

Goals



This fortnight we are going to:

- Recognise the properties of common two-dimensional geometric shapes and three-dimensional solids (EMA15)
- Interpret different forms of two-dimensional representations of three-dimensional objects, including nets and perspective diagrams (EMA16)
- Use symbols and conventions for the representation of geometric information; for example, point, line, ray, angle, diagonal, edge, curve, face, and vertex (EMA17)

Theoretical Components

Resources:

PDF file: Week 6 and 7 Notes and Exercises

Knowledge Checklist:

- 2D and 3D shapes and properties
- Faces, edges, vertices
- Angles
- Points, line, segments, and rays

Order:

1. Work through the Week 6 and 7 notes and exercises
2. Complete the Portfolio task
3. Complete the reflection at the end of the booklet
4. Show your teacher your completed booklet
5. Make sure Weeks 1-5 are up to date as your test in Week 8 is coming up.

Practical Components

Work through the exercises and show the complete tasks to your teacher.

You will need a ruler, a pair of compasses to complete some of the questions.

Be sure to ask for help as you need for the successful completion of all tasks.

Portfolio Task

See the last page of the booklet

Other

Have you organised your folders yet? Don't forget you are allowed to take your classwork to the test as reference.

ESSENTIAL MATHEMATICS 3

WEEK 6 AND 7 – ANGLES, 2D SHAPES AND 3D SOLIDS

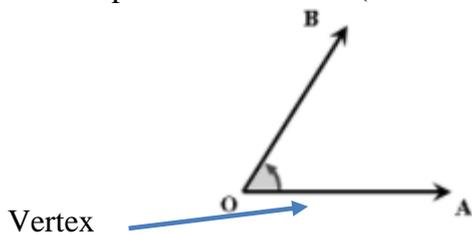
Angles

These are the definitions of the five different types of angles:

- Acute an angle less than 90°
- Right angle an angle exactly equal to 90°
- Obtuse an angle more than 90° but less than 180°
- Straight angle an angle exactly equal to 180°
- Reflex an angle more than 180° but less than 360°

An angle is formed by two rays with a common endpoint.

The endpoint is the **vertex** (or corner) of the angle and the symbol for angle is \angle



An angle can be named in different ways:

- by a number or letter written inside the angle $\angle 1$
- by the name of the vertex $\angle O$
- by the vertex and a point on each ray $\angle BOA$ or $\angle AOB$

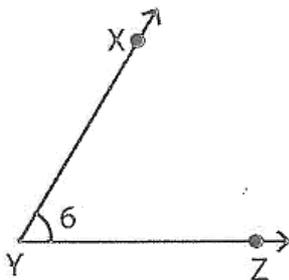
So, the four ways to name this angle are: $\angle 1$, $\angle O$, $\angle BOA$ or $\angle AOB$

An angle is measured in degrees and the symbol for degrees is $^\circ$.

Exercise 1

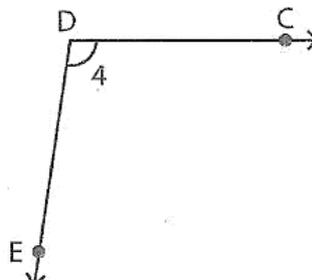
1. Write the missing representation of each angle.

a.



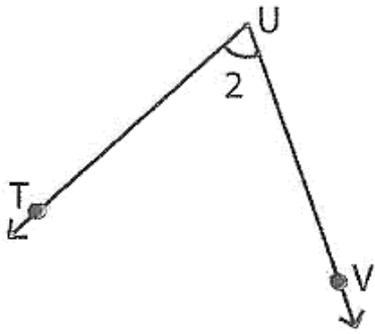
_____ $\cong \angle ZYX \cong \angle Y \cong \angle 6$

b.



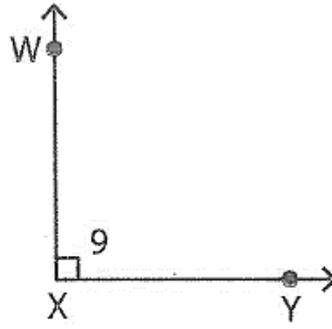
$\angle CDE \cong$ _____ $\cong \angle 4 \cong \angle EDC$

c.



