



# First Steps in Mathematics

## Space

### Diagnostic Tasks – Student Worksheets

Represent Location

Represent Shape

Represent Transformation

Reason Geometrically

## ***First Steps in Mathematics: Space***

Diagnostic tasks – Student worksheets

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## Introduction

### **First Steps in Mathematics: Diagnostic tasks - Student worksheets**

Task review and planning sessions are a critical component of using First Steps in Mathematics. After completing each First Steps in Mathematics content session, teachers should use some of the diagnostic tasks with their students and then work with a small group of colleagues to review the completed tasks and plan for further learning.

# Diagnostic TASK

**FOCUS****Represent Location**

- Key Understanding 1
- Key Understanding 2

## The School Delivery

Ages 8–12 years

### Purpose

To determine:

- how the student attends to proximity and proportion when drawing a plan.
- whether the student attends to grid coordinates to represent location.
- what language the student uses to describe position and direction, and pathways in familiar environments.

### Materials

Pen or pencil

A selection of paper such as:

- A3 and A4 plain and ruled paper
- 1cm<sup>2</sup> A4 graph paper
- Isometric A4 paper

Voice recorder (Optional)

### Procedure

1. Provide the student with a range of paper and a pen or pencil.

*Say: Something is being delivered to the school soon. The delivery person has never been here before and needs the exact directions on how to get from the delivery van to the \_\_\_\_\_ (Nominate a difficult place to get to in the school).*

*Draw a plan of the school that the delivery person can use to find the way. They won't have time to wander around; they need to go straight from their vehicle to the \_\_\_\_\_. You may choose whichever paper you want.*

Student draws the plan.

2. Then, once the student has drawn the plan, say: *Now, just in case they lose the plan someone will need to tell them the directions over the phone. Use your plan to give directions on how to get from the vehicle to the \_\_\_\_\_. You can speak into the voice recorder or write down the instructions.*
3. Play back or read the instructions to the students and say: *Now, do you think the instructions are clear enough for the person to find the way? Is there anything else you need to say to make the directions clearer?*

Record student responses.

## The School Delivery: Teacher Recording Sheet

Name \_\_\_\_\_ Year \_\_\_\_\_ Date \_\_\_\_\_

**How did the student attend to proximity and proportion when drawing the plan?**

**What language did the student use for the directions?**

**What did the student add to make the direction clearer?**

**Did the student consider grid coordinates when drawing their plan?**

# Diagnostic TASK

FOCUS

**Represent Location**

- Key Understanding 1
- Key Understanding 2

## The Farm

Ages 5–8 years

### Purpose

To observe:

- How the student attends to position and orientation when copying the layout of objects
- What student attends to when they draw a plan showing the position and orientation of objects
- What language of position and orientation the student responds to and uses.

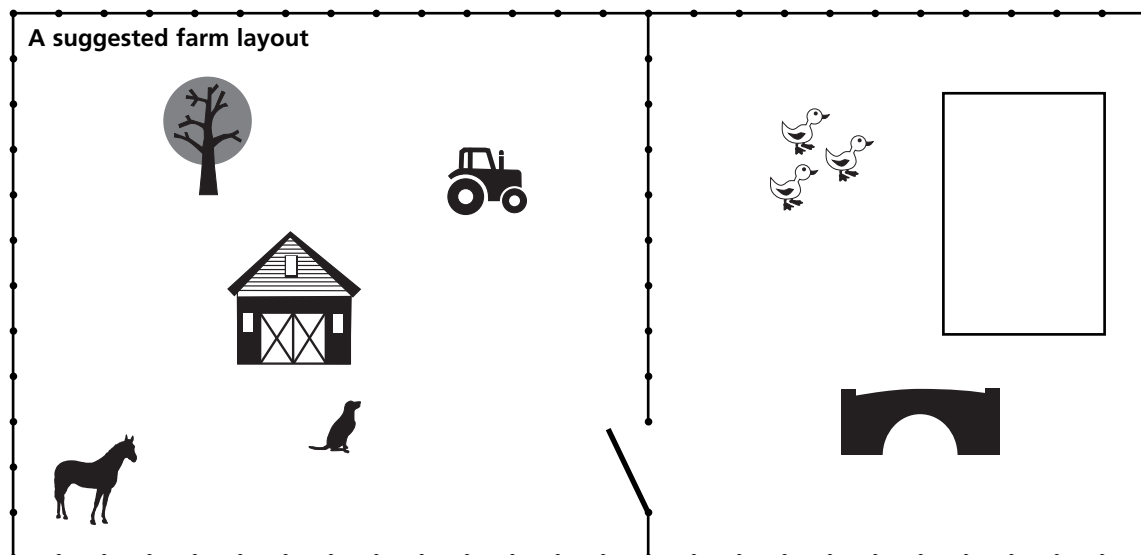
### Materials

Two sets of farm objects (a teacher's set and a student's set), consisting of:

- A farmhouse, a tree, a bridge, a blue rectangle for the pond, some ducks, a horse, a tractor, a chicken or a dog
- Match or pop sticks for the fence boundary
- Two sheets of green A3 paper
- Blu-Tack® to hold the objects upright
- Student Worksheet (to be photocopied)

### Procedure

1. Have the student sitting next to you with the same orientation. Set out the farm scene on one sheet of green paper, with the student watching. Talk about the objects, not the positions, as you do it. (See suggested farm layout provided.)



2. Provide the student with the other farm set. Say: *Here is your set. On your paper you need to copy my farm and put your animals and things in exactly the same place.*

See if the student makes an identical farm layout.

Record any unprompted language.

