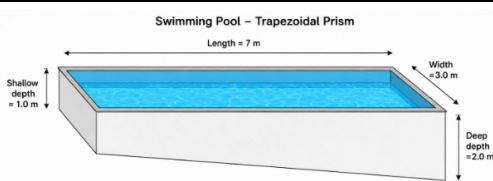
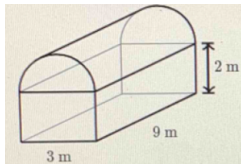


Helping Your Child with Area, Volume & Circles

Measurement · Year 7 to Year 10 · Australian Curriculum Mathematics

Measurement is all around us — from tiling a floor to filling a tank, from cutting fabric to calculating how much paint to buy. In high school your child moves from basic areas and perimeters to circles, cylinders, and composite solids. They also learn to work with **composite shapes** (shapes made up of simpler ones) and develop confidence with formulas using π (pi).

Year	What your child learns	What this looks like at home
Year 7	Area of triangles and parallelograms; volume of prisms area — the amount of surface inside a shape (measured in cm^2, m^2). Your child finds areas of: Rectangle: $A = l \times w$ Triangle: $A = \frac{1}{2} \times \text{base} \times \text{height}$ Parallelogram: $A = \text{base} \times \text{height}$ volume — the amount of 3D space inside a solid shape (measured in cm^3, m^3). Your child finds the volume of prisms: volume of a prism — $V = \text{Area of cross-section} \times \text{length}$ Rectangular prism (box): $V = l \times w \times h$ Triangular prism: $V = (\text{area of triangular cross-section}) \times \text{length}$	'What is the area of our kitchen floor if it is $4 \text{ m} \times 3.5 \text{ m}$?' ($4 \times 3.5 = 14 \text{ m}^2$) 'A triangular sail has base 2 m and height 3 m. What is its area?' ($\frac{1}{2} \times 2 \times 3 = 3 \text{ m}^2$) Estimate the area of a room: count tiles or measure sides, then calculate.
Year 8	Circles, and area of composite shapes circumference — the distance around a circle: $C = 2\pi r$ or $C = \pi d$ area of a circle — $A = \pi r^2$ ($\pi \approx 3.14159$) radius — distance from the centre to the edge (r) diameter — distance all the way across through the centre ($d = 2r$) composite shape — a shape made of two or more simpler shapes: Split it up, find each area, then add (or subtract) them. capacity — how much a container can hold, found using the same volume formulas: Note: 1 Litre = $1,000 \text{ cm}^3$ and $1 \text{ m}^3 = 1000 \text{ Litres}$ (important for tanks and containers).	'Our round pizza has a diameter of 30 cm. What is its area?' ($r = 15$, $A = \pi \times 15^2 \approx 707 \text{ cm}^2$) 'A water tank is a cylinder: radius 0.5 m, height 1 m. How many litres does it hold?' ($V = \pi \times 0.25 \times 1 = 0.785 \text{ m}^3 \approx 785 \text{ litres}$) Measure a tin can — estimate its volume and check with the label.
Year 9	Surface area and volume of right prisms and cylinders. Your child finds volume and surface area of right prisms and solves problems related to these shapes. volume of a prism — $V = \text{Area of cross-section} \times \text{length}$ Rectangular prism (box): $V = l \times w \times h$ Cylinder: $V = \pi r^2 h$ (circle area $\times$ height) Surface Area of a prism - For surface area of rectangular and triangular (and other) right prisms students are encouraged to identify the number and types of faces, and then add the areas of all the faces. Cylinder SA $= 2\pi r^2 + 2\pi r h$ Precision and error in measurement absolute error — the maximum possible error in a measurement: If measured to nearest cm, absolute error = $\pm 0.5 \text{ cm}$ relative error — error as a fraction of the measurement: relative error = absolute error $\div$ measurement limits of accuracy — the range within which the true value lies:	 'Our pool is a trapezoidal prism: length 7 m, width 3 m, shallow end 1 m deep, deep end 2 m deep. What is its volume?' (Cross-section: $\frac{1}{2} \times (1 + 2) \times 7 = 10.5 \text{ m}^2$. Volume = $10.5 \times 3 = 31.5 \text{ m}^3$) 'A plank is 'measured' as 2 m (to the nearest cm). What are the limits of its true length?' (Between 1.995 m and 2.005 m — or $\pm 0.005 \text{ m}$ or $\pm 0.5 \text{ cm}$) 'How much soil do we need to fill a raised garden bed 2 m $\times$ 1 m $\times$ 0.4 m?' (0.8 m^3) Look at packaging: 'Is a cylinder or rectangular box more efficient for a given volume?'

