

Volume of Triangular Prisms

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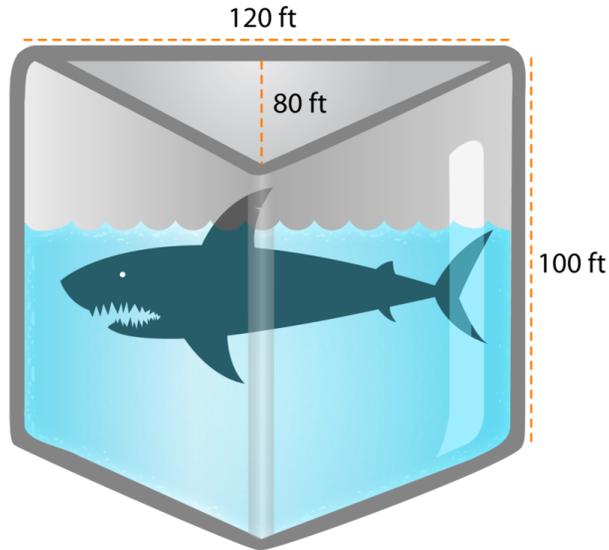
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CONCEPT 1 Volume of Triangular Prisms

Here you'll find volumes of triangular prisms using formulas.

Have you ever been to an aquarium?



On their day off, Candice and Trevor went to the aquarium. The Berryville Aquarium has a shark tank in the shape of a triangular prism. There is only one shark in the tank, so right now the tank is only $\frac{2}{3}$ full.

How many cubic feet of water are in the tank?

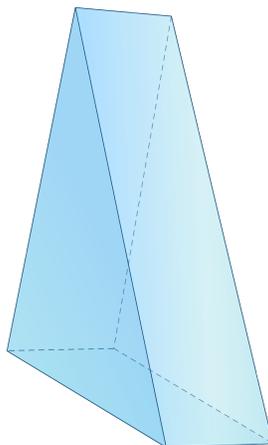
To figure this out, you will need to know how to calculate the volume of triangular prisms. Pay close attention and you will see this problem again at the end of the Concept.

Guidance

You have just finished working with rectangular prisms, now we are going to look at volume with triangular prisms.

What is the difference between a rectangular prism and a triangular prism?

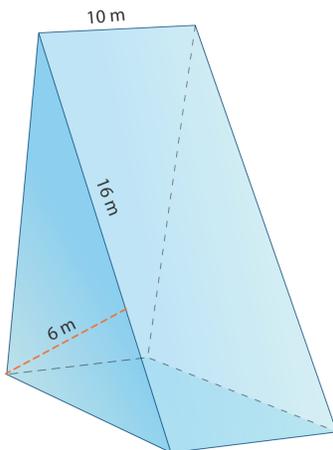
A rectangular prism has two parallel faces that are rectangles, then the other faces are rectangles as well. With a triangular prism, the two parallel faces are triangles and then the other faces are still rectangles. Here is a picture of a triangular prism.



We calculate the volume of triangular prisms almost the same way that we find the volume of rectangular prisms. We still use the formula $V = Bh$. However, this time the bottom layer of the prism is a triangle, not a rectangle. Therefore we need to use the area formula for a triangle to find B . Then we can multiply this amount by the height.

Let's look at a problem to see how this works.

What is the volume of this triangular prism?



As we have seen, the volume formula for any prism is $V = Bh$. First we need to find the base area. Because the base is a triangle, we need to use the formula for the area of a triangle: $\frac{1}{2}bh$. The height of the triangle, h , is indicated by a dashed line. The base of the triangle, b , is the side perpendicular to the height. Remember, we use the height and base measurements for the triangular face, not the height measurement for the whole prism. Look carefully at the image!

