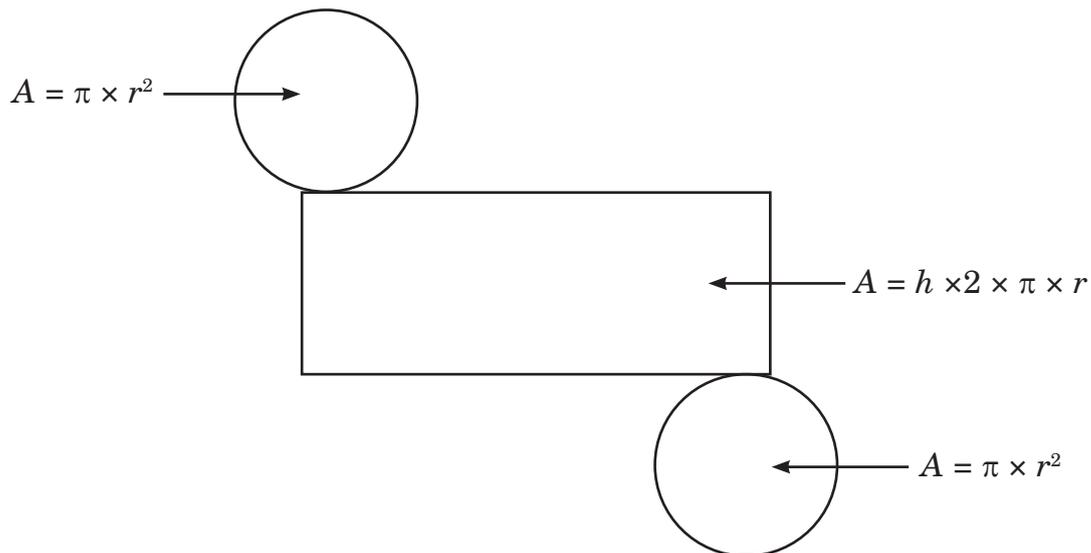
W2 – Lesson 10: Surface Area of 3D Objects

Materials required:

- Paper, pencil, grid paper, calculator, 3D solids of: cylinder, rectangular prism and triangular prism

Part 1: Finding Surface Area of 3D Objects

Finding the Total Surface Area of the Cylinder



So the total surface area of the cylinder or SA is:

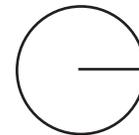
$$SA = (\pi \times r^2) + (\pi \times r^2) + (h \times 2 \times \pi \times r)$$

Or to shorten it:

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

Recall Facts!

$$\text{Radius} = \text{Diameter} \div 2$$



r = radius, the distance from the center of the circle to the outside.

Example 1

Find the surface area of a cylinder with a radius of 2 cm, and a height of 10 cm.

