Remote Learning Packet

There is no need to submit this packet at the end of the week. Enjoy your summer break!

Week 9: May 25-29, 2020

Course: Math Fundamentals

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Monday, May 25

Happy Memorial Day! No School!

Tuesday, May 26 - Friday May 29

Part 1: Review

We are finishing up the year with a final look at Volume and Surface Area. Work through the packet carefully, reading through the notes and completing the exercises. If you would like extra practice with this, look at Chapter 10 in your Textbook.

Part 2: The Logical Conclusion

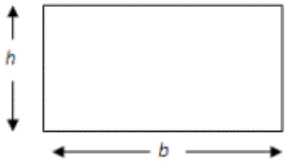
We started out the year with some logic puzzles, logic being the foundation for mathematics, so let's finish the year out with some as well! I have included a few logic puzzles in the packet for you to puzzle over. If you would like to read the story the puzzles are based on, it is available on the internet.

That's it! Thank you all for an excellent (if somewhat abnormal) school year and I hope you all have a wonderful summer break!

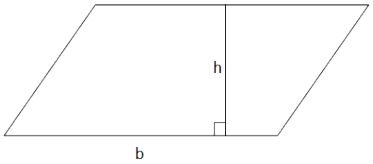
Area Review

In Chapter 10 we learned about area, volume, and surface area. In order to succeed in this chapter, we needed a good foundation in finding the area of different shapes. Write the equation for the area of each shape.

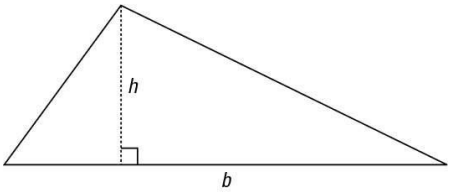
Rectangle:



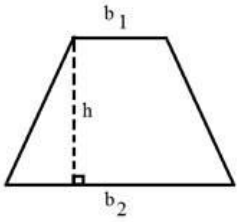
Parallelogram:



Triangles:



Trapezoids:



Notice how each area has one important element: the **base** of the figure. Recall that area is two-dimensional. The base is the one-dimensional line that forms the foundation, or base, of the figure.

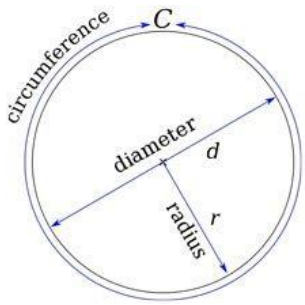
Circles

After finding the area of these polygons, we also learned how to find the area of a circle. This includes one of mathematics most famous and certainly tastiest number: π (pi).

$$\pi = \frac{circumference}{diameter}$$

For **any circle,** the ratio of the circumference to the diameter of the circle will *always* equal π! Even since the ancient times people have known this fact and continually tried to find out the exact value of π (even though it is irrational and continues forever!).

Area of a circle:

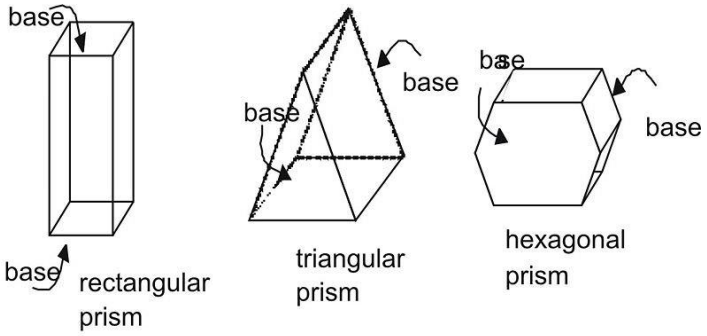


Polyhedrons

After learning how to find the area of two-dimensional shapes, we moved on to three-dimensional shapes like **prisms** and **pyramids** (and dodecahedrons).