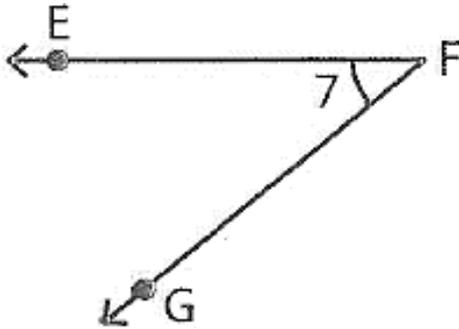
$\angle 2 \cong \angle TUV \cong \underline{\hspace{2cm}} \cong \angle U$

d.



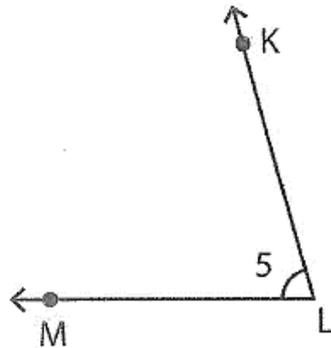
$\angle X \cong \angle WXY \cong \angle YXW \cong \underline{\hspace{2cm}}$

e.



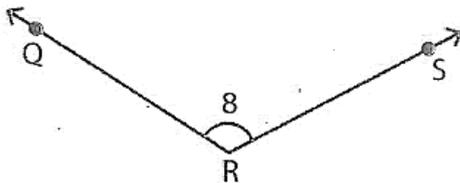
$\angle EFG \cong \underline{\hspace{2cm}} \cong \angle 7 \cong \angle F$

f.



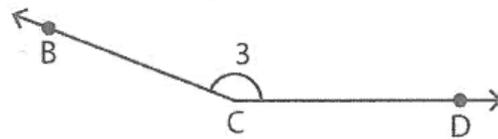
$\underline{\hspace{2cm}} \cong \angle KLM \cong \angle MLK \cong \angle 5$

g.



$\angle 8 \cong \angle SRQ \cong \underline{\hspace{2cm}} \cong \angle QRS$

h.



$\angle DCB \cong \angle C \cong \angle 3 \cong \underline{\hspace{2cm}}$

2. Draw and label an angle using the given information.

a. an obtuse angle, $\angle ABC$

b. a right angle, $\angle XYZ$

c. an acute angle, $\angle 1$

d. an obtuse angle, $\angle PQR$

e. a right angle, $\angle LMN$

f. an acute angle, $\angle U$

g. an acute angle, $\angle EFG$

h. an obtuse angle, $\angle 6$

Points, lines, segments, and rays

These are some definitions:

Name	Drawing	Description
Point		A point is an exact position on a plane surface.
Line		A line is a set of points in a straight path that extends in opposite directions without ending.
Segment		A line segment is a part of a line between two end points.
Ray		A ray is a part of a line that has one end point and extends in one direction without ending.

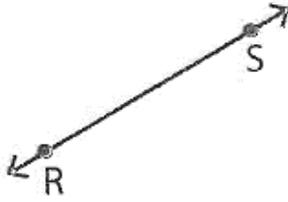
A line, segment and ray are named like the following:

<p>A line</p>  <p>\overleftrightarrow{AB} or \overleftrightarrow{BA}</p>	<p>A ray</p>  <p>\overrightarrow{PQ}</p>	<p>A line segment</p>  <p>\overline{XY} or \overline{YX}</p>
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Exercise 2

1. Name each line, ray, or line segment.

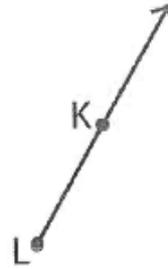
a.



b.



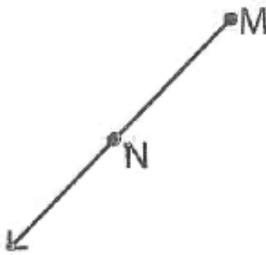
c.



d.



e.



f.



2. Draw and label each of the following:

a. \overline{BC}

b. \overleftrightarrow{YZ}

c. \overrightarrow{QR}

Two-dimensional shapes

Shapes surround us every day. The most common shapes are triangles and quadrilaterals (four sided shapes). Triangles and quadrilaterals are examples of two-dimensional shapes.

