Ordered strictly alphabetically

2D

11. parts of circles: centre, circumference, diameter, radius: write down the name

10. mixed polygons: 5, 6, 8 or 10 sides: write down the name

7. equilateral, isosceles, right, scalene: recognise or count or write down the name FYI once

5. pentagon or hexagon: recognise or count or write down the name LESLEY needs to edit to just hexagon

4. square or rectangle: recognise or count or write down the name {NOT that square is special type of rectangle}

3. triangle: recognise or count or write down the name FYI once layer 2 mastered start topic circle

2. circle: recognise or count or write down the name

1. **scaffold to** write down the mathematical name of a polygon **scaffold is** reminder to count sides and look up table of number of sides and polygon names

3D

12. plan, side and front elevations: recognise solid from or draw or complete {for solids other than a cuboid}

10. count the number of edges, faces, vertices and name e.g. the edge AB or the face ABCD

9. 3D net: name solid

8. 3D solid: write down the mathematical name

7. **scaffold to** work out the surface area of cuboid **scaffold is** given net

6. **scaffold to** name prism or pyramid **scaffold is** given one prism and one pyramid with similar base from similar view point

4. cone or cylinder: recognise or count or write down the name

3. cuboid or sphere: recognise or count or write down the name

2. cube: recognise or count or write down the name

1. use words: solid, flat, 2D and 3D to describe shapes or solids

angle

12. find a missing angle in isosceles or equilateral triangle

10. find exterior angle/number of sides of regular polygon

9. **scaffold to** calculate exterior and interior angle of regular polygon **scaffold is** given proportional triangle $360/n = e$) and 360 written as a product of prime factors

8. use conventional angle naming e.g. ABC to solve missing angle problems {use skills from layers 4 to 7}

7. use angles in quadrilateral $= 360°$: to calculate a missing angle {and give reason}

6. use angles in triangle $= 180°$: to calculate a missing angle {and give reason} FYI Once layer 5 mastered learner should begin angleParallel

5. use straight line $= 180°$: to calculate a missing angle {and give reason}

4. use whole turn $= 360°$: to calculate a missing angle {and give reason}

3. name these types of angle: acute, obtuse, reflex

2. **scaffold to** name these types of angle: acute, right, obtuse, reflex **scaffold is** given list: acute, right, obtuse, reflex and a well placed $+$ sign FYI once layer 1 mastered learners should begin angleCircle

1. **scaffold to** draw right angle symbol and know right angle $= 90$ degrees **scaffold is** a well placed $+$ sign

angleCircle

5. find missing angle in circle and state reason: 4 {1 step} problems: centre/circumference (acute), tangent, same segment, semi-circle

4. **scaffold to** find angles in same segment and angles in a semi-circle rules **scaffold is** given angle at centre/circumference rule and hints

3. **scaffold to** find angle at centre/circumference (acute) **scaffold is** given angle at centre/circumference rule and hints

1. **scaffold to** name lines which miss/touch/intersect circle recognise **scaffold is** recognise **not** cold recall the vocabulary: centre, chord, diameter, tangent

angleParallel

8. find a missing angle in parallelogram or trapezium

4. **scaffold to** find angle between parallel line and state reason **scaffold is** parallel lines always horizontal and choice: alternate or corresponding or vertically opposite angles are equal

2. **scaffold to** find corresponding angle between parallel lines **scaffold is** parallel lines always horizontal $+$ hint: corresponding - visualise translate of a parallel line

1. **scaffold to** find vertically opposite angle **scaffold is** compact of angles on a straight line twice

area

12. work out the area of right triangle {can't count 1/2 squares}

10. work out the area of parallelogram

8. work out the area of rectangle {width and height labelled, no square grid, so not possible to count squares}

7. work out the area of rectangle {partially obscured rectangle so hard to be accurate without using multiply}

6. work out the area of irregular shape or triangle {by counting squares and half squares}

5. **scaffold to** work out the area of rectangle **scaffold is** given multiplication table

4. **scaffold to** work out the area of rectangle **scaffold is** example which leads from systematically counting squares to using a multiplication table

3. work out the area of irregular shape {by counting squares}

2. **scaffold to** work out the area of rectangle **scaffold is** easy to count squares

