Mathematics Level 5

Chapter 5 — Measurement

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Contents

Choosing metric units for length, mass and capacity

Code `VC2M5M01` (Victorian Curriculum F–10 Version 2.0, Mathematics, Level 5; authority file `maths_5.json`): "choose appropriate metric units when measuring the length, mass and capacity of objects; use smaller units or a combination of units to obtain a more accurate measure". This section draws on `VC2M5M01.E01`, `.E02`, `.E03`, `.E04` and `.E05`.

Theory

What are we measuring?

Three big ideas in this section: **length**, **mass** and **capacity**.

Length is how long, how tall or how far something is. We measure length with tools like rulers and tape measures.

Mass is how heavy something is. We measure mass with scales.

Capacity is how much a container can hold. Think of the water that fits in a bottle or a jug.

Every measure has two parts: a **number** and a **unit**. The number 5 on its own tells you nothing. 5 cm tells you a length. Choosing the unit that fits the job is the skill in this section.

The metric units and their order

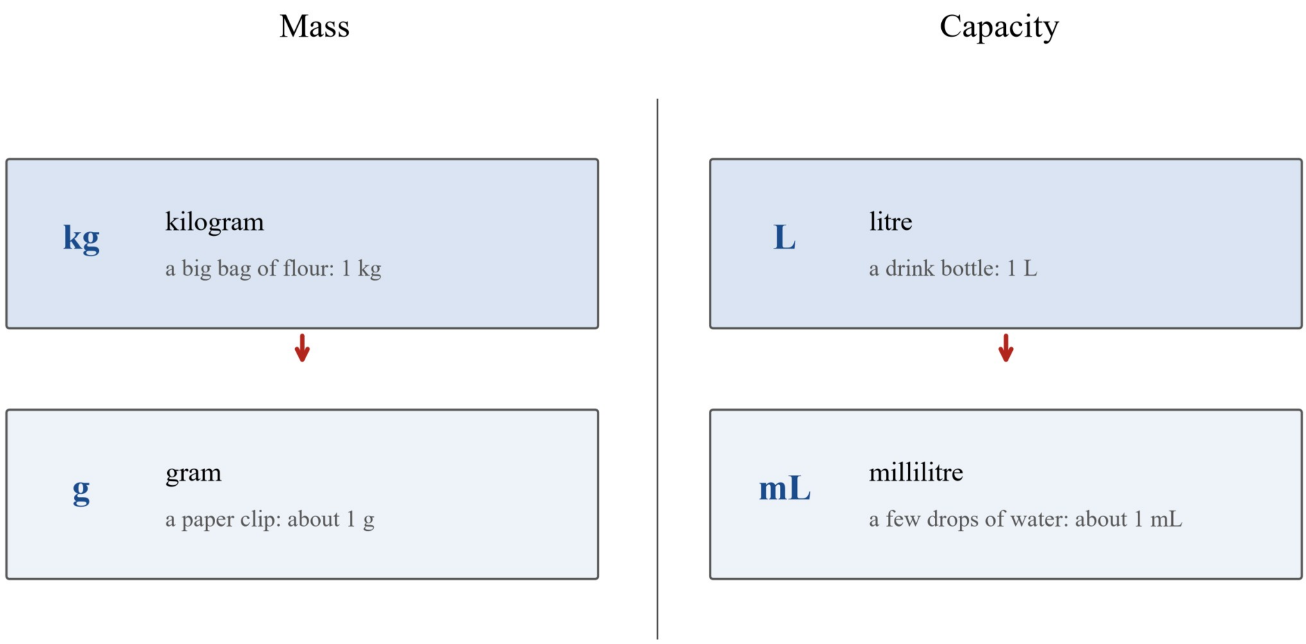
The units we use belong to the **metric system**. Here are the length units, ordered from largest to smallest, each with a picture to remember it by.

Length units, largest to smallest

Four rows from largest to smallest: kilometre (km), the road between two towns; metre (m), the height of a door; centimetre (cm), the width of your fingernail; millimetre (mm), the thickness of a coin. A red arrow points down, labelled smaller units.

Read down the list: **kilometre (km)**, **metre (m)**, **centimetre (cm)**, **millimetre (mm)**. A kilometre is for big lengths like the road between two towns. A millimetre is for tiny lengths like the thickness of a coin.

Mass and capacity have their own units, ordered the same way.



Largest unit on top, smallest at the bottom,
just like the length units.

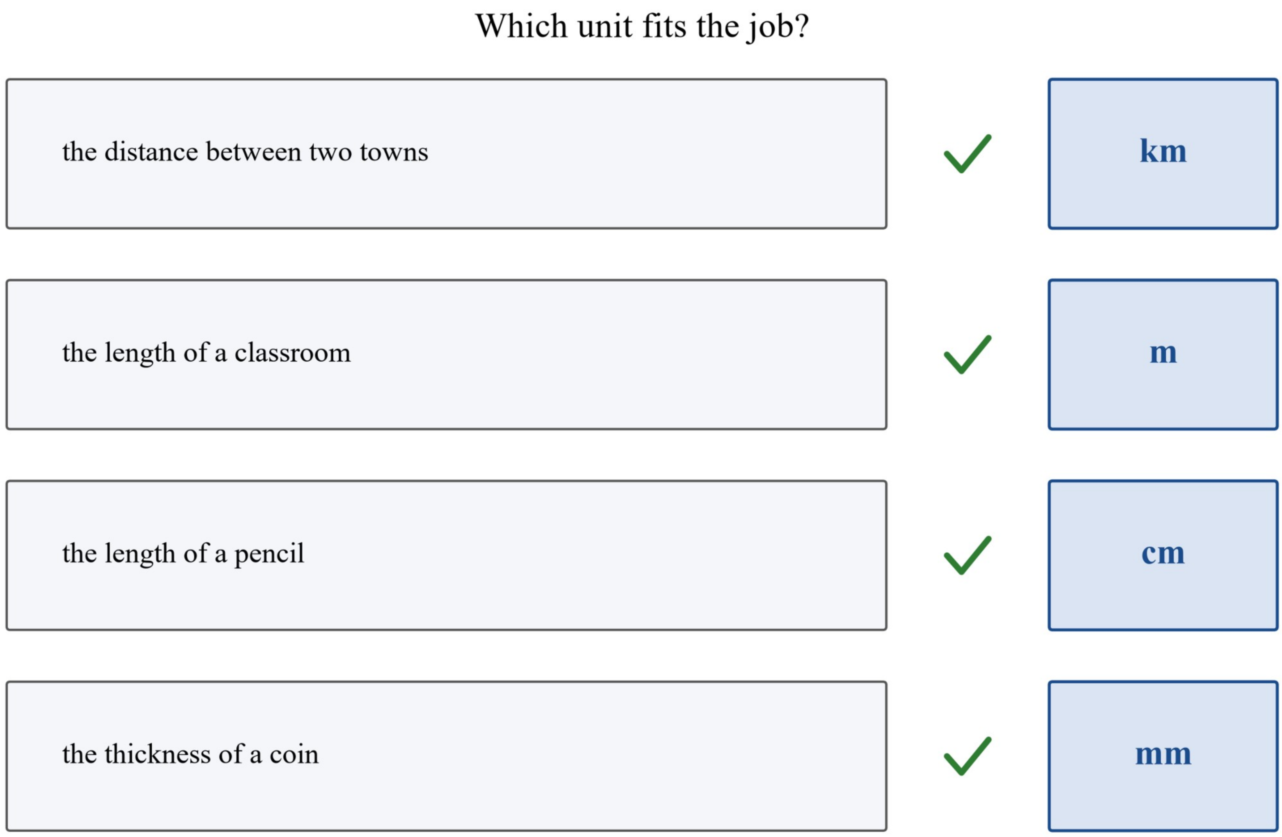
Two columns. Mass: kilogram (kg), a big bag of flour 1 kg, above gram (g), a paper clip about 1 g. Capacity: litre (L), a drink bottle 1 L, above millilitre (mL), a few drops of water about 1 mL. Largest unit on top, smallest at the bottom.

Mass: the **kilogram (kg)** is the big unit and the **gram (g)** the smaller one. Capacity: the **litre (L)** is the big unit and the **millilitre (mL)** the smaller one.

Watch how the units are written. The symbol is never made plural: we write 5 km, not 5 kms.

Choosing the unit that fits the job

Big jobs take big units. Small jobs take small units.



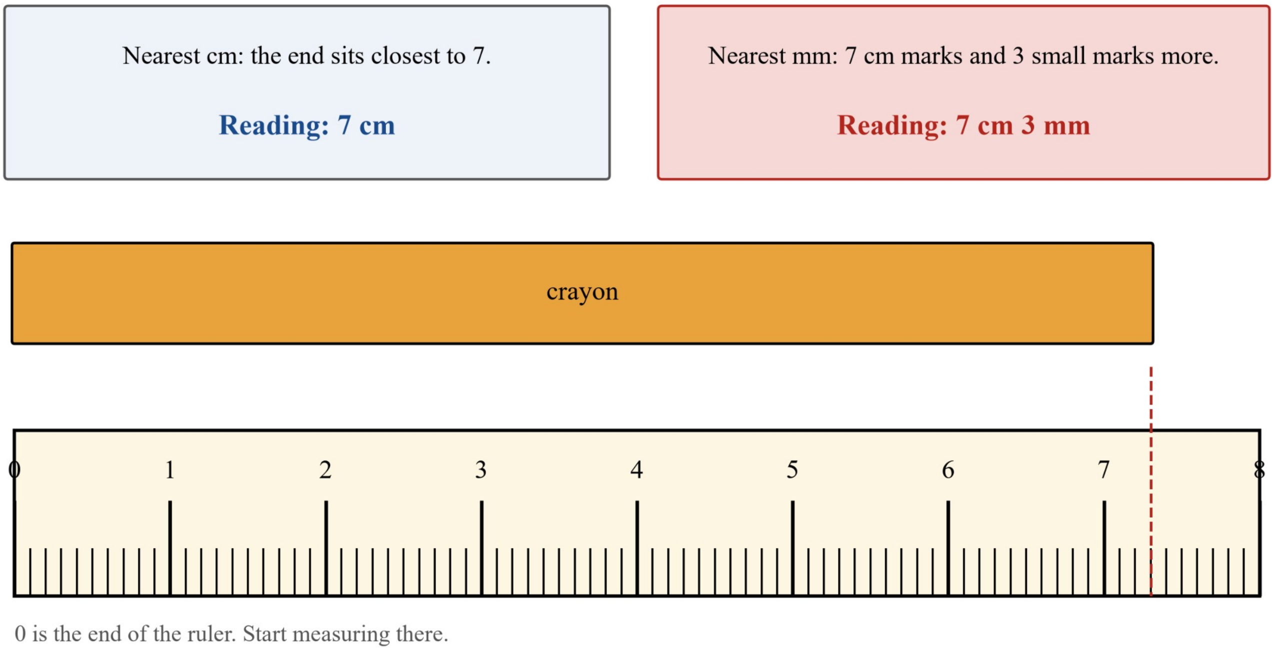
Big jobs take big units. Small jobs take small units.

Four jobs matched to units with green ticks: the distance between two towns to km; the length of a classroom to m; the length of a pencil to cm; the thickness of a coin to mm. Big jobs take big units. Small jobs take small units.

Why does the choice matter? You *could* measure the road between two towns in centimetres, but the count of centimetres would be huge and hard to use. In kilometres the same road gives a number that is easy to say and easy to picture. The unit that fits the job makes the number make sense.

A more accurate measure: smaller units, and two units together

The second skill in this section: using a smaller unit, or a smaller unit for the part left over, gives a more accurate measure.

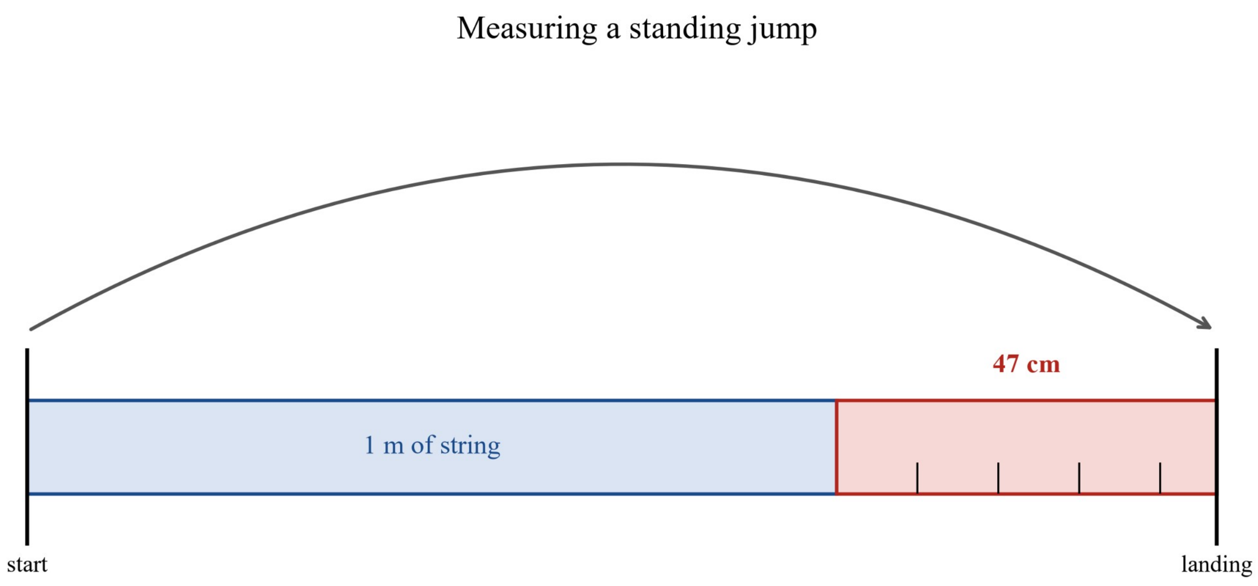


The smaller unit gives the more accurate reading.

A ruler from 0 to 8 with small mm marks between the cm marks. A crayon starts at 0 and ends 3 small marks past 7. Two boxes: nearest cm reading 7 cm; nearest mm reading 7 cm 3 mm. The smaller unit gives the more accurate reading.

The crayon ends past the 7 mark. To the nearest cm, the reading is 7 cm. The small mm marks let us say more: the end sits 3 small marks past 7, so the reading is 7 cm 3 mm. The two-unit reading is the more accurate one. It tells more exactly where the crayon's end really is.

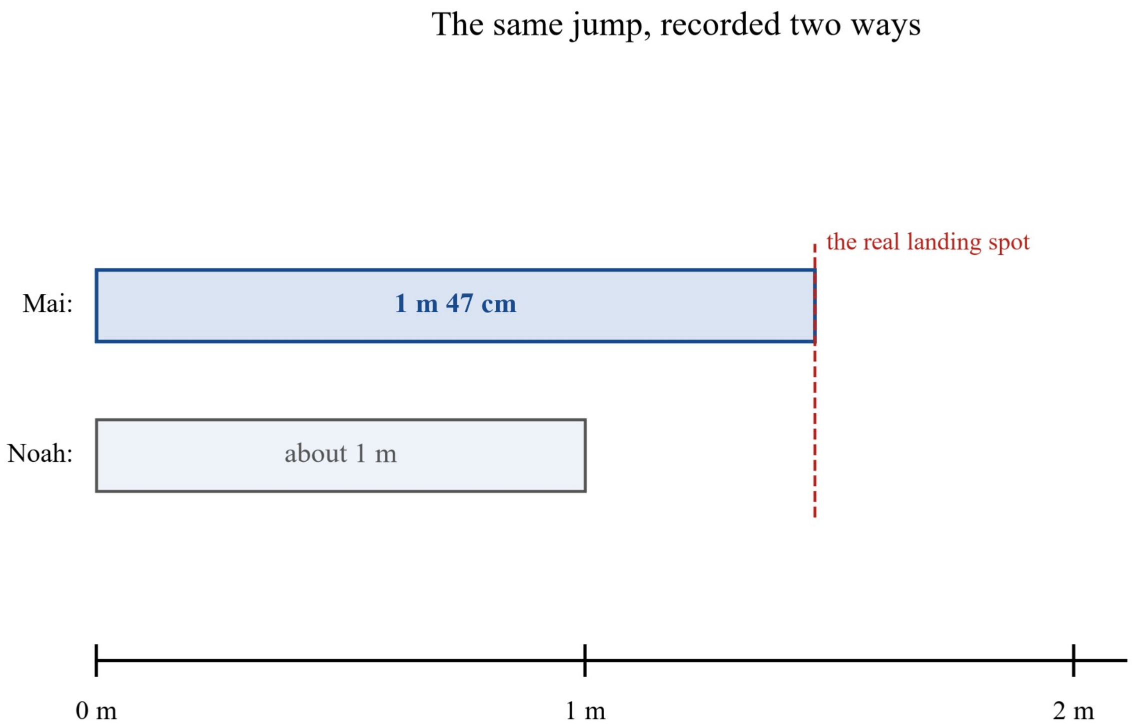
The same idea works for long jumps too. Lay a metre length of string along a jump. The string fits once, and the part left over is measured with a cm ruler: 47 cm.



Record the whole metres and the part metre together: 1 m 47 cm.

A standing jump measured from a start line to a landing line. One metre of string covers the first part, then a cm ruler measures the part left over as 47 cm. The record is 1 m 47 cm.

Record the whole metres and the part together: **1 m 47 cm**.



Mai's record is closer to the real jump. The smaller units give the more accurate record.

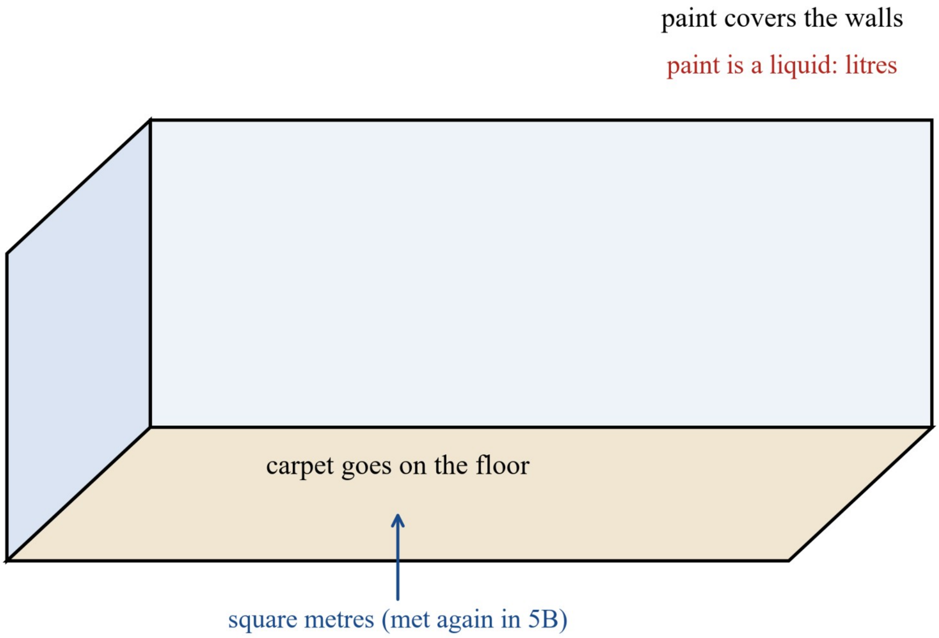
Two bars on a 0 to 2 m scale. Mai's bar is labelled 1 m 47 cm and reaches the red dashed line marking the real landing spot. Noah's bar is labelled about 1 m and stops well short. Mai's record is closer to the real jump.

Noah's record, about 1 m, leaves out the 47 cm. Mai's record, 1 m 47 cm, lands right on the real landing spot. **Using a smaller unit for the part left over makes the measure more accurate.**

Justifying a choice of unit

Sometimes the job itself tells you the unit. To carpet a room you measure the floor. Carpet covers a surface, so the unit is square metres (you will meet area again in 5B). To paint the walls you need paint, and paint is a liquid, so the unit is litres.