3. Now say: *We are going to play a game. Close your eyes – I'm going to see if I can trick you by moving something on my farm.*
  - (a) While the student's eyes are closed, move the tractor in front of the house, then ask the student to open their eyes. Ask the student: *Tell me where the tractor has moved to?*

They may need to refer to their own farm at first, but must not touch anything. When the student has said where the tractor is now located, ask: *Where was it before?*

Repeat the process, making sure the student's eyes are shut before anything is moved.

- (b) Move the tractor behind the ducks. Ask: *Where was it before?*
- (c) Move the tractor between the ducks and the pond. Ask: *Where was it before?*
- (d) Move the tractor next to the horse. Ask: *Where was it before?*
- (e) Lay the horse down and ask: *What was it doing before?*
- (f) Put the horse under the bridge and ask: *What was it doing before?*
- (g) Take the horse to the top of the bridge and ask: *What was it doing before?*

Record the student's responses.

4. Ask the student to draw a plan of the teacher's layout of the farm. Say to the student: *Imagine you are sitting on the horse in front of the farmhouse. I want you to take the horse where I tell you. You need to show on your plan where the horse goes.*

- *Go out of the gate and turn left*
- *Go between the pond and the ducks*
- *Go around the pond to the bridge*
- *Go under the bridge then over the bridge*
- *Go behind the farmhouse.*

Ask: *Can the horse see the pond, the bridge, and the tree from there?*

Record the student's responses.

5. Now say to the student: *Now it's your turn. I'll ride the horse and you tell me where to go.*

# The Farm: Teacher Recording Sheet

Name \_\_\_\_\_ Year \_\_\_\_\_ Date \_\_\_\_\_

**1. Does the student make an identical farm? If no, record where the student places the farm objects.**

**2. What language did the student use?**



3. Is the student able to say where the truck/horse was re-located?

| Tractor/horse movement                    | Yes/No | Language used to describe the new location | Where was it before?<br>Language used |
|---|--------|--|---------------------------------------|
| Tractor in front of the house             |        |  |                                       |
| Tractor behind of ducks                   |        |  |                                       |
| Tractor between the pond and ducks        |        |  |                                       |
| Truck into the farmyard next to the horse |        |  |                                       |
| Lay the horse down                        |        |  |                                       |
| Put the horse under the bridge            |        |  |                                       |
| Take the horse to the top of the bridge   |        |  |                                       |

**4. Record the student's responses.**

**5. What language did the student use?**

# The Farm: Student Worksheet

Name \_\_\_\_\_ Year \_\_\_\_\_ Date \_\_\_\_\_

## Plan of farm



# First Steps in Mathematics

## Space

### Diagnostic Tasks – Student Worksheets

Represent Location  
Represent Shape  
Represent Transformation  
Reason Geometrically

# Diagnostic TASK

FOCUS

## Represent Shape

- Key Understanding 2
- Key Understanding 3

## The Coloured Cube

Ages 8–12 years

### Purpose

To reveal if the student can see in their 'mind's eye' the transformation from a 2D net to a 3D object.

### Materials

3D objects: cube (with each face coloured differently), square pyramid, square prism, triangular prism and rectangular prism

Net Sheet 1 – nets for different shapes (only 1 out of 5 is a cube)

Net Sheet 2 – different configurations for cube nets

Net Sheet 3A and 3B – both nets of cubes

Coloured pencils

Scissors

### Procedure

1. Show the student the objects and Net Sheet 1 and ask: *Can you match these nets to the objects? How do you know that they match?*

- If the student is unable to visualise which nets match each object prompt them by asking: *If we fold on the dotted lines, which one would make this object here?*
- If the student is still unsure allow them to cut out and fold the net.

Observe what the student does and says.

2. Show the student Net Sheet 2. Point to the coloured cube and ask: *Which of these nets would you be able to fold to make this? How do you know? Are there any other nets that you could fold to make a cube?*

- If the student is unable to visualise which nets would make the cube prompt them by asking: *If we fold on the dotted lines, which one would make this object here?*
- If the student is still unsure allow them to cut out and fold the nets.

Observe what the student does and says.

3. Show the student Net Sheets 3A and 3B. Point to the coloured cube and say: *Here are two nets that you could fold to make this cube. You will need to colour the faces of the nets before you fold them, and to make sure that the faces have the same colours in the same places as this cube.*

Ensure that the coloured cube does not have a red or green face as its base. Point to the coloured cube and Net Sheet 3A and say: *If this part of the net is black and this part (the base) is black, colour the faces of the net that should be coloured red and green.*

