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| **UNIT 7: Perimeter, area and volume, plane shapes and prisms, circles, cylinders, spheres, cones; Accuracy and bounds** |

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**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*πr* = *πd*, 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**

Triangle, rectangle, parallelogram, trapezium, area, perimeter, formula, length, width, prism, compound, measurement, polygon, cuboid, volume, nets, isometric, symmetry, vertices, edge, face, circle, segment, arc, sector, cylinder, circumference, radius, diameter, pi, composite, sphere, cone, capacity, hemisphere, segment, frustum, bounds, accuracy, surface area

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| **7a. Perimeter, area and circles**  (N8, N14, N15, A5, R1, G1, G9, G14, G16, G17, G18) | **Teaching time**  4-6 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*πr* = *πd* and area of a circle = *πr*2) using a variety of metric measures;
* Use *π* ≈ 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**

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.

**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.