Exercise 3

Use the word list to complete the following paragraphs. Each word is used at least once. **You can use words more than once.**

1. The three sides on the surface of this pyramid are equal.



Word List

angle	equilateral	scalene	angles
sides	two	90°	acute

We name triangles according to the lengths of their _____.

A triangle with three sides the same length is called an _____ triangle. This triangle also has three equal _____. Each _____ is equal to 60°.

An isosceles triangle has _____ sides and _____ angles equal.

A _____ triangle has no sides the same length.

A triangle with three angles less than 90° is called an _____-angled triangle. A right-angled triangle has one angle of _____.

2. The rectangle and square.



Word List

diagonals	equal	rhombus
90°		parallelogram

A rectangle has all the features of a _____. However, in a rectangle all the angles are _____ and the diagonals are also _____ lengths.

A square has all the features of a _____. In addition, the sides are all _____. The angles are all _____. The _____ are the same length.

3. More polygons.



Word List

decagon	hexagon	number	octagon
pentagon	quadrilaterals	regular	regular

A polygon is a shape with straight sides. We use the _____ of sides to name each polygon.

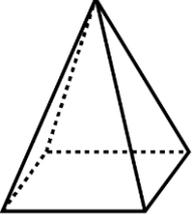
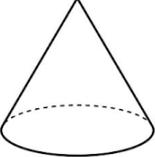
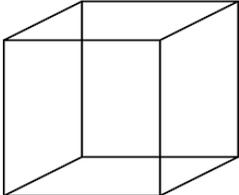
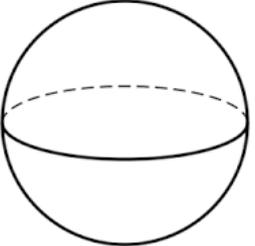
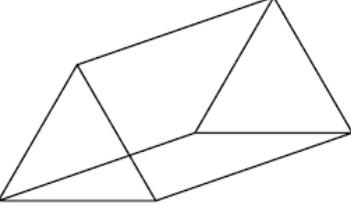
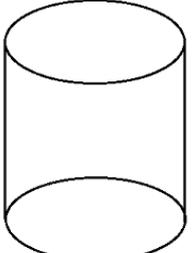
We just need to look at triangles and _____.

When all the sides of a polygon are equal, it is called a _____ polygon. The equilateral triangle and squares are _____ polygons.

The following names are applied to polygons with more than 4 sides. Complete the table next page.

Name	Sketch	Number of sides
		5
		6
Heptagon		7
		8
Nonagon		9
		10
Undecagon		11
Dodecagon		12

4. Complete the table:

Shapes	Number of faces	Number of edges	Number of vertices
 <p>Rectangular pyramid</p>			
 <p>Cone</p>			
 <p>Cube</p>			
 <p>Sphere</p>			
 <p>Triangular prism</p>			
 <p>Cylinder</p>			

Constructing regular polygons

We can construct some regular polygons using a compass, ruler, and pencil.

Exercise 4

1. The easiest regular polygon to construct is a hexagon.

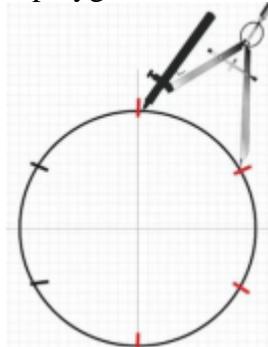


Figure 1

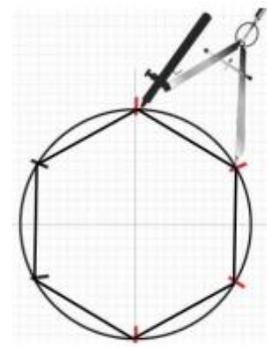


Figure 2

To construct a hexagon, use a compass to draw a circle.

Now, (keeping the compass at the same exact setting), place the compass point on the circumference and strike an arc on the circumference.

Next, place the compass *point* in the *arc* just drawn and strike another arc. Do this until you have drawn six arcs. (Same as figure 1).

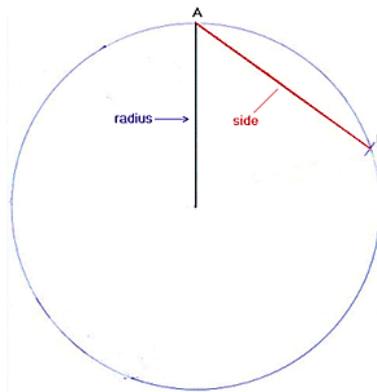
Now, get a ruler, and draw lines from one arc to the next.

