COMPREHENSIVE LESSON NOTEBOOK

GCSE MATHEMATICS

FOUNDATION TIER

UNIT 4 | GEOMETRY & MEASURES

PURPOSE

This unit develops visualisation, accurate construction, geometric reasoning and mensuration. Diagrams are original and every formula is connected to the shape it measures.

Specification map and tier boundary

Lesson	AQA	Focus
1	G1,G4	Geometrical language, polygons and symmetry
2	G2	Ruler-and-compass constructions and loci
3	G3	Angle facts, parallel lines and polygons
4	G5,G6,G19	Congruence, similarity and geometric reasoning
5	G7,G24,G25	Transformations and vectors
6	G9	Circle language and properties
7	G11	Coordinate geometry problems
8	G12,G13	3D solids, nets, plans and elevations
9	G14,G15	Measurement, scale drawings and bearings
10	G16,G17	Perimeter and area of plane shapes
11	G17,G18	Circles, arcs and sectors
12	G16,G17	Volume and surface area of prisms
13	G20	Pythagoras theorem
14	G20,G21	Right-angled trigonometry
15	G19,R12	Similarity: length, area and volume factors

FOUNDATION COVERAGE

Covers basic and additional Foundation content G1-G25 where specified. Higher-only circle theorems, negative enlargement factors, sine/cosine rules and general-triangle area are excluded.

Formula bank

POLYGON INTERIOR SUM

$(n-2)\times180°$

TRIANGLE AREA

1/2 × base × perpendicular height

TRAPEZIUM AREA

$1/2(a+b)h$

CIRCLE

$C=2\pi r=\pi d$; $A=\pi r^2$

PRISM VOLUME

cross-sectional area × length

PYTHAGORAS

$a^2+b^2=c^2$

TRIG

sin=opp/hyp; cos=adj/hyp; tan=opp/adj

SIMILARITY

length k; area k^2; volume k^3

CHAPTER 01 • G1,G4

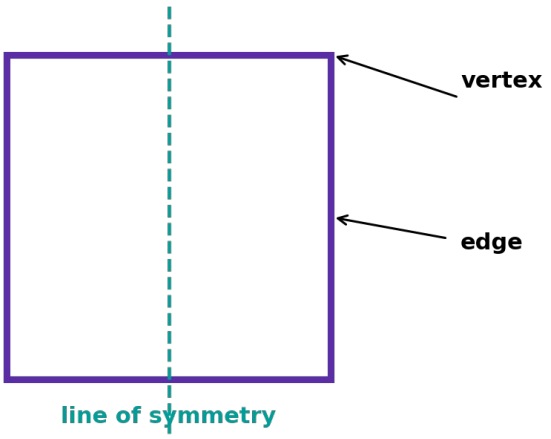
Geometrical language, polygons and symmetry

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 4. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Shape language and symmetry



Understand the idea

Geometry depends on precise vocabulary.

A vertex is a corner, an edge is a boundary and a plane is a flat surface.

Parallel lines remain equidistant; perpendicular lines meet at 90°.

Regular polygons have equal sides and equal angles.

Reflection symmetry uses mirror lines; rotational symmetry counts matching positions during one full turn.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Name a triangle with two equal sides.

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain isosceles.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

isosceles

Second model

QUESTION

State rotational order of a rectangle.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 2.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

2

Guided practice

GUIDED QUESTION 1

How many symmetry lines has a regular hexagon?

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Name a 10-sided polygon.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Name a triangle with two equal sides.

2. State rotational order of a rectangle.

3. How many symmetry lines has a regular hexagon?

4. Name a 10-sided polygon.

5. State one property of a rhombus.

6. Explain difference between parallel and perpendicular.

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

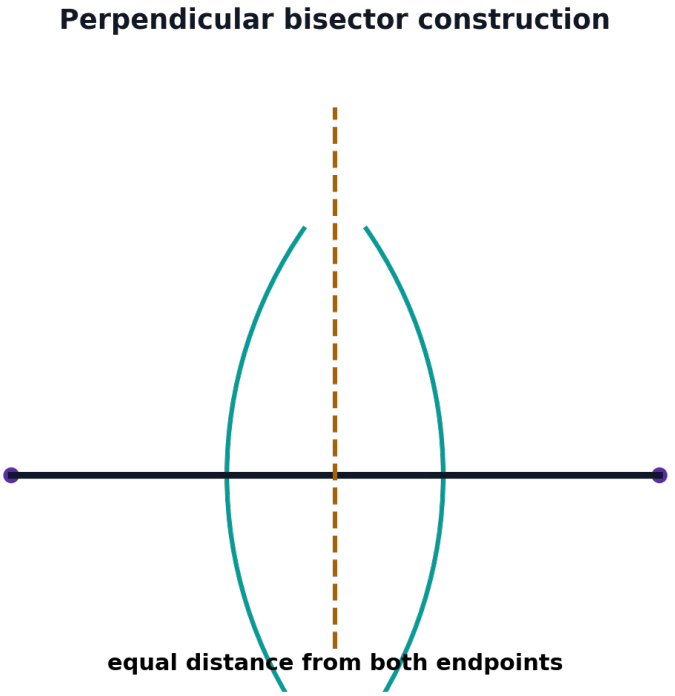
CHAPTER 02 • G2

Ruler-and-compass constructions and loci

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: his lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.



Understand the idea

A construction must preserve compass arcs because they prove equal distances.

A perpendicular bisector contains every point equidistant from two endpoints.

An angle bisector contains points equidistant from both arms.