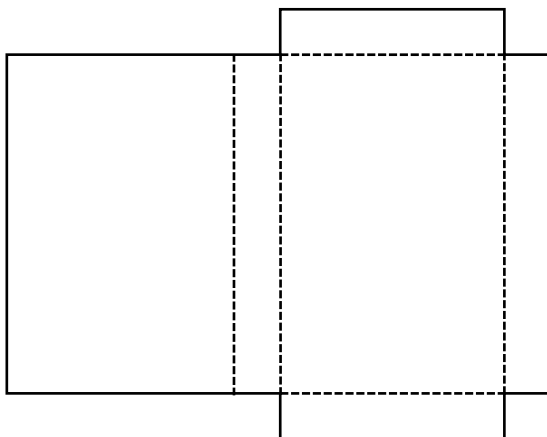
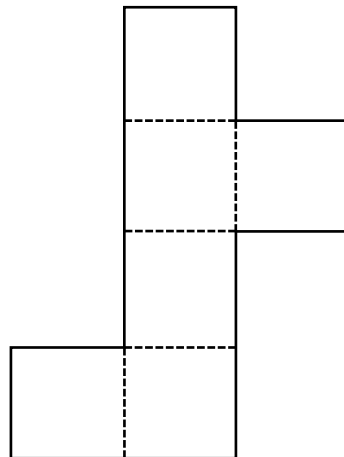
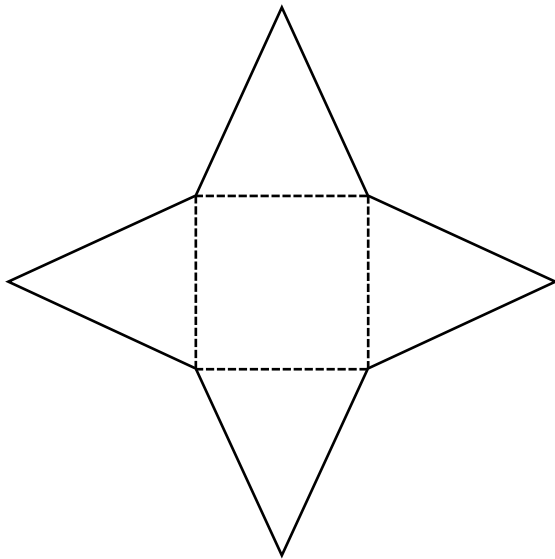
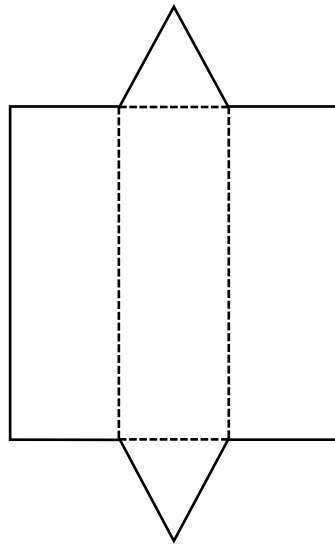
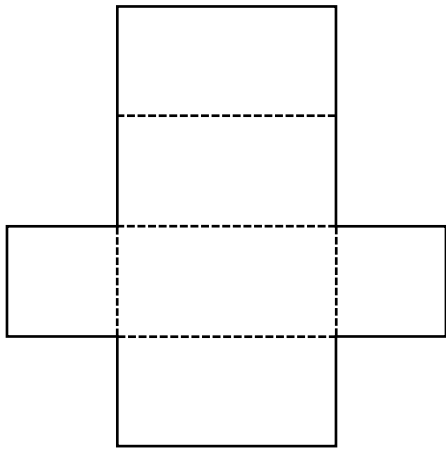
After the student has coloured the two faces ask: *How did you work out which faces to colour?*

Record the student's response.

Repeat this for Net Sheet 3B.

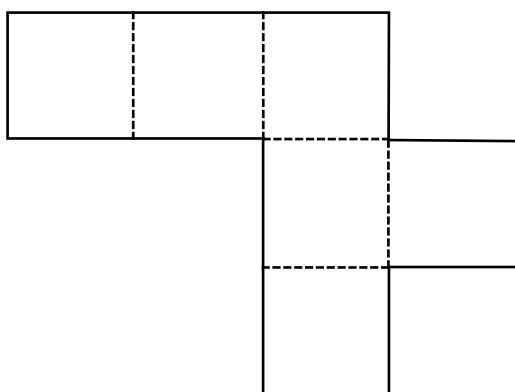
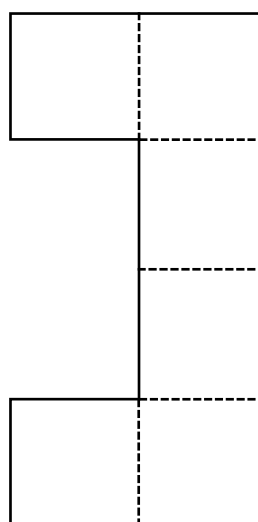
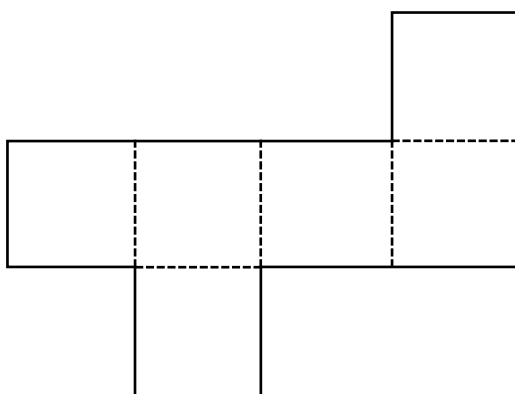
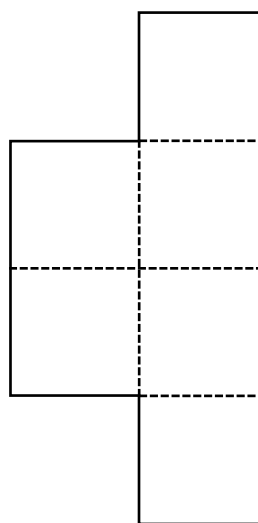
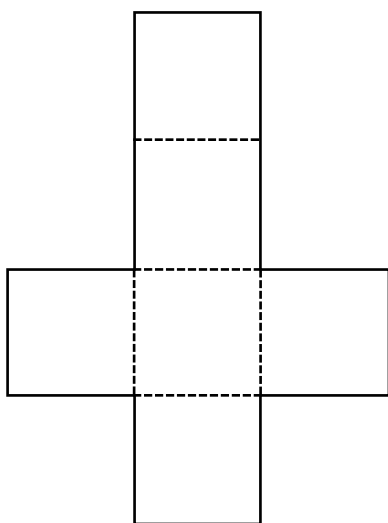
# The Coloured Cube