Painting and carpeting a room



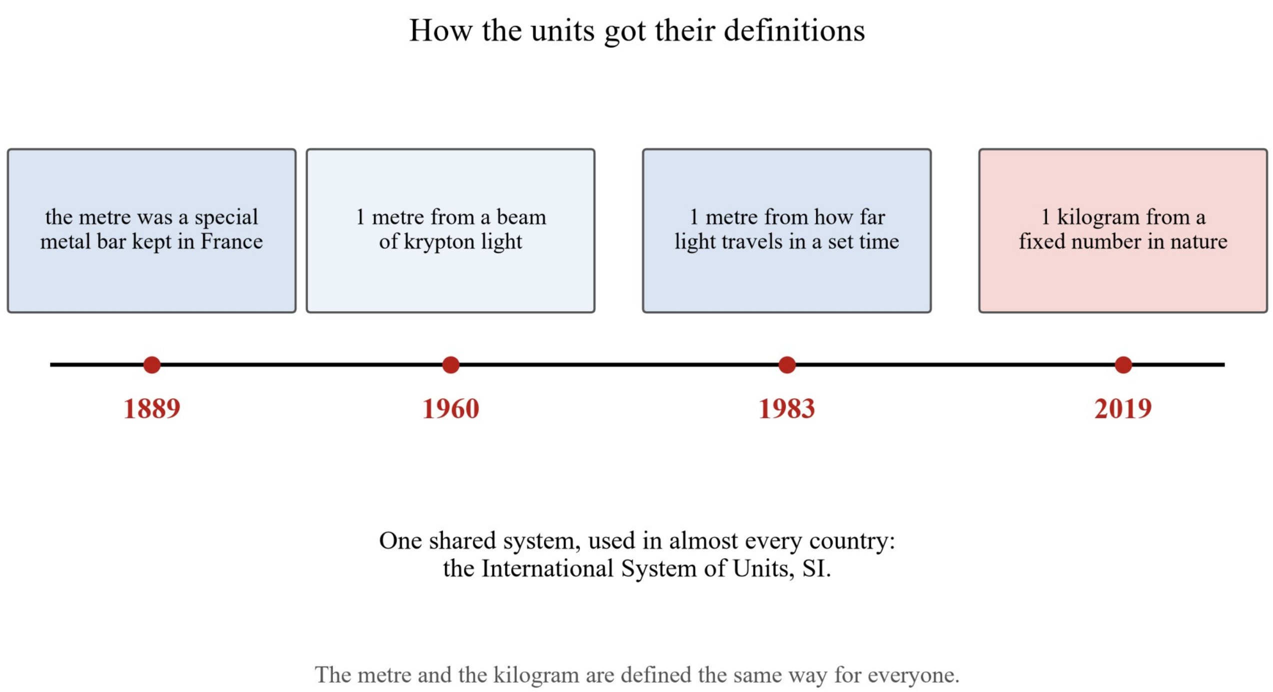
A simple room. The floor is labelled carpet goes on the floor, square metres, and the walls are labelled paint covers the walls, paint is a liquid: litres.

To **justify** your choice means to say why the unit fits the job, and how accurate the measure needs to be. Buying carpet needs a careful measure: too little and the floor is not covered. A rough estimate is enough for a guess at the paint for one wall.

One shared system: the SI story

The metric system has a full name: the **International System of Units**, or **SI**. Its unit names are international standards. A metre is the same length in every country that uses it.

But how long is a metre, exactly? The answer has not always been the same.



A timeline with four stops. 1889: the metre was a special metal bar kept in France. 1960: the metre from a beam of krypton light. 1983: the metre from how far light travels in a set time. 2019: the kilogram from a fixed number in nature. One shared system, used in almost every country: the International System of Units, SI.

In 1889 the metre was a special metal bar kept in France. In 1960 it came from a beam of krypton light, and in 1983 from how far light travels in a set time. In 2019 the kilogram was tied to a fixed number in nature. Each new way of fixing the units gave every country the same exact metre and kilogram.

Source: BIPM (International Bureau of Weights and Measures), *History of the SI* and *Measurement units*, bipm.org, retrieved 20 August 2026.

Research (like E05): pick the metre or the kilogram and find out one more fact about how its size is fixed today. Share it with your class.

Worked examples

Example 1 — with help: put the units in order

Put these length units in order from largest to smallest: mm, m, km, cm.

Working	Comment
Think of the job each unit does: km for the road between towns, m for a door, cm for a fingernail, mm for a coin.	A picture for each unit
Largest to smallest: km, m, cm, mm.	The order from the first figure

So the order is **km, m, cm, mm**.

Example 2 — with help: choose the better unit

Circle the better unit and say why: (a) the mass of a full school bag, g or kg; (b) the mass of a paper clip, g or kg.

Working	Comment
(a) A full school bag is heavy, more like a bag of flour.	kg is the unit for heavy things
(a) **kg**	
(b) A paper clip is very light, about 1 g.	g is the unit for light things

Working	Comment

(b) **g**

The unit that fits the job gives a number that makes sense.

Example 3 — with help: two readings of the same crayon

Look at the crayon on the ruler in the figure. (a) Read its length to the nearest cm. (b) Read it in cm and mm. (c) Which reading is more accurate?

Working	Comment
(a) The end sits closest to the 7 mark: 7 cm.	Nearest cm
(b) The end is 3 small marks past 7: 7 cm 3 mm.	The mm marks say more
(c) 7 cm 3 mm is more accurate. It names the end more exactly.	A smaller unit gives a more accurate measure

Example 4 — on your own: a longer jump

A jump is measured with a metre length of string. The string fits twice, and the part left over measures 35 cm. Record the jump using two units.

Whole metres: 2. Part left over: 35 cm. **The record is 2 m 35 cm.**

Example 5 — on your own: which record is more accurate?

Two students record the same throw. Ana writes 3 m. Ben writes 3 m 28 cm. Which record is more accurate? Why?

Ben's. 3 m 28 cm includes the part left over after the whole metres, so it tells more exactly how far the throw really went.

Example 6 — on your own: carpet and paint

A room needs new carpet on the floor and new paint on the walls. Which unit would you use to measure each? Justify your choices.

Carpet: square metres, because carpet covers the floor surface, and the measure must be careful so the whole floor is covered. **Paint: litres**, because paint is a liquid, and a rough estimate is enough for the walls.

Practice questions

With help

Q1. Put these length units in order from largest to smallest: cm, km, mm, m.

Q2. Put each pair in order from largest to smallest: (a) g, kg; (b) mL, L.

Q3. Circle the better unit: (a) the length of a pencil, cm or m; (b) the distance between two towns, m or km; (c) the capacity of a drink bottle, mL or L; (d) the mass of a full school bag, g or kg.

Q4. Which unit would you choose for the capacity of a bath full of water? **A** mL **B** L **C** g **D** km

Q5. Which unit would you choose for the mass of an apple? **A** km **B** L **C** g **D** m

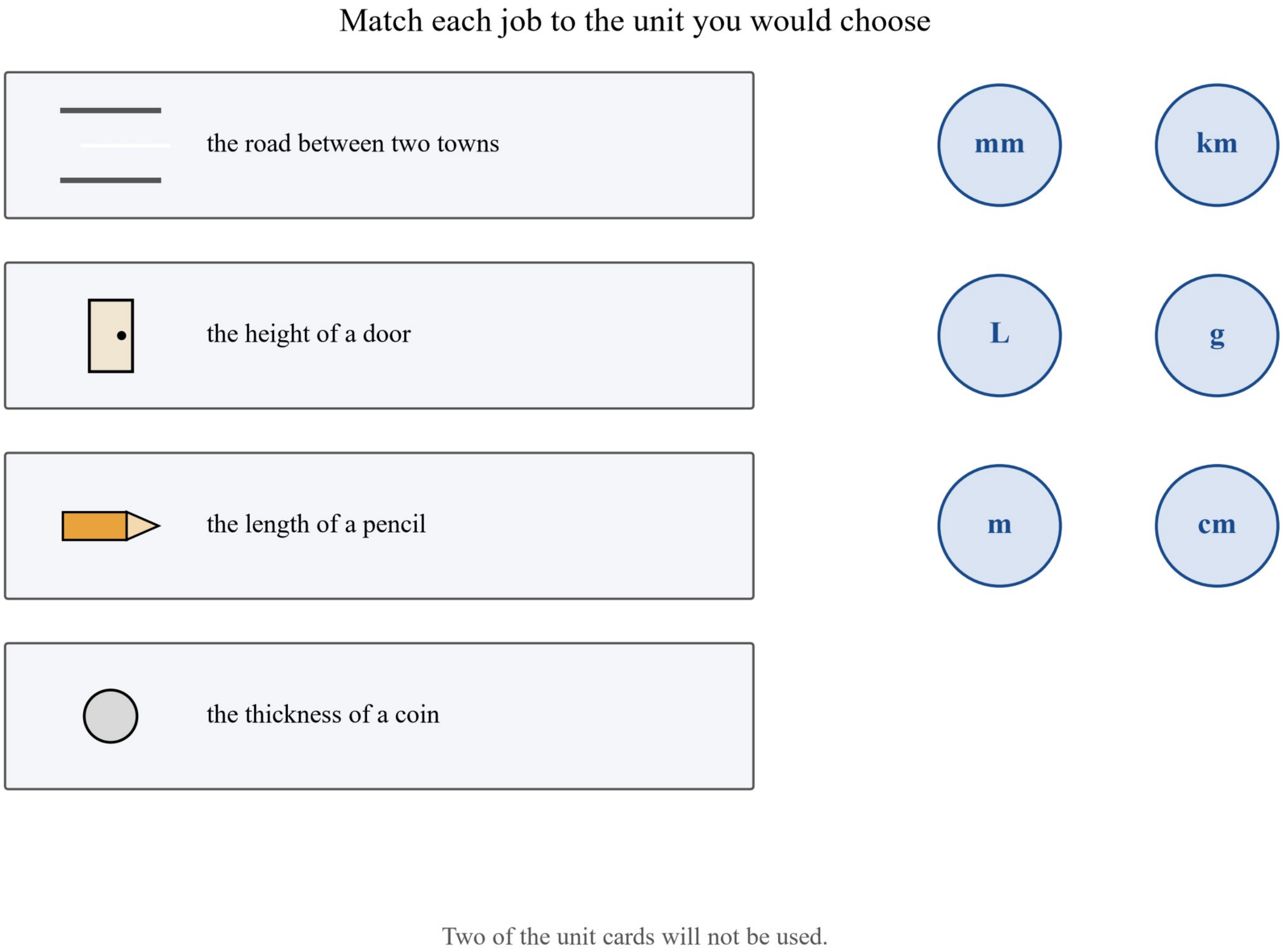
Q6. Look at the crayon on the ruler. (a) Read its length to the nearest cm. (b) Read it in cm and mm. (c) Which reading is more accurate?

Q7. A jump is one whole metre of string plus a part of 47 cm. Write the record using two units.

Q8. Look at the figure with Noah's and Mai's records. (a) Whose record is more accurate? (b) Why?

On your own

Q9. Put these length units in order from smallest to largest: m, mm, km, cm.



Left column, four job cards with small pictures: the road between two towns; the height of a door; the length of a pencil; the thickness of a coin. Right column, six unit cards: mm, L, m, km, g, cm. Two of the unit cards will not be used.

Q10. Look at the matching figure above. Draw a line from each job to the unit you would choose. Two unit cards will not be used. Which two are they?

Q11. Choose a unit and say why it fits: (a) the height of a classroom door; (b) the width of your fingernail; (c) the mass of a bicycle; (d) the capacity of a jug of juice.

Q12. Which unit would you choose for the length of a crayon? **A** km **B** m **C** cm **D** mm

Q13. Four students record the length of the same ribbon. Which record is the most accurate? **A** about 1 m **B** 1 m **C** 1 m 12 cm **D** 2 m

Q14. Tom measures a ribbon. A metre stick fits 3 times, and the part left over is 60 cm. Write the length using two units.

Q15. True or false? Say why. (a) mm is a good unit for the thickness of a coin. (b) km is a good unit for the length of a pencil. (c) L is a good unit for a few drops of water.

Q16. The same desk is recorded two ways: 2 m, and 2 m 4 cm. Which record is more accurate? Why?

Maths in real life

Q17. Look at the SI timeline. (a) From which year did the metre first come from light? (b) For how many years was the metal bar used, before the krypton light took its place?

Q18. At the athletics carnival, the long jump judge records each jump in metres and centimetres, not just metres. Why?

Q19. A doctor records your height to the nearest cm. Why not to the nearest m?

Answers

Q1. km, m, cm, mm. **Q2.** (a) kg, g. (b) L, mL. **Q3.** (a) cm. (b) km. (c) L. (d) kg. **Q4.** B. **Q5.** C. **Q6.** (a) 7 cm. (b) 7 cm 3 mm. (c) The cm-and-mm reading: the smaller unit gives a more accurate measure. **Q7.** 1 m 47 cm. **Q8.** (a) Mai's. (b) It includes the part left over, so it lands on the real jump. **Q9.** mm, cm, m, km. **Q10.** Road: km; door: m; pencil: cm; coin: mm. Left over: L and g. **Q11.** (a) m. (b) cm. (c) kg. (d) L. **Q12.** C. **Q13.** C. **Q14.** 3 m 60 cm. **Q15.** (a) True. (b) False. (c) False. **Q16.** 2 m 4 cm. **Q17.** (a) 1960. (b) 71 years. **Q18.** So the judge can see which of two close jumps was longer; the cm part makes the record more accurate. **Q19.** To the nearest m, almost everyone would be the same height; the cm part shows how tall you really are.

Worked answers

Q1. A kilometre fits the road between towns; a millimetre fits a coin. So: km, m, cm, mm. ∴ km, m, cm, mm.

Q2. A kilogram is heavier-thing sized and a gram is paper-clip sized; a litre fills a bottle and a millilitre is a few drops. ∴ (a) kg, g; (b) L, mL.

Q3. The unit that fits the job gives a number that makes sense. ∴ (a) cm; (b) km; (c) L; (d) kg.

Q4. A bath holds a lot of water: many litres. mL would give a huge, hard-to-use count, and g and km are not capacity units at all. ∴ B.

Q5. An apple is light-thing sized, like a few paper clips: grams. km, L and m are not mass units. ∴ C.

Q6. (a) The end sits closest to 7: 7 cm. (b) 3 small marks past 7: 7 cm 3 mm. (c) 7 cm 3 mm, because the smaller unit says more exactly where the end is.

Q7. Whole metres: 1. Part left over: 47 cm. ∴ 1 m 47 cm.

Q8. (a) Mai's record. (b) Noah's "about 1 m" leaves out the 47 cm. Mai's 1 m 47 cm lands right on the real landing spot, so it is the more accurate record.

Q9. Smallest first: the coin unit, then the fingernail, the door, the road. ∴ mm, cm, m, km.

Q10. The road between two towns: km. The height of a door: m. The length of a pencil: cm. The thickness of a coin: mm. The jobs are all lengths, so the capacity unit L and the mass unit g are not used. ∴ left over: L and g.

Q11. (a) m, a door is about 2 m tall. (b) cm, a fingernail is about 1 cm wide. (c) kg, a bicycle is heavy-thing sized. (d) L, juice is a liquid and a jug holds about a litre.

Q12. A crayon is hand-sized: cm. km and m are far too big, and mm is smaller than this job needs. ∴ C.

Q13. The record with the part left over tells the length most exactly. ∴ C, 1 m 12 cm.

Q14. Whole metres: 3. Part left over: 60 cm. ∴ 3 m 60 cm.

Q15. (a) True: a coin is mm-thin, so mm fits. (b) False: a pencil is cm-sized; km is far too big for the job. (c) False: a few drops is mL-sized; L is far too big.

Q16. 2 m 4 cm includes the part left over after the whole metres, so it tells the desk's length more exactly. ∴ 2 m 4 cm is the more accurate record.

Q17. (a) 1960, the krypton light. (b) $1960 - 1889 = 71$. ∴ (a) 1960; (b) 71 years.

Q18. Two jumpers can land close together. The cm part shows which jump was the longer one, so the record in metres and centimetres is more accurate than whole metres only.

Q19. To the nearest m, most people would record the same height. The cm part shows how tall you really are, and how much you grow.

Perimeter and area of regular and irregular shapes

Code `VC2M5M02` (Victorian Curriculum F–10 Version 2.0, Mathematics, Level 5; authority file `maths_5.json`): “solve practical problems involving the perimeter and area of regular and irregular shapes using appropriate metric units”. This section draws on `VC2M5M02.E01`, `.E02`, `.E03`, `.E04` and `.E05`.

From the Level 5 achievement standard: *Students choose and use appropriate metric units to measure the attributes of length, mass and capacity, and to solve problems involving perimeter and area.*

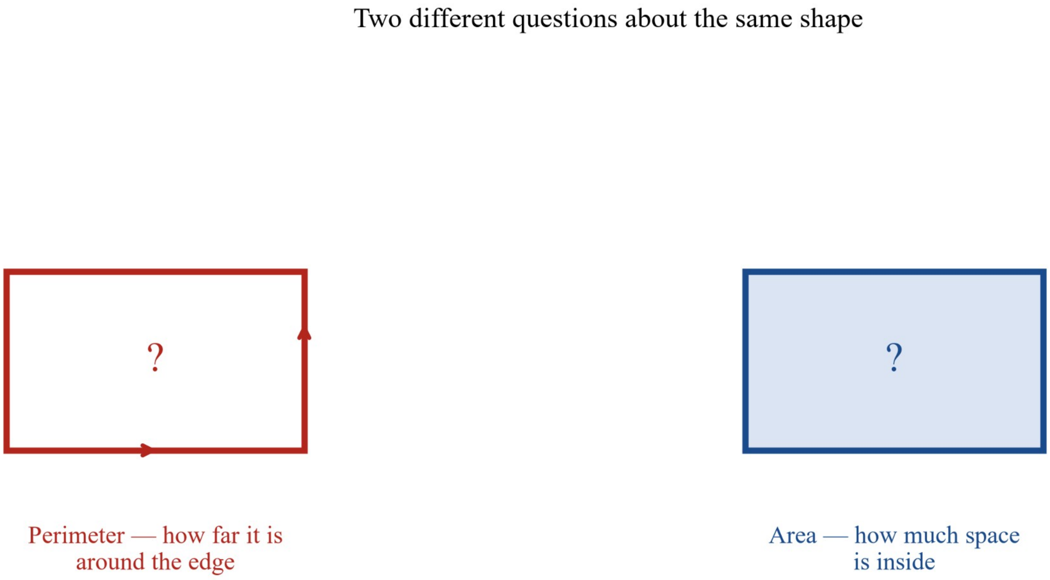
Theory

Two questions about every shape

In this section we answer two questions about every shape we meet. How far is it around the edge? That is the **perimeter**. How much space is inside? That is the **area**.

A **regular** shape, like a square, has sides that are all the same length and corners that are all square corners. An **irregular** shape, like an L-shape or a T-shape, has sides of different lengths. The good news: one way of working finds the perimeter of any shape, and one way of working finds the area of any shape — regular or irregular.

Here is the same rectangle, asked about in two different ways:



The same 5 by 3 rectangle shown twice. On the left, red arrows follow the edge to show the perimeter, how far it is around. On the right, the inside is shaded blue on a square grid to show the area, how much space is inside.

The **perimeter** is how far it is around the edge. It is a length, so we measure it in centimetres (cm) or metres (m), and we find it by adding up all the sides.

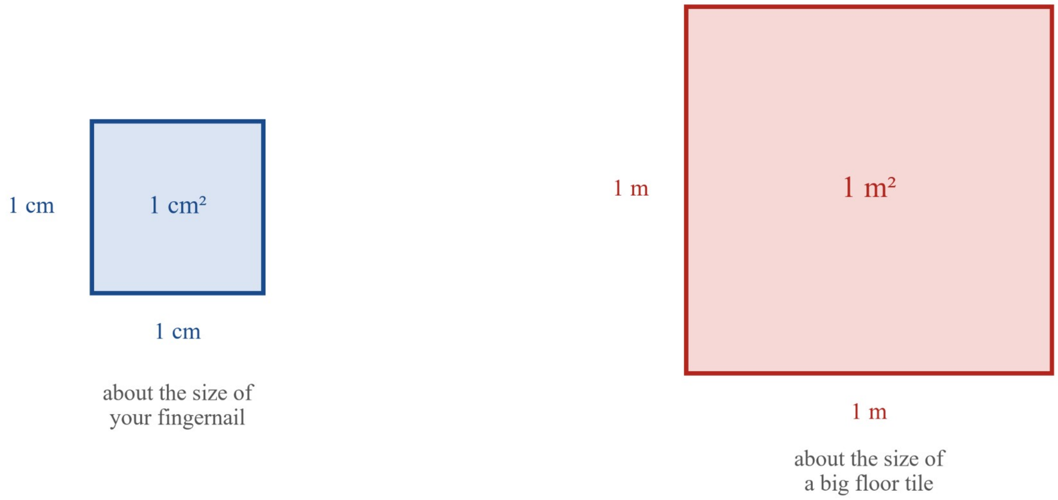
The **area** is how much space is inside. It is measured in **square units**, so instead of adding sides we count squares.

Perimeter and area are different questions with different answers and different units. A shape can have a big area and a small perimeter, or the other way around.