A locus is a path satisfying a condition; shade intersections when several conditions apply.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

What locus is equidistant from two points?

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain perpendicular bisector.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

perpendicular bisector

Second model

QUESTION

What locus is 3 cm from point A?

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain circle centre A radius 3 cm.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

circle centre A radius 3 cm

Guided practice

GUIDED QUESTION 1

What locus is equidistant from two intersecting lines?

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Construct 60° using what basic shape?

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. What locus is equidistant from two points?

2. What locus is 3 cm from point A?

3. What locus is equidistant from two intersecting lines?

4. Construct 60° using what basic shape?

5. Shortest distance from point to line is measured how?

6. Explain why construction arcs remain visible.

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 03 • G3

Angle facts, parallel lines and polygons

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

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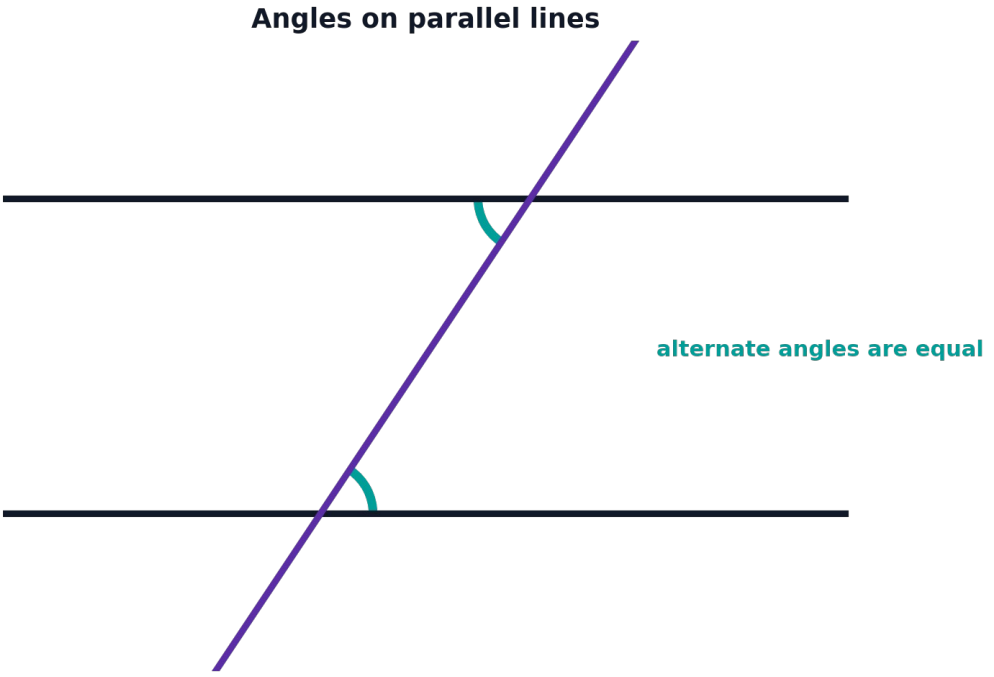


Understand the idea

Angles at a point total 360°; on a straight line total 180°; vertically opposite angles are equal.

With parallel lines, corresponding and alternate angles are equal, while co-interior angles total 180°.

Triangle angles total 180°.

Polygon interior sum is (n-2)×180° and exterior angles total 360°.

> **REASON FROM THE DIAGRAM**
>
> Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

> **QUESTION**
>
> Find angle on straight line with 137°.

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 43°.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

43°

Second model

QUESTION

Two vertically opposite angles: one 68°. Find other.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 68°.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

68°

Guided practice

GUIDED QUESTION 1

Triangle angles 42°,71°,x. Find x.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Interior sum of hexagon.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Find angle on straight line with 137°.

2. Two vertically opposite angles: one 68°. Find other.

3. Triangle angles 42°,71°,x. Find x.

4. Interior sum of hexagon.

5. Exterior angle of regular 15-gon.

6. State relationship of co-interior parallel-line angles.

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 04 • G5,G6,G19

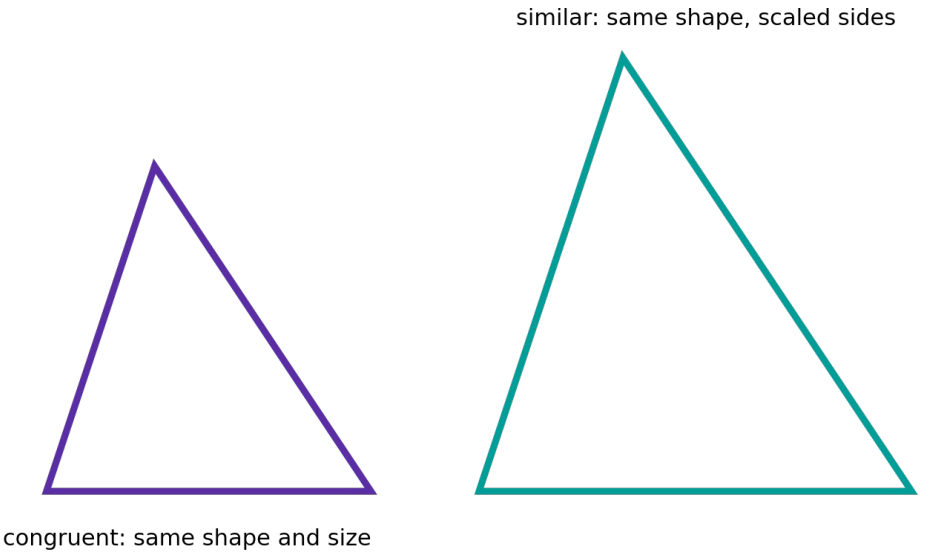
Congruence, similarity and geometric reasoning

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 6,G19. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Congruent and similar triangles



Understand the idea

Congruent shapes are identical in shape and size.

