



STUDENT PRINT PACK

Geometry Engineer

Investigate shape properties, measure carefully and build a structure that passes every mathematical test.

Engineer: _____

Bring: pencil, eraser, ruler, two coloured pencils, scissors, tape, 6 spare A4 sheets and a small object of about 50 g.
Ask an adult to help with scissors if needed.

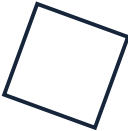
Property Detective

Name a shape from evidence, not from the way it is turned.

Use sides, vertices and angles to support every name. Size and the way a shape is turned do not change its properties.



A



B



C



D



E

Shape	Sides and vertices	Name	One property that proves it
A			
B			
C			
D			
E			

1 **Property riddle**

I have four straight sides. Opposite sides are equal. Every angle is a right angle. Write **every name** that fits.

2 **A turned shape**

Shape B is still a square because

Regular or Irregular?

A regular polygon has all sides equal and all angles equal.

all sides equal

all angles equal

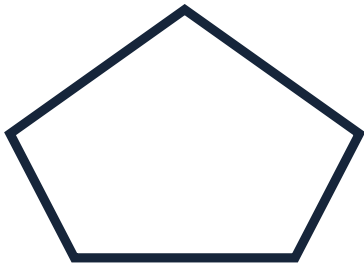
some sides differ

some angles differ

regular

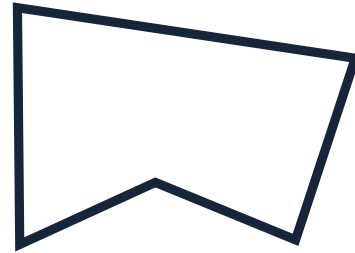
irregular

REGULAR PENTAGON



What evidence would you mark on this drawing?

IRREGULAR PENTAGON



Which regularity condition fails?

1 Same number of sides, different regularity

Draw one regular hexagon and one irregular hexagon. Your regular drawing may be approximate: the equality marks or labels are the important evidence.

REGULAR HEXAGON



IRREGULAR HEXAGON



2 Complete the mathematical explanation

Both of my shapes are hexagons because _____

The first is regular because _____

The second is irregular because _____

Deep-thinking challenge: Can a triangle be irregular? Draw an example on the back and justify your answer.

3D Shape Investigator

Rotate the digital solid before you record what is hidden.

Vocabulary: A flat face is a flat 2D region. An edge is a line where two surfaces meet. A vertex is a corner. A cylinder, cone and sphere also have curved surfaces.

3D shape	Flat faces	Curved surfaces	Edges	Vertices	A property that proves its name
Cube					
Cuboid					
Triangular prism					
Square pyramid					
Cylinder					
Cone					
Sphere					

1 Compare

A triangular prism and a square pyramid both have triangular faces. How are they different?

2 Predict a net

Before pressing "open net", sketch where you think the faces of one solid will go.