Square units for area

A square unit is a square with sides 1 unit long. The two we use most are the square centimetre (cm²), about the size of your fingernail, and the square metre (m²), about the size of a big floor tile:

Square units for area: small shapes use cm^2, rooms use m^2

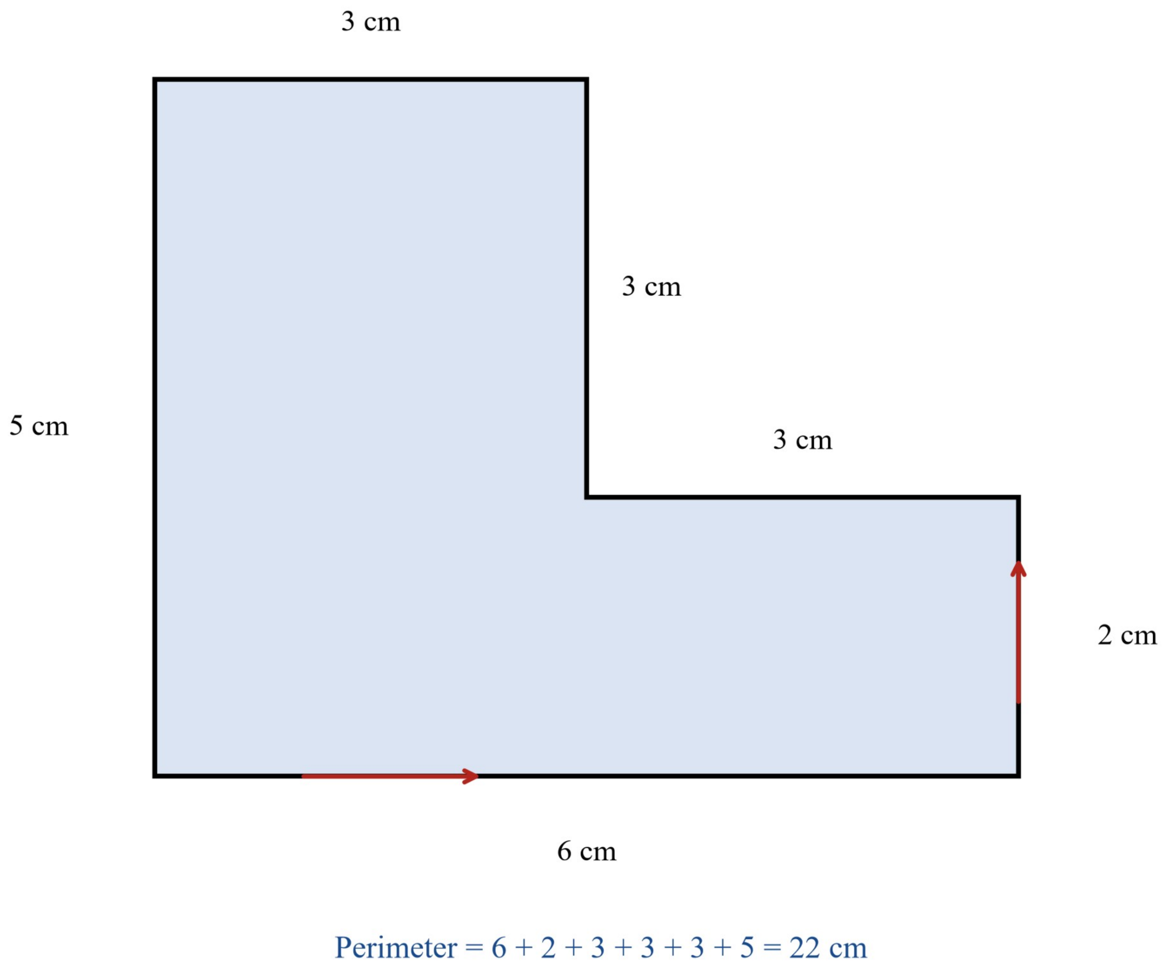


A small blue square with sides 1 cm, labelled 1 cm^2 and about the size of a fingernail, next to a big red square with sides 1 m, labelled 1 m^2 and about the size of a big floor tile.

We write cm^2 and m^2, and we say “square centimetres” and “square metres”. Small shapes on paper are measured in cm^2. Floors, rooms and gardens are measured in m^2. Always write the unit with your answer: 12 cm^2 is a very different amount of space from 12 m^2.

Perimeter — add up all the sides

To find a perimeter, put your finger on one corner and walk once around the shape, adding every side as you pass it. Here is an irregular L-shape with every side marked:



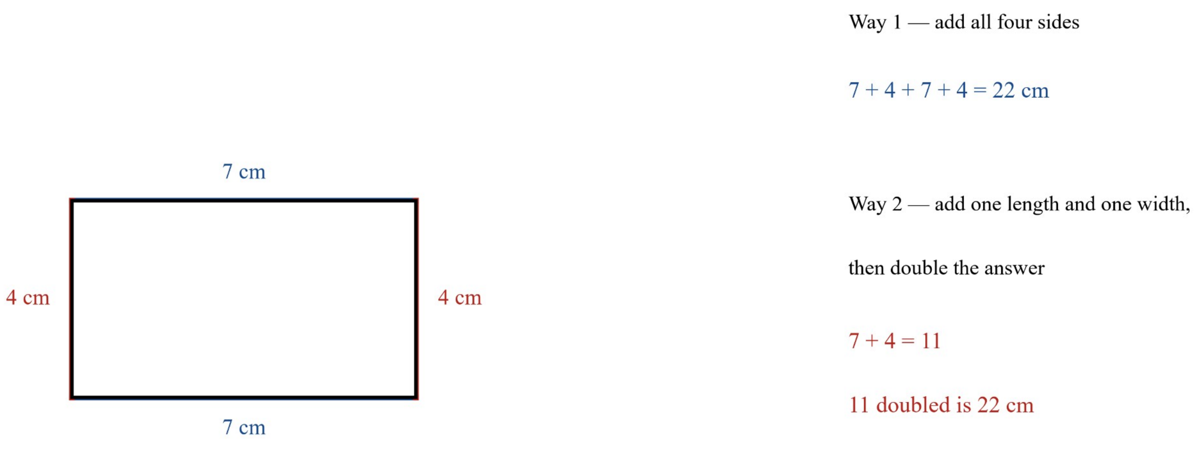
An L-shape with sides marked 6, 2, 3, 3, 3 and 5 cm. Adding all six sides gives 6 + 2 + 3 + 3 + 3 + 5 = 22 cm, the perimeter.

Perimeter = 6 + 2 + 3 + 3 + 3 + 5 = 22 cm.

Every side counts — including the two sides where the shape cuts in. A good check is to look back at the shape and make sure your finger has touched all six sides once each.

A shortcut for rectangles

On a rectangle, opposite sides are equal. So adding one length and one width gives half of the perimeter — double it to get the whole perimeter:



Both ways give the same perimeter: 22 cm.

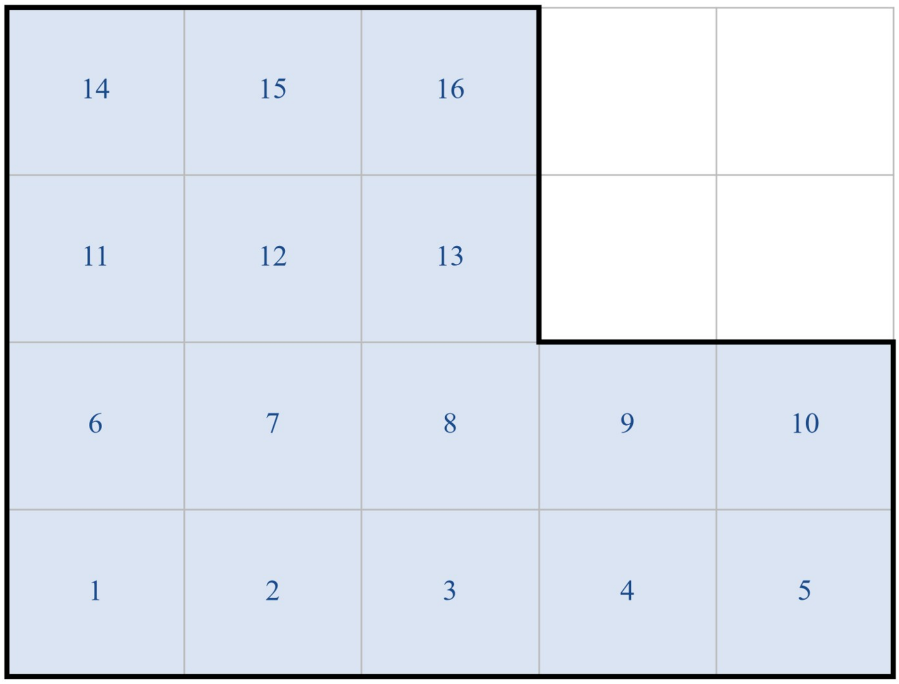
A rectangle 7 cm by 4 cm. Way 1 adds all four sides: 7 + 4 + 7 + 4 = 22 cm. Way 2 adds one length and one width, 7 + 4 = 11, then doubles: 11 doubled is 22 cm. Both ways give the same perimeter, 22 cm.

Way 1 adds all four sides: 7 + 4 + 7 + 4 = 22 cm. Way 2 adds one length and one width, then doubles the answer: 7 + 4 = 11, and 11 doubled is 22 cm. Both ways give the same perimeter, 22 cm. Use either way you trust, and use the other one to check.

Area — count the squares

Area is counted, not added. Cover the shape with square units and count them all. Numbering the squares as you go stops you missing one or counting one twice:

Each small square is 1 cm².



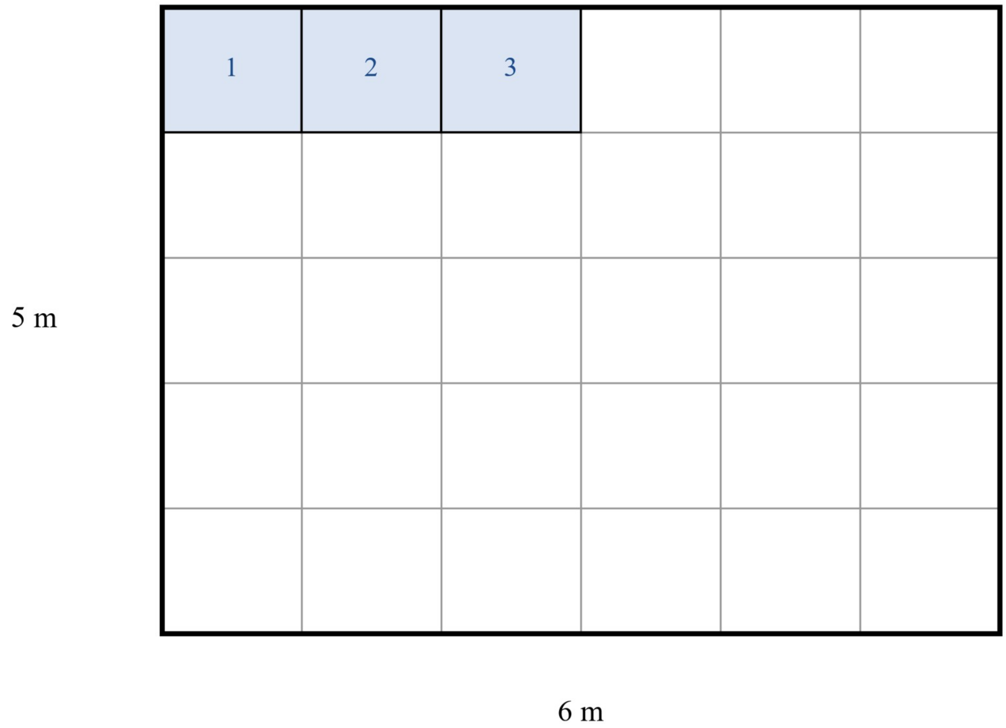
Count them all: 16 squares, so the area is 16 cm².

An irregular shape on a grid of 1 cm² squares, with the squares numbered 1 to 16 as they are counted. Count them all: 16 squares, so the area is 16 cm².

Count them all: 16 squares, so the area is 16 cm². (The perimeter of this same shape is 18 cm — a different question, a different number, and a different unit.)

For big spaces we count m² tiles instead. This classroom floor is 6 m by 5 m, and each tile is 1 m². Count the rows one at a time, counting on by sixes: 6, 12, 18, 24, 30.

Each square is 1 m².



The count has started: 1, 2, 3 … how many tiles cover the whole floor?

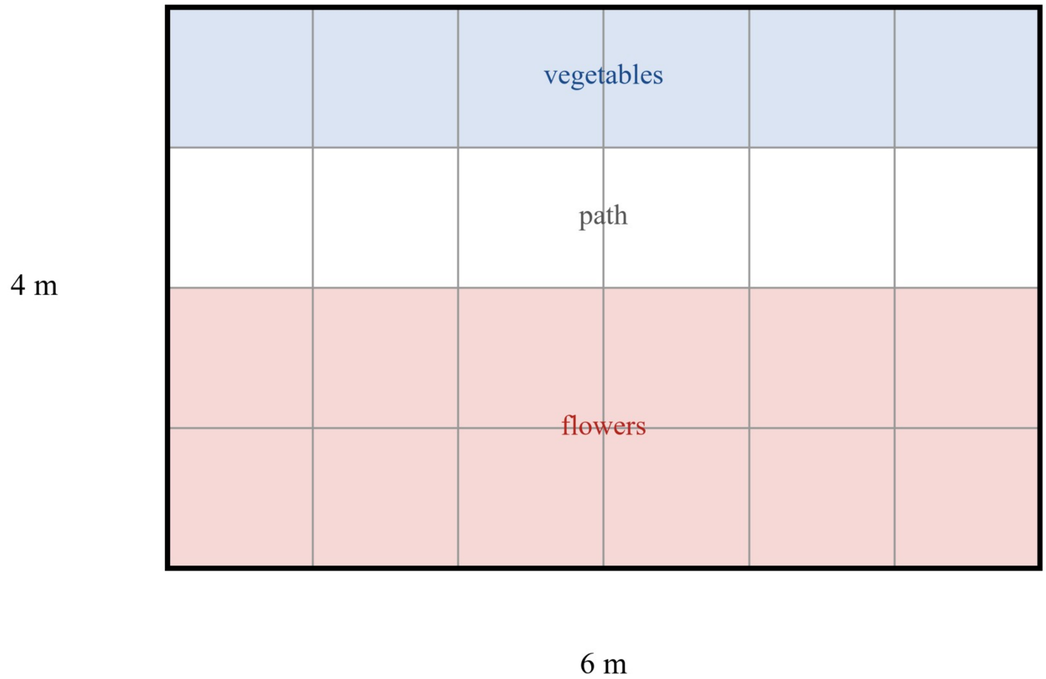
A classroom floor 6 m by 5 m drawn as a grid of 1 m² tiles, with the first three tiles numbered 1, 2, 3. The count has started: 1, 2, 3 — how many tiles cover the whole floor?

Thirty tiles cover the floor, so the area of the floor is 30 m².

A garden with labelled parts

Sometimes a space is divided into parts, and each part has its own area. Here is a class garden drawn on a metre grid:

Each square is 1 m².



A class garden, drawn on a metre grid

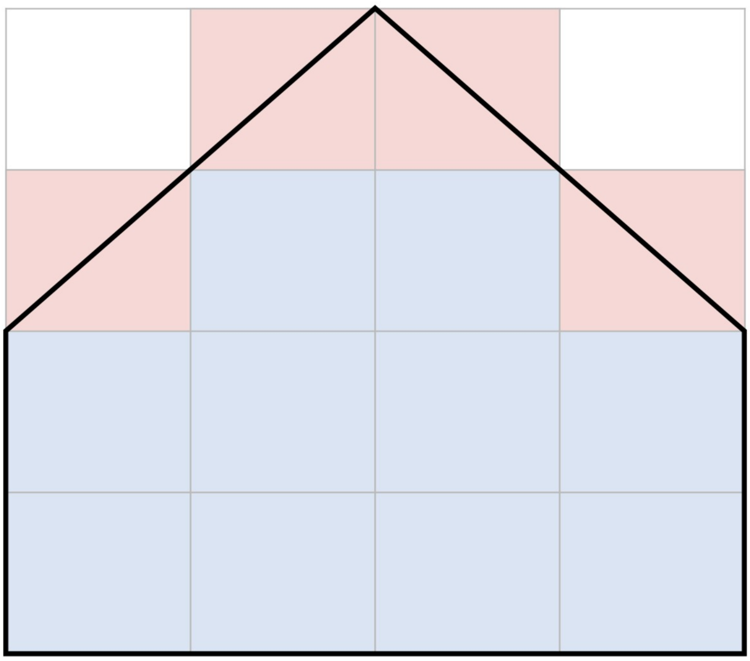
A class garden 6 m by 4 m on a metre grid. The top row is vegetables covering 6 m², the next row is a path covering 6 m², and the bottom two rows are flowers covering 12 m².

The vegetables cover 6 m², the path covers 6 m², and the flowers cover 12 m². All together the garden covers 6 + 6 + 12 = 24 m² — the same as counting every square in the 6 m by 4 m grid.

Half-squares: when the edge cuts across

Not every edge runs along the grid lines. Some edges cut across a square from corner to corner, making two half-squares. Two halves make one whole square:

Blue: 10 whole squares. Red: 4 half-squares.



Two halves make one whole: 4 halves = 2 squares.

Area = 10 + 2 = 12 cm²

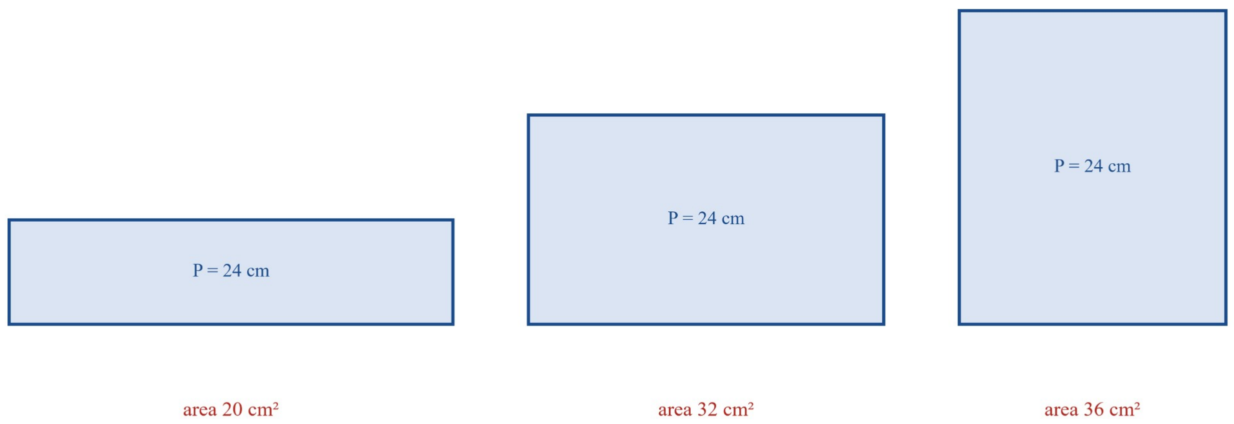
A house shape on a grid of 1 cm² squares. Ten whole squares are shaded blue and four half-squares are shaded red. Two halves make one whole, so 4 halves = 2 squares, and the area is 10 + 2 = 12 cm².

The house shape holds 10 whole squares and 4 half-squares. The 4 halves pair up to make 2 whole squares, so the area is 10 + 2 = 12 cm².

Same perimeter, different area

Here is something worth noticing: two shapes can have the same perimeter but different areas. These three rectangles each go 24 cm around the edge:

Same perimeter — different area



All three go 24 cm around the edge, but they cover different amounts inside.

Three rectangles, each with perimeter 24 cm: 10 cm by 2 cm with area 20 cm², 8 cm by 4 cm with area 32 cm², and 6 cm by 6 cm with area 36 cm². All three go 24 cm around the edge but cover different amounts inside.

All three have a perimeter of 24 cm, but the areas are 20 cm², 32 cm² and 36 cm². The closer a rectangle is to a square, the more space it covers for the same perimeter.

A geoboard, or dot paper, shows the same idea with irregular shapes. Stretch a rubber band around pins to make two different shapes with the same perimeter:

Two bands on geoboards: same perimeter, different area

Perimeter 10 units — area 6 square units

Perimeter 10 units — area 5 square units

Two geoboards with rubber bands around 10 pins each. The first makes a rectangle with perimeter 10 units and area 6 square units. The second makes an L-shape with perimeter 10 units and area 5 square units. Same perimeter, different area.

Both bands go 10 units around, but the rectangle covers 6 square units and the L-shape covers only 5. Same perimeter does not mean same area — and the other way around, same area does not mean same perimeter either.

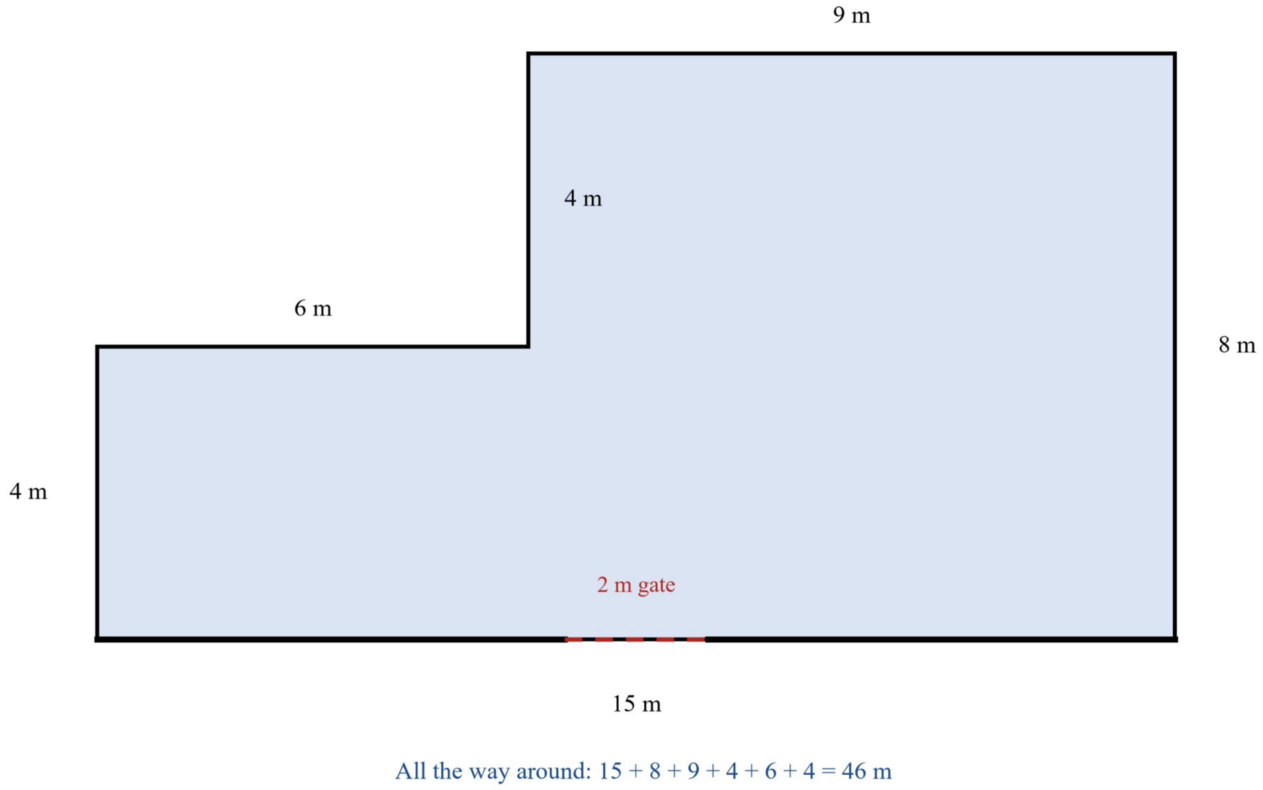
Where this leads

This year, counting square units **is** the method for area. Next year you will build a faster shortcut for rectangles from exactly this counting — but the shortcut only makes sense once the counting does. The idea that perimeter and area are different questions comes back whenever you measure a real space: fencing goes around the edge, carpet or mulch covers the inside.

