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, cones, and spheres. 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, quadrilaterals and composite shapes** **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: $A = \frac{1}{2} \times$ base × height** **Parallelogram: A = base × height** **Rhombus: $A = \frac{1}{2} \times d_1 \times d_2$ (half product of diagonals)** **Kite: $A = \frac{1}{2} \times d_1 \times d_2$** **composite shape** — a shape made of two or more simpler shapes: Split it up, find each area, then add (or subtract) them.	'What is the area of our kitchen floor if it is 4 m × 3.5 m?' ($4 \times 3.5 = 14\ m^2$) **'A triangular sail has base 2 m and height 3 m. What is its area?'** **($\frac{1}{2} \times 2 \times 3 = 3\ m^2$)** **Estimate the area of a room: count tiles or measure sides, then calculate.**
Year 8	**Circles, cylinders and volume** **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 ($d = 2r$) **volume of a prism** — V = Area of cross-section × length **Rectangular prism (box): $V = l \times w \times h$** **Cylinder: $V = \pi r^2 h$ (circle area × height)** 1 litre = 1,000 cm^3 (important for tanks and containers)	'Our round pizza has a diameter of 30 cm. What is its area?' ($r = 15$, $A = \pi \times 15^2 \approx 707\ cm^2$) **'A water tank is a cylinder: radius 0.5 m, height 1 m. How many litres does it hold?'** **($V = \pi \times 0.25 \times 1 \approx 785$ litres)** **Measure a tin can — estimate its volume and check with the label.**
Year 9	**Surface area and volume of pyramids, cones and spheres** **pyramid** — a 3D shape with a polygon base and triangular faces $V = \frac{1}{3} \times$ base area × height **cone** — a 3D shape with a circular base tapering to a point $V = \frac{1}{3}\pi r^2 h$ | Surface area = $\pi r^2 + \pi r l$ (l = slant height) **sphere** — a perfectly round 3D shape (like a ball) $V = (\frac{4}{3})\pi r^3$ | Surface area = $4\pi r^2$ Your child also finds composite volumes and surface areas: e.g. a cone on top of a cylinder — find each part separately and add. They choose appropriate units and check reasonableness of answers.	'A basketball has radius 12 cm. What is its volume?' ($V = \frac{4}{3} \times \pi \times 12^3 \approx 7{,}238\ cm^3$) **'An ice cream cone has r = 3 cm and h = 10 cm. How much ice cream fits inside?'** **($V = \frac{1}{3} \times \pi \times 9 \times 10 \approx 94\ cm^3$)** **Look at packaging: 'Is a cylinder or rectangular box more efficient for a given volume?'**
Year 10	**Precision, error and application of measurement** **absolute error** — the maximum possible error in a measurement: If measured to nearest cm, absolute error = ±0.5 cm **relative error** — error as a fraction of the measurement: relative error = absolute error ÷ measurement **limits of accuracy** — the range within which the true value lies: A length measured as 15 cm (to nearest cm) lies between 14.5 and 15.5 cm Your child applies measurement to real contexts: Building, surveying, engineering and design problems Problems with composite 3D shapes Choosing appropriate levels of accuracy for the context	'A plank is 'measured' as 2 m. What are the limits of its true length?' (Between 1.995 m and 2.005 m — or ±0.005 m) **'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)** **'How much soil do we need to fill a raised garden bed 2 m × 1 m × 0.4 m?' ($0.8\ m^3$ = 800 litres)**

★ Key measurement formulas — Year 7 to Year 10

Shape	Formula	Real-life use
Rectangle	**Area = l × w**	Tiling, painting walls
Triangle	**Area = $\frac{1}{2}$ × b × h**	Sails, roof sections
Circle (area)	**Area = π × r^2**	Pizza, round garden
Circle (circumference)	**C = 2 × π × r**	Fencing around circular garden
Rectangular prism	**Volume = l × w × h**	Boxes, rooms, tanks
Cylinder	**Volume = π × r^2 × h**	Tanks, tin cans, pools
Cone	**Volume = $\frac{1}{3}$ × π × r^2 × h**	Ice cream, funnels
Sphere	**Volume = ($\frac{4}{3}$) × π × r^3**	Balls, domes, tanks