Triangle tests are SSS, SAS, ASA and RHS; AAA proves similarity, not congruence.

Similar shapes have equal corresponding angles and proportional sides.

A proof must name each angle or side fact and form a logical chain.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Which test uses two sides and included angle?

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain SAS.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

SAS

Second model

QUESTION

Are triangles with same three angles congruent?

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain No, only similar.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

No, only similar

Guided practice

GUIDED QUESTION 1

Scale factor 1.5, side 8 cm: image side?

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Similar sides 6 and 15. Find scale factor.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Which test uses two sides and included angle?

2. Are triangles with same three angles congruent?

3. Scale factor 1.5, side 8 cm: image side?

4. Similar sides 6 and 15. Find scale factor.

5. Length factor 3: area factor?

6. Why is SSA not a standard congruence test?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

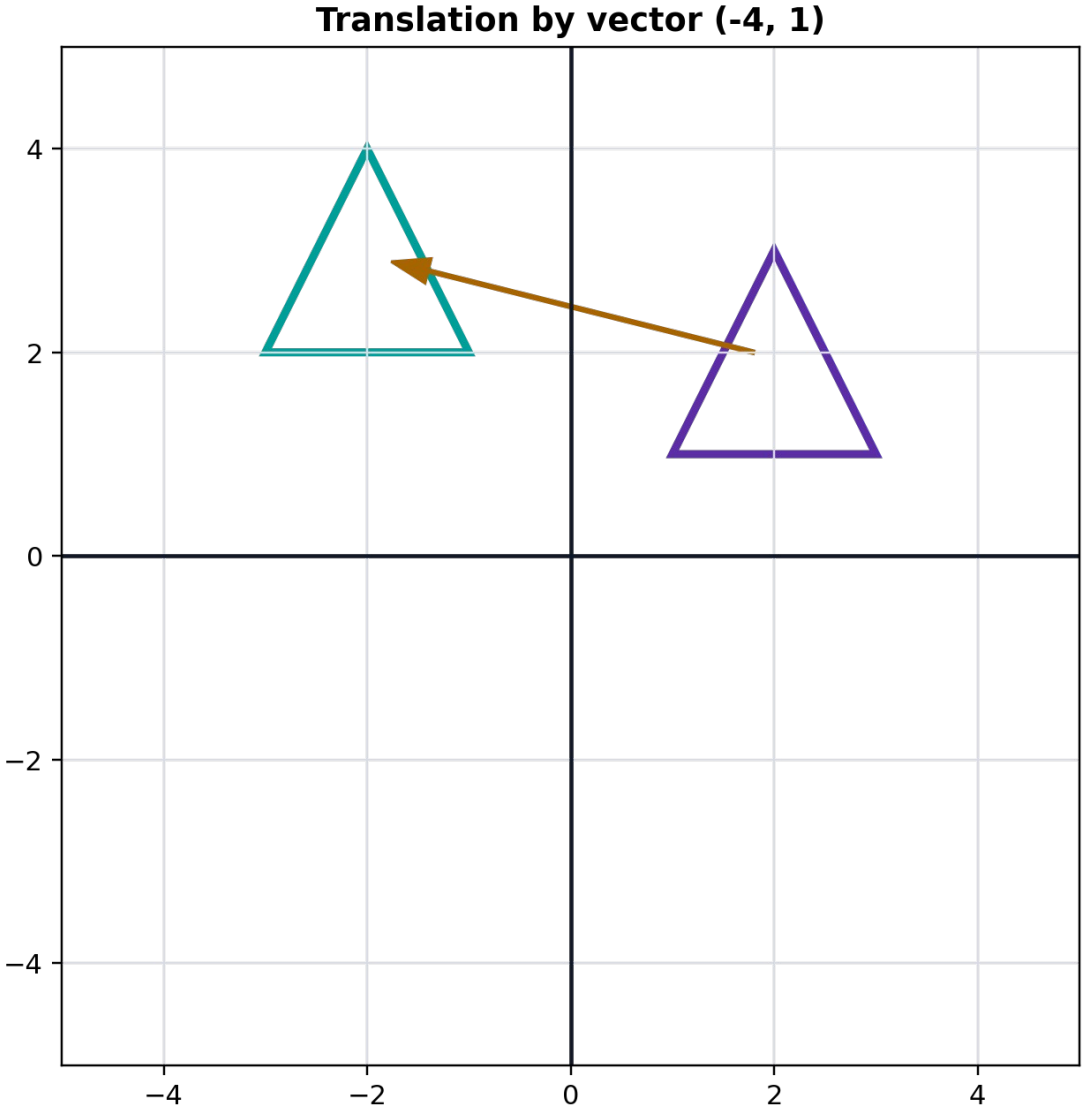
CHAPTER 05 • G7,G24,G25

Transformations and vectors

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 24,G25. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.



Understand the idea

A translation moves every point by the same vector.

A reflection needs a mirror line; a rotation needs centre, angle and direction; an enlargement needs centre and scale factor.

Congruence is preserved by translation, reflection and rotation.

Vector addition combines movements component by component.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Translate (2,-1) by vector (-3,5).

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain (-1,4).