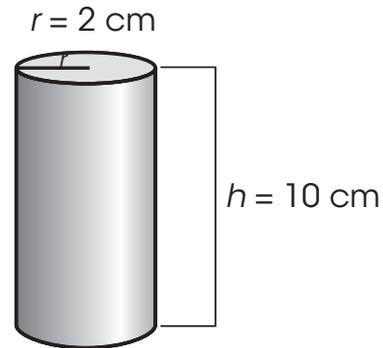
$$SA = 2\pi r^2 + 2\pi rh$$

$$SA = (2 \times 3.14 \times 2^2) + (2 \times 3.14 \times 2 \times 10)$$

$$SA = (6.28 \times 4) + (6.28 \times 20)$$

$$SA = (25.12) + (125.6)$$

$$\text{Surface Area} = 150.72 \text{ cm}^2$$



Example 2

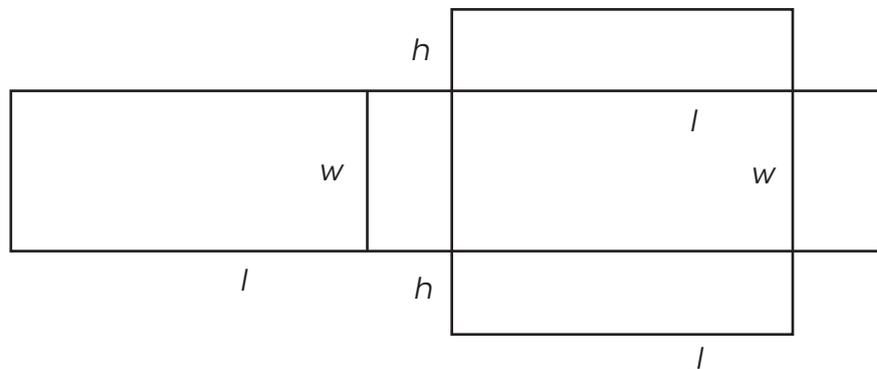
Finding Surface Area of Rectangular Prisms

Top Face = Bottom Face
 Front Face = Back Face
 Right Face = Left Face

So to find the area of each face:

Top = $l \times w$ or (lw)
 Bottom = $l \times w$ or (lw)
 Front = $h \times l$ or (hl)
 Back = $h \times l$ or (hl)
 Left = $h \times w$ or (hw)
 Right = $h \times w$ or (hw)

Recall Facts!
 Recall Facts:
 The area of a rectangle is:
 $A = l \times w$



$$\text{Total Surface Area} = (lw) + (lw) + (hl) + (hl) + (hw) + (hw)$$

$$\text{Total Surface Area} = 2(lw) + 2(lh) + 2(wh)$$

$$\text{Total Surface Area} = 2(lw + hl + hw)$$

Note: Any one of these formulas work for calculating the total surface area of a prism. Choose the one that works best for you.

Find the surface area for this rectangular prism.

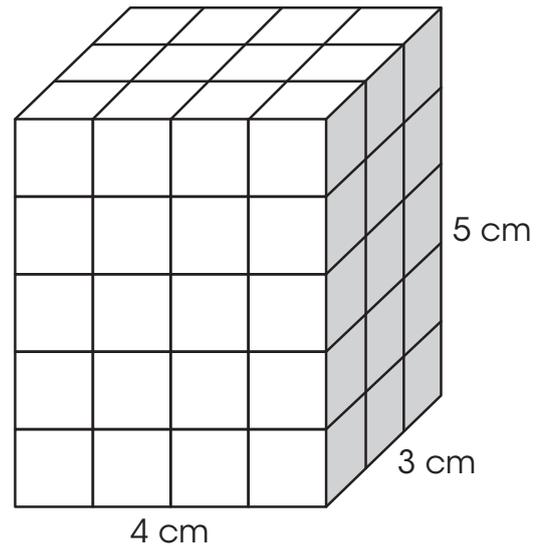
$$SA = 2(lw) + 2(lh) + 2(wh)$$

$$SA = 2(4 \times 3) + 2(4 \times 5) + 2(3 \times 5)$$

$$SA = 2(12) + 2(20) + 2(15)$$

$$SA = 24 + 40 + 30$$

$$SA = 94 \text{ cm}^2$$

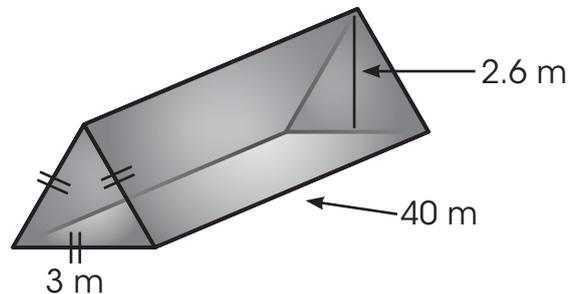


Example 3

Finding Surface Area of Triangular Prisms With the Height given

The formula is: $SA = 2\left(\frac{1}{2} \text{ base} \times \text{height}\right) + 3(\text{length} \times \text{width})$

Find the surface area of a triangular prism if the height of the triangle is 2.6 m, and each side of the triangle measures 8 m. The prism is 40 m long.