1. **scaffold to** state area shape {whole number of cm^2} **scaffold is** given example

changeUnits

15. convert mm to cm or mm to m or cm to m

14. convert grams to kg, or m to km or millilitres to litres

13. convert kg to grams or km to m or litres to ml

8. convert m to cm

6. **scaffold to** recall metric conversion constants **scaffold is** blank proportional triangle, conversion stick and function diagram

4. convert cm to mm

3. **scaffold to** convert e.g. 7.2 cm to mm {not whole number of cm} **scaffold is** proportional triangle, conversion stick and function diagram {encourage learners to use the scaffold they prefer}

2. **scaffold to** convert e.g. 7 cm to mm {only whole number of cm} **scaffold is** proportional triangle, conversion stick and function diagram {encourage learners to use the scaffold they prefer}

1. **scaffold to** convert cm to mm **scaffold is** correctly aligned measuring stick marked in cm on one edge, the other edge has 0 and 10 mm labelled

coordinate

10. write down the midpoint between 2 coordinates {only first quadrant}

9. plot and write down coordinate {only on x or y axis}

8. write down coordinate {any except on x or y axis}

7. plot coordinate {any except on x or y axis}

6. **scaffold to** (i) write down and (ii) plot coordinate in 3rd quadrant **scaffold is** given 2 choices for (i)

5. plot and write down coordinate {only 2nd or 4th quadrants, i.e. only one negative}

4. write down coordinate e.g. (3, 1) {only first quadrant}

3. plot coordinate at e.g. (3, 1) {only first quadrant}

2. **scaffold to** write down coordinate e.g. (3, 1) {only first quadrant} **scaffold is** (,) labelled with x and y

1. **scaffold to** plot coordinate at e.g. (3, 1) {only first quadrant} **scaffold is** coordinate labelled with x and y

enlarge

6. describe transformation {always enlargement, scale factor is small positive integer}

5. enlarge shape {has sloping sides}

4. enlarge shape {with only vertical and horizontal lines}

3. **scaffold to** enlarge shape **scaffold is** formula **edge × scale factor = EDGE** and one vertex for enlarged shape drawn {for non rectangles hints on measuring or drawing sloping side}

2. **scaffold to** enlarge shape {only rectangle} **scaffold is** example calculation and one side of enlarged shape drawn

1. **scaffold to** enlarge shape {only rectangle} **scaffold is** enlarged edges calculated and 2 enlarged sides drawn

perimeter

8. write down perimeter of square {given length of one side}

7. write down perimeter of rectangle {width and/or height a decimal - no square grid, so not possible to count}

6. write down perimeter of odd shape {on cm grid}

4. write down perimeter of rectangle {width and height labelled - no square grid, so not possible to count}

2. write down perimeter of rectangle {on cm grid}

1. **scaffold to** write down perimeter of rectangle **scaffold is** line segments counted out on half the perimeter of the rectangle

reflect

12. reflect a shape in line y = x or y = - x

11. reflect a shape in e.g. the line x = 3 or y = -2 or x = 0 or y = 0

10. complete a pattern by shading triangles or squares for the requested number of lines of symmetry {easier as no choice of lines of symmetry}

9. draw on all lines of symmetry or state number of lines of symmetry or choose the shapes with a given number of lines of symmetry {including rectangle and parallelogram}

8. **scaffold to** draw only correct lines of symmetry on parallelogram or rectangle **scaffold is** to reflect/think about reflecting 2 sides of a parallelogram or rectangle in line which is **not** a line of symmetry

7. reflect shape in x or y axis

6. reflect shape {mirror line is diagonal}

5. draw on **all** lines of symmetry {polygons but not hard ones e.g. parallelogram or rectangle}

4. reflect shape {mirror line is horizontal or vertical but NOT on an edge of the shape}

3. **scaffold to** draw a line of symmetry on each shape {there may be more than one} **scaffold is** reminder that some shapes do not have a line of symmetry

2. reflect shape {mirror line is horizontal or vertical and along one edge of shape}

1. **scaffold to** reflect shape {mirror line is horizontal or vertical and along one edge of shape} **scaffold is** instructions on how to use tracing paper

rotate

8. rotate a shape 90/180/270 anti/clockwise about a coordinate {which is **not** on the vertex of the shape - on edge or away from shape}