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

(-1,4)

Second model

QUESTION

Reflect (4,2) in y-axis.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain (-4,2).

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

(-4,2)

Guided practice

GUIDED QUESTION 1

Rotate (3,1) 180° about origin.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Enlarge length 6 by factor 1/2.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Translate (2,-1) by vector (-3,5).

2. Reflect (4,2) in y-axis.

3. Rotate (3,1) 180° about origin.

4. Enlarge length 6 by factor 1/2.

5. Add vectors (3,2)+(-1,4).

6. What information fully describes a rotation?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 06 • G9

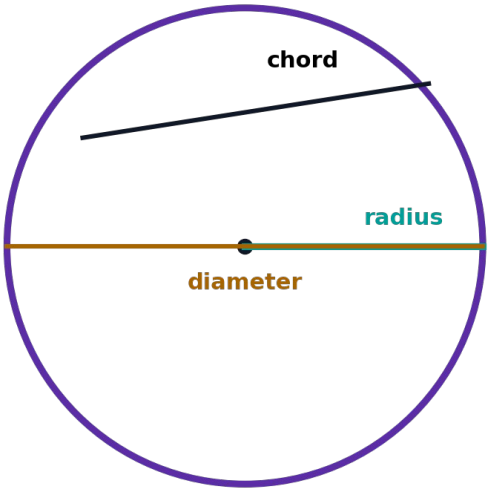
Circle language and properties

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: his lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Circle definitions



Understand the idea

A radius joins centre to circumference; diameter is twice radius; chord joins two circumference points.

A tangent touches at one point and is perpendicular to the radius there.

An arc is part of circumference; a sector is bounded by two radii and an arc; a segment is bounded by chord and arc.

> **REASON FROM THE DIAGRAM**
>
> Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

> **QUESTION**

Radius 7 cm: diameter?

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 14 cm.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

14 cm

Second model

QUESTION

Diameter 18 cm: radius?

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 9 cm.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

9 cm

Guided practice

GUIDED QUESTION 1

Name line touching circle once.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Angle between tangent and radius?

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Radius 7 cm: diameter?

2. Diameter 18 cm: radius?

3. Name line touching circle once.

4. Angle between tangent and radius?

5. Difference sector and segment?

6. Can a diameter be a chord?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

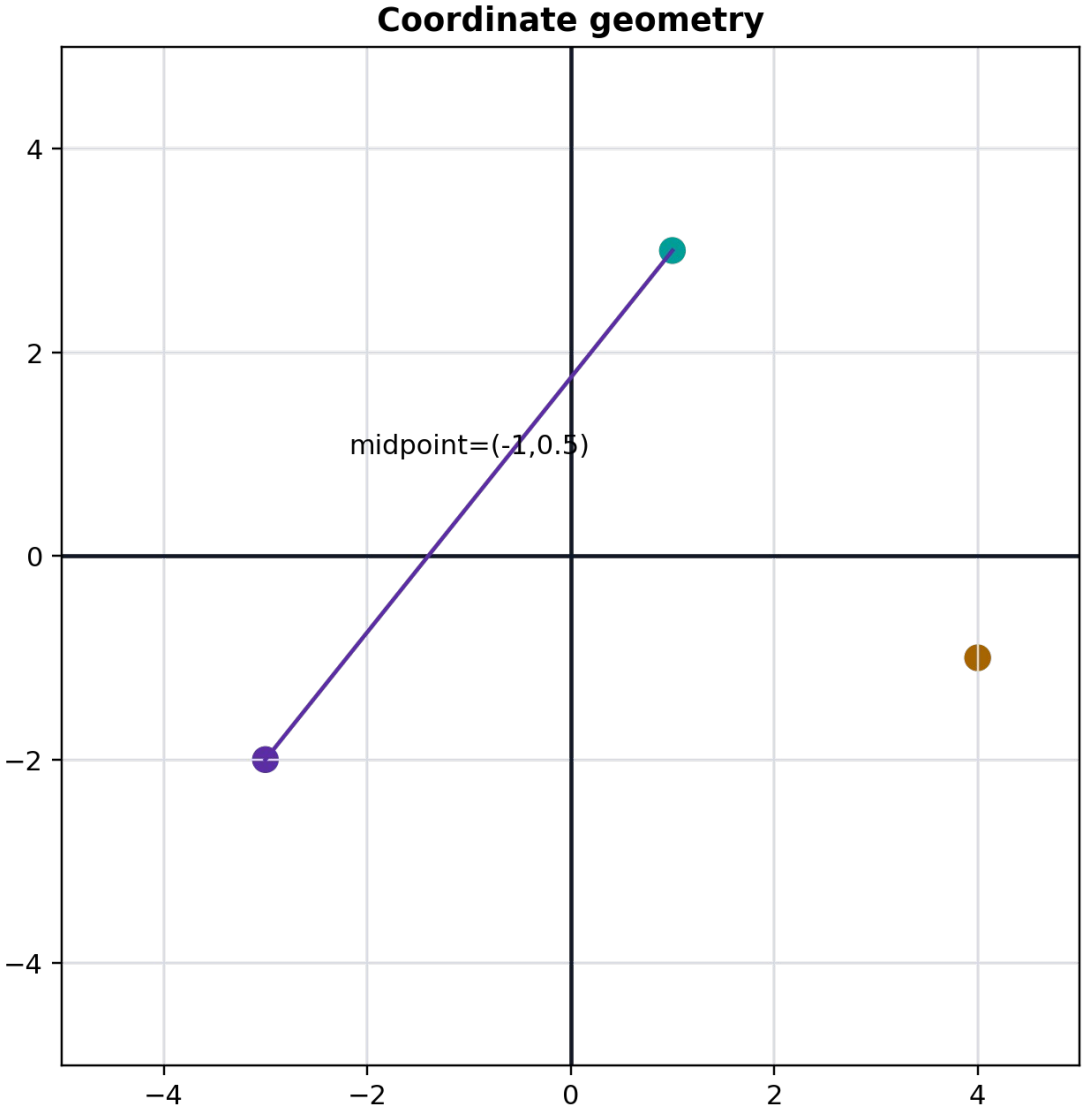
CHAPTER 07 • G11

Coordinate geometry problems

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.