So there are two things that we need to accomplish, we need to find the area of one of the triangular bases and then we can take that measurement and multiply it with the height of the entire prism.

$$\begin{aligned} V &= Bh \\ B &= \frac{1}{2}bh \\ B &= \frac{1}{2}(16)(6) \\ B &= 48 \\ V &= (48)H \\ V &= (48)(10) \\ V &= 480 \text{ in}^3 \end{aligned}$$

The volume of this triangular prism is 480 inches³.

Find the volume of the following triangular prisms.

Example A

$$b = 12 \text{ in}, h = 10 \text{ in}, H = 15 \text{ in}$$

Solution: 900 in^3

Example B

$$b = 7 \text{ cm}, h = 5 \text{ cm}, H = 9 \text{ cm}$$

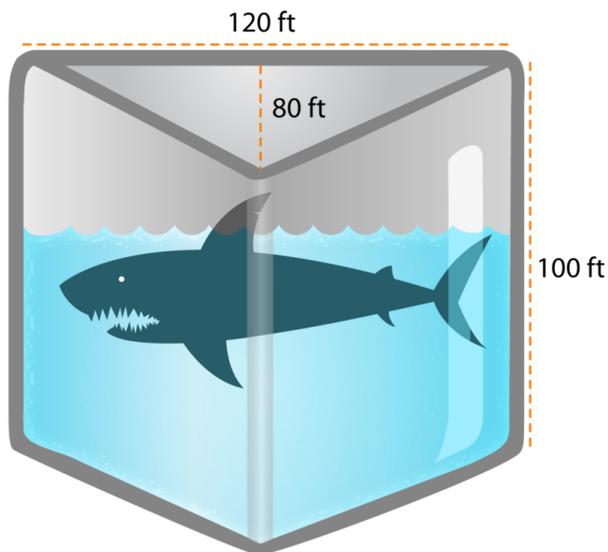
$$\text{Solution: } 157.5 \text{ cm}^3$$

Example C

$$b = 4 \text{ mm}, h = 3 \text{ mm}, H = 5 \text{ mm}$$

$$\text{Solution: } 30 \text{ mm}^3$$

Here is the original problem once again.



On their day off, Candice and Trevor went to the aquarium. The Berryville Aquarium has a shark tank in the shape of a triangular prism. There is only one shark in the tank, so right now the tank is only $\frac{2}{3}$ full.

How many cubic feet of water are in the tank?

This problem is tricky because there are two parts to it. First, we have to figure out how much water would be in the tank if it were full. Then we can figure out two - thirds of that volume.

Let's begin. Here is the formula for volume of a prism.

$$V = Bh$$

Our B is the base of the prism which is triangular. Here is the formula for finding the area of a triangle.

$$B = \frac{1}{2}bh$$

$$B = \frac{1}{2}(120)(80)$$

$$B = 4800$$

Now we can use this measure in the formula for volume.

$$V = (4800)(100)$$

$$V = 480,000 \text{ ft}^3$$

This is the volume if the tank was full. However, we need to figure out two- thirds of this amount.

$$V = \frac{2}{3}(480,000)$$

$$V = 320,000 \text{ ft}^3$$

This is our answer.

Vocabulary

Here are the vocabulary words in this Concept.

Prism

a three-dimensional solid with two flat parallel polygon bases and rectangular faces. The bases can be any polygon in shape.

Volume

the measure of the space inside a solid figure. Volume often is measured in terms of capacity connected with liquid measure.

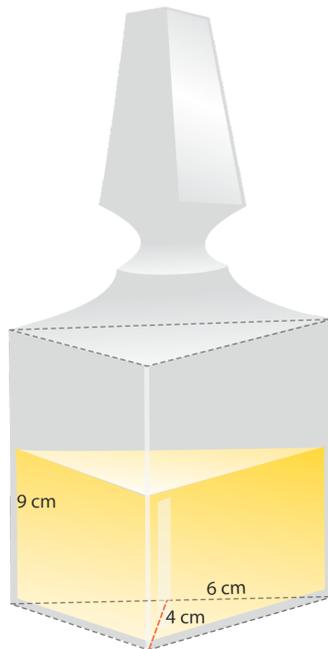
Cubic Units

volume is measured in cubic units because three parts of a solid are being measured, length, width and height.