## Net Sheet 1



# The Coloured Cube

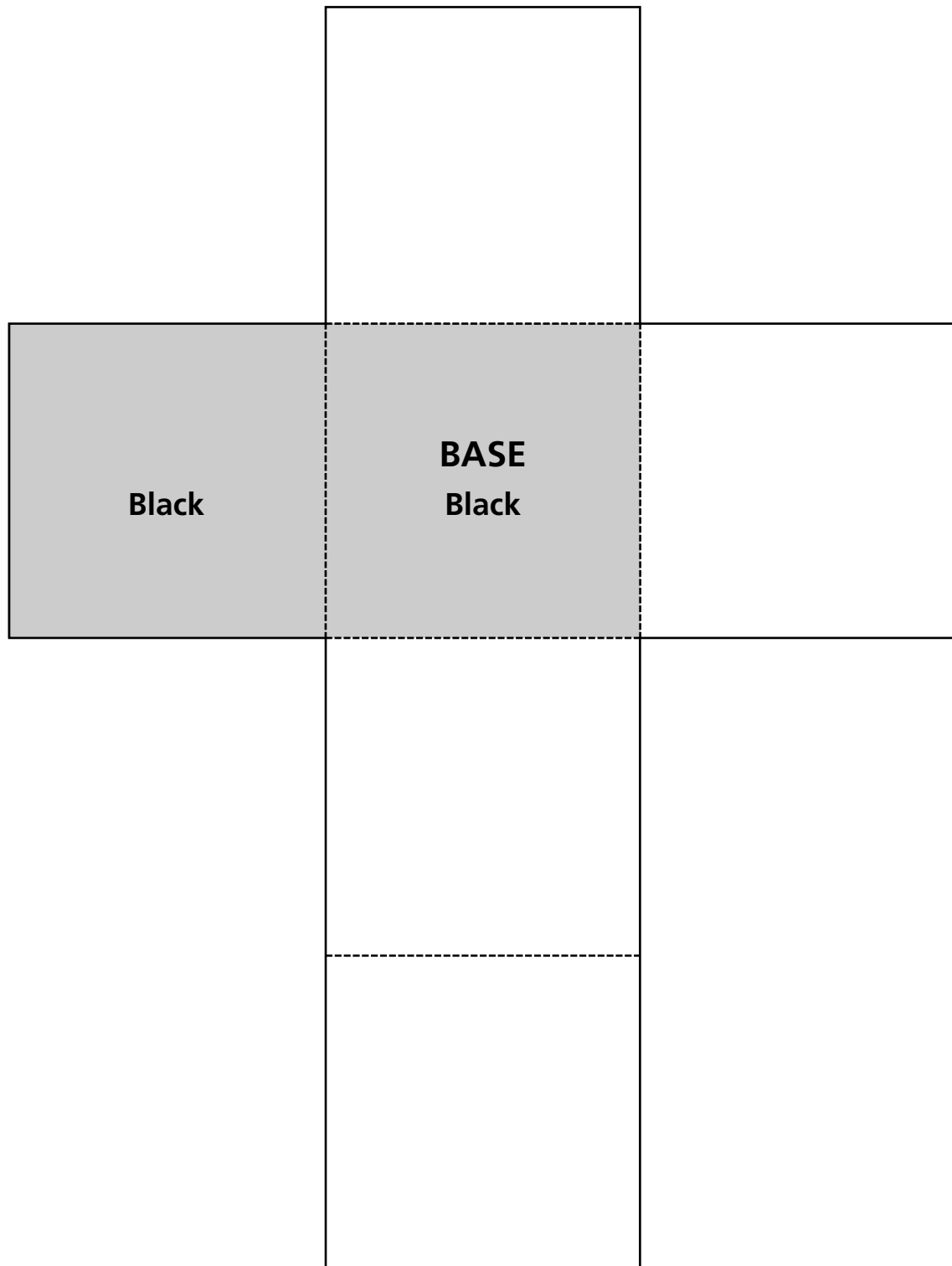
## Net Sheet 2





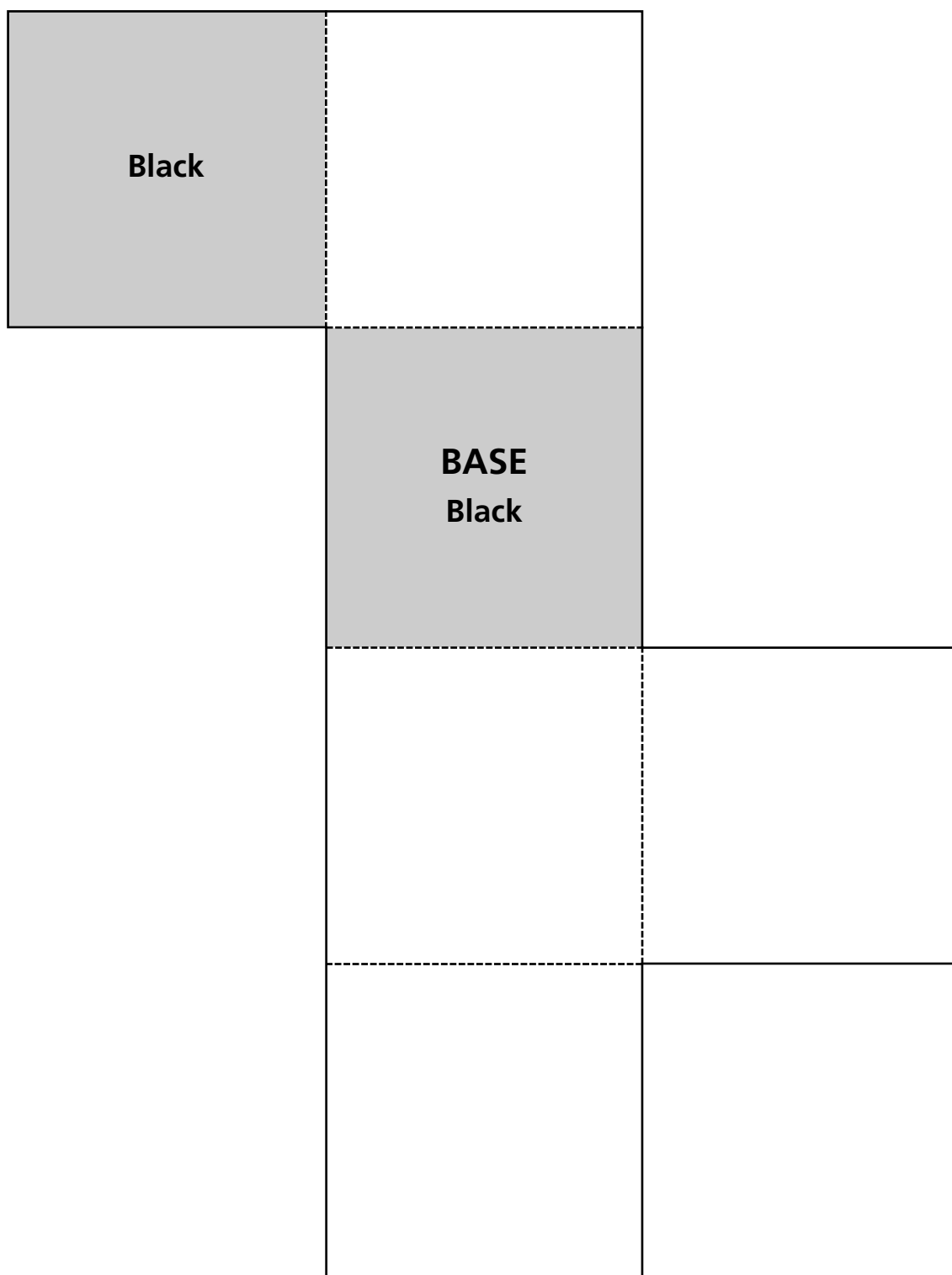
# The Coloured Cube

## Net Sheet 3A



# The Coloured Cube

## Net Sheet 3B



# The Coloured Cube: Teacher Recording Sheet

Name \_\_\_\_\_ Year \_\_\_\_\_ Date \_\_\_\_\_

## Net Sheet 1

| 3D Object                | YES. Any additional comments? | NO. Any additional comments? |
|--------------------------|-------------------------------|------------------------------|
| <b>Cube</b>              |                               |                              |
| <b>Square Pyramid</b>    |                               |                              |
| <b>Square Prism</b>      |                               |                              |
| <b>Rectangular Prism</b> |                               |                              |
| <b>Triangular Prism</b>  |                               |                              |

How do you know? (Record the responses.)

## Net Sheet 2

Can the student identify which net/nets could be used to make a cube? Yes / No

How do you know? (Record the responses.)

## Net Sheets 3A and 3B

Can the student colour the correct faces? 3A: Yes / No 3B: Yes / No

How did you work it out? (Record what the student says and does.)

# Diagnostic TASK

FOCUS

## Represent Shape

- Key Understanding 1
- Key Understanding 2

## Covering the Box

Ages 5–9 years

### Purpose

To reveal if the student can:

- match the 2D shape accurately.
- visualise what 2D shapes would be needed to cover a 3D object.

### Materials

Rectangular prism

Cut out representations of various 2D shapes (multiple copies).

### Procedure

1. Show the student the rectangular prism (but they may not pick it up).

Ask: *What shapes would I need to cover this?*

Record response.

2. Tell the student to pick up the prism now.