	A length measured as 15 cm (to nearest cm) lies between 14.5 and 15.5 cm	Year 10 on next page
Year 10	Surface Area and Volume of Composite objects Your child also finds composite volumes and surface areas : e.g. a triangular prism (or half a cylinder) on top of a rectangular prism or a L shaped prism— find each part separately and add. They choose appropriate units and check reasonableness of answers. Your child applies measurement to real contexts: Building, surveying, engineering and design problems Choosing appropriate units and checking reasonableness of answers	 'Our greenhouse is a rectangular prism (3m × 9m × 2m) with a half-cylinder roof (diameter 3m, length 9m) on top. What is the total volume?' (Prism: $3 \times 9 \times 2 = 54\text{m}^3$. Half-cylinder: $\frac{1}{2} \times \pi \times 1.5^2 \times 9 \approx 31.8\text{m}^3$. Total $\approx 85.8\text{m}^3$) 'Why does a small error in the radius of a circle cause a bigger error in the area?' (Area uses r^2, so the error is squared too)

★ Key measurement formulas — Year 7 to Year 10

Shape	Formula	Real-life use
Rectangle	Area = $l \times w$	Tiling, painting walls
Triangle	Area = $\frac{1}{2} \times b \times h$	Sails, roof sections
Circle (area)	Area = $\pi \times r^2$	Pizza, round garden
Circle (circumference)	$C = 2 \times \pi \times r$ or $C = \pi \times d$	Fencing around circular garden
Rectangular prism	Volume = $l \times w \times h$ Surface Area = add up the areas of the 6 faces	Boxes, rooms, tanks
Triangular prism	Volume = (triangle area) × length	Tents, roof sections, wedges
Cylinder	Volume = $\pi \times r^2 \times h$ Surface Area = $2\pi r^2 + 2\pi rh$	Tanks, tin cans, pools

About π (pi): π is the ratio of any circle's circumference to its diameter — always the same: ≈ 3.14159 . On a calculator use the π button for accuracy. $\pi \times r^2$ gives area; $2 \times \pi \times r$ gives circumference. Answers are often expressed in terms of π , to preserve accuracy.

Helping at Home — Area, Volume & Circles

Worked examples and questions to ask · Year 7 to Year 10

How it works — worked examples

Year 7 — Volume of a prism

A shoebox (rectangular prism) is 30 cm × 20 cm × 15 cm. What is its volume?

Rectangular prism	$V = l \times w \times h = 30 \times 20 \times 15 = 9,000 \text{ cm}^3$
A tent (triangular prism)	Triangular cross-section: base 2 m, height 1.5 m, length 3 m
Tent volume	$V = (\frac{1}{2} \times 2 \times 1.5) \times 3 = 1.5 \times 3 = 4.5 \text{ m}^3$

Year 8 — Composite area

An L-shaped room: 8 m long, 5 m wide — with a 3 m × 2 m section cut from one corner. Find the area.

Full rectangle	$8 \times 5 = 40 \text{ m}^2$
Cut-out section	$3 \times 2 = 6 \text{ m}^2$
L-shape area	$40 - 6 = 34 \text{ m}^2$

Year 9 — Volume and surface area of right prisms and cylinders

A cylindrical water tank has diameter 1.2 m and height 2 m. How many litres does it hold?

Radius	$r = \text{diameter} \div 2 = 1.2 \div 2 = 0.6 \text{ m}$
Circle area	$\pi \times r^2 = 3.14159 \times 0.6^2 = 3.14159 \times 0.36 \approx 1.131 \text{ m}^2$
Volume	$1.131 \times 2 = 2.262 \text{ m}^3$
In litres	$2.262 \text{ m}^3 \times 1,000 = 2,262 \text{ litres}$

Year 9 — Surface area of a rectangular prism

A tissue box (rectangular prism) is 24 cm × 12 cm × 10 cm. What is its surface area?