Prisms

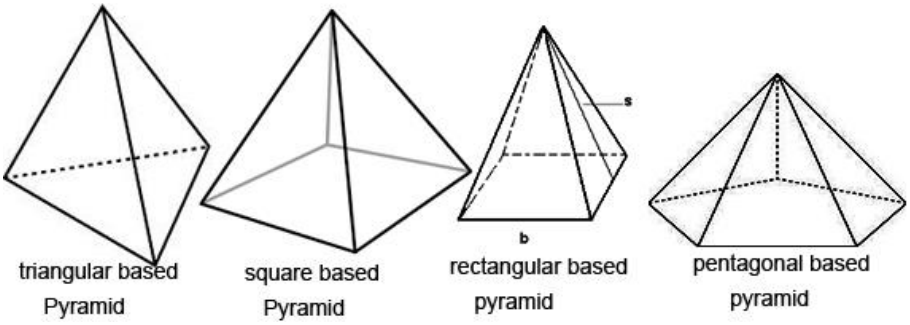
A **prism** is a polyhedron with two congruent bases that are parallel.



Notice how with each type of prism, the name is determined by the shape of the bases. A triangular prism has two parallel triangles that form the bases, and a hexagonal prism has two parallel hexagons that form the bases.

Pyramids

A **Pyramid** is a polyhedron with one base.



Again, the name of a pyramid is determined by the shape of the two-dimensional base.

What is the name of a regular polyhedron with 8 faces? 20 faces?

Volume

We noticed when finding the area of polygons that the base of a figure was vital. Even though volume is a *three-dimensional* measurement, the base of the figure is still important. Since polyhedrons are a *three-dimensional* shape, the base is a *two-dimensional* figure like a triangle or trapezoid.

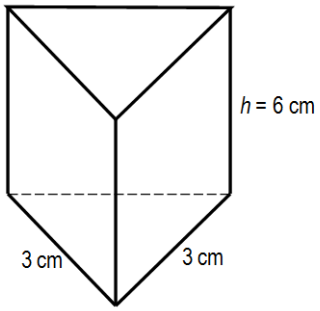
Finding the area of a prism is very similar to finding the area of a rectangle:

Volume of a prism = Base area × height

The only difference is now the base is a polygon, so we must find the area of the base in order to multiply it by the height. If the base is a triangle, we find the area of the triangle. If the base is a rectangle, we find the area of the rectangle.

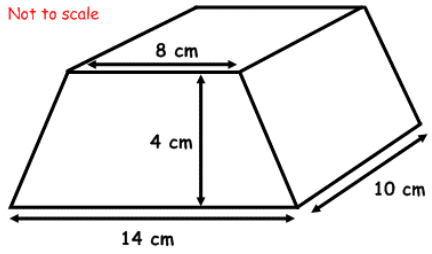
Volume of Prisms

Volume (*V*) of Prism = area of base (*B*) × height (*h*)

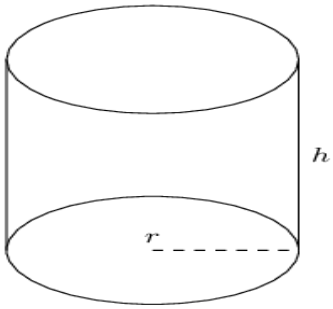


Area of triangle = ½ *bh*
Area of base (*B*) = ½ (3cm × 3cm) = $4.5cm^2$
Volume = $4.5cm^2$ × 6cm = $\mathbf{27}\boldsymbol{cm^3}$

Find the area of this trapezoidal prism. Remember, the base is a trapezoid.

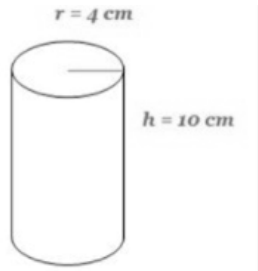


Cylinders



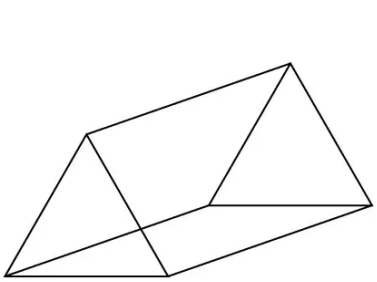
When the bases are circles, the figure is called a **cylinder**. The volume of a cylinder is the same as the volume of a prism:
Base area × height
The only difference is the shape of the base.