Ask: *Can you show me where the 2D shapes would go?*

Prompt: *What would go on this side? What would go on this side?*

Record responses.

# Covering the Box: Teacher Recording Sheet

Name \_\_\_\_\_ Year \_\_\_\_\_ Date \_\_\_\_\_

**1. Can the student visualise what 2D shape would be needed?**

**2. Can the student match the 2D shape to cover the 3D object?**

# Diagnostic TASK

FOCUS

## Represent Shape

- Key Understanding 1
- Key Understanding 2

## Make a Box

Ages 8–12 years

### Purpose

To reveal if the student can use visualisation skills or concrete matching to construct a net.

### Materials

Jar of lollies/sweets/candy

Pencil, eraser, card, ruler, glue, sticky tape

### Procedure

1. Show the student the jar of sweets. Say: *I want to send this jar of sweets to my Mum for her birthday. I need to make a box for it to go in so that it doesn't get damaged in the post. Can you use these materials here to make a box for this jar?*

Ask the student to make up the box.

Record what the student does.

If the student completes the task successfully stop here.

2. If it doesn't work continue by asking the student these questions: *What do you think is wrong? Why do you think it hasn't worked?*  
Then ask: *What could you have done differently? If you made it again, what would you do?*

Record the responses.

## Make a Box: Teacher Recording Sheet

Name \_\_\_\_\_ Year \_\_\_\_\_ Date \_\_\_\_\_

**Can the student visualise the net? Record what the student does.**

**If it doesn't work:**

**Is the student able to say what is wrong?**

**Is the student able to make suggestions to try to rectify the incorrect net?**



# Diagnostic TASK

FOCUS

## Represent Shape

- Key Understanding 2
- Key Understanding 3

## The Carton and the Cup

Ages 6–12 years

### Purpose

To reveal if the student can:

- draw an object from different positions.
- draw an object by visualising it from different positions.