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. π × r^2 gives area; 2 × π × r gives circumference.*

Helping at Home — Area, Volume & Circles

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

How it works — worked examples

Year 7 — 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	$8 \times 5 = 40\ m^2$
Cut-out section	$3 \times 2 = 6\ m^2$
L-shape area	**$40 - 6 = 34\ m^2$**

Year 8 — Volume of a cylinder

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

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

Year 9 — Volume of a cone

An ice cream cone has radius 3 cm and height 12 cm. What is its volume?

Formula	$V = \frac{1}{3} \times \pi \times r^2 \times h$
Substitute	$V = \frac{1}{3} \times 3.14159 \times 3^2 \times 12$
Calculate	**$= \frac{1}{3} \times 3.14159 \times 9 \times 12 \approx 113.1\ cm^3$**

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?
→ An L-shaped garden: a 4 m × 6 m rectangle with a 1 m × 2 m piece removed. What is the area?
→ Tiles are 50 cm × 50 cm. How many do you need to cover a 3 m × 3 m floor?

8 Year 8

→ A circle has radius 5 cm. What is its area? What is its circumference?
→ A can of baked beans has radius 4 cm and height 10 cm. What is its volume?
→ Convert: 1.5 m^3 to litres. (Answer: 1,500 litres)
→ A circular pool has diameter 6 m and depth 1.2 m. How many kilolitres of water does it hold?

9 Year 9

→ A sphere has radius 5 cm. What is its volume? ($V = \frac{4}{3} \times \pi \times 125$)
→ A pyramid has a 4 m × 4 m square base and height 6 m. What is its volume?
→ A composite shape is a cylinder (r = 3, h = 8) with a cone (r = 3, h = 4) on top. Find the total volume.
→ What is the surface area of a sphere with radius 7 cm?

10 Year 10

→ 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?
→ 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?

Things to try at home

Year 7: Measure a room with a tape measure. Calculate the area. Then estimate how many 1 m × 1 m tiles you would need.	**Year 7:** Look at a triangular piece of food or fabric. Estimate its area using base and height.
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 8:** Calculate how many litres a pot, bucket or tank holds. Measure the dimensions and use $V = \pi \times r^2 \times h$.
Year 9: Estimate the volume of a ball (basketball, football). Measure the diameter and use $V = (\frac{4}{3})\pi r^3$.	**Year 10:** Home project: work out how much concrete is needed for a garden path 10 m × 0.5 m × 0.1 m deep.

Key words to learn together

area: the amount of surface inside a 2D shape, measured in square units (cm^2, m^2)	**perimeter:** the total distance around the outside of a 2D shape
composite shape: a shape made by joining or cutting simpler shapes — find each part separately	**circumference:** the distance around a circle: $C = 2\pi r = \pi d$
radius: the distance from the centre of a circle to its edge (r)	**diameter:** the distance across a circle through its centre ($d = 2r$)
pi (π): the ratio of circumference to diameter for any circle: ≈ 3.14159	**volume:** the amount of 3D space inside a solid shape, measured in cubic units (cm^3, m^3)
prism: a 3D shape with the same cross-section all the way through: V = area × length	**cylinder:** a prism with a circular cross-section: $V = \pi r^2 h$
cone: a 3D shape with a circular base tapering to a point: $V = \frac{1}{3}\pi r^2 h$	**sphere:** a perfectly round 3D ball shape: $V = (\frac{4}{3})\pi r^3$ | SA $= 4\pi r^2$
surface area: the total area of all the outside faces of a 3D shape	**absolute error:** the maximum amount by which a measurement might be wrong (±half the precision)