The 6 lines you just drew are the *sides* of the regular hexagon. (Same as figure 2). A hexagon is the *only* case in which a polygon's sides will exactly equal the radius.

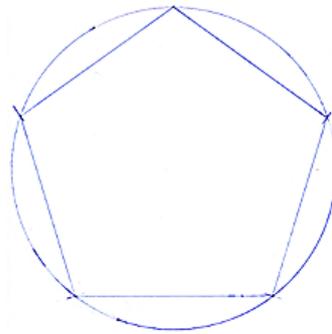
Following the instructions, construct a regular hexagon.

2. Constructing a pentagon.

Start by drawing a circle. For this exercise, use a radius of 4cm.



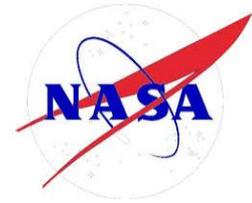
For a regular polygon with radius 4 cm, the length of each side can be calculated to be 4.7 cm. Now, as precisely as you can, set the compass width to be 4.7 cm. Place the compass point at point A and strike an arc at point B, then continuing from B strike another 4 arcs.



Following the instructions, construct a regular pentagon.

Geometric designs

Geometric designs are all around us. They are used in creating logos for businesses and organisations.



Example 1

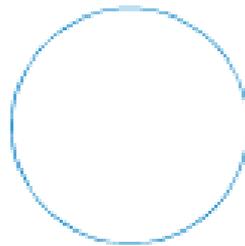
Ella works for a design company. When she produces a design for a logo, she does a sketch first. At other times, Ella writes down a description of the design and other people are responsible for drawing it. This can be done by hand or using a computer design program.

Ella's design for a logo is described as follows:

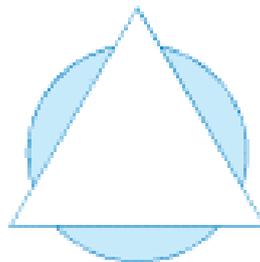
- The logo is a circle overlaid by an equilateral triangle.
- The vertices are outside the circle and the segments between the triangle and circle are shaded.

Solution

Draw a circle first.



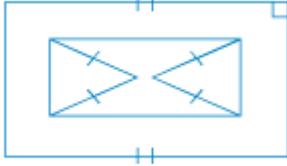
Add the equilateral triangle – a triangle where all sides are equal in length – and shade.



Exercise 4

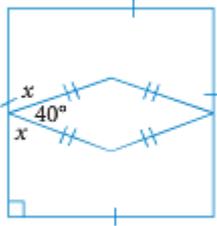
1. Copy these designs accurately. You can do this with a ruler and protractor.

- a. In the large rectangle, the length is twice the width and in the small rectangle, the width is half the width of the large rectangle.

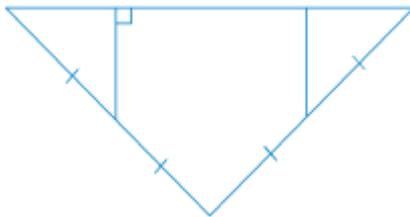


This is not to scale.

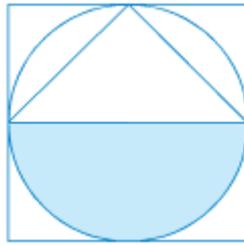
b.



c.



2. Use the word list to complete the description of the logo.



Word List

circle	circumference	diameter	four
isosceles	semicircle	square	vertex

The perimeter of the logo is a square. Inside the _____, there is a large circle whose _____ touches each of the _____ sides of the square.

The lower _____ is coloured grey. There is an _____ triangle in the top semicircle.

The vertices of the triangle are on either ends of the _____ and the third _____ is on the circumference of the _____.

3. Read the following descriptions of some logos and then draw each logo.

a. The vertices of an equilateral triangle are on the circumference of a circle. The segments between the triangle and the circle are shaded.

b. The four vertices of a square are on the circumference of a circle. Both diagonals of the square have been drawn. Two of the four congruent (identical) triangles have been shaded.