Worked examples

Example 1 — with help: fencing the paddock

A farmer's paddock is the shape below, with sides 15, 8, 9, 4, 6 and 4 m. There is a 2 m gate in the bottom side. The gate needs no fencing. How many metres of fencing does the farmer need?



An irregular paddock with sides marked 15, 8, 9, 4, 6 and 4 m and a 2 m gate in the bottom side. All the way around: 15 + 8 + 9 + 4 + 6 + 4 = 46 m.

Working	Comment
15 + 8 + 9 + 4 + 6 + 4 = 46	Add every side: the perimeter is 46 m.
46 − 2 = 44	Take away the 2 m gate, which needs no fencing.

∴ The farmer needs 44 m of fencing.

Example 2 — with help: the house shape, with half-squares

Find the area of the house shape from the theory above.

Working	Comment
Whole squares: 10	Count the blue squares first.
Half-squares: 4	The roof cuts across 4 squares.
4 halves = 2 wholes	Two halves make one whole square.
10 + 2 = 12	Add the wholes and the paired halves.

∴ The area of the house shape is 12 cm².

Example 3 — with help: same perimeter, same area?

The two geoboard shapes above both have a perimeter of 10 units. Do they have the same area as well?

Working	Comment
Rectangle: count 6 squares.	Area 6 square units.
L-shape: count 5 squares.	Area 5 square units.
6 and 5 are not equal.	The areas are different.

∴ No. Same perimeter does not mean same area — the rectangle covers 6 square units and the L-shape covers 5.

Example 4 — on your own: the rectangle shortcut

A bookmark is a rectangle 9 cm by 5 cm. Use the shortcut (add one length and one width, then double) to find its perimeter.

9 + 5 = 14, and 14 doubled is 28.

∴ The perimeter of the bookmark is 28 cm. (Check the long way: 9 + 5 + 9 + 5 = 28 cm.) ✓

Example 5 — on your own: tiles for the classroom floor

The classroom floor above is 6 m by 5 m, and the count has started 1, 2, 3. Count on by sixes, one row at a time, to find how many 1 m² tiles cover the floor.

Count on by sixes: 6, 12, 18, 24, 30.

∴ 30 tiles cover the floor, so the area of the floor is 30 m².

Example 6 — on your own: the biggest area for the same perimeter

Look again at the three rectangles with a perimeter of 24 cm. Which one covers the most space, and what is that area?

The areas are 20 cm², 32 cm² and 36 cm², and 36 is the biggest.

∴ The 6 cm by 6 cm rectangle covers the most space: 36 cm². For the same perimeter, the shape closest to a square wins.

Practice questions

With help

Q1. Say whether each one is a perimeter question or an area question.

a. How far you walk all the way around a block.
b. How much grass is inside a garden bed.
c. How much paper you need to cover the front of a book.
d. How much ribbon you need around the edge of a card.

Q2. Find the perimeter of a rectangle 8 cm by 5 cm by adding all four sides.

Q3. Use the rectangle shortcut to find the perimeter of a garden bed 9 m by 6 m.

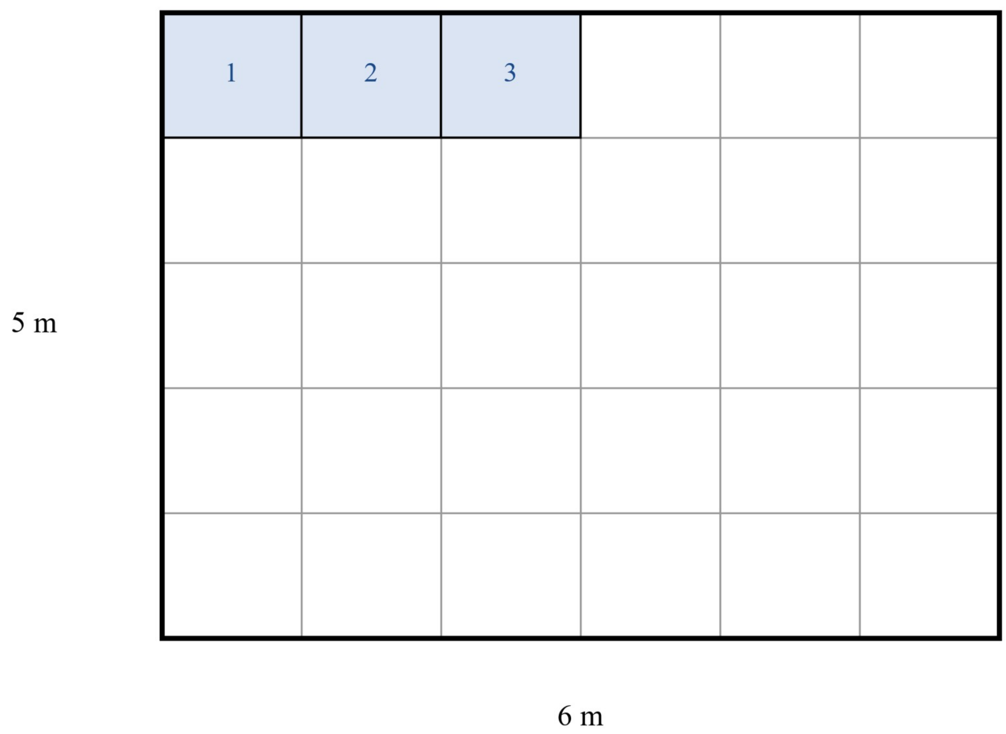
Q4. Choose the better unit (cm² or m²) for each area.

a. the cover of a book
b. the floor of a classroom
c. the top of an eraser

d. the school playground

Q5. Use the classroom floor figure. Count on by sixes to find how many 1 m² tiles cover the whole floor, and write the area of the floor.

Each square is 1 m².

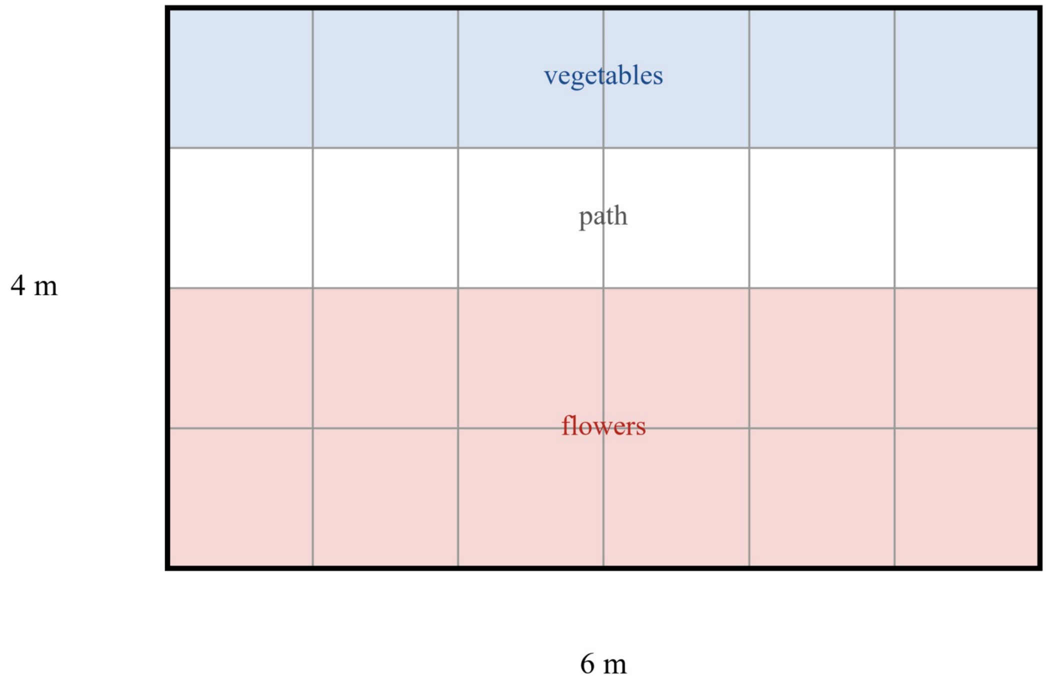


The count has started: 1, 2, 3 … how many tiles cover the whole floor?

A classroom floor 6 m by 5 m drawn as a grid of 1 m² tiles, with the first three tiles numbered 1, 2, 3. Count on by sixes to find how many tiles cover the whole floor.

Q6. In the class garden figure, what area do the flowers cover?

Each square is 1 m².



A class garden, drawn on a metre grid

A class garden 6 m by 4 m on a metre grid. The top row is vegetables, the next row is a path, and the bottom two rows are flowers. What area do the flowers cover?

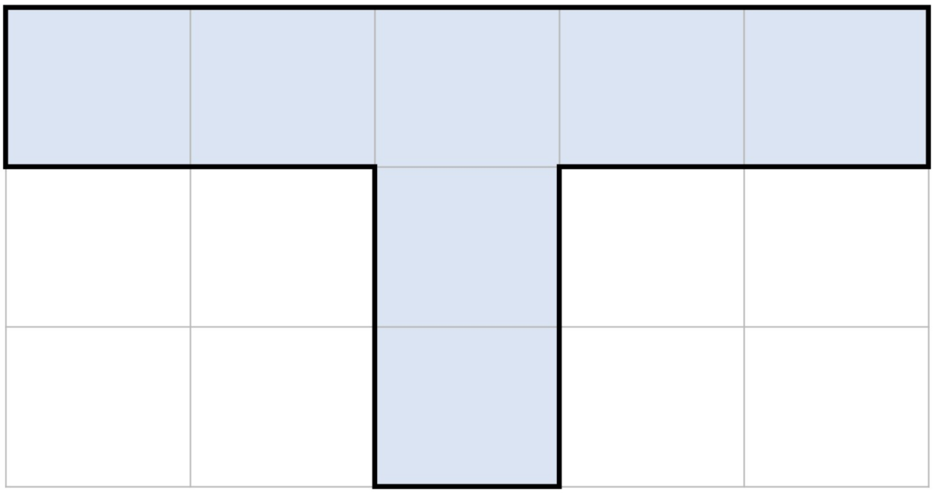
Q7. A shape on a 1 cm² grid holds 8 whole squares and 2 half-squares. What is its area?

Q8. The L-shape from the theory above has sides 6, 2, 3, 3, 3 and 5 cm. Count the squares inside it (try counting 2 rows of 6, then 3 rows of 3) to find its area.

On your own

Q9. The T-shape below is drawn on a 1 cm² grid. Find its perimeter and its area.

Each small square is 1 cm².



A T-shape on a grid of 1 cm² squares. Each small square is 1 cm².

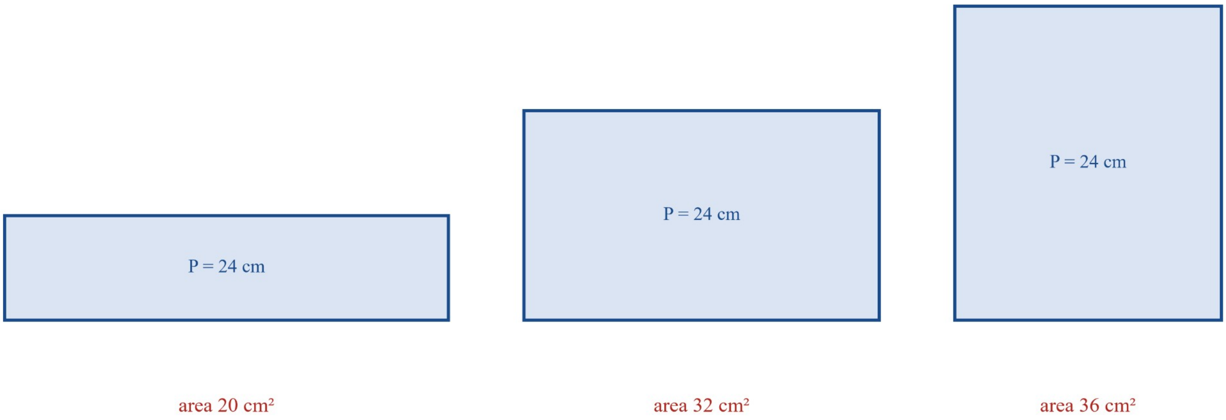
Q10. Find the perimeter of the class garden (6 m by 4 m).

Q11. In the class garden figure, what area do the vegetables and the flowers cover together?

Q12. A rectangle has a perimeter of 20 cm. One side is 6 cm long. Find the length of the other pair of sides.

Q13. Three rectangles each have a perimeter of 24 cm. Which one has the biggest area, and what is that area?

Same perimeter — different area



All three go 24 cm around the edge, but they cover different amounts inside.

Three rectangles, each with perimeter 24 cm: 10 cm by 2 cm, 8 cm by 4 cm, and 6 cm by 6 cm. Which one has the biggest area?

Q14. A shape on a 1 cm² grid holds 6 whole squares and 4 half-squares. What is its area?

Q15. True or false? If false, say why or give an example.

a. Two shapes with the same perimeter always have the same area.
b. Two shapes with the same area always have the same perimeter.
c. Perimeter and area are measured in the same units.
d. A shape's perimeter is always more than its area.

Q16. Two shapes are each made from 8 squares of 1 cm². Shape A is 2 rows of 4 squares. Shape B is 1 row of 8 squares. Find the perimeter of each shape. What do you notice about the areas and the perimeters?

Maths in real life

Q17. A rectangular paddock is 12 m by 8 m, with a 3 m gate in one side. The gate needs no fencing. How many metres of fencing are needed?

Q18. A bedroom floor is 5 m by 4 m. How much carpet is needed to cover it? Count on by fives to find out.

Q19. The class puts compost on the garden in the class garden figure. One bag of compost covers 1 m².

a. How many bags are needed for the vegetables?
b. How many bags are needed if the flowers get compost too?

Answers

Q1. a. Perimeter. b. Area. c. Area. d. Perimeter. **Q2.** 26 cm. **Q3.** 30 m. **Q4.** a. cm². b. m². c. cm². d. m². **Q5.** 30 tiles; area 30 m². **Q6.** 12 m². **Q7.** 9 cm². **Q8.** 21 cm². **Q9.** Perimeter 16 cm; area 7 cm². **Q10.** 20 m. **Q11.** 18 m². **Q12.** 4 cm. **Q13.** The 6 cm by 6 cm rectangle; 36 cm². **Q14.** 8 cm². **Q15.** a. False. b. False. c. False. d. False. **Q16.** Shape A: 12 cm; Shape B: 18 cm; same area, different perimeter. **Q17.** 37 m. **Q18.** 20 m². **Q19.** a. 6 bags. b. 18 bags.

Worked answers

Q1. Walking around a block follows the edge: perimeter. Grass inside a bed is space inside: area. Paper covering a book is space inside: area. Ribbon around an edge follows the edge: perimeter. ∴ a. Perimeter. b. Area. c. Area. d. Perimeter.

Q2. 8 + 5 + 8 + 5 = 26. ∴ The perimeter is 26 cm.

Q3. 9 + 6 = 15, and 15 doubled is 30. ∴ The perimeter is 30 m.

Q4. Small flat things are measured in cm²; big spaces in m². ∴ a. cm². b. m². c. cm². d. m².

Q5. Count on by sixes, one row at a time: 6, 12, 18, 24, 30. ∴ 30 tiles cover the floor, so the area is 30 m².

Q6. The flowers fill the bottom two rows: 12 squares. ∴ 12 m².

Q7. The 2 halves make 1 whole square. 8 + 1 = 9. ∴ The area is 9 cm².

Q8. The bottom part is 2 rows of 6: 6, 12. The top part is 3 rows of 3: 15, 18, 21. ∴ The area is 21 cm².

Q9. Walk around once: 5 + 1 + 2 + 2 + 1 + 2 + 2 + 1 = 16, so the perimeter is 16 cm. Count the squares: 5 in the top row and 2 in the stem, so the area is 7 cm². ∴ Perimeter 16 cm; area 7 cm².

Q10. 6 + 4 + 6 + 4 = 20. ∴ The perimeter is 20 m. (Shortcut: 6 + 4 = 10, doubled is 20.)

Q11. Vegetables 6 m² plus flowers 12 m²: 6 + 12 = 18. ∴ 18 m².

Q12. The two 6 cm sides use 6 + 6 = 12 cm of the perimeter, leaving 20 − 12 = 8 cm for the other pair. 8 split into two equal sides is 4 each. ∴ The other sides are 4 cm long.

Q13. The areas are 20 cm², 32 cm² and 36 cm². ∴ The 6 cm by 6 cm rectangle has the biggest area, 36 cm².

Q14. The 4 halves make 2 whole squares. 6 + 2 = 8. ∴ The area is 8 cm².

Q15. a. False: the two geoboard shapes both have perimeter 10 units, but areas of 6 and 5 square units. b. False: 8 squares make 2 rows of 4 with perimeter 4 + 2 + 4 + 2 = 12 cm, but 1 row of 8 with perimeter 8 + 1 + 8 + 1 = 18 cm — same area, different perimeter. c. False: perimeter is a length (cm or m); area is in square units (cm² or m²). d. False: the 6 cm by 6 cm rectangle has perimeter 24 cm but area 36 cm², and 36 is more than 24, so there the area is more. ∴ All four are false.

Q16. Shape A: 4 + 2 + 4 + 2 = 12 cm. Shape B: 8 + 1 + 8 + 1 = 18 cm. Both shapes cover 8 cm². ∴ Same area does not mean same perimeter.

Q17. 12 + 8 = 20, doubled is 40, so the perimeter is 40 m. Then 40 − 3 = 37. ∴ 37 m of fencing are needed.

Q18. Count on by fives, one row at a time: 5, 10, 15, 20. ∴ 20 tiles of carpet are needed, so the carpet covers 20 m².

Q19. a. The vegetables cover 6 m², and each bag covers 1 m²: 6 bags. b. Vegetables 6 m² plus flowers 12 m² is 18 m². ∴ a. 6 bags. b. 18 bags.

12-hour and 24-hour time

> *compare 12- and 24-hour time systems and solve practical problems involving the conversion between them* — VC2M5M03

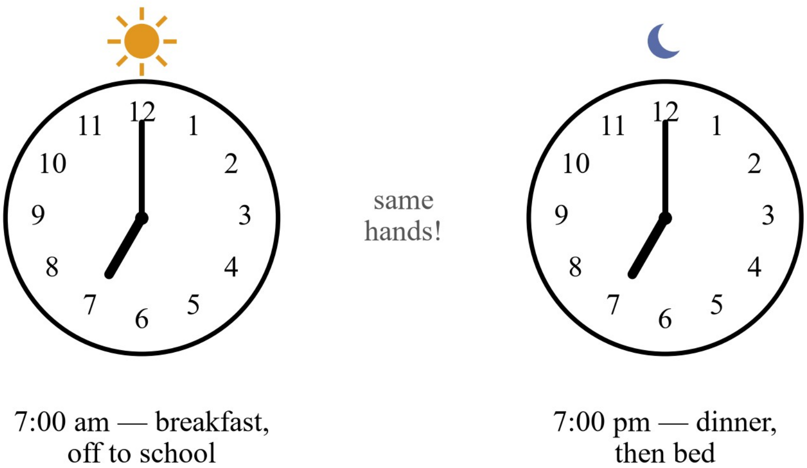
Level 5 achievement standard (extract): *Students convert between 12- and 24-hour time.*

A clock on the wall can tell you it is 7 o'clock — but it looks exactly the same at breakfast time and at dinner time. That is why we have two systems for writing the time of day. The 12-hour system fixes it with the labels am and pm. The 24-hour system fixes it by counting all 24 hours of the day, so every hour has its own number. In this section you will compare the two systems and convert between them, on clock faces, on digital screens and on a real train timetable.

Theory

One day is 24 hours

A day runs from midnight to midnight. It holds 24 hours, but a clock face only has the numbers 1 to 12 on it. So the hour hand goes around the face twice every day: once through the morning, and once from noon to midnight.