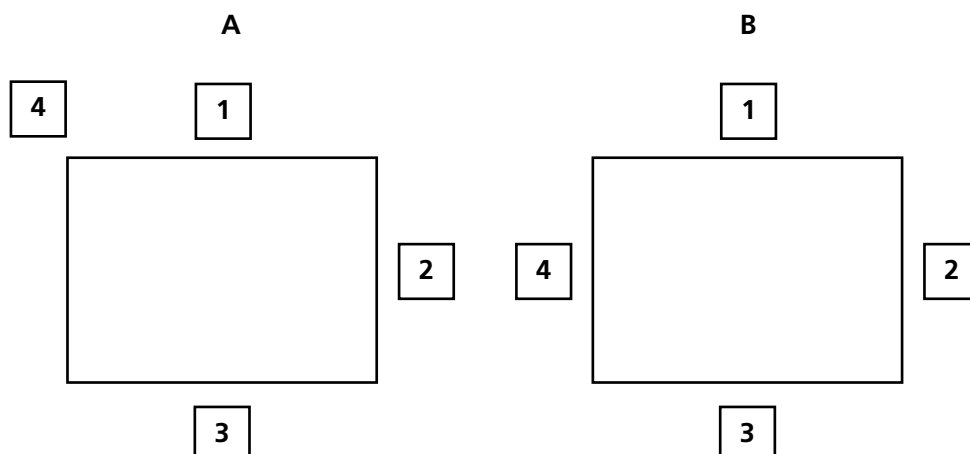
### Materials

Milk carton  
Cup with handle  
Pencil

### Procedure

Arrange a table and chairs as layout A below, with the student sitting on chair 1.

1. Place a milk carton in the middle of the table with the open spout pointing to the left.  
*Ask: Look at this milk carton. I want you to draw exactly what you see from where you are sitting.* Tell the student: *do not worry about the writing on the carton.*
2. Ask the student to move to the next chair (chair 2). *Ask: Draw exactly what you see from where you are sitting now.*
3. Continue for chairs 3 and 4 (chair 4 is a diagonal view). Then ask the student to move back to chair 1 and move chair 4 to opposite chair 2 (see B below).
4. Now, place a cup in the centre of the table with the handle pointing to the right of the student. Ask the student to draw what they see.
5. *Say: This time, I want you to imagine what the cup would look like if you are sitting here* (point to chair 2). *Without moving, draw what you would see.*
6. Continue for chairs 3 and 4 (chair 4 is opposite chair 2).



# The Carton and the Cup: Teacher Recording Sheet

Name \_\_\_\_\_ Year \_\_\_\_\_ Date \_\_\_\_\_

|   |
|---|
| <b>Record student responses for steps 1 to 6.</b> |
|   |
|   |
|   |
|   |
|   |
|   |
|   |
|   |
|   |

# Diagnostic TASK

FOCUS

**Represent Shape**

- Key Understanding 1

## Describe an Object

Ages 11–13 years

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### Purpose

To reveal what spatial language students use when describing an object.

### Materials

A part from an everyday object, such as a familiar appliance or tool (relating to the scenario)

### Procedure

Place the object in front of the student.

*Say: I have broken my \_\_\_\_\_ and I need to replace this part. I don't know the name of it and I need to describe it to the sales assistant at the supplier. I'm going to order it over the phone. What would you say to describe this part to someone over the phone?*

Record the language the student uses.

## Describe an Object: Teacher Recording Sheet

Name \_\_\_\_\_ Year \_\_\_\_\_ Date \_\_\_\_\_

**Record the spatial language the student uses.**



# First Steps in Mathematics

## Space

### Diagnostic Tasks – Student Worksheets

Represent Location  
Represent Shape  
Represent Transformation  
Reason Geometrically

# Diagnostic TASK

FOCUS

## Represent Shape

- Key Understanding 1
- ## Reason Geometrically
- Key Understanding 2
  - Key Understanding 3

## Categorisation

Ages 6–12 years

### Purpose

To reveal if students can:

- analyse the features of a shape and generalise about shapes.
- know the properties of shapes and say how shapes are the same or different
- see what language students use when describing common features.

### Materials

Cut out copies of the 2D figures on Sheets 1–5, keeping within each categorisation.

### Procedure

1. Arrange the 2D figures for one category. Ask: *Could you put these into groups of things that are the same. You can make as many groups as you want. Can you give me a name for this group? Can you tell me why you put these figures together?*

Repeat for each category of shapes.

Record the responses.

2. Additional questions at the interviewer's discretion, for example: *Why didn't you put these shapes (e.g. rhombus) with these shapes (e.g. squares)? Can you re-sort all of these figures so that there are fewer groups? Why did you sort them that way?*

## Categorisation: Teacher Recording Sheet

Name \_\_\_\_\_ Year \_\_\_\_\_ Date \_\_\_\_\_

Record the student's responses to:

| Category | Name for the group | What language was used? |
|----------|--------------------|-------------------------|
| 1        |                    |                         |
| 2        |                    |                         |
| 3        |                    |                         |
| 4        |                    |                         |
| 5        |                    |                         |