Guided Practice

Here is one for you to try on your own.

Every year Jeanie gets a bottle of her favorite perfume for her birthday. The perfume comes in a bottle shaped like a triangular prism. She is worried that she might run out of perfume before her next birthday because the bottle is only half full. How much perfume does she have left?



Answer

First, let's think about what the problem is asking us to find. We need to know how much perfume Jeanie has *left*. This means we need to find the volume of a full bottle and then divide by 2. Before we can use the volume formula,

we also need to decide what kind of prism this is. The problem tells us that the bottle is in the shape of a triangular prism, so we'll need to use the area formula for triangles to find the base area, B .

$$B = \frac{1}{2}bh$$

$$B = \frac{1}{2}(6)(4)$$

$$B = 3(4)$$

$$B = 12 \text{ cm}^2$$

The base area is 12 square centimeters. Now we can put this into the volume formula and solve.

$$V = Bh$$

$$V = 12 \times 9$$

$$V = 108 \text{ cm}^3$$

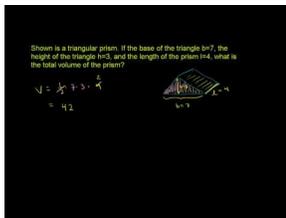
Now we know that the volume of the perfume bottle is 108 cubic centimeters. This is the amount a full bottle can contain. Remember, Jeanie's bottle is only half full. Therefore we need to divide the volume in half:

$$108 \text{ cm}^3 \div 2 = 54 \text{ cm}^3$$

There are 54 cubic centimeters of perfume left in Jeanie's perfume bottle.

Video Review

Here is a video for review.



MEDIA

Click image to the left for more content.

- [This is a KhanAcademyvideo on solid geometryvolume.](#)

Practice

Directions: Find the volume of each triangular prism. Remember that h means the height of the triangular base and H means the height of the whole prism.

1. $b = 6 \text{ in}$, $h = 4 \text{ in}$, $H = 5 \text{ in}$
2. $b = 7 \text{ in}$, $h = 5 \text{ in}$, $H = 9 \text{ in}$
3. $b = 10 \text{ m}$, $h = 8 \text{ m}$, $H = 9 \text{ m}$
4. $b = 12 \text{ m}$, $h = 10 \text{ m}$, $H = 13 \text{ m}$
5. $b = 8 \text{ cm}$, $h = 6 \text{ cm}$, $H = 9 \text{ cm}$

6. $b = 9 \text{ cm}$, $h = 7 \text{ cm}$, $H = 8 \text{ cm}$

7. $b = 5.5 \text{ mm}$, $h = 4 \text{ mm}$, $H = 4 \text{ mm}$

8. $b = 11 \text{ cm}$, $h = 9 \text{ cm}$, $H = 8 \text{ cm}$

9. $b = 20 \text{ ft}$, $h = 17 \text{ ft}$, $H = 19 \text{ ft}$.

10. $b = 20 \text{ ft}$, $h = 18 \text{ ft}$, $H = 15 \text{ ft}$.

11. $b = 18 \text{ ft}$, $h = 16 \text{ ft}$, $H = 17 \text{ ft}$.

12. $b = 24 \text{ ft}$, $h = 21 \text{ ft}$, $H = 19 \text{ ft}$.

13. $b = 24.5 \text{ ft}$, $h = 18 \text{ ft}$, $H = 16 \text{ ft}$.

14. $b = 99 \text{ ft}$, $h = 80 \text{ ft}$, $H = 75 \text{ ft}$.

15. $b = 100 \text{ ft}$, $h = 80 \text{ ft}$, $H = 110 \text{ ft}$.