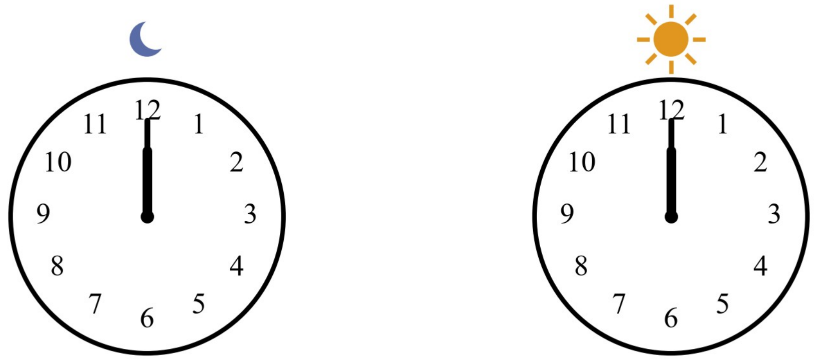
Two clock faces with the same hand positions at 7 o'clock: one labelled 7:00 am with a sun above it (breakfast, off to school), the other labelled 7:00 pm with a moon above it (dinner, then bed).

The hands make the same shape twice a day, so "7 o'clock" on its own does not say which 7 we mean. Each system solves this in its own way.

The 12-hour system — am and pm

The 12-hour system is the one you have used since the early years. It adds a small label after the time: **am** or **pm**. The am hours run from midnight to noon (the morning). The pm hours run from noon to midnight (the afternoon and evening). We write 12-hour times with lower-case letters and a space: `7:05 am`, `2:35 pm`.

The tricky pair is the two times when both hands point at the 12:



12:00 am — midnight,
the day starts here

= 00:00

12:00 pm — noon,
the middle of the day

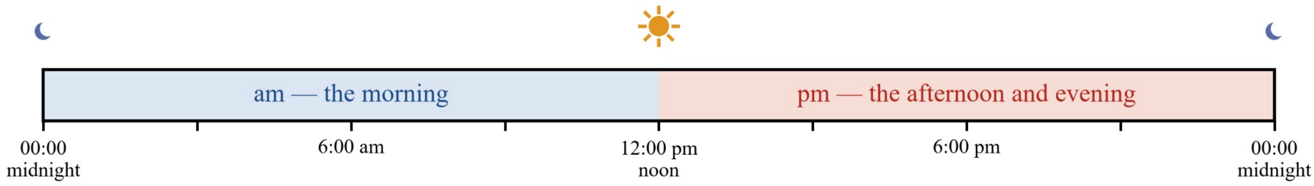
= 12:00

Two clock faces with both hands at the 12: one with a moon above, labelled 12:00 am, midnight, the day starts here, equal to 00:00; the other with a sun above, labelled 12:00 pm, noon, the middle of the day, equal to 12:00.

Midnight, where a new day starts, is written `12:00 am`. Noon, the middle of the day, is `12:00 pm`. It is a convention — an agreement everyone follows — and it also means that a little past midnight we write `12:15 am`, and a little past noon we write `12:15 pm`. In the 12-hour system there is no hour called 0: the hour after `11:59 pm` is `12:00 am`.

The 24-hour system — counting the hours from 0

The 24-hour system solves the same problem a different way. It counts the hours of the day from 0 to 23, starting at midnight, so no two times can ever be mixed up and no am or pm is needed.

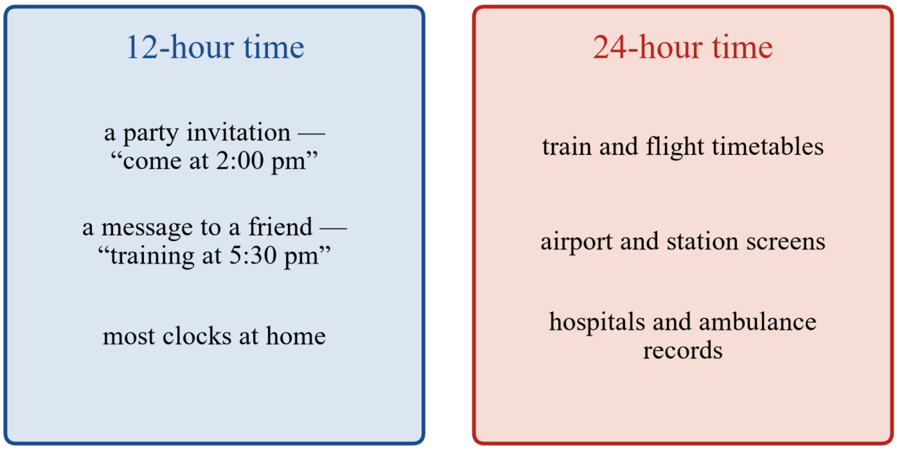


The hours of one day, counted 0 to 24

A day strip from 0 to 24 hours: the first half shaded blue and labelled am, the morning, the second half shaded red and labelled pm, the afternoon and evening, with a moon at each midnight end, a sun at noon, and labels 00:00 midnight, 6:00 am, 12:00 pm noon, 6:00 pm and 00:00 midnight.

A 24-hour time is written with two digits for the hour, then the mark :, then two digits for the minutes: `04:46`, `14:35`, `00:15`. Hours below 10 get a zero in front, so the time always shows four digits. You say `14:35` out loud as "fourteen thirty-five".

Where do you meet it? In the places where a time must not be read the wrong way:

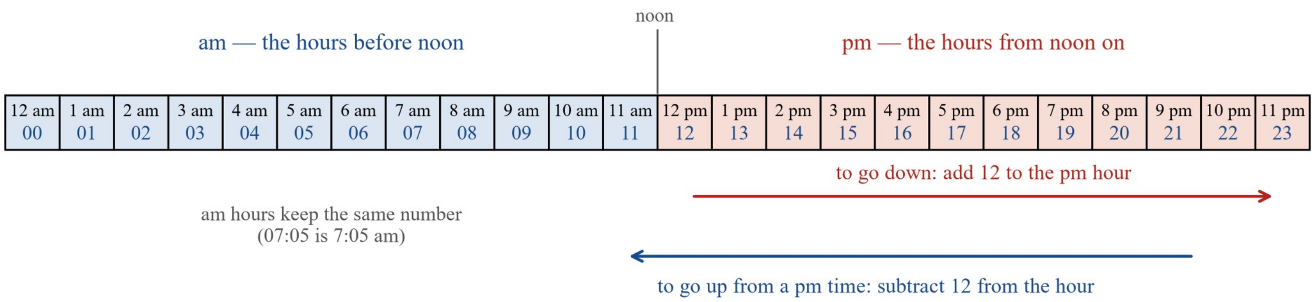


Two sorting panels: under 12-hour time, a party invitation (come at 2:00 pm), a message to a friend (training at 5:30 pm), and most clocks at home; under 24-hour time, train and flight timetables, airport and station screens, and hospitals and ambulance records.

Converting between the two systems

To **convert** a time means to write the same moment in the other system. The minutes never change — only the hour does.

Before noon, the hours already match: `7:05 am` is `07:05` in 24-hour time. After noon, the 24-hour hour is 12 more: 1 pm is 13, 2 pm is 14, and so on. The strip below lines the two systems up, hour by hour:



A conversion strip of 24 cells: the top row names each hour in 12-hour time from 12 am to 11 pm, the bottom row gives the matching 24-hour hour from 00 to 23; the am cells are shaded blue and the pm cells red, with an arrow under the pm half labelled to go down, add 12 to the pm hour, and an arrow back labelled to go up from a pm time, subtract 12 from the hour.

So, to go from 12-hour to 24-hour time, add 12 to the hour of a pm time. To go back, subtract 12. The am hours keep their number, and the three special cases below take care of the middles of the day.

From 12-hour to 24-hour:

3:20 pm $\longrightarrow$ 3 + 12 = 15 $\longrightarrow$ 15:20

Keep the minutes. Only the hour changes.

From 24-hour to 12-hour:

21:45 $\longrightarrow$ 21 − 12 = 9 $\longrightarrow$ 9:45 pm

The hour is 12 or more, so it is a pm time.

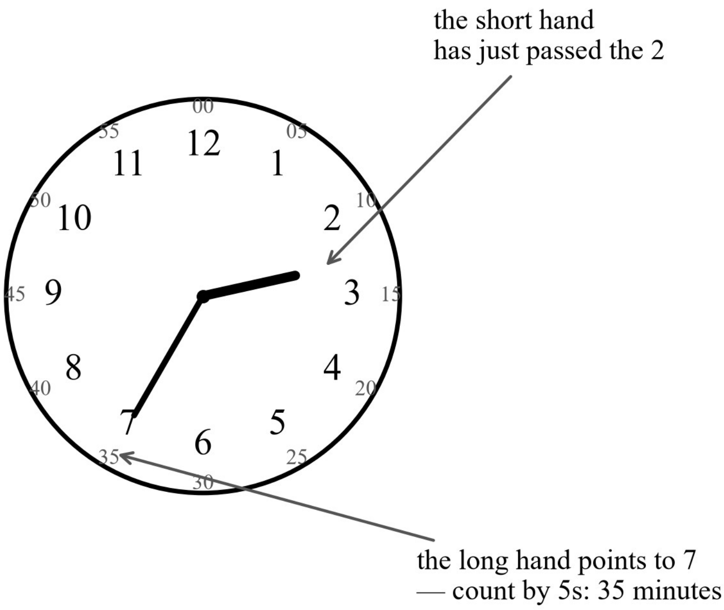
Two conversion panels: from 12-hour to 24-hour, 3:20 pm becomes 3 + 12 = 15, so 15:20, keeping the minutes; from 24-hour to 12-hour, 21:45 becomes 21 − 12 = 9, so 9:45 pm because the hour is 12 or more.

The three special cases to learn by heart:

- Times just past midnight swap the 12 for a 0: `12:15 am` = `00:15`, and `12:40 am` = `00:40`.
- Times around noon keep the 12: `12:15 pm` = `12:15`, and `12:40 pm` = `12:40`.
- A 24-hour time starting `00:` is a midnight time: `00:15` = `12:15 am`.

Analog and digital — the same time two ways

The same time can be shown by hands on a face (an **analog** clock, also spelled *analogue*) or by digits on a screen (a **digital** display). Reading a face is a skill from earlier years: the short hand names the hour it has passed, and the long hand counts the minutes by 5s.

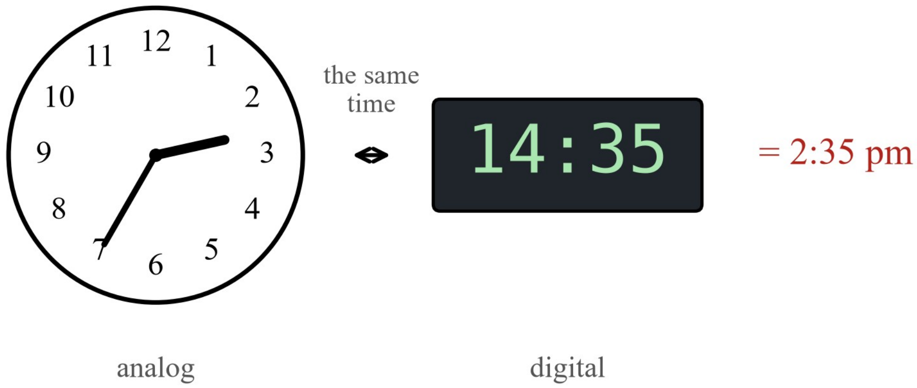


The face shows 2:35.

A clock face with a minute ring from 00 to 55, the short hand just past the 2 and the long hand on the 7, with labels naming the short hand and the long hand and the caption the face shows 2:35.

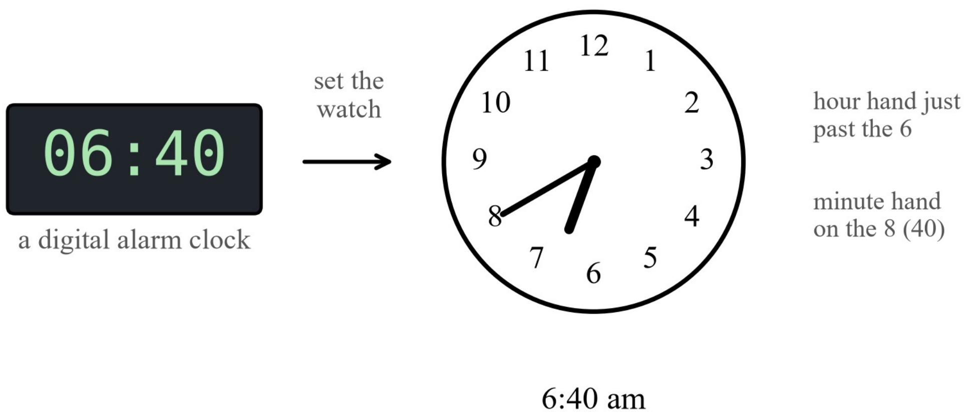
Put the two displays side by side and they must agree:

The hour is 14, so it is a pm time: 14 − 12 = 2.



The same time shown two ways: an analog clock face with the short hand past the 2 and the long hand on the 7, a double arrow labelled the same time, a digital display reading 14:35, and the note that this equals 2:35 pm because 14 − 12 = 2.

To set an analog clock from a digital display, first put the time into 12-hour form in your head, then place the hands. A digital alarm clock showing `06:40` means 6:40 am, so the hour hand goes just past the 6 and the minute hand goes on the 8:



A digital alarm clock reading 06:40 with an arrow labelled set the watch pointing to an analog watch showing 6:40 am, with notes that the hour hand sits just past the 6 and the minute hand on the 8.

Notice what a clock face can never tell you: whether it is am or pm. The face for 6:40 am and the face for 6:40 pm are exactly the same — that is the whole reason am and pm exist.

Timetables use 24-hour time

Real timetables are written in 24-hour time, which is why they make the natural home for this skill. Here is an excerpt from the Geelong line:

Geelong line — Monday to Friday, Melbourne to Geelong

Departs Southern Cross (times in 24-hour time)

04:46	06:05	07:26	07:50	09:10	12:30	16:49	19:25

The first train leaves before 5 in the morning; the last one here leaves after 7 at night.

Five of these departures are am times and three are pm times — but the timetable does not write am or pm at all. 24-hour time does that job by itself.

An excerpt of the Geelong line timetable, Monday to Friday, Melbourne to Geelong: Southern Cross departures in 24-hour time, 04:46, 06:05, 07:26, 07:50, 09:10, 12:30, 16:49 and 19:25, with the note that the timetable never writes am or pm.

Source: V/Line (Department of Transport and Planning), *Geelong Line* timetable, effective 1 February 2026, retrieved 20 August 2026.

Every time you read off a timetable, converting it tells you which part of the day it names — `04:46` is before dawn, `19:25` is after dark. That is the skill this section builds: turning a printed time into one you can picture. (Working out how long a trip takes is a later year's job; here we only convert the times.)

Worked examples

Worked example 1 — step by step: 24-hour to 12-hour

Write each 24-hour time in 12-hour time. a. `04:46` b. `13:10` c. `21:22`

Working	Comment
a. Hour 4 is below 12, so 4:46 am.	Morning hours keep their number.
b. Hour 13 is 12 or more: 13 − 12 = 1, so 1:10 pm.	Subtract 12 from the hour.
c. 21 − 12 = 9, so 9:22 pm.	The same rule works at night.

Worked example 2 — step by step: 12-hour to 24-hour

Write each 12-hour time in 24-hour time. a. 7:05 am b. 3:20 pm c. 12:15 am

Working	Comment
a. An am hour keeps its number: 07:05.	Two digits, with a zero in front.
b. A pm hour adds 12: 3 + 12 = 15, so 15:20.	The minutes stay 20.
c. 12 am is the special midnight hour: 00:15.	In a 12 am time the hour 12 becomes 00.

Worked example 3 — step by step: set the clock from the screen

A digital alarm clock shows `06:40`. Name the time in 12-hour form and say where the hands go.

The hour 6 is below 12, so it is 6:40 am. On the face, the minute hand goes on the 8 (8 × 5 = 40 minutes) and the hour hand goes past the 6 — most of the way to the 7, because 40 minutes is most of an hour. The picture above shows the result.

Worked example 4 — on your own: the timetable

A train departs Southern Cross at `19:25` on the Geelong line excerpt. Write this departure in 12-hour time.

19 − 12 = 7, so ∴ the train leaves at 7:25 pm.

Worked example 5 — on your own: find the mistake

Noah writes `00:40` as 12:40 pm. Find his mistake and write the correct 12-hour time.

The hour 00 is the midnight hour, and midnight hours are am, not pm. ∴ `00:40` is 12:40 am. Noah used the right 12, but the wrong label.

Practice questions

Q1. Write each 24-hour time in 12-hour time.

a. `05:30` b. `11:15` c. `16:40` d. `22:05` e. `00:20` f. `12:50`

Q2. Write each 12-hour time in 24-hour time.

a. 6:10 am b. 10:45 am c. 1:05 pm d. 7:30 pm e. 11:55 pm f. 12:20 am

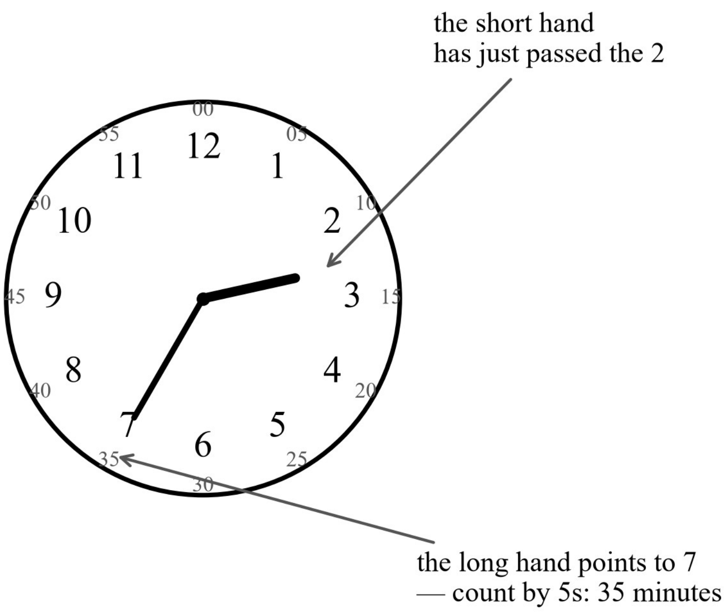
Q3. Is each time an am time or a pm time?

a. `03:15` b. `15:30` c. `00:10` d. `12:10` e. `23:55` f. `09:05`

Q4. True or false? If false, fix it.

a. `13:00` is 1:00 pm.
b. `00:00` is noon.
c. 8:00 pm is `20:00` in 24-hour time.
d. `07:07` and 7:07 am name the same moment.
e. A clock face showing 9:00 could be `09:00` or `21:00`.

Q5. Look at the clock face that shows 2:35.

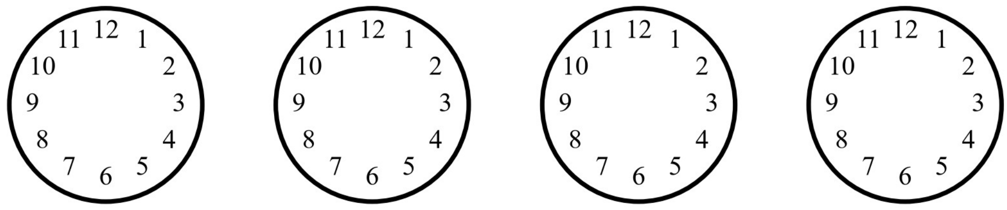


The face shows 2:35.

A clock face with a minute ring from 00 to 55, the short hand just past the 2 and the long hand on the 7, with labels naming the short hand and the long hand and the caption the face shows 2:35.

If you know it is the afternoon, write the time in 24-hour form.

Q6. Copy the four faces below onto paper and draw hands to show each time. Say where each hand goes.



a. b. c. d.

Four blank clock faces with the numbers 1 to 12 and no hands, labelled a, b, c and d.

a. `07:20` b. `15:45` c. `00:50` d. `21:10`

Q7. Your watch has stopped. A digital clock shows `17:05`. Write the time in 12-hour form and say where the two hands belong.

Q8. Use the Geelong line excerpt.

Geelong line — Monday to Friday, Melbourne to Geelong

Departs Southern Cross (times in 24-hour time)

04:46	06:05	07:26	07:50	09:10	12:30	16:49	19:25

The first train leaves before 5 in the morning; the last one here leaves after 7 at night.

Five of these departures are am times and three are pm times — but the timetable does not write am or pm at all. 24-hour time does that job by itself.

An excerpt of the Geelong line timetable, Monday to Friday, Melbourne to Geelong: Southern Cross departures in 24-hour time, 04:46, 06:05, 07:26, 07:50, 09:10, 12:30, 16:49 and 19:25, with the note that the timetable never writes am or pm.

a. The first train departs at `04:46`. Write this in 12-hour time.
b. Is the `12:30` departure an am time or a pm time?
c. Which printed departure is 7:50 am?
d. Write the `16:49` and `19:25` departures in 12-hour time.

Q9. Put these times in order from first to last in the day: `21:10`, 9:40 am, `12:05 pm`, `00:30`, `16:15`.

Q10. Match each job to the system you would expect it to use, and say why for one of them.

a. a party invitation
b. a train timetable
c. a message to a friend
d. an airport departure screen

Q11. Which comes first in the day: `21:10` or 9:40 pm? Show your thinking.