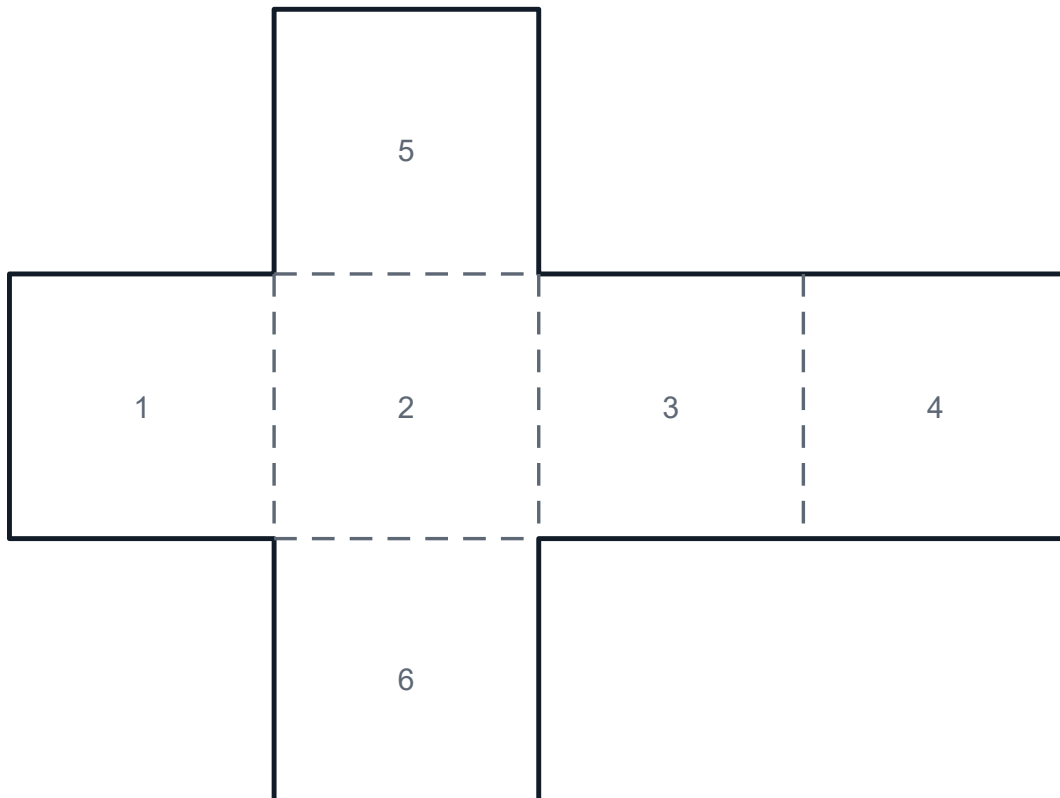
I know it is a _____ because _____

Cube Net

Predict which faces meet, then turn six squares into one solid.

_____ This line must measure 5 cm. Print at 100% / actual size.

——— Cut line - - - - - Fold line



Before cutting

Face 2 will be opposite face: _____

Face 1 will meet face 4:

☐ Yes ☐ No

After building

Faces: _____ Edges: _____ Vertices:

One prediction I would revise:

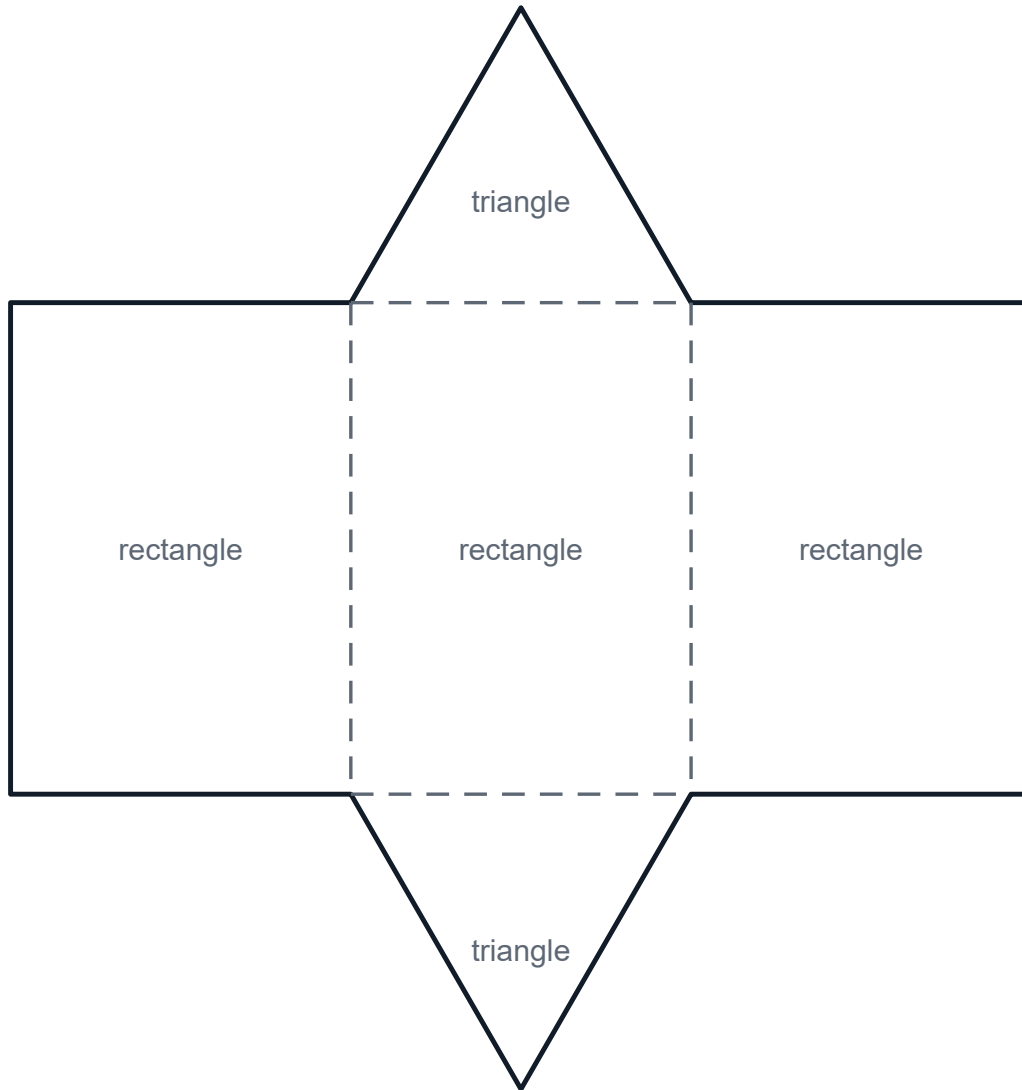
Build safely. Cut only on the solid outer line. Fold the dashed lines. Use small pieces of tape on the outside edges. If cutting is difficult, trace the net and label matching edges instead.