- c. A regular hexagon has two equilateral triangles inside it. One vertex of each triangles is at the centre of the hexagon and the triangles are opposite each other. One triangle has the letter R in it and the other has the letter M in it.

- d. A rectangle contains the letters B and B, back to back

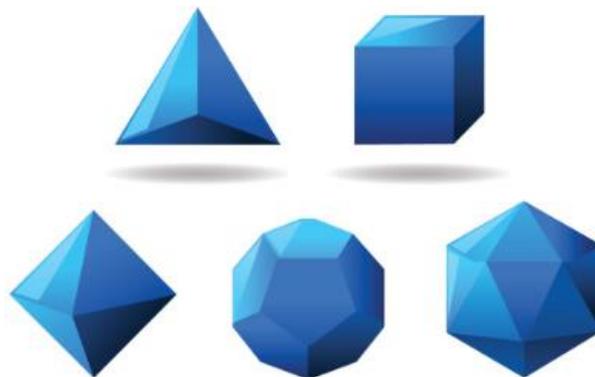
Three-dimensional solids

We live in a 3D world. Everywhere around us, we see 3D solids – books, buildings, boxes, etc.

Exercise 5

Use the word list to complete the following paragraphs. Each word is used at least once. You can use words more than once.

1. Polyhedrons



Word List

edge	flat	hexahedron	pentahedron
prism	pyramid	rectangular	vertex

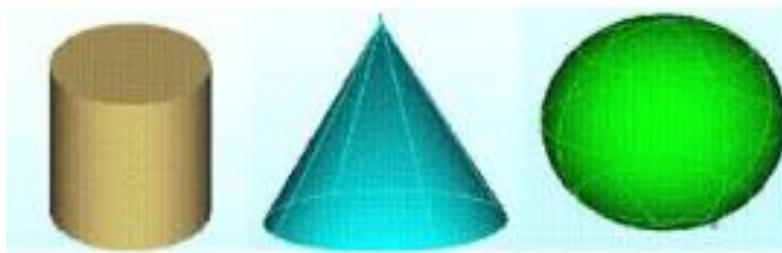
Solids can have flat faces or curved faces. Solids that only have _____ faces are called polyhedrons.

Some of the common polyhedrons are the _____ prism, the triangular _____ and the square _____ . Polyhedrons have similar names to polygons.

We call a solid with five faces a _____. A solid with six faces is called a _____.

When the faces of a polyhedron meet, they form an _____. When three or more edges meet, they form a _____.

2. Solids with curved surfaces



Word List

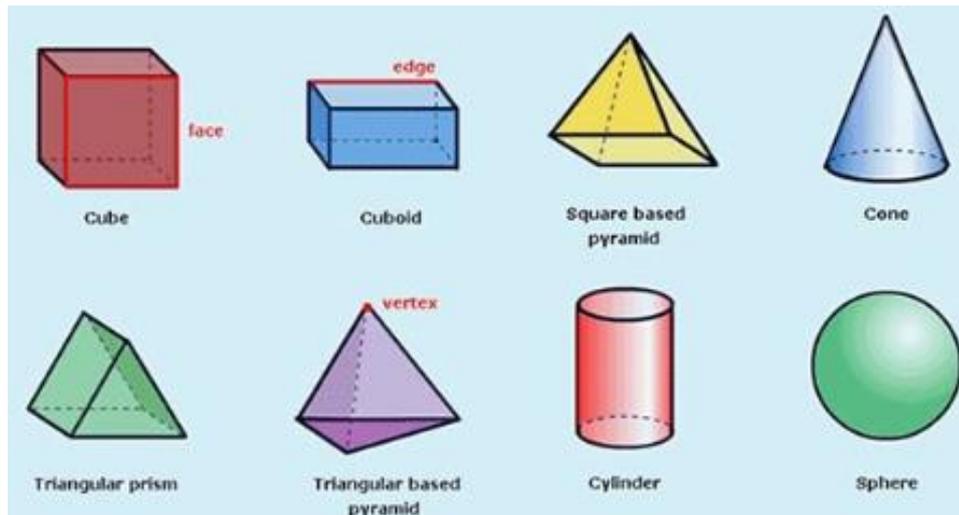
circle	cone	curved
flat	sphere	rectangle

Some solids are not polyhedrons because they have _____ faces. A solid that has only one curved face is the _____.