$$SA = 2\left(\frac{1}{2} b \times h\right) + 3(l \times w)$$

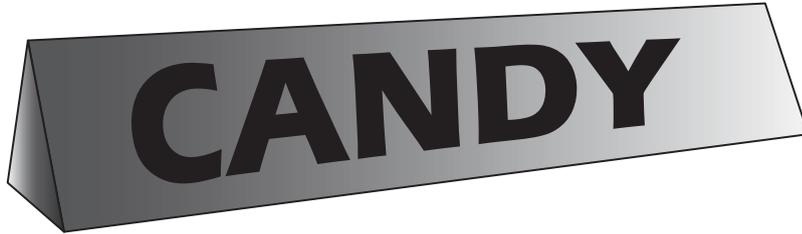
$$SA = 2\left(\frac{1}{2} \times 3 \times 2.6\right) + 3(40 \times 3)$$

$$SA = 7.8 + 360$$

$$SA = 367.8 \text{ m}^2$$

Finding Surface Area of Triangular Prisms With the Height given

If the height of the triangular base is not given, then you must first calculate the missing height, using The Pythagorean Theorem.



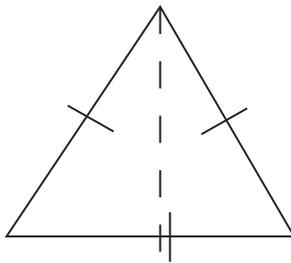
Remember, the Pythagorean Theorem is:

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

- This only works on right triangles.
- "C" always refers to the side opposite to the right angle; it is always the hypotenuse.

Find the surface area of a giant Candy Bar. Each side of the triangle measures 4 cm. The prism is 21 cm long. No triangle height has been given, so it must first be calculated, using the Pythagorean Theorem.

Take the equilateral triangle and split it up into 2, right angled triangles, like this:



Note: Each side is 4 cm long, so half of a side will be 2 cm.

$$a^2 + b^2 = 10^2$$

$$2^2 + b^2 = 4^2$$

$$4 + b^2 = 16$$

$$b^2 = 12$$

$$b = 3.46 \text{ cm}$$

Then calculate the surface area of the entire Candy Bar:

$$SA = 2 \left(\frac{1}{2} b \times h \right) + 3 (l \times w)$$

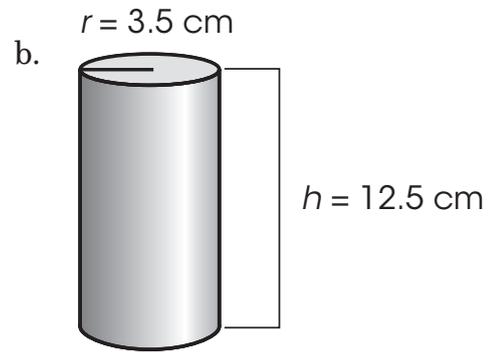
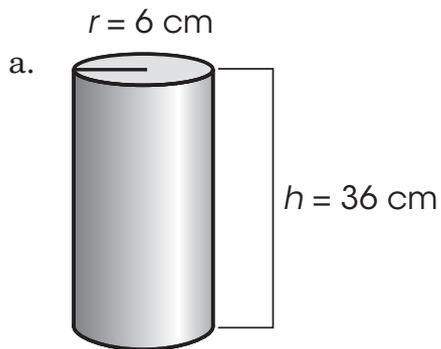
$$SA = 2 \left(\frac{1}{2} \times 4 \times 3.46 \right) + 3 (21 \times 4)$$

$$SA = 13.84 + 252$$

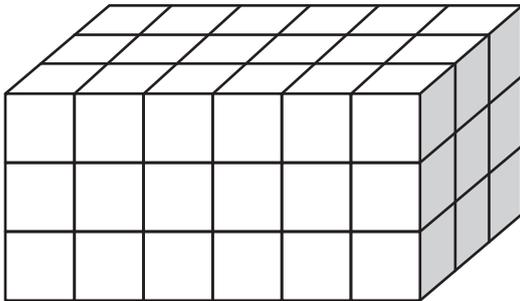
$$SA = 265.84 \text{ cm}^2$$

Practice Questions

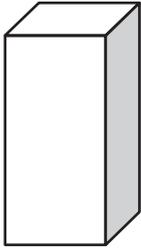
1. Find the surface area of the following cylinders.



