4c. Ratio and proportion	**Teaching time**
(N11, N12, N13, R2, R3, R4, R5, R6, R7, R8, R10)	7–9 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Express the division of a quantity into a number parts as a ratio;
- Write ratios in form 1 : m or m : 1 and to describe a situation;
- Write ratios in their simplest form, including three-part ratios;
- Divide a given quantity into two or more parts in a given part : part or part : whole ratio;
- Use a ratio to find one quantity when the other is known;
- Write a ratio as a fraction;
- Write a ratio as a linear function;
- Identify direct proportion from a table of values, by comparing ratios of values;
- Use a ratio to compare a scale model to real-life object;
- Use a ratio to convert between measures and currencies, e.g. £1.00 = €1.36;
- Scale up recipes;
- Convert between currencies.

POSSIBLE SUCCESS CRITERIA/EXAM QUESTIONS

Write/interpret a ratio to describe a situation such as 1 blue for every 2 red …, 3 adults for every 10 children …

Recognise that two paints mixed red to yellow 5 : 4 and 20 : 16 are the same colour.

When a quantity is split in the ratio 3:5, what fraction does each person get?

Find amounts for three people when amount for one given.

Express the statement 'There are twice as many girls as boys' as the ratio 2 : 1 or the linear function $y = 2x$, where x is the number of boys and y is the number of girls.

$x^2 - 9y^2 = 0$ where $x > 0$ and $y > 0$

Work out the ratio $x : y$

(Total 3 marks)

Mock Papers Set 3, Paper 1H qu.17a (R8, A4 – AO1)

Asif is going on holiday to Turkey.
The exchange rate is £1 = 3.5601 lira.
Asif changes £550 to lira.

(*a*) Work out how many lira he should get.
Give your answer to the nearest lira.

(2)

Asif sees a pair of shoes in Turkey.
The shoes cost 210 lira.
Asif does not have a calculator.
He uses £2 = 7 lira to work out the approximate cost of the shoes in pounds.

(*b*) Use £2 = 7 lira to show that the approximate cost of the shoes is £60

(2)

(*c*) Is using £2 = 7 lira instead of using £1 = 3.5601 lira a sensible start to Asif's method to work out the cost of the shoes in pounds?
You must give a reason for your answer.

(1)

(Total 5 marks)
New SAMs Paper 3F qu.19 / 3H qu.2 (R5, R10 – AO1/AO2/AO3)

Anna and Bill share some money in the ratio 2 : 5

Anna gets £A
Bill gets £B

Carl and Donna share twice as much money as Anna and Bill share.
They share the money in the ratio 3 : 1

Carl gets £C
Donna gets £D

Find $A : B : C : D$
Give your answer in its simplest form.

(Total 3 marks)
Mock Papers Set 3, Paper 2H qu.11 (R6, R4 – AO1/AO3)

In a company, the ratio of the number of men to the number of women is 3 : 2

40% of the men are under the age of 25
10% of the women are under the age of 25

What percentage of all the people in the company are under the age of 25?

(Total 4 marks)
New SAMs Paper 1F qu.25 / 1H qu.5 (R8, R9 – AO1/AO3)

OPPORTUNITIES FOR REASONING/PROBLEM SOLVING

Problems involving sharing in a ratio that include percentages rather than specific numbers such can provide links with other areas of Mathematics:

> In a youth club the ratio of the number of boys to the number of girls is 3 : 2 . 30% of the boys are under the age of 14 and 60% of the girls are under the age of 14. What percentage of the youth club is under the age of 14?

NOTES

Three-part ratios are usually difficult for students to understand.

Also include using decimals to find quantities.

Use a variety of measures in ratio and proportion problems.

Include metric to imperial and vice versa, but give them the conversion factor,

e.g. 5 miles = 8 km, 1 inch = 2.4 cm – these aren't specifically in the programme of study but are still useful.

UNIT 7: Perimeter, area and volume, plane shapes and prisms, circles,

SPECIFICATION REFERENCES

N8 calculate exactly with … multiples of π; …
N14 estimate answers; check calculations using approximation and estimation, including answers obtained using technology
N15 round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures); use inequality notation to specify simple error intervals due to truncation or rounding
N16 apply and interpret limits of accuracy, **including upper and lower bounds**
A5 understand and use standard mathematical formulae; rearrange formulae to change the subject
A21 translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution
R1 change freely between related standard units (e.g. time, length, area, volume/capacity, mass) … in numerical and algebraic contexts
G1 use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries; …
G9 identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
G12 identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres
G13 construct and interpret plans and elevations of 3D shapes.
G14 use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc)
G16 know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders)
G17 know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes; surface area and volume of spheres, pyramids, cones and composite solids
G18 calculate arc lengths, angles and areas of sectors of circles

PRIOR KNOWLEDGE

Students should know the names and properties of 3D forms.