The cylinder has two _____ faces and one _____ face. When we flatten the curved face, it is a _____.

A _____ has one flat face and one curved face. When we flatten the curved section, it is a sector of a _____.

3. Prisms and pyramids



Word List

bottom	pointed	square	triangle
cross-sectional	rectangle	shape	

Prisms and pyramids are special types of polyhedrons. A prism has the same _____ shape from one end to the other.

Both ends are the same _____. Prisms take their names from the shape at each end.

A rectangular prism has a _____ at each end and a triangular prism has a _____ at each end.

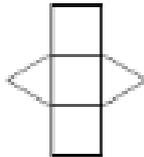
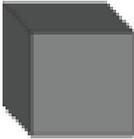
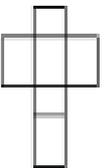
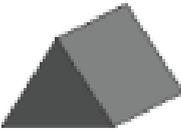
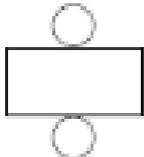
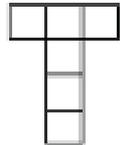
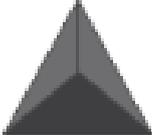
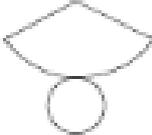
A pyramid has a _____ top, called the apex.

The shape at the _____ of the pyramid gives the pyramid its name. A square pyramid has a _____ at the bottom.

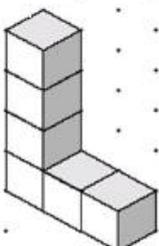
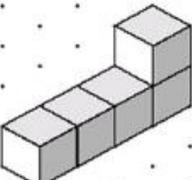
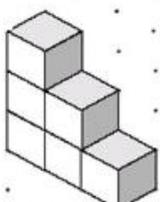
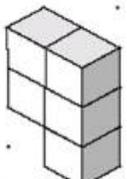
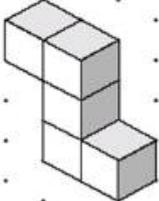
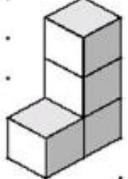
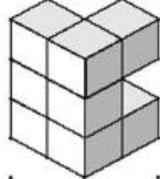
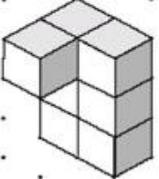
Drawing solids