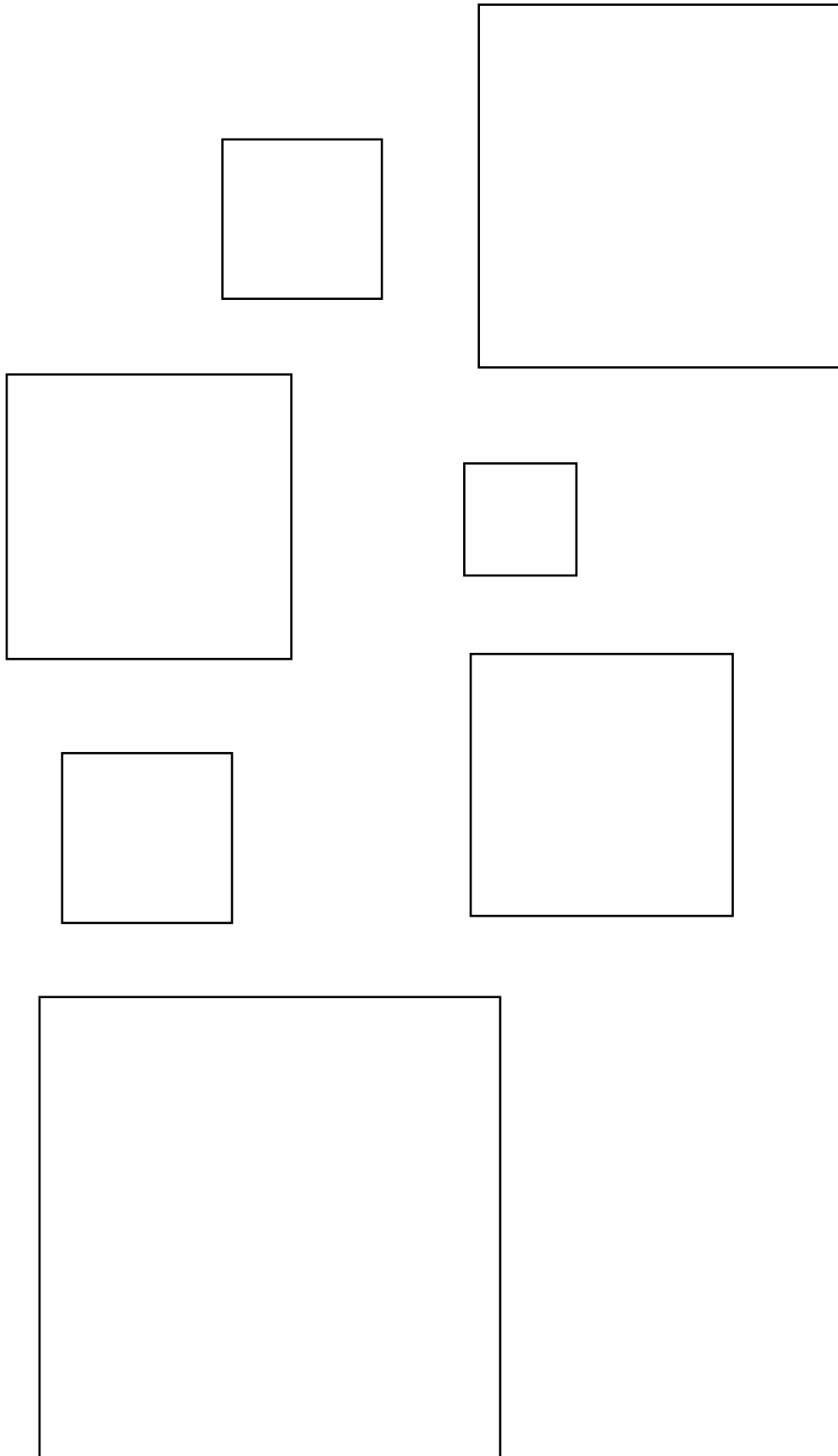
### Additional Questions

**Did the student analyse and generalise about the shapes?  
Record what the student said.**

**Was the student able to re-sort the shapes? If so, how?**

# Categorisation

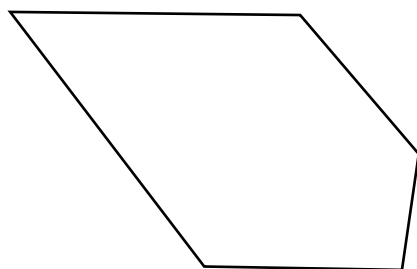
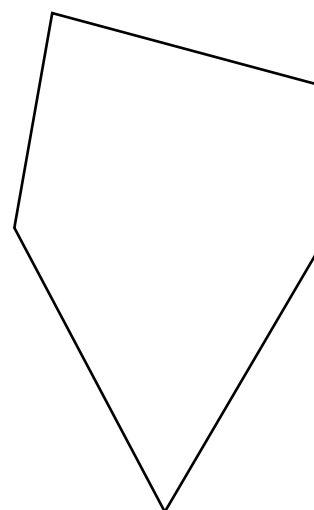
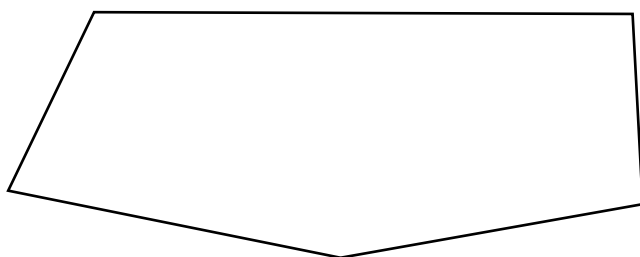
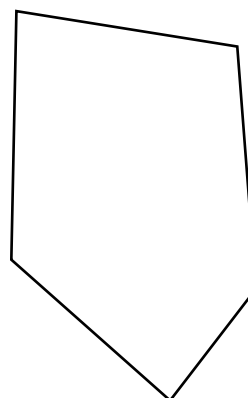
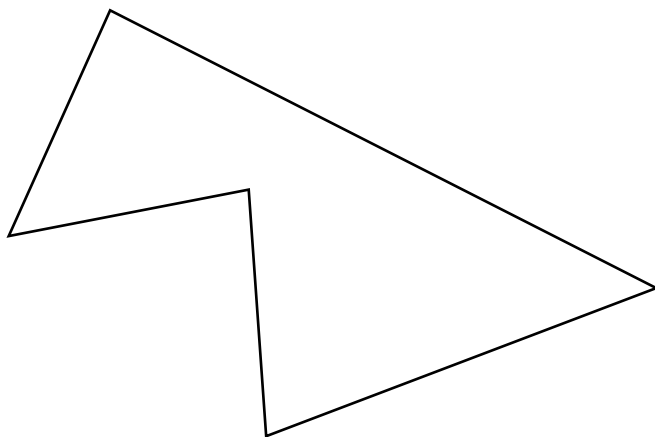
## Sheet 1





