esri Australia

GIS For Schools

Finding the volume of rectangular and triangular prisms

Lesson Map: http://esriaustralia.com.au/education/SpatialActivity84

Engage

Finding the volume of rectangular prisms

→ Click on the URL above to open the lesson map. Satellite imagery of a 3D world will be displayed. Move your mouse cursor along the bottom of the scene and you will notice that there are six (6) scenes that have been prepared for this activity. Throughout the activity, you will be directed to navigate to these scenes in a specific order.

– Throughout this activity, you will be calculating the volume of prisms. You will have to perform measurements, display your knowledge of formulas, and demonstrate your working.

→ On the scene pane at the bottom of the page click on the second scene, which is titled *New York, USA*.

– A 3D model of the buildings and structures of New York City will appear in white. Please note, as the modelling is 3D, it may take a few moments to buffer.

? Record the formula for finding the volume of a rectangular prism. Record your response below this question or in your subject book. *[Volume of rectangular prism = L x W x H.]*

→ Zoom in tight on the structure marked by the yellow pin on the **east side (right side)** of the river. A compass is in the top-left for orientation purposes. The Black arrow marks the direction of North. You can zoom in using the **+** and **–** symbols or by using the scroll wheel on your mouse.

Download student worksheet here.

Time

30 minutes

Activity

Calculate the volume of prisms and pyramids

Learning Outcome

Students will be able to:

- Find the volume of rectangular prisms
- Find the volume of triangular prisms
- Find the volume of pyramids
- Engage with ICTs and locate shapes for measurement in Australian cities

ACARA Curriculum Link

Year 7 Mathematics: Geometry and measurement

ACMMG160

Year 8 Mathematics: Geometry and measurement

ACMMG198

Teacher Feedback:

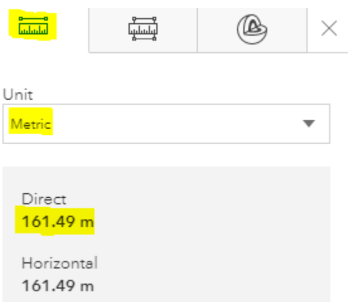
To share your feedback on this, or any Spatial Activity, please contact education@esriaustralia.com.au

➔ You can rotate the scene by holding down the right-click button on your mouse and dragging the scene in the way you want to view it. You can drag the scene up, down, left and right. Release the right-click button to stop rotating the scene. You can also do this by selecting the **pan** tool on the left-hand toolbar.

− This rectangular, low-lying structure is an indoor sports centre used by the population of New York City and Brooklyn. You will find the volume of this structure. To do this, you will need to measure the distances of the length, width and height of the structure.

➔ Click on the **Analyse** button on the toolbar on the right-hand side of the scene.

➔ Select the **Measure distance** option. Ensure that the **Metric** unit is selected. Then click on one vertex to begin the measurement. Drag your mouse to the next vertex on the length-side of the structure and click the mouse again to complete the measurement. Your measurement should look like the image below:



? You have now found the length of the indoor sports centre (rectangular prism). Now find the Width and Height. Once you have completed your measurements of the structure, find the volume of the indoor sports centre. Show your working in your subject book or in the space provided below this question. Round your answer to two decimal places. *[Note to educators: measurements may vary slightly depending on the accuracy of student measurement.]*

Working	*Volume of indoor sports centre = L x W x H* *Volume of indoor sports centre = 161.49m x 88.13m x 9.82m* *Volume of indoor sports centre = 139,759.36*m^3
Final answer	*The volume of the indoor sports centre is 139,759.36*m^3.

➔ Close the measurement tool. Zoom out from the indoor sports centre until you can see New York City again. You will notice a building on the opposite side of the river, which is also marked by a yellow pin. Zoom in on this riverside building so that you can clearly see it.

? Calculate the volume of this building. Use the **analyse** tool to assist you once again in finding key measurements. Show your working in your subject book or in the space provided below this question. Round your answer to two decimal places.

Working	*Volume of building = L x W x H* *Volume of building = 66.71m x 51.22m x 105.29m* *Volume of building = 332,799.18m^3*
Final answer	*The volume of the building is 332,799.18m^3.*

Explore

Finding the volume of triangular prisms

→ On the scene pane at the bottom of the page click on the third scene, which is titled *Brisbane, Australia*.

– A 3D model of the buildings and structures of the city of Brisbane will appear. Please note, as the modelling is 3D, it may take a few moments to buffer. You may wish to take a short time to explore some of the city. Use your mouse or the navigation tools on the left-hand toolbar to have a closer look.

→ Zoom in tight on the structure marked by the yellow pin on the **east side** of the city. It is the building that is closest to the **Story Bridge** (also in 3D). A compass is in the top-left for orientation purposes. This building takes on the shape of a triangular prism. It might take a few moments to buffer when you zoom in.