Understand the idea

Coordinates are ordered (x,y).

Horizontal distance changes x; vertical distance changes y.

Midpoint averages corresponding coordinates.

For horizontal or vertical segments, length is the absolute coordinate difference.

Shapes can be completed using parallelism, equal lengths and symmetry.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Midpoint of (2,3),(8,11).

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain (5,7).

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

(5,7)

Second model

QUESTION

Horizontal distance (-4,2) to (7,2).

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 11.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

11

Guided practice

GUIDED QUESTION 1

Vertical distance (3,-5) to (3,4).

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Reflect (-2,6) in x-axis.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Midpoint of (2,3),(8,11).

2. Horizontal distance (-4,2) to (7,2).

3. Vertical distance (3,-5) to (3,4).

4. Reflect (-2,6) in x-axis.

5. Complete rectangle A(1,1),B(6,1),C(6,4). Find D.

6. Why use absolute differences for lengths?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 08 • G12,G13

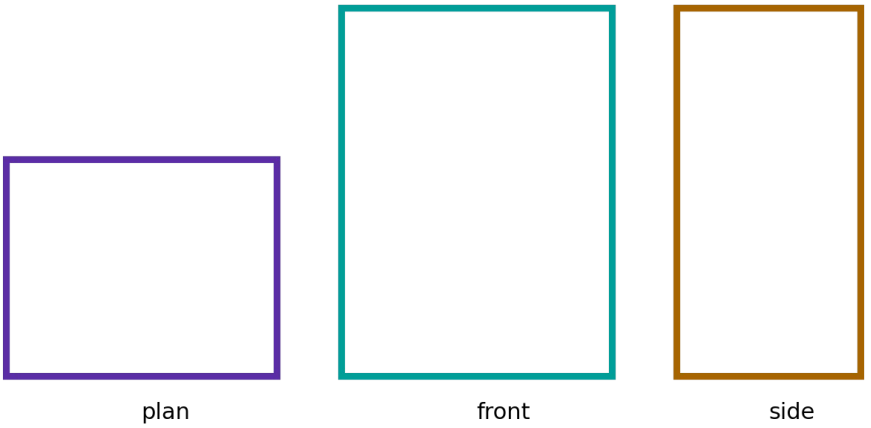
3D solids, nets, plans and elevations

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 13. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Plan, front and side elevation



Understand the idea

Faces are flat surfaces, edges are meeting lines and vertices are corners.

A prism has constant cross-section.

A plan is the view from above; front and side elevations show height and width from named directions.

Hidden depth is not shown unless required by convention.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Faces of cube?

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 6.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

6

Second model

QUESTION

Edges of cuboid?

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 12.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

12

Guided practice

GUIDED QUESTION 1

Vertices of triangular prism?

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Name solid with circular cross-section and two circular faces.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Faces of cube?

2. Edges of cuboid?

3. Vertices of triangular prism?

4. Name solid with circular cross-section and two circular faces.

5. Which view is from above?

6. What must elevations preserve?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 09 • G14,G15

Measurement, scale drawings and bearings

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 15. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Three-figure bearings

Understand the idea

Choose suitable units and measure from the correct zero mark.

Bearings are measured clockwise from north and written with three figures.

Reverse bearings differ by 180°.

Scale drawings require unit consistency and accurate ruler/protractor use.

> **REASON FROM THE DIAGRAM**
>
> Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

> **QUESTION**

Write bearing 45° correctly.

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 045°.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

045°

Second model

QUESTION

Reverse bearing of 070°.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 250°.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

250°

Guided practice

GUIDED QUESTION 1

Reverse bearing of 235°.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

1:200 plan, 6 cm represents?

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Write bearing 45° correctly.

2. Reverse bearing of 070°.

3. Reverse bearing of 235°.

4. 1:200 plan, 6 cm represents?

5. Eight compass point for 135°?

6. Why three digits in bearings?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 10 • G16,G17

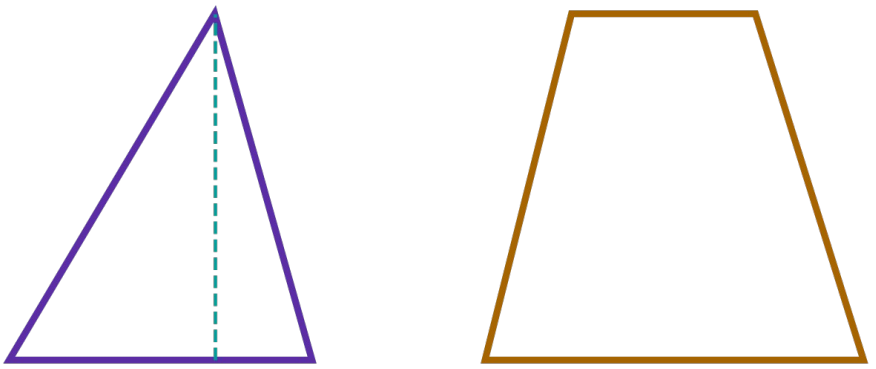
Perimeter and area of plane shapes

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 17. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Area models



triangle: ½bh **trapezium: ½(a+b)h**

Understand the idea

Perimeter is boundary length; area is surface coverage.