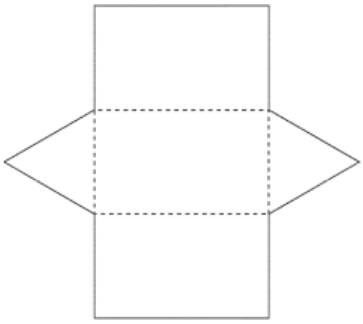
Find the volume of the cylinder. Remember the area of a circle: $\pi \cdot r^2$



Surface Area

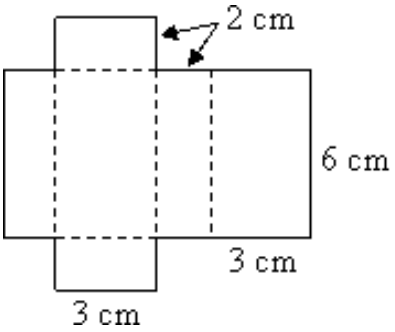
Once we discovered how much volume fit inside of each figure, we learned how to cover the outside of the figure using the **surface area**. The surface area is exactly what it sounds like: the area of all the different surfaces added together.

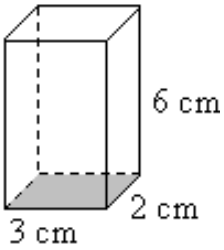




Looking at this triangular prism, we see 5 different shapes: 2 triangles and 3 rectangles. In order to find the surface area, we need to find the area of each shape and add them together.

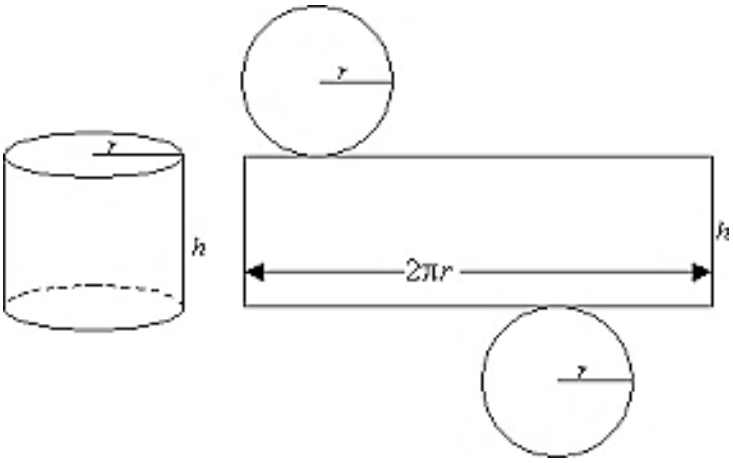
When we flatten a prism into the two-dimensional shapes it is called the *net* of the prism.





Here we can see the net of a rectangular prism. It is made up of 6 rectangles of three different sizes. To find the surface area of a rectangular prism, add together the area of the 6 rectangles.

Find the surface area of this rectangular prism:



We can also find the net of a cylinder. We have the two circles which form the bases and the rectangle which forms the lateral surface, the surface along the sides. Since the rectangles goes all the way around the outside of the circles, it is the length of the circumference of the circles.

Find the surface area of the cylinder if the radius is 5m and the height is 15m:

◆ 2 ◆

Ladies or Tigers?

Many of you are familiar with Frank Stockton's story "The Lady or the Tiger?," in which the prisoner must choose between two rooms, one of which contains a lady and the other a tiger. If he chooses the former, he marries the lady; if he chooses the latter, he (probably) gets eaten by the tiger.

The king of a certain land had also read the story, and it gave him an idea. "Just the perfect way to try my prisoners!" he said one day to his minister. "Only, I won't leave it to chance; I'll have signs on the doors of the rooms, and in each case I'll tell the prisoner certain facts about the signs. If the prisoner is clever and can reason logically, he'll save his life—and win a nice bride to boot!"

"Excellent idea!" said the minister.

THE TRIALS OF THE FIRST DAY

On the first day, there were three trials. In all three, the king explained to the prisoner that each of the two rooms contained either a lady or a tiger, but it *could* be that there were

tigers in both rooms, or ladies in both rooms, or then again, maybe one room contained a lady and the other room a tiger.

1 ◆ The First Trial

"Suppose both rooms contain tigers," asked the prisoner. "What do I do then?"

"That's your hard luck!" replied the king.

"Suppose both rooms contain ladies?" asked the prisoner.

"Then, obviously, that's your good luck," replied the king. "Surely you could have guessed the answer to that!"

"Well, suppose one room contains a lady and the other a tiger, what happens then?" asked the prisoner.

"In that case, it makes quite a difference which room you choose, doesn't it?"