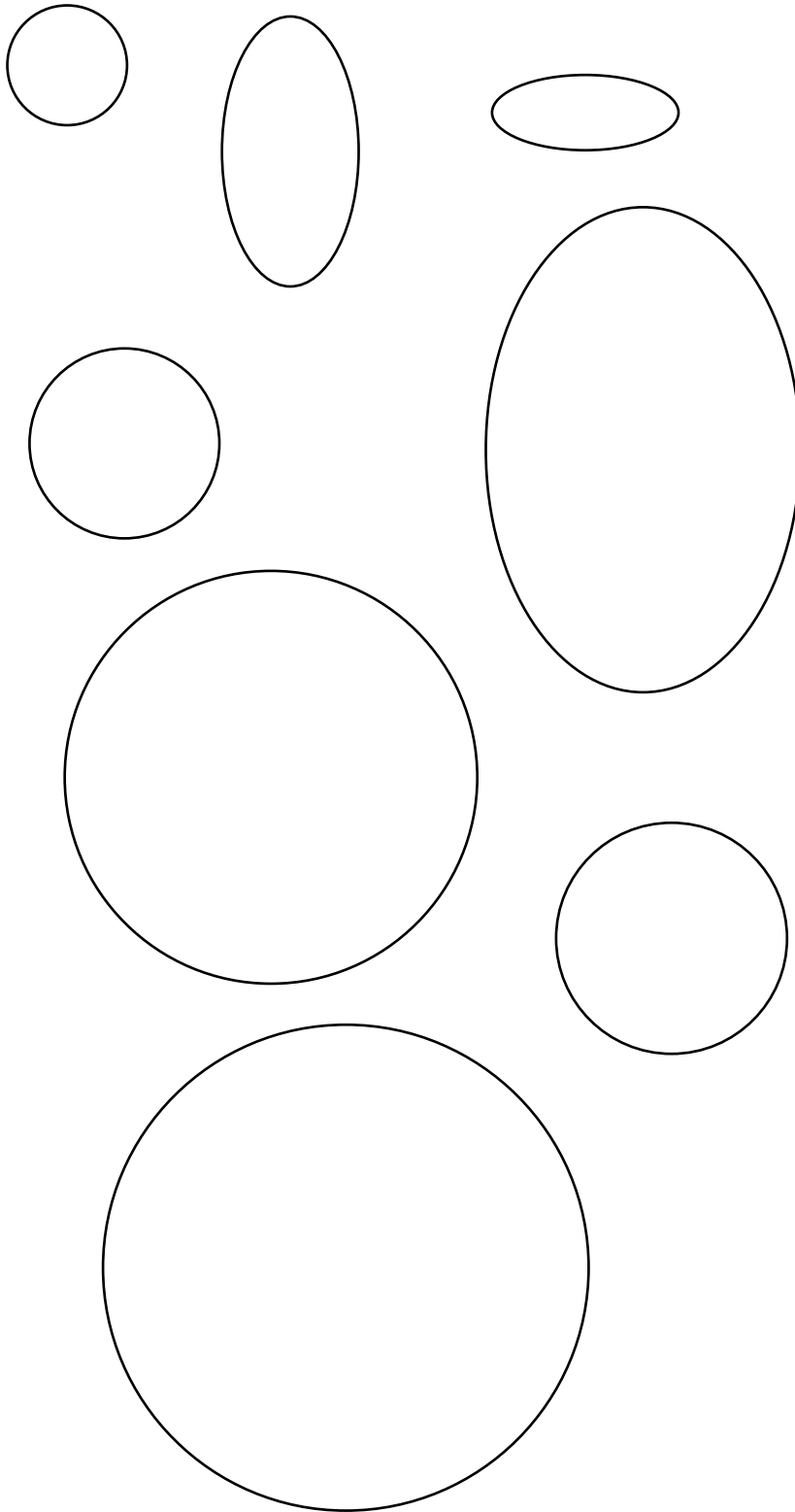
# Categorisation

## Sheet 2



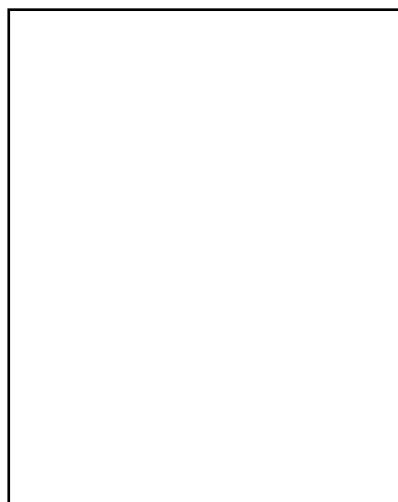
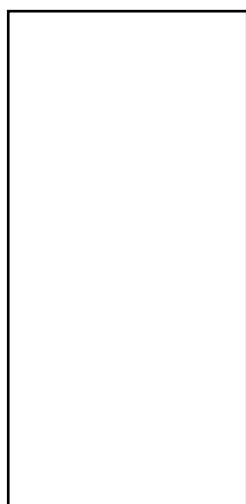
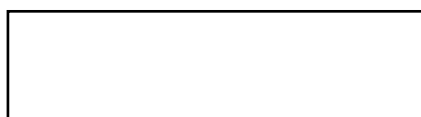
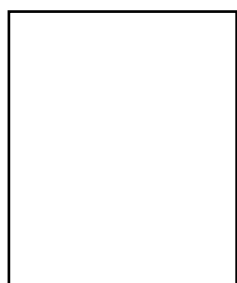
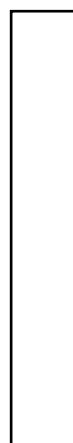
# Categorisation

## Sheet 3



# Categorisation

## Sheet 4



# Categorisation

## Sheet 5