Triangular Prism Net

Three rectangles wrap around two triangular ends.

_____ This line must measure 5 cm. Print at 100% / actual size.

— Cut line - - - - - Fold line



Before cutting

Circle the two matching faces—the same shape and the same size. Put a star on a rectangular face.

Which edges of the rectangles will meet?
Mark matching pairs.

After building

Flat faces: _____ Edges: _____ Vertices: _____

It is a prism because _____

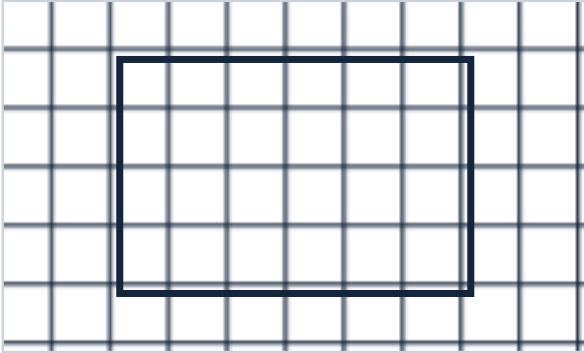
No-cut alternative. Use a coloured pencil to trace a path across faces that will touch after folding. Compare your prediction with the folding animation.

Boundary or Interior?

Perimeter measures the distance around. Area measures the space covered.

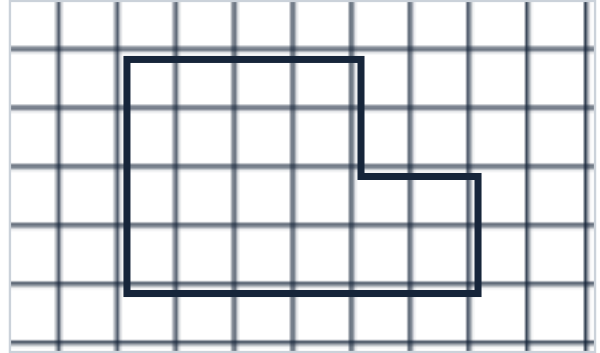
Each small square is **1 unit by 1 unit**. Count perimeter in units and area in square units. Show how you counted.

SHAPE A



Perimeter = ____ units
Area = ____ square units

SHAPE B



Perimeter = ____ units
Area = ____ square units

1 What did you count?

For perimeter, I counted:

☐ boundary lengths ☐ tiles inside

For area, I counted:

☐ boundary lengths ☐ tiles inside

2 Compare your counts

Which shape covers more square units?

Shape ____

Which has the longer boundary?