"How do I know which room to choose?" asked the prisoner.

The king pointed to the signs on the doors of the rooms:

I
IN THIS ROOM THERE IS A LADY, AND IN THE OTHER ROOM THERE IS A TIGER

II
IN ONE OF THESE ROOMS THERE IS A LADY, AND IN ONE OF THESE ROOMS THERE IS A TIGER

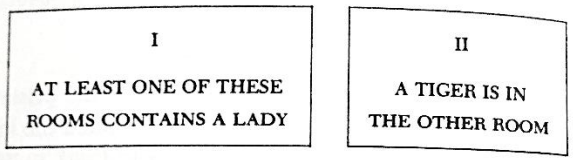
"Is it true, what the signs say?" asked the prisoner.

"One of them is true," replied the king, "but the other one is false."

If you were the prisoner, which door would you open (assuming, of course, that you preferred the lady to the tiger)?

2 • The Second Trial

And so, the first prisoner saved his life and made off with the lady. The signs on the doors were then changed, and new occupants for the rooms were selected accordingly. This time the signs read as follows:



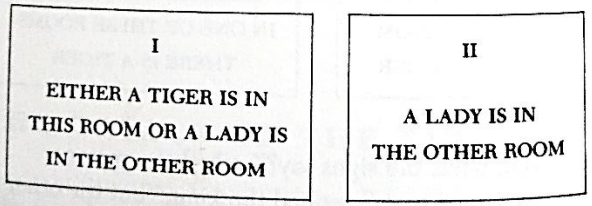
"Are the statements on the signs true?" asked the second prisoner.

"They are either both true or both false," replied the king.

Which room should the prisoner pick?

3 • The Third Trial

In this trial, the king explained that, again, the signs were either both true or both false. Here are the signs:



Does the first room contain a lady or a tiger? What about the other room?

THE SECOND DAY

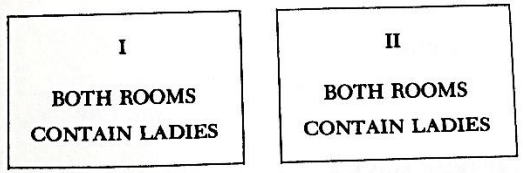
"Yesterday was a fiasco," said the king to his minister. "All three prisoners solved their puzzles! Well, we have five trials coming up today, and I think I'll make them a little tougher."

"Excellent idea!" said the minister.

Well, in each of the trials of this day, the king explained that in the lefthand room (Room I), if a lady is in it, then the sign on the door is true, but if a tiger is in it, the sign is false. In the righthand room (Room II), the situation is the opposite: a lady in the room means the sign on the door is false, and a tiger in the room means the sign is true. Again, it is possible that both rooms contain ladies or both rooms contain tigers, or that one room contains a lady and the other a tiger.

4 • The Fourth Trial

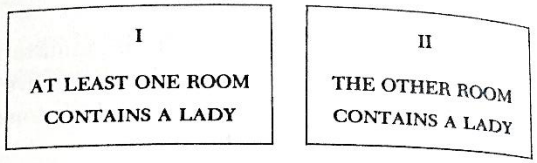
After the king explained the above rules to the prisoner, he pointed to the two signs:



Which room should the prisoner pick?

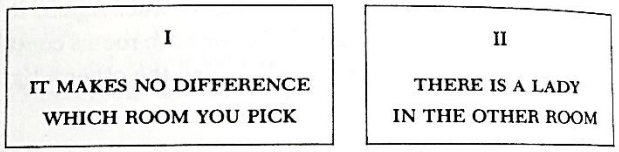
5 ◆ The Fifth Trial

The same rules apply, and here are the signs:



6 ◆ The Sixth Trial

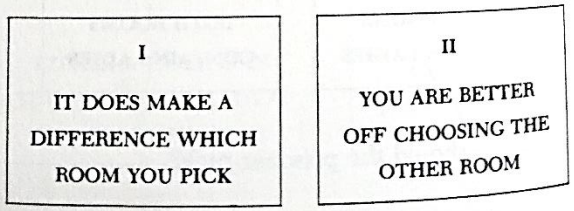
The king was particularly fond of this puzzle, and the next one too. Here are the signs:



What should the prisoner do?

7 ◆ The Seventh Trial

Here are the signs:



What should the prisoner do?