3 pairs of faces	$24 \times 12, 24 \times 10 \text{ and } 12 \times 10 = 288, 240 \text{ and } 120 \text{ cm}^2$
Total surface area	$2 \times (288 + 240 + 120) = 1,296 \text{ cm}^2$

Questions to ask your child

You don't need to solve these. Ask them and let your child explain their thinking!

7 Year 7

- Our living room is 6 m × 4 m. What is its area?
- A triangle has base 5 m and height 3 m. What is its area?
- Tiles are 50 cm × 50 cm. How many do you need to cover a 3 m × 3 m floor?
- A shoebox is 30 cm × 20 cm × 15 cm. What is its volume?

8 Year 8

- A circle has radius 5 cm. What is its area? What is its circumference?
- Convert: 1.5 m³ to litres.
- An L-shaped garden: a 4 m × 6 m rectangle with a 1 m × 2 m piece removed. What is the area?
- A toy box is 60 cm × 40 cm × 30 cm. How many litres does it hold?

9 Year 9

- A can of baked beans has radius 4 cm and height 10 cm. What is its volume?
- A circular pool has diameter 6 m and depth 1.2 m. How many kilolitres of water does it hold?
- A plank is measured as 3.6 m (to nearest 0.1 m). What are the limits of its true length?
- If a room is measured as 5 m × 4 m (both to nearest m), what is the maximum possible area?

Year 10 on next page

Year 10 – Volume of a composite solid

A garden shed is a rectangular prism ($3\text{ m} \times 2\text{ m} \times 2.2\text{ m}$) with a triangular-prism roof (base 2 m , height 1 m , length 3 m) on top. What is the total volume?

Prism volume	$3 \times 2 \times 2.2 = 13.2\text{ m}^3$
Roof volume	$\frac{1}{2} \times 2 \times 1 \times 3 = 3\text{ m}^3$
Total volume	$13.2 + 3 = 16.2\text{ m}^3$

10 Year 10

- Why is it important to use the exact value of π in calculations rather than 3.14?
- A builder needs to tile a floor of 28.5 m^2 . Tiles come in boxes of 1.5 m^2 . How many boxes?
- A shed is a cube ($2\text{ m} \times 2\text{ m} \times 2\text{ m}$) with a triangular-prism roof (cross-section base 2 m , height 1 m , length 2 m) on top. What is the total volume?
- A water tank is a cylinder (radius 0.5 m , height 1.5 m) sitting on a square concrete slab ($2\text{ m} \times 2\text{ m} \times 0.3\text{ m}$). What is the combined volume of tank and slab?

Things to try at home

Year 7: Measure a room with a tape measure. Calculate the area. Then estimate how many $1\text{ m} \times 1\text{ m}$ tiles you would need.

Year 8: Find a circular object (plate, lid, tin). Measure the diameter. Calculate the circumference and check by wrapping a piece of string around it.

Year 9: Measure a can or cereal box at home. Calculate its volume, then work out its surface area — how much material would it take to wrap it?

Year 7: Look at a triangular piece of food or fabric. Estimate its area using base and height.

Year 8: Measure a shoebox or drawer. Calculate how many litres it could hold if it were a container ($1\text{ litre} = 1,000\text{ cm}^3$).

Year 10: Home project: work out how much concrete is needed for a garden path $10\text{ m} \times 0.5\text{ m} \times 0.1\text{ m}$ deep.

Key words to learn together

area: the amount of surface inside a 2D shape, measured in square units (cm^2 , m^2)

composite shape: a shape made by joining or cutting simpler shapes — find each part separately

radius: the distance from the centre of a circle to its edge (r)

pi (π): the ratio of circumference to diameter for any circle: ≈ 3.14159

prism: a 3D shape with the same cross-section all the way through: $V = \text{cross-section area} \times \text{length}$

surface area: the total area of all the outside faces of a 3D shape

perimeter: the total distance around the outside of a 2D shape

circumference: the distance around a circle: $C = 2\pi r = \pi d$

diameter: the distance across a circle through its centre ($d = 2r$)

volume: the amount of 3D space inside a solid shape, measured in cubic units (cm^3 , m^3)

cylinder: a prism with a circular cross-section: $V = \pi r^2 h$ and Surface Area = $2\pi r^2 + 2\pi rh$

absolute error: the maximum amount by which a measurement might be wrong ($\pm$ half the precision)