The concept of perimeter and area by measuring lengths of sides will be familiar to students.

Students should be able to substitute numbers into an equation and give answers to an appropriate degree of accuracy.

Students should know the various metric units.

KEYWORDS

Tier 2

Area, perimeter, length, width, compound, measurement, edge, face, composite, capacity, accuracy

Tier 3

Triangle, rectangle, parallelogram, trapezium, formula, prism, compound, polygon, cuboid, volume, nets, isometric, symmetry, vertices, circle, segment, arc, sector, cylinder, circumference, radius, diameter, pi, sphere, cone, hemisphere, segment, frustum, bounds, surface area

7a. Perimeter, area and circles (N8, N14, N15, A5, R1, G1, G9, G14, G16, G17, G18)	**Teaching time** 7–9 hours

OBJECTIVES

By the end of the unit, students should be able to:

- Recall and use the formulae for the area of a triangle, rectangle, trapezium and parallelogram using a variety of metric measures;
- Calculate the area of compound shapes made from triangles, rectangles, trapezia and parallelograms using a variety of metric measures;
- Find the perimeter of a rectangle, trapezium and parallelogram using a variety of metric measures;
- Calculate the perimeter of compound shapes made from triangles and rectangles;
- Estimate area and perimeter by rounding measurements to 1 significant figure to check reasonableness of answers.
- Recall the definition of a circle and name and draw parts of a circle;
- Recall and use formulae for the circumference of a circle and the area enclosed by a circle (using circumference = $2\pi r = \pi d$ and area of a circle = πr^2) using a variety of metric measures;
- Use $\pi \approx 3.142$ or use the π button on a calculator;
- Calculate perimeters and areas of composite shapes made from circles and parts of circles (including semicircles, quarter-circles, combinations of these and also incorporating other polygons);
- Calculate arc lengths, angles and areas of sectors of circles;
- Find radius or diameter, given area or circumference of circles in a variety of metric measures;
- Give answers to an appropriate degree of accuracy or in terms of π;
- Form equations involving more complex shapes and solve these equations.

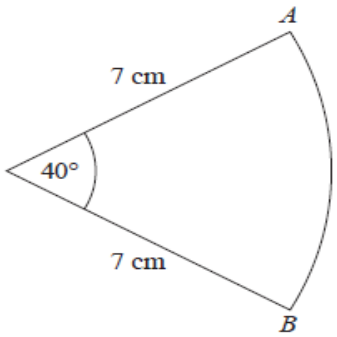
POSSIBLE SUCCESS CRITERIA/EXAM QUESTIONS

Calculate the area and/or perimeter of shapes with different units of measurement.

Understand that answers in terms of π are more accurate.

Calculate the perimeters and/or areas of circles, semicircles and quarter-circles given the radius or diameter and vice versa.

The diagram shows a sector of a circle of radius 7 cm.



Work out the length of arc AB.
Give your answer correct to 3 significant figures.

(Total 2 marks)

New SAMs Paper 2H qu.17 (G18 – AO1)

OPPORTUNITIES FOR REASONING/PROBLEM SOLVING

Using compound shapes or combinations of polygons that require students to subsequently interpret their result in a real-life context.

Know the impact of estimating their answers and whether it is an overestimate or underestimate in relation to a given context.

Multi-step problems, including the requirement to form and solve equations, provide links with other areas of mathematics.

COMMON MISCONCEPTIONS

Students often get the concepts of area and perimeter confused.

Shapes involving missing lengths of sides often result in incorrect answers.

Diameter and radius are often confused, and recollection of area and circumference of circles involves incorrect radius or diameter.

NOTES

Encourage students to draw a sketch where one isn't provided.

Emphasise the functional elements with carpets, tiles for walls, boxes in a larger box, etc. Best value and minimum cost can be incorporated too.

Ensure that examples use different metric units of length, including decimals.

Emphasise the need to learn the circle formulae; "Cherry Pie's Delicious" and "Apple Pies are too" are good ways to remember them. Ensure that students know it is more accurate to leave answers in terms of π, but only when asked to do so.