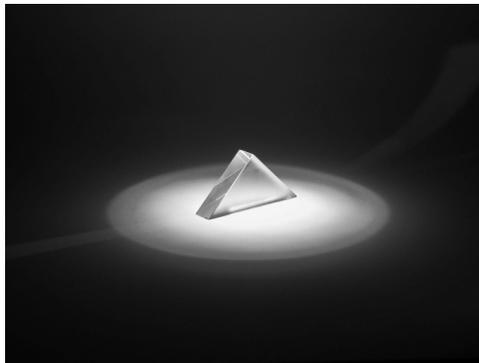
2. Find the surface area for this rectangular prism.



3. Find the surface area of a rectangular prism with a length of 4 cm, a width of 5 cm, and a height of 10 cm.



4. Find the surface area of this glass prism if it is 66 mm high and each side of the triangle is 110 mm long.



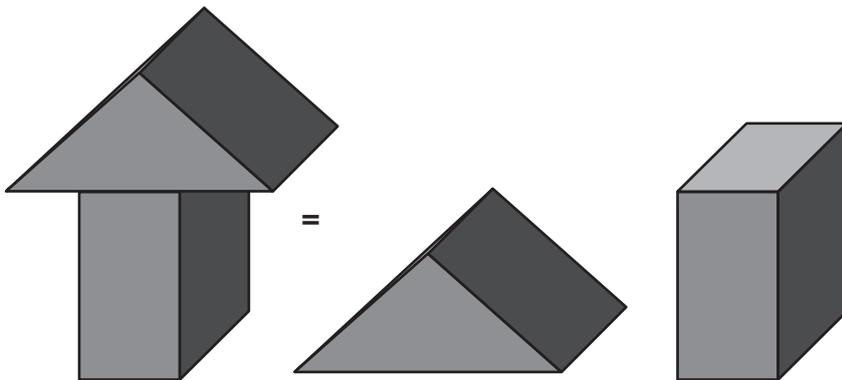
Part 2: Finding the Surface Area of Composite Objects

To find the surface area of composite objects, simply break the object up into the 3D objects that form the composite.

Consider how the shape is made from the component parts. Determine the surface area of each part. Then remove the area of any overlapping part.

Example 1

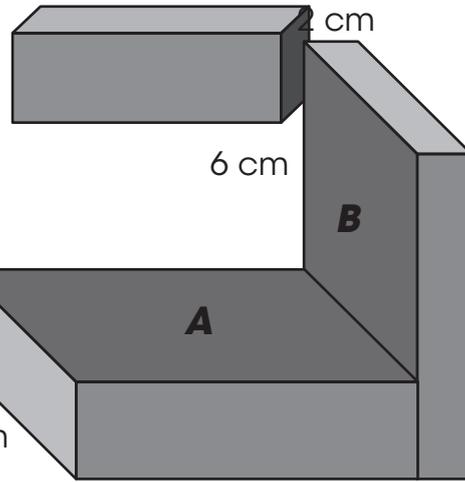
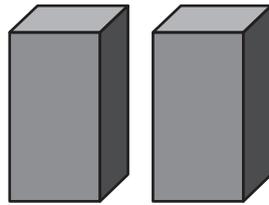
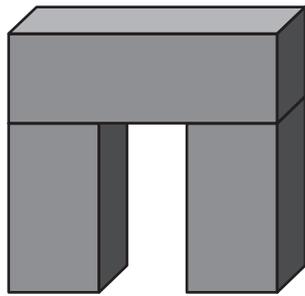
What 3D objects make up this composite?



Example 2

What 3D objects make up this composite?

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Example 3

What is the surface area of this composite object?

Surface Area Shape A

$$SA = 2(lh) + 2(lw) + 2(hw)$$

$$SA = 2(4 \times 8) + 2(4 \times 10) + 2(10 \times 8)$$

$$SA = 2(32) + 2(40) + 2(80)$$

$$SA = 64 + 80 + 160$$

$$SA = 304 \text{ cm}^2$$

Surface Area Shape B

$$SA = 2(lh) + 2(lw) + 2(hw)$$

$$SA = 2(10 \times 2) + 2(8 \times 10) + 2(2 \times 8)$$

$$SA = 2(20) + 2(80) + 2(16)$$

$$SA = 40 + 160 + 32$$

$$SA = 232 \text{ cm}^2$$

Overlap - This is where part A meets part B.

$$\text{Area} = lw$$

$$A = 8 \times 4$$

$$A = 32 \text{ cm}^2$$

The overlap must be subtracted from Shape A and Shape B.