6. rotate a shape 90/180/270 anti/clockwise about a coordinate {which is on the vertex of the shape}

5. write order of rotational symmetry e.g. regular /irregular polygon

4. **scaffold to** write down order of rotational symmetry of a shape **scaffold is** worked example

3. rotate a shape 90 anti/clockwise about a symbol

2. complete a shape/shading on a shape with given rotational order of symmetry

1. **scaffold to** complete a shape/shading on a shape with given rotational order of symmetry **scaffold is** instructions to use tracing paper

scaleInterpret

14. measure bearing and interpret length given scale {1 cm represents 1 km or 1m or 100 km or 10 km or 100m or 10m}

13. measure angle {only from horizontal}

12. **scaffold to** measure angle {only from horizontal} **scaffold is** correctly aligned angle measurer given

11. measure bearing

9. **scaffold to** measure bearing {includes 0 to 99} **scaffold is** correctly aligned angle measurer and instructions

8. **scaffold to** measure bearing {only 100 to 359} **scaffold is** correctly aligned angle measurer and instructions

6. measure length in cm {line not horizontal and/or part of a shape}

5. measure length in cm {horizontal line}

4. **scaffold to** use ruler correctly **scaffold is** to explain why Name is incorrect

3. **scaffold to** measure length in cm and mm **scaffold is** pictures of 2 correctly aligned rulers one marked in cm and one marked in mm

2. **scaffold to** measure length of line, {whole number of cm} **scaffold is** ruler placed correctly

1. **scaffold to** measure length of line {whole number of cm} **scaffold is** ruler placed correctly NO mm on ruler

shapeProblemNC

8. draw a rectangle of a given area {paper not large enough for 1 × width or sometimes 2 × width}

4. find missing coordinate vertex {use properties of e.g. rhombus}

3. find area of shape given area clue in pattern {requires multiply or divide}

2. find radius/diameter given pattern of touching circles and radius/diameter clue

1. find missing length in a composite rectangle {requires subtraction only}

translateANDvector

12. write down the vector e.g. $3\mathbf{a} + 2\mathbf{b}$ {but not e.g $3\mathbf{a}$ - $2\mathbf{b}$} as a column vector given column vectors $\mathbf{a}$ and $\mathbf{b}$

11. write down the vector $\mathbf{a} + \mathbf{b}$ as a column vector given column vectors $\mathbf{a}$ and $\mathbf{b}$

10. write down a vector {shown in diagram} in terms of vectors $\mathbf{a}$ or $\mathbf{b}$ {shown in diagram} e.g. $2\mathbf{a}$ or $3\mathbf{b}$ {but not e.g -$2\mathbf{a}$}

9. write down the column vector e.g. $2\mathbf{a}$ or $3\mathbf{b}$ given $\mathbf{a}$ and $\mathbf{b}$ as column vectors

8. translate a shape by a column vector

7. write a column vector given a diagram

5. **scaffold to** translate a shape by a column vector **scaffold is** no negatives in column vector

3. translate a shape{in horizontal and vertical direction} description given in words

2. translate a shape{in horizontal or vertical direction} description given in words Not loaded yet **scaffold to** describe translation {whole number of cm in horizontal direction} **scaffold is** e.g. translate ... to the left

volume

9. find the volume of cuboid {$w \times d \times h$, individual cubes NOT shown}

8. find the volume of odd shape prism {cross section may be counted}

7. **scaffold to** find the volume of odd shape prism {cross section may be counted} **scaffold is** 1 dimension of prism $= 1$ cm

6. find the volume of cuboid {$1 \times m \times n$, individual cubes shown, either width or depth $= 1$} FYI: for some learners this is a trivial extension of layer 3, other learners need to develop their ability to see in 3D

5. find the volume of cuboid {$w \times d \times h$, individual cubes shown}

4. **scaffold to** find the volume of cuboid {$w \times d \times h$} **scaffold is** alternate layers shaded and asked to complete number of cubes on top layer $= \ldots$ and number of layers $= \ldots$

3. find volume of cuboid: {$w \times d \times 1$}

2. find volume of cuboid: {$1 \times 1 \times n$}

1. **scaffold to** find volume of cuboid: {$1 \times 1 \times n$} **scaffold is** example given with alternate cubes shaded