# Icing on the cake

This lesson incorporates optional Path content including volume and surface area of cones, pyramids and spheres. This can be removed if required.

Students explore volume and surface area through the trend of transforming a basic cake into a new design. The purpose of this lesson is to allow students to apply their knowledge of volume and surface area to a variety of solids they have explored throughout this unit.

## Visible learning

### Learning intention

* To be able to solve practical problems related to the volume and surface areas of composite solids.

### Success criteria

* I can name and identify solids that make up a composite solid.
* I can apply my knowledge of volume to solve practical problems.
* I can apply my knowledge of surface area to solve practical problems.

### Syllabus outcomes

A student:

* develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly **MAO-WM-01**
* solves problems involving the surface area of right prisms and practical problems involving the area of composite shapes and solids **MA5-ARE-C-01**
* solves problems involving the volume of composite solids consisting of right prisms and cylinders **MA5-VOL-C-01**
* applies knowledge of the surface area of right pyramids and cones, spheres and composite solids to solve problems**MA5-ARE-P-01**
* applies knowledge of the volume of right pyramids, cones and spheres to solve problems involving related composite solids **MA5-VOL-P-01**

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## Activity structure

### Launch

1. Show students Tigga Mac’s cake hack (0:59) video on YouTube ([bit.ly/caterpillarcake](https://bit.ly/caterpillarcake)).
2. As students are watching the video, have them write down anything they notice or wonder ([bit.ly/noticewonderstrategy](https://bit.ly/noticewonderstrategy)).
3. Students share their notice and wonder lists with a partner before sharing as a class through a class discussion. Prompts for the class discussion might include:
4. What shape was the cake at the start?
5. Do you know the name of each shape cut from the original cake? (This is an opportunity for students to explore annuluses).
6. What happened to the icing on the cake? Is there the same amount, more or less than the original cake had?
7. Has the volume of cake changed?

### Explore

1. Share some more creative cake designs with students. Examples to share could include:
2. Hamish Blake’s birthday cakes ([bit.ly/hamishcakes](https://bit.ly/hamishcakes))
3. Tigga Mac’s YouTube channel ([bit.ly/tiggacakes](https://bit.ly/tiggacakes))
4. The Australian Women’s Weekly children’s birthday cakes ([bit.ly/wwcakes](https://bit.ly/wwcakes))

When viewing links on external websites, please ensure the images and advertisements are appropriate for your students before sharing your screen.

1. Explain to students that they will be designing their own birthday cake or a cake for an event of their choosing. For example, a younger child’s birthday, a wedding cake and so on.

Below are a few options that students can explore when designing their cake. The first is an optional modelling clay activity where they design their cake physically. Following this, students are to sketch their cake and consider some criteria to be met, whilst determining the amount of cake mix and icing need.

#### Optional modelling clay activity

##### Equipment

* Modelling clay (approximately 100 g per student)
* Rulers

##### Method

1. Provide each student with their own modelling clay.
2. Students mould their modelling clay into various solids for which they know how to find the volume and surface area.

Students who have explored Path content may choose to make a sphere, cone and/or pyramid, whilst students that have not explored Path content may choose to only use prisms, cylindrical solids and/or composite solids.

1. Students mould their modelling clay to create their cake design which should incorporate at least 2 solids. Encourage students to be creative.
2. Students are to explore, using their model, the solids that make up their cake, as well as which areas would need icing. Students should recognise that not all surfaces of each solid used would need icing.

Another way to allow students to design their cake physically is to bring in a range of containers and solids, including cans, packaging, balls, ice cream cones and so on.

#### Cake design

1. Explain to students that they need to meet the following criteria:
2. Their cake must be made from solids that they can name, find the volume of and find the surface area of.
3. The volume of their cake cannot exceed 1 kg, which is equivalent to a 23 cm diameter round cake tin with a height of 8 cm.
4. Students are to draw and label a neat sketch of the dimensions of their cake design. They can do this by any means, including:
5. by hand
6. using an online applet such as GeoGebra
7. using a 3D program such as AutoCAD.
8. Once students have considered their design and dimensions, they are to calculate the volume of their cake. Remind students of the above criteria.
9. Students are to then calculate the surface area of their cake that needs to be iced.
10. Pose the optional challenges:
11. A 200 g tub of icing fully covers a 23 cm diameter round cake tin with a height of 8 cm, excluding the base. How many tubs of icing would you need to fully ice your cake, excluding the base?
12. What if the cake had layers? How many tubs of icing would be needed?

### Summarise

1. Students share what they found out about their design with a partner. For example:
2. How many and which solids did they combine?
3. Do they think their design was stable?
4. Did more smaller solids have a greater surface area then fewer larger solids?
5. The class should then do a gallery walk ([bit.ly/DLSgallerywalk](https://bit.ly/DLSgallerywalk)) to view all the cake designs.

### Apply

1. Pose the following problem for students to explore in pairs or small groups of 3:
2. Jamarra and 5 friends want to share a 30 cm cube-shaped chocolate cake with vanilla icing. How can they cut the cake so that everyone receives an equal share of cake and icing?
3. To make the problem clearer to students, you could model sharing the cake between:
4. two friends
5. three friends.

Solutions, including diagrams for a 9-inch cube cake, can be found at the *Figure This!* website ([bit.ly/cakecuttingchallenge](https://bit.ly/cakecuttingchallenge)).

## Assessment and Differentiation

### Suggested opportunities for differentiation

* At multiple points throughout the lesson, students decide which solids to explore. Students can incorporate Path content or explore the solids presented in the Core content.
* For students who are struggling, suggest a simple cake design, such as one large and one smaller rectangular prism stacked on top of one another.
* To challenge students, suggest they get creative with their designs to incorporate as many solids as they can.
* Students have the option of exploring how much icing is required.

### Suggested opportunities for assessment

* Collect the cake designs along with the calculations performed to check for student understanding and address any misconceptions.

## References

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