? Record the formula for finding the volume of a triangular prism. Record your response below this question or in your subject book. *[Volume of triangular prism = Area of triangle x H **or** V = (½ x b x h) x H]*

? Calculate the volume of this building. Use the **analyse** tool to assist you once again in finding key measurements (base of triangle, height of triangle, height of prism). For ease of measurement, assume the building is a strict triangular prism. Do not consider the parts of the building that extend beyond the boundary of the triangular prism. Show your working in your subject book or in the space provided below this question. Round your answer to two decimal places. *[Note to educators: measurements may vary slightly depending on the accuracy of student measurement.]*

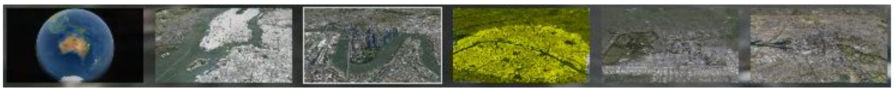
Working	*Volume of building = (½ x b x h) x H* *Volume of building = (½ x 26.99m x 29.81m) x 56.09m* *Volume of building = 402.29m x 56.09m*

	Volume of building = 22,564.45m³
Final answer	*The volume of the building is 22,564.45m³.*

Explain

Finding the volume of a pyramid

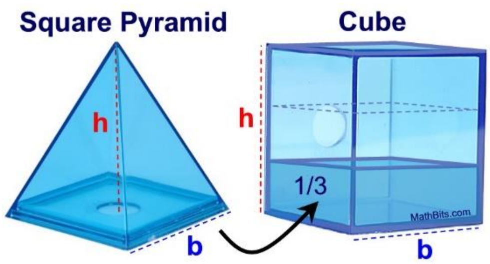
→ On the scene pane at the bottom of the page click on the fourth scene, which is titled *Paris, France*.



– A 3D model of the buildings and structures of Paris will appear. Please note, as the modelling is 3D, it may take a few moments to buffer.

→ You will notice that a yellow pin is located over a structure near the centre of Paris. Zoom in tight on the structure marked by the yellow pin. As you zoom in closer, a pyramid structure will come into sight. This structure is the *Louvre*, the world's largest art museum and a historic monument of Paris. You may wish to look it up on Google images to see how it appears in real life.

– The formula for finding the volume of a pyramid is as follows: **V = Area of base x Height of structure ÷ 3** or **V = L x W x H ÷ 3** or **S x S x H ÷ 3** as the length and width should be identical with a perfect square. You divide by 3 as a pyramid would fit into a square prism with the same dimensions exactly 3 times. See the image below for reference:



? To calculate the volume of this pyramid, find the measurements for the side of the base and vertical height of the Louvre. Use the **analyse** tool to assist you with this. Show your working in your subject book or in the space provided below this question. Round your answer to two decimal places.

Working	*Volume of Louvre = L x W x H ÷ 3* *Volume of Louvre = 18.48m x 18.48m x 11.32m ÷ 3* *Volume of Louvre = 1,288.63m³*
Final answer	*The volume of the pyramidal section of the Louvre is 1,288.63m³.*

Extend

Finding the volume of a complex prism

➔ On the scene pane at the bottom of the page click on the fifth scene, which is titled *Christchurch, New Zealand*.

− A 3D model of the buildings and structures of Christchurch will appear. Please note, as the modelling is 3D, it may take a few moments to buffer.

➔ You will notice that a yellow pin is located over a structure near the centre of Christchurch. Zoom in tight on the structure marked by the yellow pin. As you zoom in closer, a factory-like structure will become clear.

? This factory is made up of two different types of prisms. Find the total volume of the factory. To assist you in finding key measurements, use the **analyse** tool. Show your working in your subject book or in the space provided below this question. Round your answer to two decimal places.

Working	*Volume of factory = Volume of rectangular prism + volume of triangular prism* *Volume of rectangular prism = L x W x H* *Volume of rectangular prism = 33.98m x 20.60m x 2.03m* *Volume of rectangular prism = 1,420.98m^3* *Volume of triangular prism = (½ x b x h) x H* *Volume of triangular prism = (½ x 20.16m x 5.22m) x 32.50m* *Volume of triangular prism = 1710.07m^3* *Volume of factory = Volume of rectangular prism + volume of triangular prism* *Volume of factory = 1,420.98m^3 + 1710.07m^3* *Volume of factory = 3,131.05m^3*
Final answer	*The volume of the factory is 3,131.05m^3.*

➔ **You have completed the worksheet**. If you would like to practice with more prisms, you can revisit any of the scenes and look for rectangular and triangular prisms, or pyramids.

Next Steps:

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