Triangle area=1/2 bh, parallelogram area=bh, trapezium area=1/2(a+b)h.

Height must be perpendicular to base.

Composite areas are found by splitting or subtracting without overlap.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Triangle b=12,h=7 area.

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 42 cm².

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

42 cm²

Second model

QUESTION

Parallelogram b=9,h=5 area.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 45 cm².

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

45 cm²

Guided practice

GUIDED QUESTION 1

Trapezium parallel sides 6,14,h=4.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Rectangle 8 by 5 perimeter.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Triangle b=12,h=7 area.

2. Parallelogram b=9,h=5 area.

3. Trapezium parallel sides 6,14,h=4.

4. Rectangle 8 by 5 perimeter.

5. L-shape: large 10×8 minus 4×3 area.

6. Why not use sloping side as height?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 11 • G17,G18

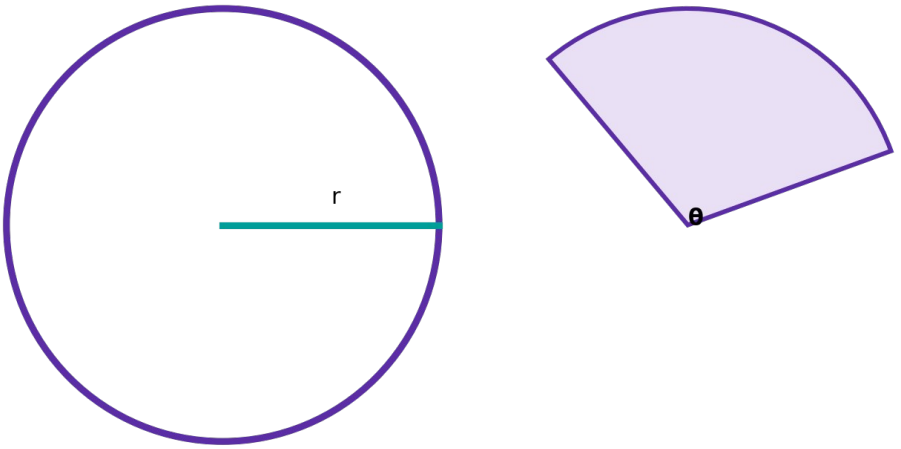
Circles, arcs and sectors

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 18. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Circle circumference, area and sectors



sector fraction = θ/360

Understand the idea

Circumference=$2\pi r=\pi d$ and area=πr^2.

Keep exact answers in terms of π when asked.

A sector is a fraction θ/360 of a full circle, so apply that fraction to circumference for arc length and area for sector area.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Circumference r=5 in terms π.

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 10π.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

10π

Second model

QUESTION

Area d=12 in terms π.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 36π.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

36π

Guided practice

GUIDED QUESTION 1

Arc length r=9, angle 80°.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Sector area r=6, angle 120°.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Circumference r=5 in terms π.

2. Area d=12 in terms π.

3. Arc length r=9, angle 80°.

4. Sector area r=6, angle 120°.

5. Semicircle perimeter r=4.

6. Why include diameter in semicircle perimeter?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 12 • G16,G17

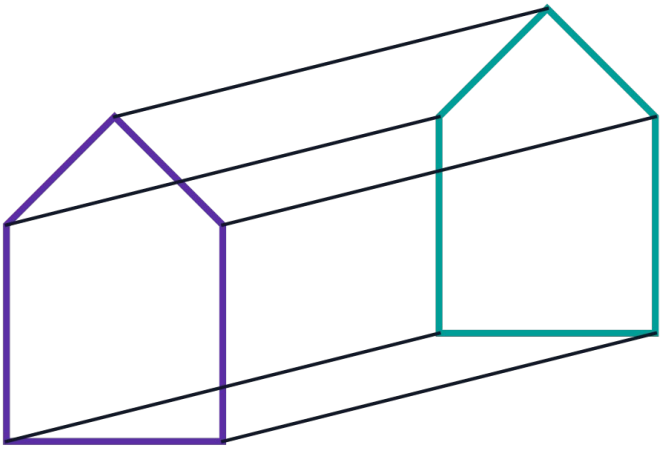
Volume and surface area of prisms

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 17. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Prism volume = cross-sectional area × length



constant cross-section

Understand the idea

Volume of a prism=cross-sectional area×length.

Cuboid volume=lwh and cylinder volume=$\pi r^2 h$.

Surface area totals every external face exactly once.

Use squared units for area and cubed units for volume.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Cuboid 3×4×8 volume.

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 96 cm^3.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

96 cm^3

Second model

QUESTION

Prism cross-section 12 cm^2 length 9.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 108 cm^3.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

108 cm^3

Guided practice

GUIDED QUESTION 1

Cylinder r=3,h=10 volume in π.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Cube side 5 surface area.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Cuboid 3×4×8 volume.