☐ A ☐ B ☐ same length

Shapes A and B have the same _____ but different _____

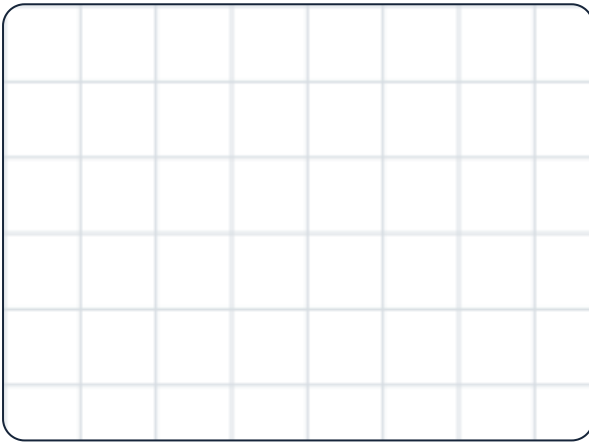
Choose One Shape Challenge

This page is optional. Try it if page 7 felt comfortable.

Choose **one** challenge. Use grid squares as units. You do not need a formula.

A Same area

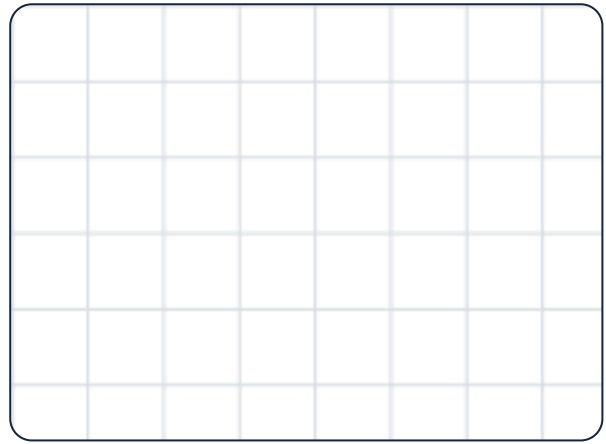
Draw two connected shapes with area **12 square units** but different perimeters.



Perimeters: ____ and ____ units

B Same perimeter

Draw two connected shapes with perimeter **16 units** but different areas.



Areas: ____ and ____ square units

What did you notice?

My two shapes are different because _____

ER

HIDDEN FIGURE SPOTLIGHT

Emily Warren Roebling

Emily learned about materials, forces, cables and curves while the Brooklyn Bridge was being built. She carried instructions, checked information and helped the project continue when its chief engineer was seriously ill.

Try her habit: Which part of your structure will you test first?

Source: American Society of Civil Engineers

Plan the Structure

Design criteria are the rules your structure must meet. Turn each rule into something you can see or measure.

Design criteria

- ☐ Stands without help for 10 seconds
- ☐ Reaches at least 30 cm high
- ☐ Fits inside a 20 cm × 20 cm base
- ☐ Uses no more than 6 A4 sheets and 60 cm of tape
- ☐ Shows at least two identifiable 2D or 3D shapes
- ☐ Holds a 50 g object for 5 seconds

Material budget

A4 sheets planned: _____ / 6

Tape planned: _____ cm / 60 cm

Object used for test: _____

My stability strategy: _____

1 Labelled side view

Show planned height, main 2D/3D shapes and where the object will rest.

2 Labelled top view

Show the base dimensions and how it stays inside 20 cm × 20 cm.

The design rule most at risk is _____ because _____

Test, Improve, Explain

A strong design is not merely finished—it is tested against evidence.

Criterion	Plan check	Mid-build check	Final result / evidence
Stands for 10 seconds	☐	☐	
At least 30 cm high	☐	☐	_____ cm
Base within 20 cm × 20 cm	☐	☐	_____ cm × _____ cm
Within paper/tape budget	☐	☐	_____ sheets; _____ cm tape
At least two named shapes	☐	☐	
Holds object for 5 seconds	☐	☐	

My mathematical features

One 2D shape: _____

Its proving property: _____

One 3D shape: _____

Its proving property: _____

My deliberate improvement

I noticed: _____

I changed: _____

The new evidence showed: _____

Exit check

M1 • 2D

I can name a 2D shape from its properties. ☐ Ready ☐ Revisit

M2 • 3D

I can name a 3D shape from its properties. ☐ Ready ☐ Revisit

M3 • Regular

I can explain regular versus irregular. ☐ Ready ☐ Revisit

M4 • Measure

I can calculate perimeter and area. ☐ Ready ☐ Revisit

M5 • Design

I used criteria to plan, test and improve. ☐ Ready ☐ Revisit

Final explanation: A mathematical choice I made was _____. My evidence is _____.