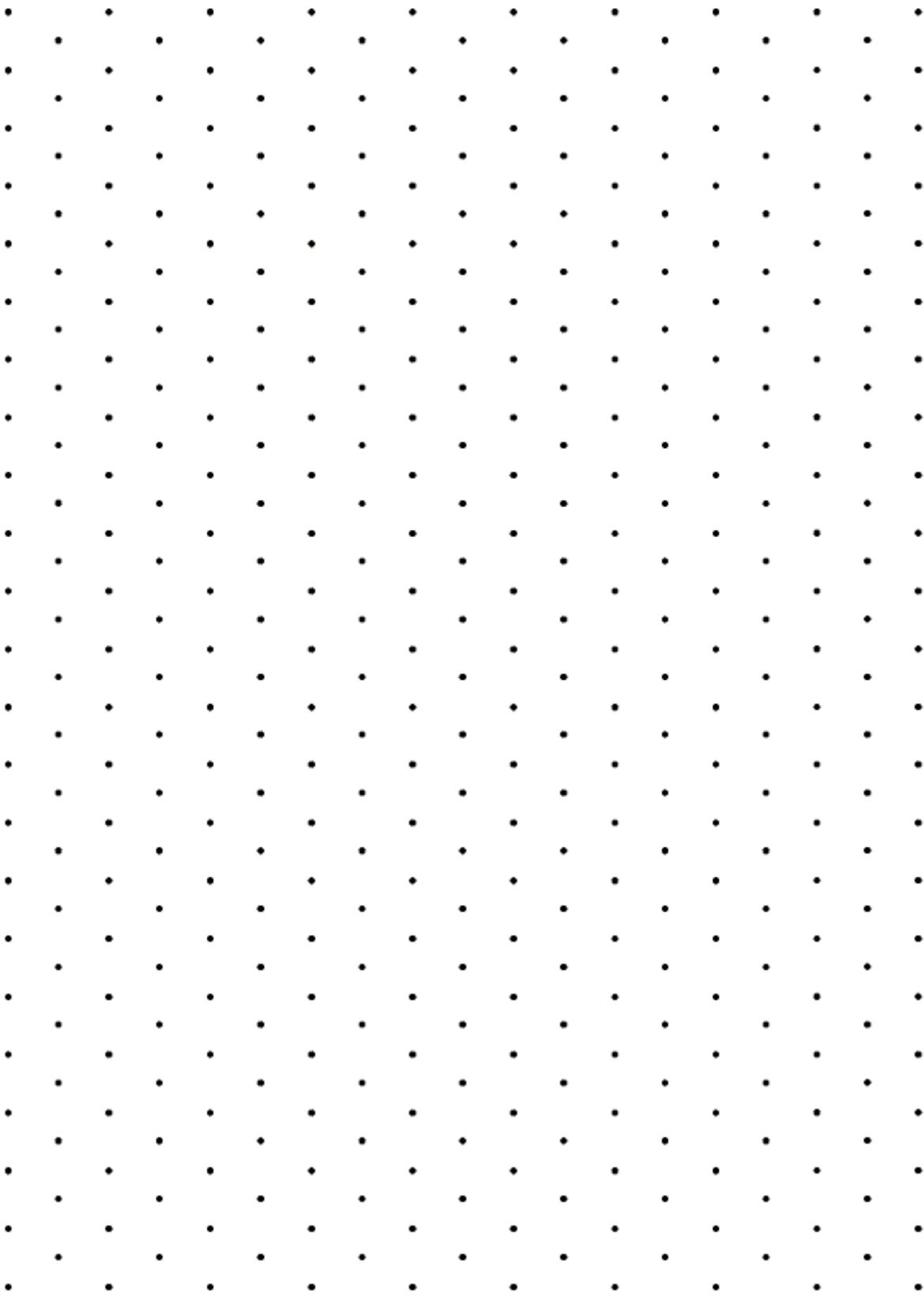
Exercise 6

1. Join each shape to the matching net.

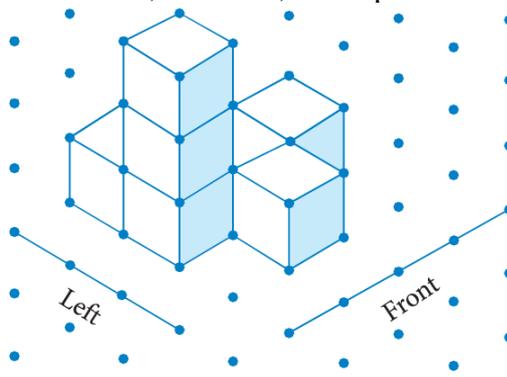
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2. Draw the following 3D shapes on the isometric paper provided.



3. For the following shape draw the front view, left view, and top view.



a. Front view

b. Left view

c. Top view

Portfolio Task Week 6/7

Road signs in Australia take on several geometric shapes.

Use the Internet to find 4 different shapes used in road signs.

Make a neat sketch of each one (marks for neatness) and state

- a. The regulation shown by the sign and
- b. The name of its geometric shape.

MARKING RUBRIC

CRITERIA	EXPECTATIONS	POSS	MULT	GIVEN	TOTAL
Practical	Student completes practical work, including exercises and Mathspace task, of the brief to an acceptable standard set by the teacher.	2	3		/6
Portfolio Task	Student completes the investigation task of the week to an acceptable standard set by the teacher.	2	2		/4
Reasoning and Communications	Student responses are accurate and appropriate in presentation of mathematical ideas, with clear and logical working out shown.	4	-		/4
Concepts and Techniques	Student submitted work selects and applies appropriate mathematical techniques to solve practical problems and demonstrates proficiency in the use of mathematical facts, techniques and formulae.	4	-		/4
	Submission Guidelines				
Timeliness	Student submits the exercises, Mathspace task and investigation by the set deadline. See scoring guidelines for specific details.	2	-		/2
				FINAL	/20

Student Reflection:

How did you go with this week's work? What was interesting? What did you find easy? What do you need to work on?