2. Prism cross-section 12 cm^2 length 9.

3. Cylinder r=3,h=10 volume in π.

4. Cube side 5 surface area.

5. Cylinder r=2,h=7 curved area.

6. Why volume units cubed?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 13 • G20

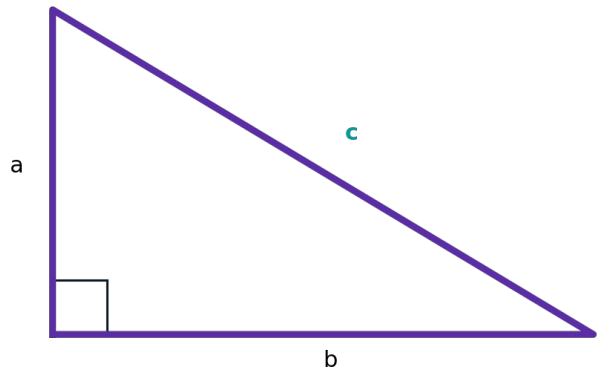
Pythagoras theorem

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Pythagoras: $a^2 + b^2 = c^2$



Understand the idea

In a right triangle, $a^2+b^2=c^2$ where c is the hypotenuse opposite the right angle.

To find hypotenuse add squares then square-root.

To find a shorter side subtract squares.

Pythagoras applies only to right-angled triangles.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Legs 6,8: hypotenuse.

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 10.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

10

Second model

QUESTION

Hypotenuse 13, leg 5: other leg.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 12.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

12

Guided practice

GUIDED QUESTION 1

Rectangle 9×12 diagonal.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Is triangle 7,24,25 right-angled?

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Legs 6,8: hypotenuse.

2. Hypotenuse 13, leg 5: other leg.

3. Rectangle 9×12 diagonal.

4. Is triangle 7,24,25 right-angled?

5. Find distance (1,2) to (4,6).

6. Why identify hypotenuse first?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 14 • G20,G21

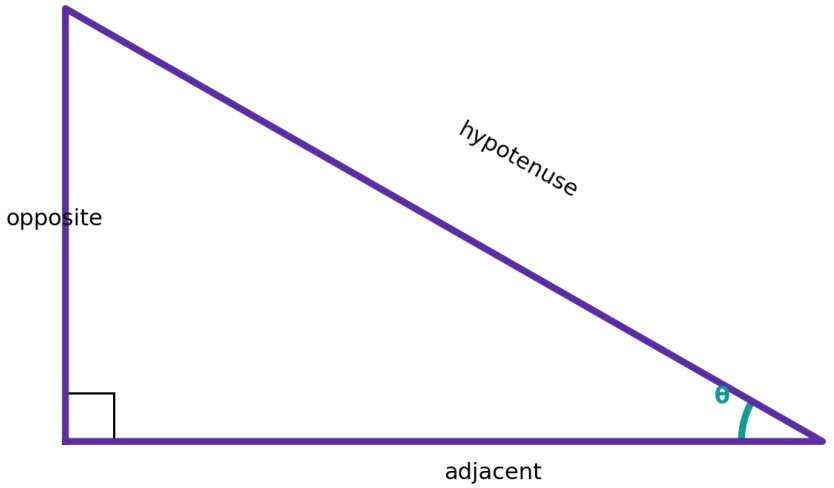
Right-angled trigonometry

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 21. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Right-triangle trigonometry



Understand the idea

SOHCAHTOA links an angle to side ratios: sin=opposite/hypotenuse, cos=adjacent/hypotenuse, tan=opposite/adjacent.

Label sides relative to the chosen angle, select the ratio containing known and required sides, then rearrange.

Inverse trig finds angles.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Opposite 6,hypotenuse 10: sin θ.

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 0.6.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

0.6

Second model

QUESTION

Adjacent 8,hypotenuse 10: cos θ.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 0.8.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

0.8

Guided practice

GUIDED QUESTION 1

Opposite 9,adjacent 12: tan θ.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Find opposite if hypotenuse 14, angle 30°.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Opposite 6,hypotenuse 10: sin θ.

2. Adjacent 8,hypotenuse 10: cos θ.

3. Opposite 9,adjacent 12: tan θ.

4. Find opposite if hypotenuse 14, angle 30°.

5. Find θ if opposite 5, adjacent 8.

6. Why do side labels change with chosen angle?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

CHAPTER 15 • G19,R12

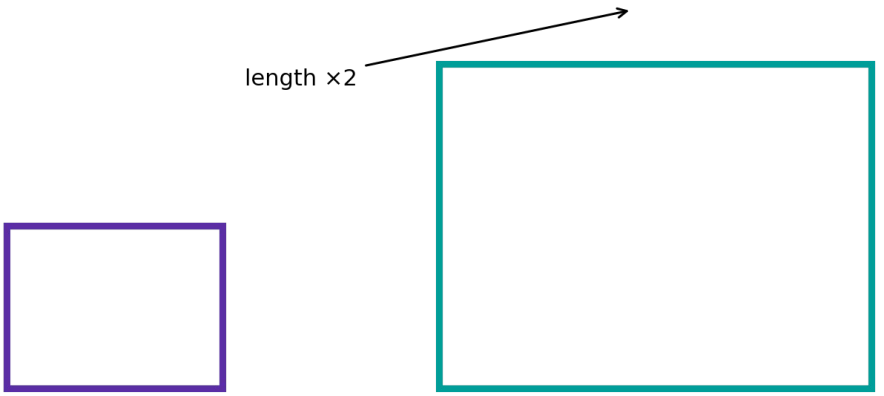
Similarity: length, area and volume factors

What does the method mean, why does it work, and when should it be used?

SPECIFICATION ALIGNMENT

AQA 8300 alignment: 12. This lesson develops accurate notation, diagram interpretation, method selection and geometric reasoning at Foundation tier.