Q12. Write `00:05` and 12:05 pm in the other system, and explain in one sentence how the two times differ.

Q13. Aisha's oven timer uses 24-hour time. She wants it to beep at 3:45 pm. What should the timer show?

Q14. Hospitals and airports prefer 24-hour time. Give one example where am and pm could be read the wrong way, and say how 24-hour time avoids it.

Q15. True or false? Explain the true ones in one sentence.

a. The hour hand makes exactly two full turns of the face in one day.
b. The minute hand makes 24 full turns of the face in one day.

Q16. Copy and complete the table so each row shows the same moment in both systems.

12-hour	24-hour
4:20 am	
	`14:50`
11:59 pm	
	`00:03`
12:02 pm	
	`12:02`

Q17. A party starts at 2:30 pm and a movie starts at `19:00`. Write both times in the same system, then say which starts later in the day.

Q18. A station clock shows 11:11. List every 24-hour time it could be showing across one day.

Answers

Q1. a. 5:30 am. b. 11:15 am. c. 4:40 pm. d. 10:05 pm. e. 12:20 am. f. 12:50 pm.

Q2. a. `06:10`. b. `10:45`. c. `13:05`. d. `19:30`. e. `23:55`. f. `00:20`.

Q3. a. am. b. pm. c. am. d. pm. e. pm. f. am.

Q4. a. True. b. False — `00:00` is midnight; noon is `12:00`. c. True. d. True. e. True.

Q5. `14:35`.

Q6. a. 7:20 am: minute hand on the 4, hour hand a third of the way from 7 to 8. b. 3:45 pm: minute hand on the 9, hour hand three-quarters of the way from 3 to 4. c. 12:50 am: minute hand on the 10, hour hand nearly at the 1. d. 9:10 pm: minute hand on the 2, hour hand just past the 9.

Q7. 5:05 pm; minute hand on the 1, hour hand just past the 5.

Q8. a. 4:46 am. b. pm. c. `07:50`. d. 4:49 pm and 7:25 pm.

Q9. `00:30`, 9:40 am, `12:05 pm`, `16:15`, `21:10`.

Q10. a. 12-hour. b. 24-hour. c. 12-hour. d. 24-hour. (Reasons vary.)

Q11. `21:10` is 9:10 pm, which is earlier than 9:40 pm.

Q12. `00:05` = 12:05 am; 12:05 pm = `12:05`. One is just past midnight, the other just past noon — 12 hours between them.

Q13. `15:45`.

Q14. Any sensible example, e.g. a medicine marked "take at 8:00" could be taken at the wrong end of the day; `20:00` can only mean the evening.

Q15. a. True — the day has 24 hours and the face shows 12, so the hour hand goes around twice. b. True — the minute hand turns once every hour, and there are 24 hours.

Q16. `04:20`; 2:50 pm; `23:59`; 12:03 am; `12:02`; 12:02 pm.

Q17. 2:30 pm = `14:30`; the movie at `19:00` = 7:00 pm starts later.

Q18. `11:11` and `23:11`.

Step-by-step solutions

Q1. Hours below 12 stay am; 12 or more subtract 12 to become pm; the special `00` hour is 12 am and `12` stays 12 pm. a. 5:30 am. b. 11:15 am. c. 16 − 12 = 4, so 4:40 pm. d. 22 − 12 = 10, so 10:05 pm. e. 00:20 is a midnight time, so 12:20 am. f. 12:50 is a noon time, so 12:50 pm.

Q2. am hours keep their number (two digits); pm hours add 12; the special 12 am hour is `00`. a. `06:10`. b. `10:45`. c. 1 + 12 = 13, so `13:05`. d. 7 + 12 = 19, so `19:30`. e. 11 + 12 = 23, so `23:55`. f. 12:20 am is `00:20`.

Q3. a. 3 is below 12 — am. b. 15 − 12 = 3 — 3:30 pm. c. The `00` hour is midnight — am. d. The `12` hour is noon — pm. e. 23 − 12 = 11 — 11:55 pm. f. 9 is below 12 — am.

Q4. a. True: 13 − 12 = 1. b. False: `00:00` is midnight, the start of the day; noon is `12:00`. c. True: 8 + 12 = 20. d. True: an am hour below 10 is the same number with a zero in front. e. True: the same face appears at 9 in the morning (hour 9) and 9 at night (hour 21).

Q5. The afternoon means pm, so add 12 to the hour: 2 + 12 = 14. ∴ `14:35`.

Q6. Convert to 12-hour first, then place the hands. a. `07:20` is 7:20 am: the minute hand is on the 4 (20 minutes) and the hour hand has gone a third of the way from 7 toward 8. b. `15:45` is 15 − 12 = 3, so 3:45 pm: minute hand on the

9, hour hand three-quarters of the way from 3 toward 4. c. `00:50` is 12:50 am: minute hand on the 10, hour hand almost at the 1. d. `21:10` is 21 − 12 = 9, so 9:10 pm: minute hand on the 2, hour hand just past the 9.

Q7. 17 − 12 = 5, so it is 5:05 pm. The minute hand goes on the 1 (5 minutes) and the hour hand sits just past the 5.

Q8. a. `04:46` is before noon: 4:46 am. b. `12:30` is in the noon hour: pm. c. 7:50 am keeps its hour with a zero in front: `07:50`. d. 16 − 12 = 4 and 19 − 12 = 7: 4:49 pm and 7:25 pm.

Q9. Convert all to one system. `21:10` = 9:10 pm; `00:30` = 12:30 am. From the start of the day: `00:30` (12:30 am), then 9:40 am, then `12:05 pm`, then `16:15` (4:15 pm), then `21:10` (9:10 pm). ∴ the order is `00:30`, 9:40 am, `12:05 pm`, `16:15`, `21:10`.

Q10. Invitations and messages between people usually carry am or pm (12-hour), while timetables and screens must never be misread (24-hour). a. 12-hour. b. 24-hour. c. 12-hour. d. 24-hour. Example reason for b: a train timetable printed in 12-hour time could send a person to the platform at the wrong end of the day; 24-hour time cannot be read two ways.

Q11. Convert `21:10`: 21 − 12 = 9, so it is 9:10 pm. 9:10 pm comes before 9:40 pm. ∴ `21:10` is earlier.

Q12. `00:05` is the midnight hour: 12:05 am. 12:05 pm is the noon hour, and noon hours keep 12: `12:05`. The two times look the same in 12-hour form except for the label — one is 5 minutes past midnight, the other 5 minutes past noon, with 12 hours between them.

Q13. A pm hour adds 12: 3 + 12 = 15. ∴ the timer should show `15:45`.

Q14. Example: a nurse's note that says "dose given at 8:00" does not say which 8:00; written as `08:00` or `20:00` it can only mean one moment. Any example where the am/pm label could be dropped or misread earns the mark.

Q15. a. True: the face holds 12 hours, the day holds 24, so the hour hand makes two full turns each day (that is the two rounds in the first picture). b. True: the minute hand makes one turn every hour, and a day has 24 hours, so 24 turns.

Q16. Row by row: 4:20 am keeps its hour, `04:20`. `14:50` is 14 − 12 = 2, so 2:50 pm. 11:59 pm is 11 + 12 = 23, so `23:59`. `00:03` is a midnight time, 12:03 am. 12:02 pm is a noon time, `12:02`. `12:02` in 24-hour time is the noon hour, so 12:02 pm.

Q17. In 24-hour time: 2:30 pm is 2 + 12 = 14, so `14:30`, and the movie is `19:00`. Because 19 is after 14, the movie starts later. (In 12-hour time: `19:00` is 7:00 pm, after 2:30 pm — same answer.)

Q18. The face shows 11:11 twice a day: at 11:11 in the morning and 11 at night. 11 am keeps its hour, `11:11`; 11 pm adds 12, `23:11`. ∴ `11:11` and `23:11`.

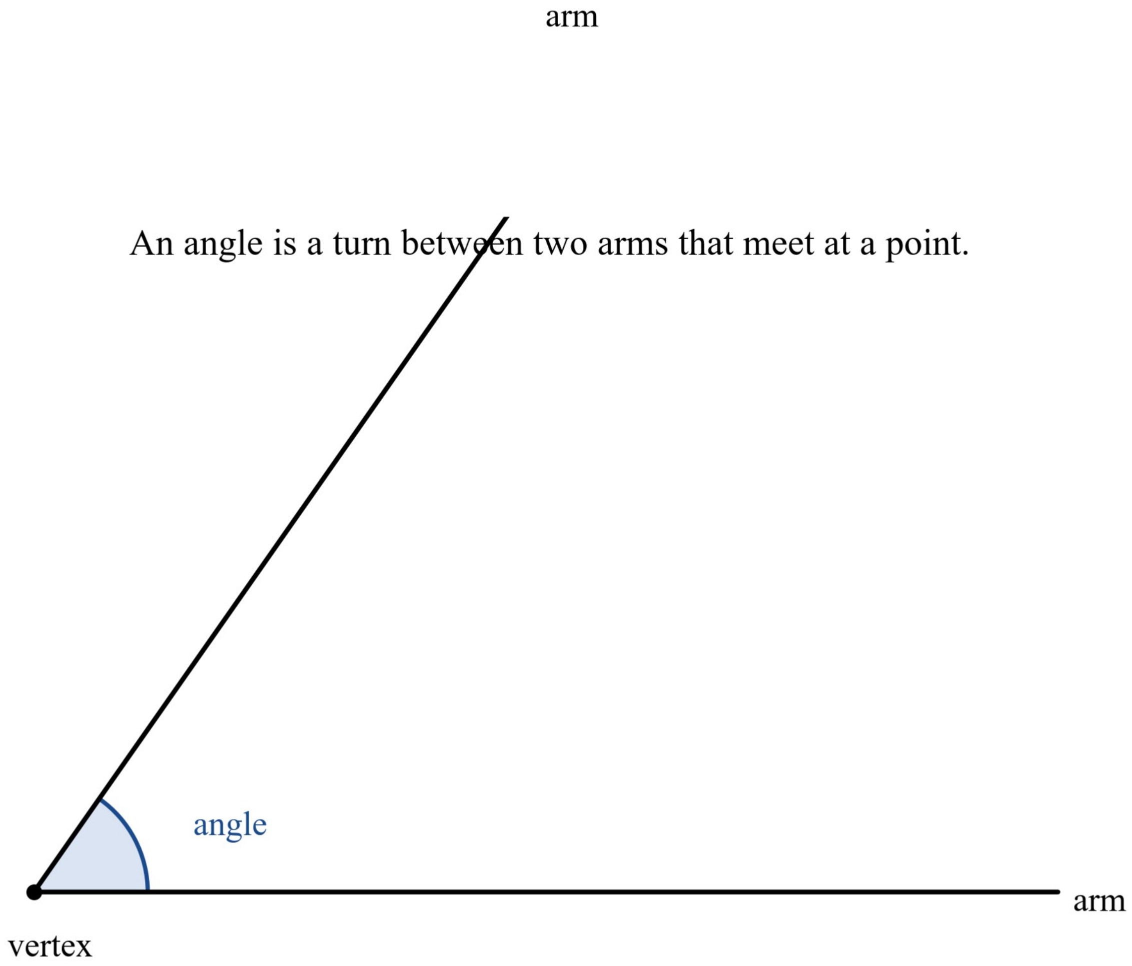
Estimating, constructing and measuring angles in degrees

Code `VC2M5M04` (Victorian Curriculum F–10 Version 2.0, Mathematics, Level 5; authority file `maths_5.json`): "estimate, construct and measure angles in degrees, using appropriate tools, including a protractor, and relate these measures to angle names". This section draws on `VC2M5M04.E01`, `.E02`, `.E03`, `.E04` and `.E05`.

Theory

An angle is a turn

An angle is the turn between two arms that meet at a point. The point where the arms meet is called the **vertex**.



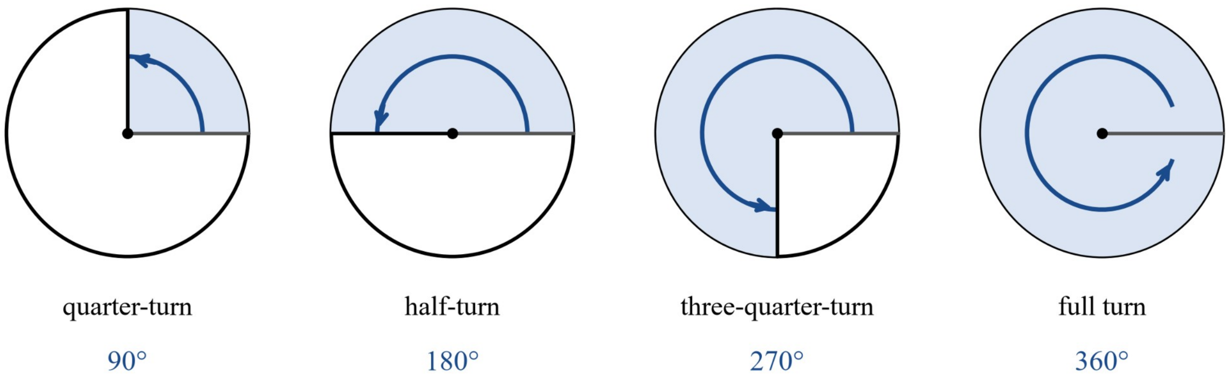
An angle drawn at exactly 35 degrees: two black arms meet at a black dot labelled vertex, and the turn between the arms is shaded and labelled angle.

In Year 4 you named angles by comparing them with a right angle. In Year 5 we do something new: we **measure** the turn with a number, and we **construct** angles of a size we choose. The unit we measure in is the **degree**, written °.

Degrees and turns

We measure turns in degrees, and it all starts with one full turn.

Turns made by one arm



Four circles. The first shows a quarter-turn of 90 degrees shaded, the second a half-turn of 180 degrees, the third a three-quarter-turn of 270 degrees, and the fourth a full turn of 360 degrees shaded all the way around with an arrow.

- A **full turn** (one whole way around) is **360°**. A full turn is also called a **revolution**.
- A **half-turn** is half of 360°: **180°**.
- A **quarter-turn** is a quarter of 360°: **90°**.

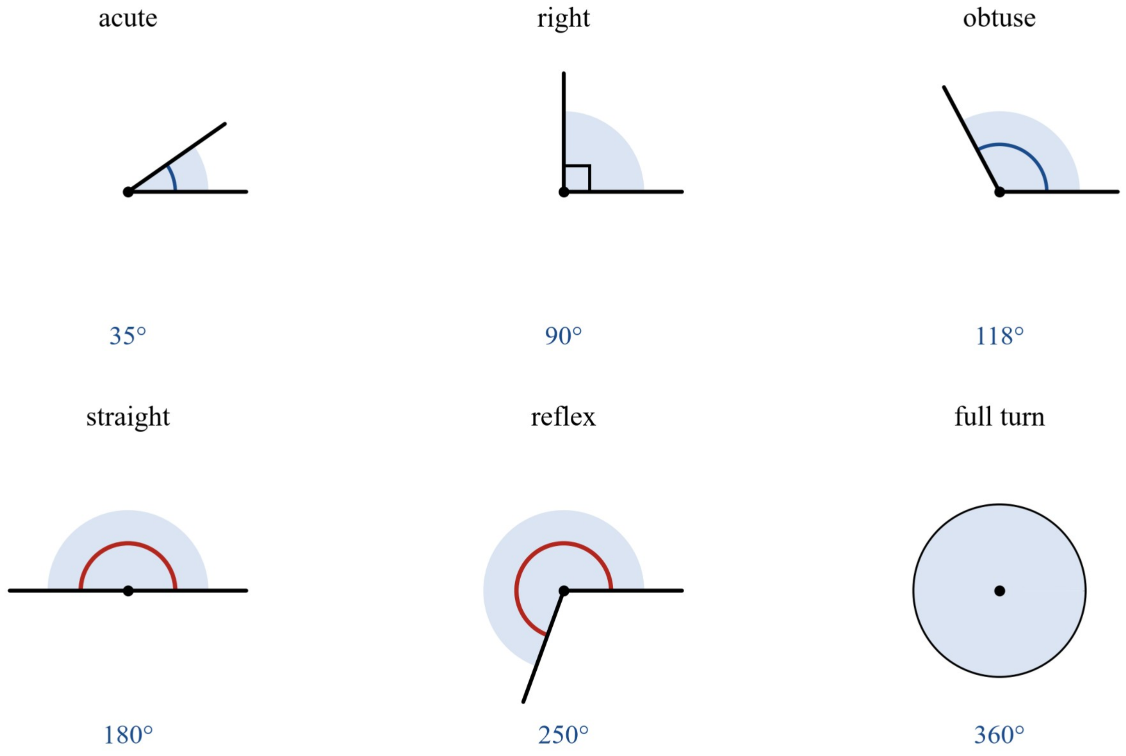
A quarter-turn is exactly a **right angle**, so a right angle is 90°. A half-turn is a **straight angle**: 180°. In books, a little square in the corner marks a right angle.

Angle names and their sizes

Now the names from Year 4 get exact sizes.

Name	Size of the turn
acute	more than 0° and less than 90°
right angle	exactly 90°
obtuse	more than 90° and less than 180°
straight	exactly 180°
reflex	more than 180° and less than 360°
full turn (revolution)	exactly 360°

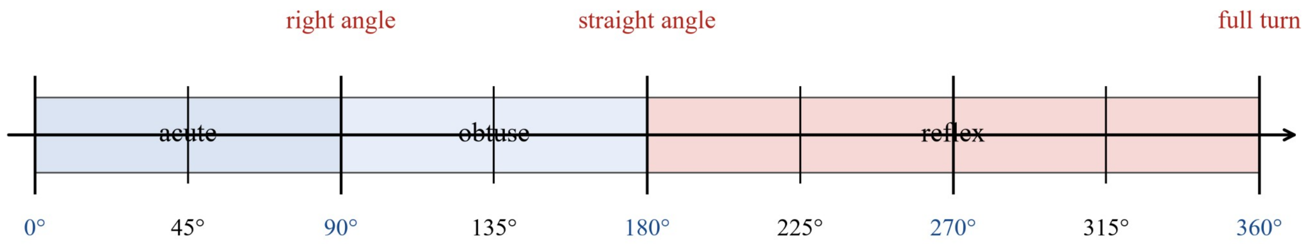
One angle of each name



Six angles drawn at their exact sizes. An acute angle of 35 degrees, a right angle of 90 degrees marked with a small square, an obtuse angle of 118 degrees, a straight angle of 180 degrees, a reflex angle of 250 degrees with the big turn shaded, and a full turn of 360 degrees shown as a shaded circle.

The number line below shows where each name lives.

Angle names on a number line



The bigger the turn, the bigger the number of degrees.

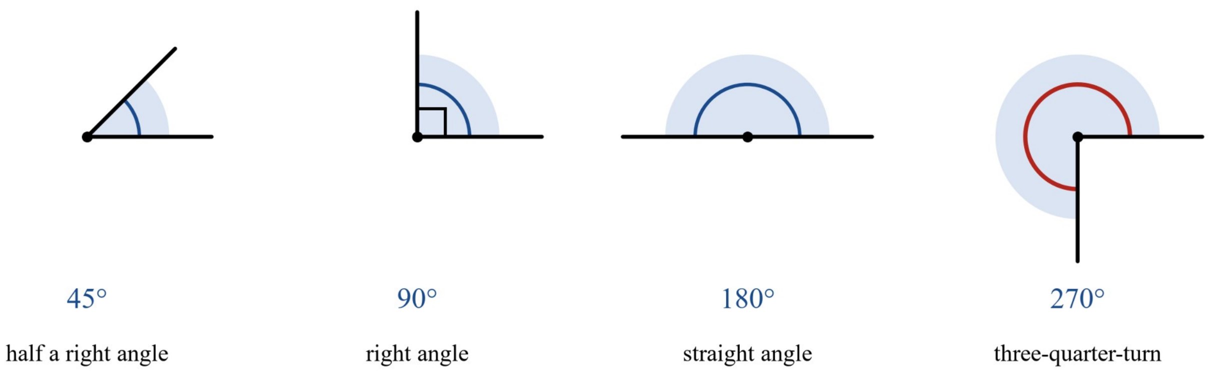
A number line from 0 degrees to 360 degrees with a tick at every 45 degrees. The band from 0 to 90 degrees is labelled acute, the band from 90 to 180 degrees is labelled obtuse, and the band from 180 to 360 degrees is labelled reflex. The ticks at 90, 180 and 360 degrees are marked right angle, straight angle and full turn.

A wider turn means more degrees. A 30° angle is a smaller turn than a 60° angle, and a 270° turn is more than a straight angle.

Estimate first

Good measurers always **estimate before they measure**. Estimate means make a sensible guess you can check later. Keep these angles in your head — know them by sight.

Know these angles by sight — they help you estimate



Four angles drawn at their exact sizes to keep in your head: 45 degrees, half a right angle; 90 degrees, a right angle; 180 degrees, a straight angle; and 270 degrees, a three-quarter-turn with the big turn shaded.