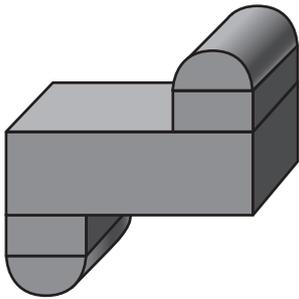
$$\text{Total Surface Area} = \text{Area A} + \text{Area B} - \text{Overlap Area}$$

$$\text{Total Surface Area} = 304 + 232 - 32 - 32$$

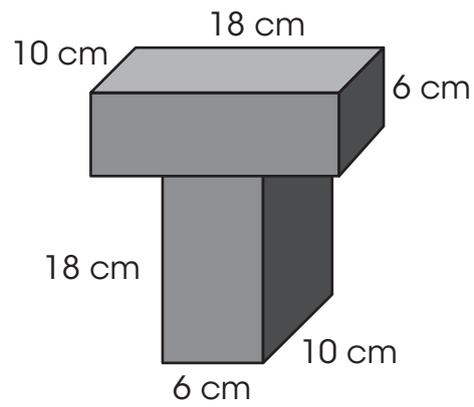
$$\text{Total Surface Area} = 472 \text{ cm}^2$$

Practice Questions

1. Draw the 3D shapes that form this composite object.

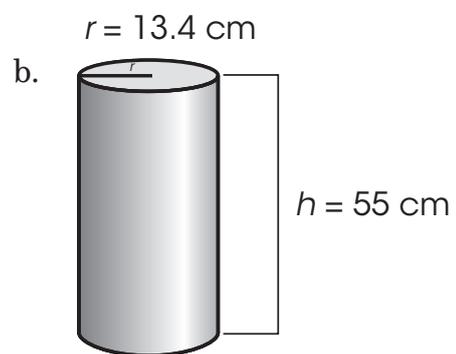
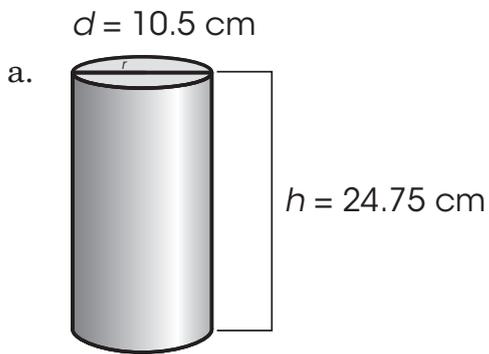


2. Find the surface area of this composite object.

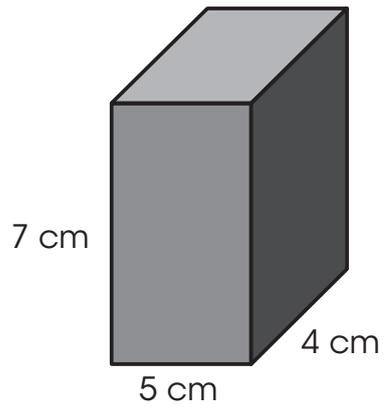


Lesson 10 Assignment

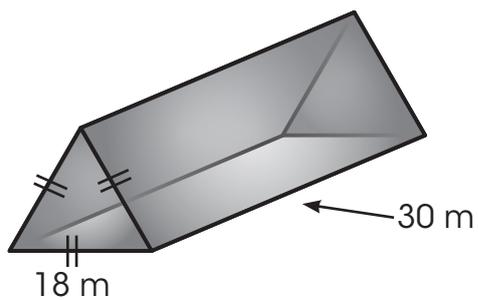
1. Find the surface area of the following cylinders.



2. Find the surface area for this rectangular prism.



3. Find the surface area of a triangular prism.



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4. Find the surface area of the following composite objects.