Similarity and scale factors



area ×2² = ×4

Understand the idea

For similar shapes, corresponding lengths share factor k, areas factor k^2 and volumes factor k^3.

Match corresponding sides before calculating.

Reverse area or volume factors using square or cube roots.

REASON FROM THE DIAGRAM

Mark known equal lengths, parallel lines, right angles and corresponding parts before calculating. A diagram records the logic of the solution.

Worked examples

Core method

QUESTION

Length factor 4: area factor.

1 **Identify:** Name the relevant property, theorem or formula.

2 **Substitute:** Use the given values carefully to obtain 16.

3 **Check:** Confirm units, scale and whether the result is geometrically possible.

ANSWER

16

Second model

QUESTION

Length factor 3: volume factor.

1 **Represent:** Add labels and construction marks to the diagram.

2 **Calculate:** Apply the relationship to obtain 27.

3 **Communicate:** State the answer with a reason and correct units.

ANSWER

27

Guided practice

GUIDED QUESTION 1

Area factor 25: length factor.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

GUIDED QUESTION 2

Volume factor 64: length factor.

HINT

Sketch or annotate first. Identify the exact fact or formula before inserting numbers.

Independent practice

1. Length factor 4: area factor.

2. Length factor 3: volume factor.

3. Area factor 25: length factor.

4. Volume factor 64: length factor.

5. Similar sides 8 and 20; smaller area 48. Larger area?

6. Smaller volume 30, length factor 2. Larger volume?

AO2-AO3 REASONING

Explain why the method is valid, identify one common diagram-reading error, and create a related real-world or proof-style problem.

Fully explained answer checks

Lesson 1: Geometrical language, polygons and symmetry

1. isosceles

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 2

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 6

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. decagon

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. All sides equal; opposite angles equal; diagonals bisect at right angles.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. Parallel lines never meet; perpendicular lines meet at 90°.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 2: Ruler-and-compass constructions and loci

1. perpendicular bisector

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. circle centre A radius 3 cm

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. angle bisectors

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. equilateral triangle

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. along a perpendicular

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. They demonstrate equal compass radii and justify the construction.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 3: Angle facts, parallel lines and polygons

1. 43°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 68°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 67°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 720°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. 24°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. They sum to 180°.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 4: Congruence, similarity and geometric reasoning

1. SAS

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. No, only similar

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 12 cm

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 2.5

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. 9

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. It can produce more than one possible triangle.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 5: Transformations and vectors

1. (-1,4)

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. (-4,2)

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. (-3,-1)

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 3

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. (2,6)

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. centre, angle and direction

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 6: Circle language and properties

1. 14 cm

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 9 cm

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. tangent

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 90°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. Sector uses two radii; segment uses a chord.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. Yes, it is the longest chord.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 7: Coordinate geometry problems

1. (5,7)

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 11

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 9

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. (-2,-6)

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. (1,4)

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. Lengths are non-negative distances.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 8: 3D solids, nets, plans and elevations

1. 6

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 12

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 6

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. cylinder

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. plan

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. correct width and height from the stated direction

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 9: Measurement, scale drawings and bearings

1. 045°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 250°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 055°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 12 m

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. south-east

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. To avoid ambiguity and maintain standard notation.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 10: Perimeter and area of plane shapes

1. 42 cm^2

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 45 cm^2

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 40 cm^2

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 26 cm

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. 68 cm^2

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. Height is perpendicular distance required by the formula.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 11: Circles, arcs and sectors

1. 10π

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 36π

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 4π

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 12π

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. $4\pi+8$

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. Perimeter includes the curved arc and straight boundary.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 12: Volume and surface area of prisms

1. 96 cm^3

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 108 cm^3

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 90π cm^3

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 150 cm^2

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. 28π cm^2

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. Three independent length dimensions are multiplied.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 13: Pythagoras theorem

1. 10

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 12

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 15

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. Yes: $7^2+24^2=25^2$

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. 5

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. It is the side squared alone and determines add/subtract setup.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 14: Right-angled trigonometry

1. 0.6

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 0.8

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 0.75

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 7

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. about 32.0°

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. Opposite and adjacent are defined relative to the selected angle.

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Lesson 15: Similarity: length, area and volume factors

1. 16

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

2. 27

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

3. 5

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

4. 4

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

5. 300

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

6. 240

Check the labelled diagram, cite the relevant geometric fact or formula, retain exact values where appropriate, and include units for measured quantities.

Unit 4 mastery record

AQA	I can demonstrate…	Secure?
G1,G4	Geometrical language, polygons and symmetry	☐
G2	Ruler-and-compass constructions and loci	☐
G3	Angle facts, parallel lines and polygons	☐
G5,G6,G19	Congruence, similarity and geometric reasoning	☐
G7,G24,G25	Transformations and vectors	☐
G9	Circle language and properties	☐
G11	Coordinate geometry problems	☐
G12,G13	3D solids, nets, plans and elevations	☐
G14,G15	Measurement, scale drawings and bearings	☐
G16,G17	Perimeter and area of plane shapes	☐
G17,G18	Circles, arcs and sectors	☐
G16,G17	Volume and surface area of prisms	☐
G20	Pythagoras theorem	☐
G20,G21	Right-angled trigonometry	☐
G19,R12	Similarity: length, area and volume factors	☐

Official source

AQA GCSE Mathematics (8300), Subject Content 3.4 Geometry and Measures: https://www.aqa.org.uk/subjects/mathematics/gcse/mathematics-8300/specification/subject-content/3.4-geometry-and-measures

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