To estimate any angle, ask:

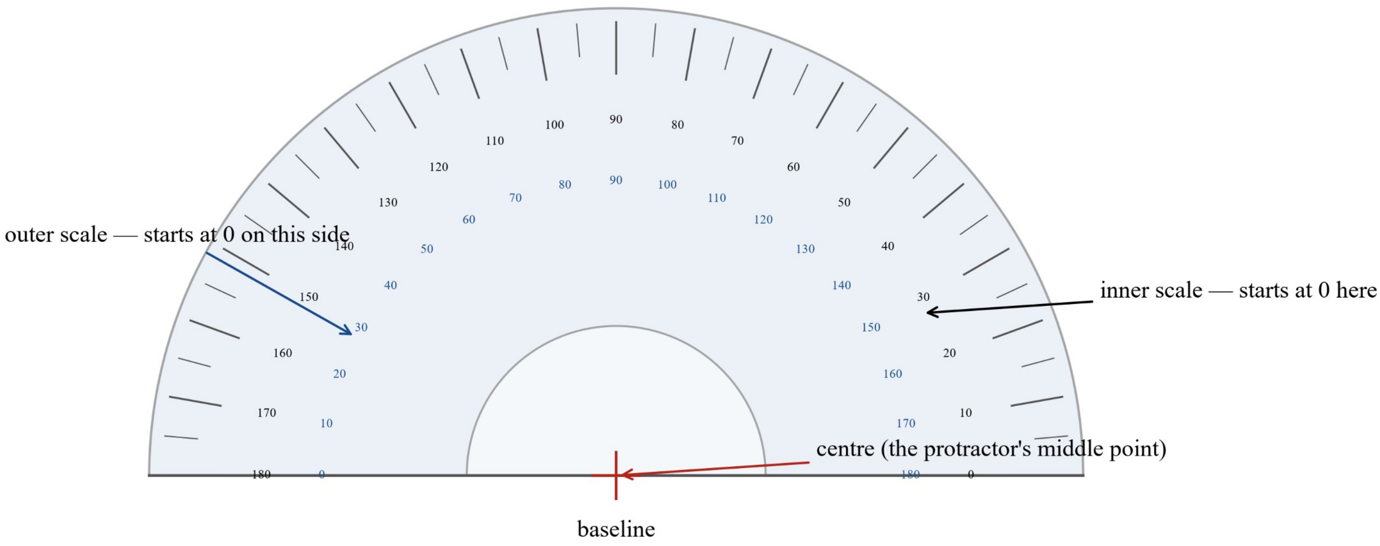
- Is it smaller than a right angle (90°), or wider than a right angle?
- Is it close to a straight angle (180°)?
- Is it more than 180°, so a reflex angle?

An angle that looks a bit wider than a right angle might be about 100°. An angle that looks like half of a right angle is about 45°.

Measuring with a protractor

The tool for measuring angles in degrees is the **protractor**.

The parts of a protractor



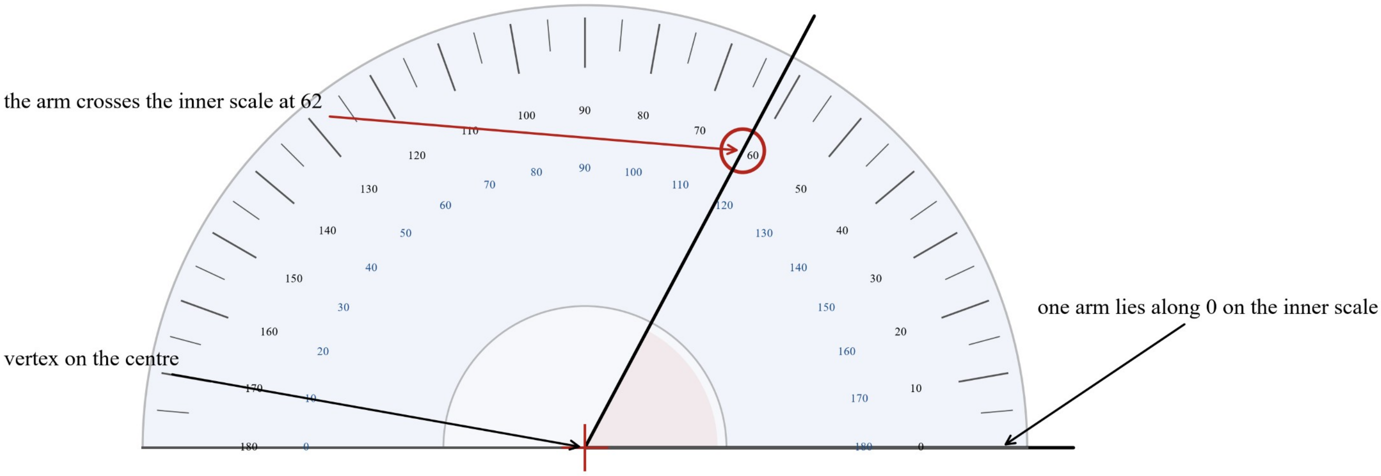
A semicircular protractor with its parts labelled: the centre point marked with a red cross, the straight baseline along the bottom, the inner scale of numbers starting at 0 on the right, and the outer scale of blue numbers starting at 0 on the left.

The protractor has a **centre** and a **baseline**, and two rows of numbers called **scales**. One scale starts at 0 on the right; the other starts at 0 on the left. Choosing the right scale is the one tricky part — your estimate saves you, because the wrong scale gives a number far from your estimate.

To measure an angle:

1. **Estimate** the angle first.
2. Put the **centre** of the protractor on the **vertex**.
3. Line the **baseline** up along one arm.
4. Read the scale that **starts at 0 on that arm**.
5. **Check** the number against your estimate.

Measuring: this angle is 62°



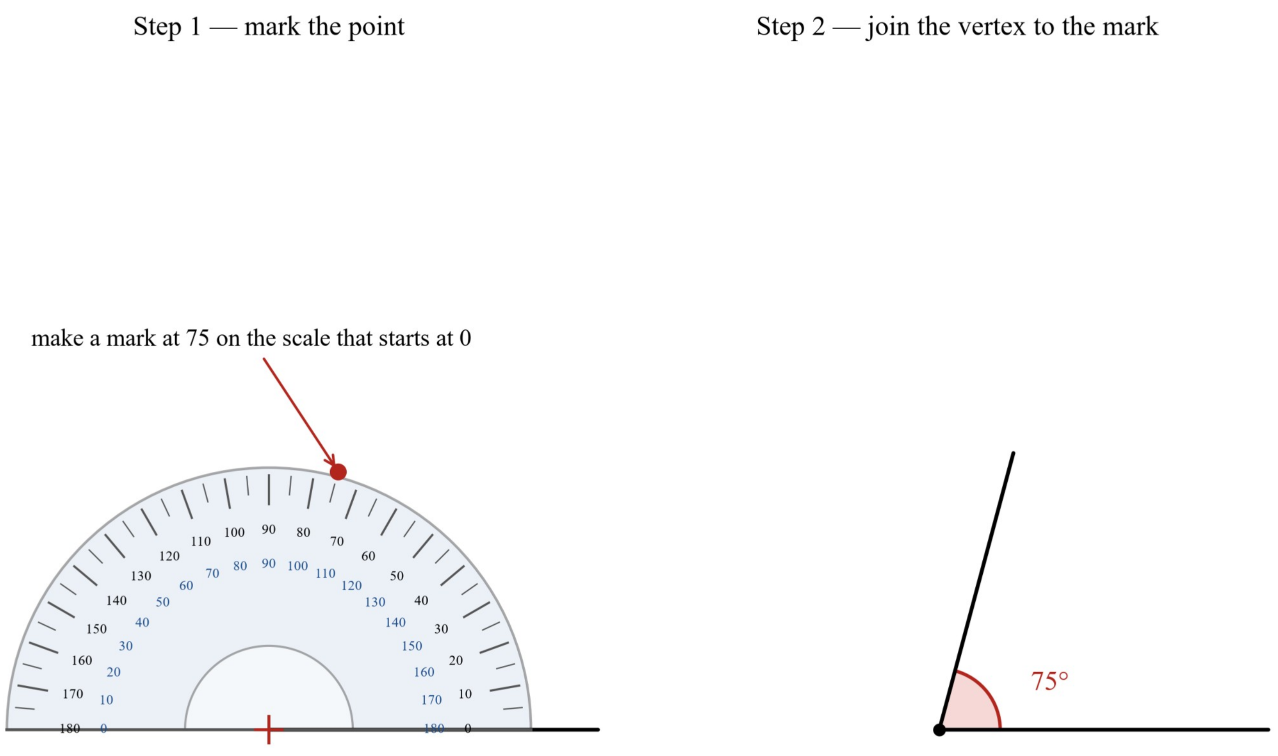
A protractor placed over an angle with its centre on the vertex and one arm along the baseline at 0. The other arm crosses the scale at 62, and that reading is circled in red: the angle is 62 degrees.

The angle above looks a little smaller than a right angle, so the estimate is about 60°. Reading the scale that starts at 0 on the bottom arm gives **62°** — close to the estimate, so the reading makes sense. (The other scale would give 118°, far from the estimate: the wrong scale.)

Constructing angles

To **construct** means to draw exactly, with tools. To construct an angle of 75°:

Constructing an angle of 75°

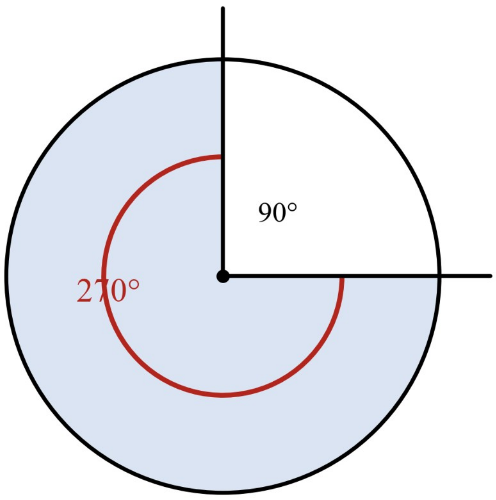


Two panels. Left: a baseline with a protractor on it and a red dot marked at 75 on the scale that starts at 0. Right: the protractor taken away and the vertex joined to the mark, making an angle labelled 75 degrees.

1. Draw a base line and mark the vertex.
2. Put the protractor’s centre on the vertex and its baseline along the line.
3. Make a mark at 75 on the scale that starts at 0.
4. Take the protractor away and join the vertex to the mark with a ruler.
5. Check with your estimate: 75° is a bit smaller than a right angle. ✓

Constructing a reflex angle. A reflex angle is more than 180°, and the protractor only counts to 180°. Use the full turn: 360° − 270° = 90°. So to construct 270°, construct a 90° angle — the reflex angle is the big turn on the other side of the arms.

Constructing the reflex angle 270°



Full turn: 360°

$360° - 270° = 90°$

Construct a 90° angle.

The reflex angle is the big turn

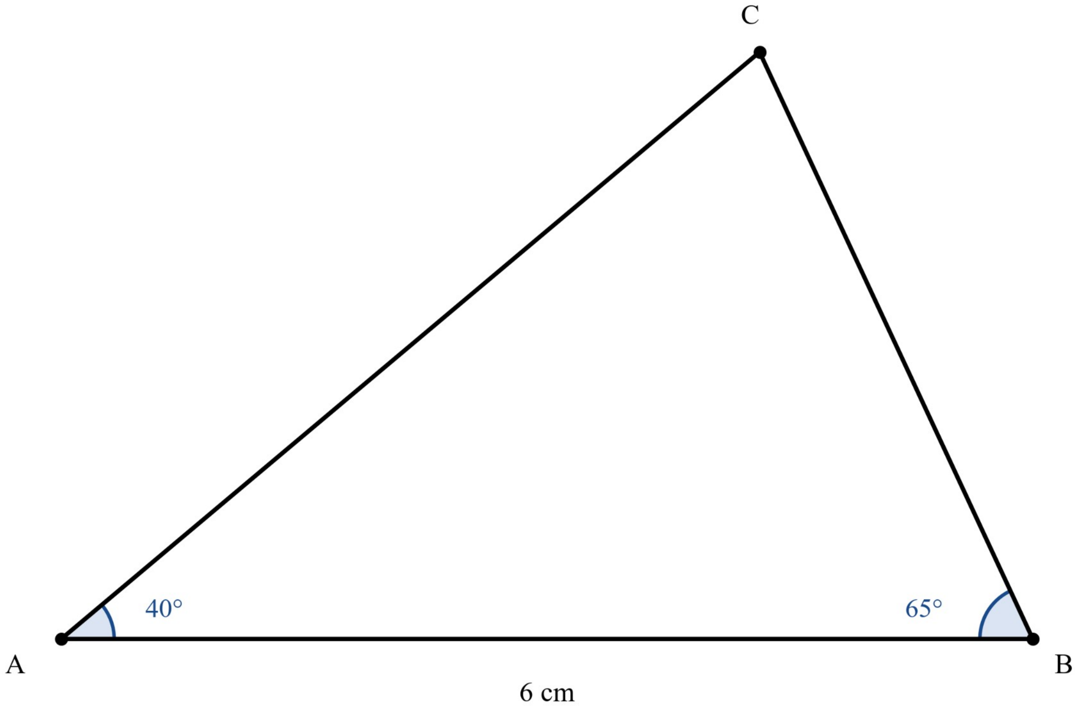
on the other side of the arms.

A circle showing the reflex angle 270 degrees shaded, made by two arms at 90 degrees to each other. The small turn between the arms is 90 degrees, and the shaded big turn around the other way is 270 degrees. Working at the right: a full turn is 360 degrees, and 270 degrees and 90 degrees together make a full turn.

Constructing triangles

A ruler and a protractor can build a whole triangle from one side and two angles. Given: a base of 6 cm, an angle of 40° at one end, A, and an angle of 65° at the other end, B.

Triangle ABC: AB = 6 cm, angle A = 40°, angle B = 65°



A triangle labelled A, B, C drawn exactly to the given sizes: the base from A to B is 6 centimetres long, the angle at A is 40 degrees and the angle at B is 65 degrees, both marked with small curves.

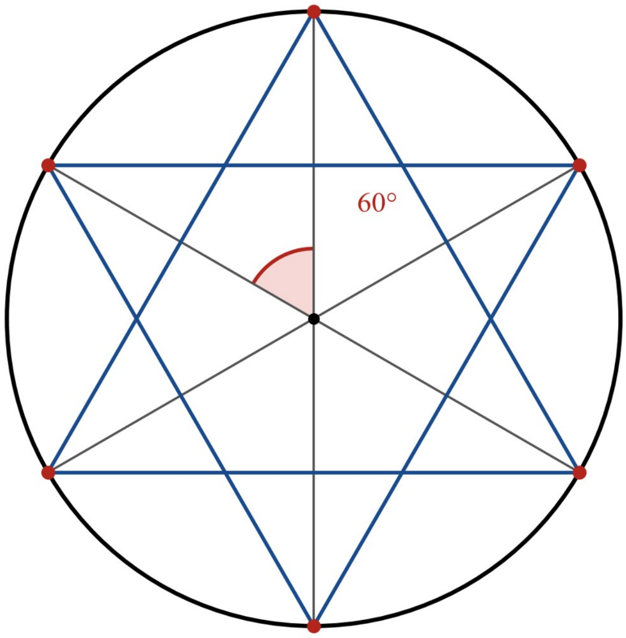
1. Rule a base line 6 cm long. Label its ends A and B.
2. Construct 40° at A, on the top side of the line.
3. Construct 65° at B, on the same side.
4. Extend the two new arms until they meet. That point is C.

Try it yourself, then **measure the angle at C** and add the three angles. Do the same for another triangle. The three measured angles of a triangle always add to the same turn — you will see it every time you measure.

Circle designs

A protractor can make patterns too. A full turn at the centre of a circle is 360°, so equal spokes split 360° into equal parts: 360° ÷ 6 = 60°.

A circle design with 6 spokes



6 equal parts

360° ÷ 6 = 60°

between the spokes

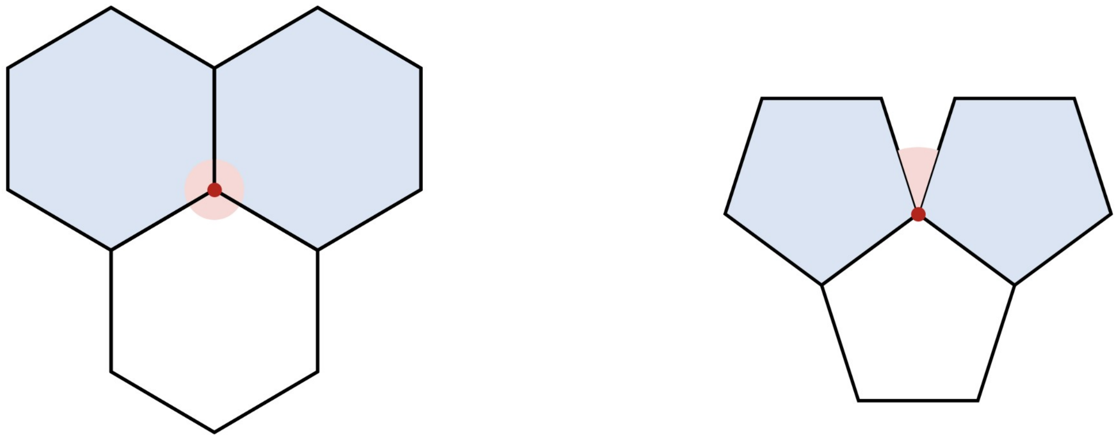
A circle with six red dots equally spaced on it and grey spokes from the centre to each dot. Blue chords join every second dot, making a six-pointed star pattern. One 60 degree wedge between two spokes at the centre is shaded and labelled 60 degrees. Working at the right: 6 equal parts; 360 degrees divided by 6 equals 60 degrees between the spokes.

Mark a dot at every 60°, then join dots with straight lines to make a string design.

Why some shapes tessellate

Shapes **tessellate** when copies of them cover a surface with no gaps and no overlaps. The angles around one point make a full turn, 360° — so measure the angles of a shape and see if they fit exactly around a point.

Do the angles fit exactly around a point?



120° + 120° + 120° = 360°

No gap — hexagons tessellate.

108° + 108° + 108° = 324°

A 36° gap — pentagons do not tessellate.

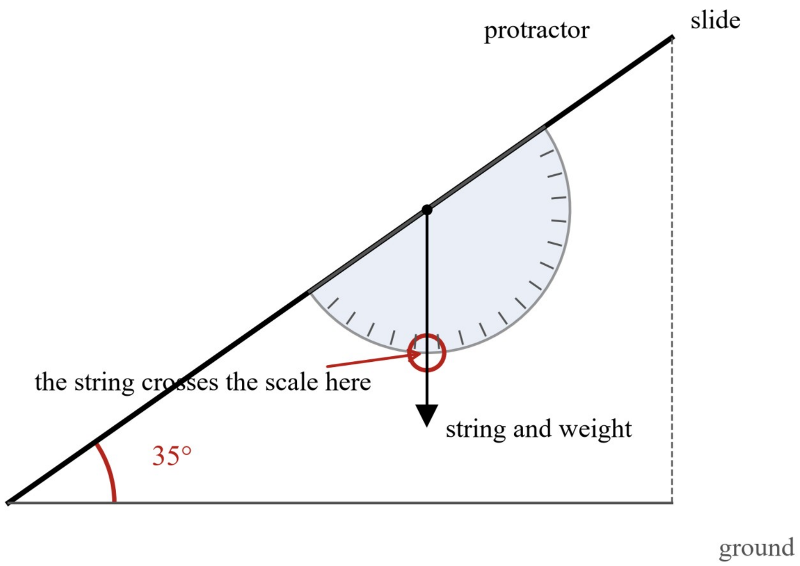
Two panels. Left: three hexagons meeting at one red point with no gap; working below reads 120 degrees plus 120 degrees plus 120 degrees equals 360 degrees, no gap, hexagons tessellate. Right: three pentagons meeting at one red point leaving a shaded gap; working below reads 108 degrees plus 108 degrees plus 108 degrees equals 324 degrees, a 36 degree gap, pentagons do not tessellate.

Each angle of a regular hexagon measures 120°. Around one point: 120° + 120° + 120° = 360° — a full turn, no gap, so hexagons tessellate. Each angle of a regular pentagon measures 108°. Around one point: 108° + 108° + 108° = 324°, which is 36° short of a full turn — a gap — so pentagons do not tessellate. (More on shapes that tessellate lives in 6C.)

Angles around you: the clinometer

Big angles out in the world — a slide, a ramp, a roof — are hard to reach with a protractor. A **clinometer** measures them. You can make one from a protractor, a string and a weight: hold the flat edge along the slope and look along it; the string hangs straight down and crosses the scale.

A homemade clinometer measures the angle of a slope



A slide drawn at exactly 35 degrees to the ground. A homemade clinometer sits on the slide: a semicircular protractor with its flat edge along the slope, and a string with a weight hanging straight down from the centre, crossing the protractor's scale at a point circled in red. The 35 degree angle between the slide and the ground is marked.

Estimate first — the slide looks about half a right angle, so about 45° — then check. This slide measures 35°, an acute angle.

Worked examples

Example 1 — with help: name the angles

Give each angle its name: 35°, 90°, 127°, 208°.

Working	Comment
35° is less than 90°.	acute
90° is exactly a quarter-turn.	right angle
127° is between 90° and 180°.	obtuse
208° is between 180° and 360°.	reflex

So: acute, right angle, obtuse, reflex.

Example 2 — with help: read the protractor

What is the angle in the measuring picture above?

Working	Comment
Estimate: a bit smaller than a right angle, about 60°.	Estimate first
Centre on the vertex, baseline along the bottom arm.	Steps 2 and 3
Read the scale starting at 0 on that arm: 62.	Step 4

Working	Comment
62° is close to the estimate of about 60°. ✓	Step 5

The angle is **62°**.

Example 3 — with help: construct 75°

Working	Comment
Rule a base line; mark the vertex.	Ruler
Protractor centre on the vertex, baseline on the line.	Line up
Mark 75 on the scale that starts at 0.	Protractor
Join vertex to mark; label 75°.	Ruler
Estimate check: a bit smaller than 90°. ✓	Sensible

Example 4 — on your own: estimate, then name

An angle is a bit wider than a right angle. It measures 104°. What is its name?

More than 90° and less than 180°, so **obtuse**. The estimate (a bit over 90°) agrees.

Example 5 — on your own: a circle design

A string design has 8 equal spokes from the centre. What is the angle between one spoke and the next?

The spokes split the full turn of 360° into 8 equal parts: 360° ÷ 8 = **45°**.

Example 6 — on your own: do squares tessellate?

Each angle of a square is 90°. Do squares tessellate?

Around one point: 90° + 90° + 90° + 90° = 360° — a full turn, no gap. **Yes, squares tessellate**, as your bathroom floor shows.

Practice questions

With help

Q1. Give each angle its name: 73°, 90°, 154°, 180°, 262°, 360°.

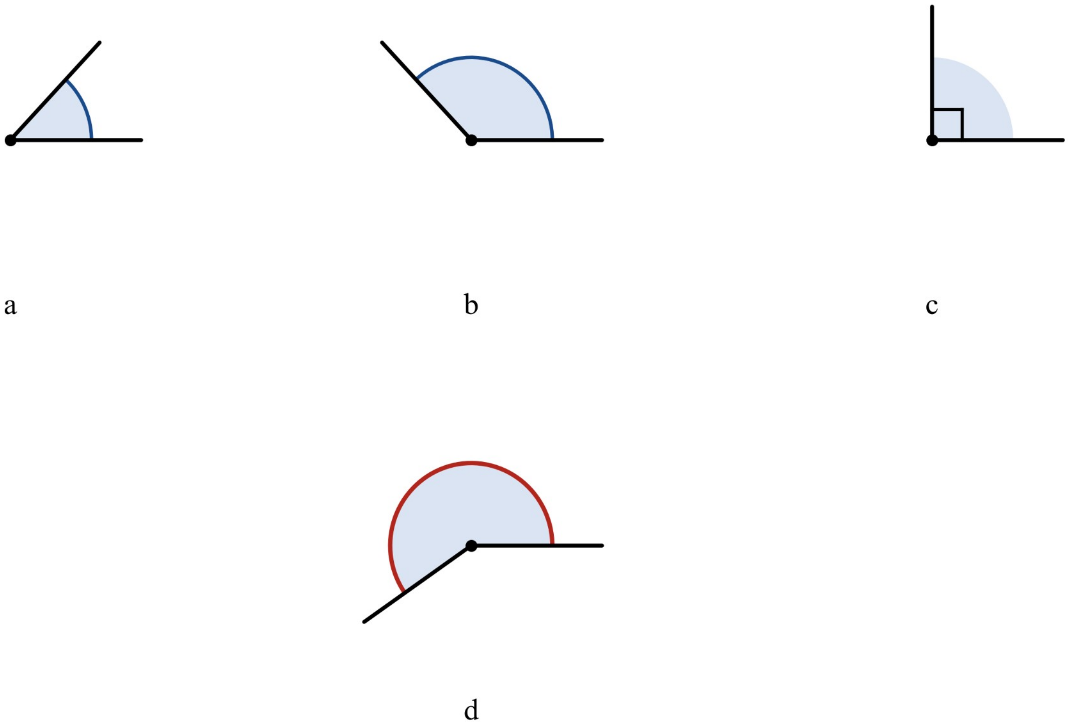
Q2. Fill in the gaps. a. An acute angle is more than 0° and less than ____°. b. An obtuse angle is more than 90° and less than ____°. c. A reflex angle is more than ____° and less than 360°.

Q3. Put in order from smallest turn to biggest turn: 170°, 89°, 15°, 91°.

Q4. Look at angles a, b, c and d in the picture below. **Estimate** each one first: is it close to 45°, 90°, 180° or 270°, or somewhere in between?

Q5. Now **measure** angles a, b and c with your protractor. Were your estimates close?

Measure each angle with your protractor



Four angles drawn at their exact sizes, labelled a, b, c and d. Angle a is 47 degrees, angle b is 133 degrees, angle c is a right angle of 90 degrees marked with a small square, and angle d is a reflex angle of 215 degrees with the big turn shaded.

Q6. Measure the reflex angle d. Hint: think about the full turn.

Q7. Construct an angle of 50°. Check it against your estimate.

Q8. Construct an angle of 115°. What is its name?

On your own

Q9. Give each angle its name: 44°, 90°, 132°, 180°, 245°, 360°.

Q10. Draw one acute angle and one obtuse angle. Measure each one and record its size and its name.

Q11. Construct the reflex angle 270°.

Q12. Construct a triangle with a base of 7 cm, an angle of 50° at the left end and an angle of 70° at the right end.

Q13. Construct a triangle with two sides of 5 cm and 4 cm and an angle of 60° between them. (Hint: draw the 60° angle first, then measure along its arms.)

Q14. A circle design has 8 equal spokes. What is the angle between one spoke and the next?

Q15. True or false? a. An angle of 179° is obtuse. b. An angle of 181° is reflex. c. An angle of 45° is a right angle.

Q16. Each angle of a square measures 90°. How many squares fit exactly around one point? Explain with an addition sentence.

Maths in real life

Q17. At 3 o'clock the hands of a clock make a right angle (90°). What angle do the hands make at 6 o'clock, and what is its name?

Q18. A playground slide makes an angle of about 35° with the ground, and a ramp makes an angle of about 20°. Name each angle. Which makes the wider turn?

Q19. Find three slopes or corners near you — a slide, a roof, an open door. Estimate each angle, then check with a protractor or a homemade clinometer, and name each one.

Answers

Q1. Acute, right angle, obtuse, straight, reflex, full turn. **Q2.** a. 90. b. 180. c. 180. **Q3.** 15°, 89°, 91°, 170°. **Q4.** Estimates will vary; sensible answers: a is about 45°, b is about 135° (between 90° and 180°), c is about 90°, and d is about 210° (between 180° and 270°). **Q5.** a = 47°, b = 133°, c = 90°. **Q6.** 215°. **Q7.** Drawn angle measures 50° (acute). **Q8.** 115°, obtuse. **Q9.** Acute, right angle, obtuse, straight, reflex, full turn. **Q10.** Answers will vary; the measured sizes must match the names. **Q11.** The big turn around the outside of a constructed 90° angle. **Q12.** Triangle with base 7 cm and the two given angles. **Q13.** Triangle with the given sides and included angle. **Q14.** 45°. **Q15.** a. True. b. True. c. False — 45° is acute (a right angle is 90°). **Q16.** 4 squares: 90° + 90° + 90° + 90° = 360°, a full turn with no gap. **Q17.** 180°, a straight angle. **Q18.** Both acute; the slide (35°) makes the wider turn. **Q19.** Answers will vary; estimates should be near the measured sizes, and names should match.

Worked answers

Q1. 73° is less than 90°: acute. 90°: right angle. 154° is between 90° and 180°: obtuse. 180°: straight. 262° is between 180° and 360°: reflex. 360°: full turn. ∴ acute, right angle, obtuse, straight, reflex, full turn.

Q2. a. Acute means less than a right angle: 90. b. Obtuse stops at a straight angle: 180. c. Reflex starts after a straight angle: 180.

Q3. More degrees means a wider turn. ∴ 15°, 89°, 91°, 170°.

Q4. a looks about half a right angle: about 45°. b looks between a right angle and a straight angle: about 130–140°. c looks like a right angle: about 90°. d is more than a half-turn but less than a three-quarter-turn: about 210–220°.

Q5. a = 47° (estimate about 45° — close). b = 133° (estimate about 135° — close). c = 90° (the little square says right angle). ∴ the estimates agree with the measures.

Q6. The small turn between the same two arms measures 145°. A full turn is 360°, and 360° − 145° = 215°, so the reflex angle is the big turn around the other way. ∴ d = 215°.

Q7. Base line; protractor centre on the vertex; mark 50; join. A protractor check reads 50°, and 50° is acute, matching the estimate (about half a right angle).

Q8. As Q7 with a mark at 115. 115° is between 90° and 180°. ∴ obtuse.

Q9. 44° acute; 90° right angle; 132° obtuse; 180° straight; 245° reflex; 360° full turn.

Q10. Check: the acute angle measures less than 90° and the obtuse one measures between 90° and 180°, and each recorded name matches its size.

Q11. 360° − 270° = 90°, so construct a 90° angle; the reflex angle is the big turn on the other side of the arms.

Q12. Rule a base 7 cm long and label its ends A and B; construct 50° at A and 70° at B on the same side; extend the arms to meet at C. A protractor check of the drawn angles reads 50° and 70°.

Q13. Construct a 60° angle; measure 5 cm along one arm and 4 cm along the other; join the two marks with a ruler.

Q14. The spokes split the full turn equally: 360° ÷ 8 = 45°. ∴ 45°.

Q15. a. 179° is between 90° and 180°: true. b. 181° is between 180° and 360°: true. c. A right angle is exactly 90°; 45° is acute: false.

Q16. Four squares: 90° + 90° + 90° + 90° = 360°, exactly a full turn, so no gap and no overlap. ∴ 4 squares fit around a point, which is why squares tessellate.

Q17. At 6 o'clock the hands point opposite ways: a half-turn. ∴ 180°, a straight angle.

Q18. 35° and 20° are both less than 90°, so both are acute. 35° is more than 20°. ∴ the slide makes the wider turn.

Q19. Check: each estimate is near its measured size (within about 10° is great), and each name matches the measured size — under 90° acute, 90° to 180° obtuse, over 180° reflex.

Test

Test T5 · Chapter 5 — Measurement

Mathematics Level 5 (Year 5) · Victorian Curriculum 2.0

Codes assessed: `VC2M5M01` · `VC2M5M02` · `VC2M5M03` · `VC2M5M04`

Name: ______________________________ Date: ______________

Total marks	20
Guidance duration	25 minutes
Timing	This is a classroom check, not an exam. There is no strict time limit. Your teacher will let you finish.
Equipment	You will need a ruler and a protractor. Your teacher will give you a printed square grid where each small square is 1 cm². You will also need a pencil.
Calculators	The content descriptions `VC2M5M01`, `VC2M5M02`, `VC2M5M03` and `VC2M5M04` do not say "without a calculator", so a calculator is allowed. You do not need one for any question in this test.

Attempt every question. Show your working where the question asks for it.

Question 1 — Choosing metric units for length, mass and capacity (5 marks)

(a) Which unit would you choose for the mass of a bicycle? (1 mark)

A. cm

B. mL

C. kg

D. km

Write the letter of the best answer: ▢

(b) On sports day, the judge measures a long jump. A metre stick fits once along the jump, and the part left over measures 32 cm. Record the jump using two units. (1 mark)

(c) Priya and Jack measure the same desk. Priya records 1 m. Jack records 1 m 8 cm. Whose record is more accurate? Give a reason. (2 marks)

(d) Circle the better unit and give a reason: the capacity of a spoon of honey — mL or L. (1 mark)

Question 2 — Perimeter and area of regular and irregular shapes (5 marks)

(a) On the printed square grid, draw a rectangle 5 cm long and 3 cm wide. Then count the 1 cm² squares inside it to find its area. (2 marks)

Area: ______________________________

(b) A farmer's rectangular paddock is 15 m long and 9 m wide. There is a 3 m gate in one side. The gate needs no fencing. How many metres of fencing does the farmer need? Show your working. (1 mark)

(c) A rectangle 8 cm by 2 cm and a square 5 cm by 5 cm both go 20 cm around the edge.

(d) Count in rows to find the area of each shape. (1 mark)

(ii) Mia says: two shapes with the same perimeter always have the same area. Is Mia right? Use your areas from part (i) to give a reason. (1 mark)

Question 3 — 12-hour and 24-hour time (5 marks)

This excerpt is from a real weekday timetable. It shows train departures from Southern Cross station on the Geelong line. The departures are printed in 24-hour time.

`06:05 07:26 09:10 12:30 16:49`

Source: V/Line (Department of Transport and Planning), *Geelong Line* timetable, effective 1 February 2026, retrieved 20 August 2026.

(a) Write each departure in 12-hour time. (2 marks)

(b) `06:05` ______________________________

(ii) `12:30` ______________________________

(b) Write each time in 24-hour time. (2 marks)

(c) 5:40 pm ______________________________

(ii) 12:05 am ______________________________

(iii) Why do train timetables print times in 24-hour time instead of 12-hour time? (1 mark)

Question 4 — Estimating, constructing and measuring angles in degrees (5 marks)

(a) Give each angle its name: 52°, 90°, 146°, 248°. (1 mark)

(b) Estimate first: is 65° smaller than a right angle or bigger than a right angle? Then construct an angle of 65° in the space below. Measure the angle you constructed with your protractor to check it. (1 mark)

(c) Two arms meet at a point. The smaller turn between them is 70°. Find the reflex angle on the other side of the arms. Show your working. (1 mark)

(d) Can angles of 45°, 120° and 190° fit exactly around one point, with no gap? Show your working. (2 marks)

Total: 20 marks

Solutions

Teacher-facing. Test T5 is a classroom check, not an exam: untimed in principle, with a 25-minute guidance duration (about 1 minute per mark plus 5 minutes reading), and the equipment stated on the paper — ruler, protractor, printed square grid — is permitted. None of the four content descriptions says "without a calculator", so a calculator is allowed and no question is calculator-free (D10); each calculation item asks for the method (the rectangle perimeter shortcut, counting square units, adding or subtracting 12), which is what makes keying numbers into a calculator useless.

Coverage and mark map

CD	Subtopic	Questions	Marks
`VC2M5M01`	5A Choosing metric units for length, mass and capacity	Q1	5
`VC2M5M02`	5B Perimeter and area of regular and irregular shapes	Q2	5
`VC2M5M03`	5C 12-hour and 24-hour time	Q3	5
`VC2M5M04`	5D Estimating, constructing and measuring angles in degrees	Q4	5
	Total		**20**

5 marks per subtopic, per the §7 marking rule: every CD the chapter owns is worth the same, and each is scored by its own question. Multiple choice is 1 mark of 20 (5%) — inside the sparingly cap — and appears only where selection is genuinely the skill being tested: Q1(a), "which unit would you choose?", the 5A example §7 itself names. Four options A–D.

Achievement-standard extracts carried on these CDs in `maths_5.json` (teacher/audit metadata): *Students choose and use appropriate metric units to measure the attributes of length, mass and capacity, and to solve problems involving perimeter and area.* (`VC2M5M01`, `VC2M5M02`.) *Students convert between 12- and 24-hour time.* (`VC2M5M03`.) *They estimate, construct and measure angles in degrees.* (`VC2M5M04`.)

Answer key

Q	Part	Answer	Marks
1	(a)	C (kg)	1
1	(b)	1 m 32 cm	1
1	(c)	Jack's; his record includes the part left over	2
1	(d)	mL; a spoon holds only a small amount of liquid	1
2	(a)	Rectangle 5 cm by 3 cm drawn; area 15 cm²	2
2	(b)	45 m	1
2	(c)(i)	Rectangle 16 cm²; square 25 cm²	1
2	(c)(ii)	No — areas 16 cm² and 25 cm² are different	1
3	(a)(i)	6:05 am	1
3	(a)(ii)	12:30 pm	1

Q	Part	Answer	Marks
3	(b)(i)	`17:40`	1
3	(b)(ii)	`00:05`	1
3	(c)	A 24-hour time cannot be read the wrong way; there is no am or pm to mix up	1
4	(a)	acute, right angle, obtuse, reflex	1
4	(b)	Constructed angle measures 65° (within about 2°)	1
4	(c)	290°	1
4	(d)	No — 45° + 120° + 190° = 355°, 5° short of a full turn	2
		Total	**20**

Worked solutions

Q1. (a) Mass is measured in grams or kilograms. cm and km are length units and mL is a capacity unit, so none of them can measure a mass. A bicycle is a heavy thing, so kilograms fit the job. The answer is **C**.

(b) Whole metres: 1. Part left over: 32 cm. The two-unit record is **1 m 32 cm**.

Marks: 1 for 1 m 32 cm. A one-unit record such as 132 cm, or "about 1 m", does not score — the skill is the combination of units.

(c) **Jack's** record is more accurate. Priya's 1 m leaves out the 8 cm. Jack's 1 m 8 cm includes the part left over after the whole metres, so the smaller unit tells more exactly where the end of the desk really is.

Marks: 1 for choosing Jack; 1 for a reason that says the cm part is included, or that a smaller unit gives a more accurate measure. Accept the reason in the student's own words.

(d) **mL**. A spoon holds only a small amount of liquid. L is the unit for bottles and jugs — far too big for this job.

Marks: 1 for mL with any true reason about the small amount.

Q2. (a) The rectangle covers 5 squares in each row and has 3 rows. Count in rows of 5: 5, 10, 15. The area is **15 cm²**.

Marks: 1 for a rectangle drawn 5 cm by 3 cm on the grid (5 squares by 3 squares); 1 for the correct area count. Working carried forward: award the area mark for a correct count of the squares inside the rectangle the student actually drew.

(b) Perimeter first. Shortcut: 15 + 9 = 24, and 24 doubled is 48, so the paddock goes 48 m around the edge. (Adding all four sides, 15 + 9 + 15 + 9 = 48, also scores.) The gate takes up 3 m of that edge and needs no fencing: 48 − 3 = 45. The farmer needs **45 m** of fencing.

Marks: 1 for 45 m with working shown. The working must show the perimeter (48 m) and the gate taken off; a bare 45 does not score.

(c)

(i) Rectangle: 2 rows of 8 — count in 8s: 8, 16, so **16 cm²**. Square: 5 rows of 5 — count in 5s: 5, 10, 15, 20, 25, so **25 cm²**. (ii) **No.** Both shapes have a perimeter of 20 cm, but their areas are 16 cm² and 25 cm² — same perimeter, different area.

Marks: 1 for both areas in (i); 1 for "No" with a reason that uses the two areas in (ii). Accept "same perimeter does not mean same area" phrased in the student's own words.

Q3. (a) (i) The hour 6 is below 12, so it is a morning time: **6:05 am**. (ii) `12:30` is in the noon hour — noon times keep the 12 and take the pm label: **12:30 pm**.

(b)

(i) A pm hour adds 12: 5 + 12 = 17, so **`17:40`** — the minutes stay 40. (ii) 12:05 am is a midnight time: the hour 12 becomes 00, so **`00:05`**.

(c) A 24-hour time can only mean one moment of the day — `17:40` can only be the evening. In 12-hour time the am or pm label can be dropped or read the wrong way, and a person could catch a train at the wrong end of the day.

Marks: 1 each for (a)(i), (a)(ii), (b)(i) and (b)(ii); 1 for any true reason in (c). In (a) and (b), the am/pm label is part of a 12-hour answer and the leading zero is part of a 24-hour answer; a 24-hour answer carrying am or pm does not score.

Q4. (a) 52° is less than 90°: **acute**. 90° is exactly a quarter-turn: **right angle**. 146° is between 90° and 180°: **obtuse**. 248° is between 180° and 360°: **reflex**.

(b) Estimate first: 65° is less than 90°, so it is smaller than a right angle. Construct: rule a base line and mark the vertex; put the protractor's centre on the vertex and its baseline along the line; make a mark at 65 on the scale that starts at 0; take the protractor away and join the vertex to the mark. Check: measuring the constructed angle should read close to 65°, which agrees with the estimate.

Marks: 1 for a constructed angle that measures 65° within about 2°. The estimate is part of the item but is not separately marked; neatness is not scored.

(c) A full turn is 360°. The reflex angle is the big turn around the other side of the same two arms: 360° − 70° = 290°. The reflex angle is **290°**.

Marks: 1 for correct working and answer (360° − 70° = 290°).

(d) Add the three angles: 45° + 120° + 190° = 355°. A full turn around one point is 360°, and 355° is 5° short of that, so the angles do not fit exactly — there would be a gap of 5°. **No.**

Marks: 1 for the working 45° + 120° + 190° = 355°; 1 for the conclusion (no — 5° short of a full turn, a gap remains).

Marking notes

- **Strategy counts.** In Q2(b) the mark goes to the fencing found from the perimeter, not to a bare number. In Q2(c)(i) any correct counting route scores — counting in rows, counting one square at a time, or pairing — the CD's method is counting square units, and no area formula is expected or required at this level.
- **Working carried forward.** Q2(a)'s area mark follows the rectangle the student actually drew, so a student who misdraws but counts correctly still scores the count.
- **Constructions.** Q4(b) is marked on the measured size of the drawn angle, within about 2° of 65°, using the student's own protractor check.
- **MC.** Q1(a) scores 1 for C and 0 otherwise; no part marks.
- **Coverage and caps (§7).** Each of the chapter's four CDs is scored by its own question at 5 marks each; MC is 1 mark of 20. Nothing in the paper crosses a level ban in D7: no unit conversion, no area formula, no elapsed time, no angle-relationship deduction, no pronumerals.