

4

Sorting

Mathematical goals

This session is designed to enable learners to:

- sort mathematical objects using given criteria;
- sort other objects using given criteria;
- devise their own criteria for sorting.
- develop a definition of 'sorting'

Materials required

- Large quantity of items such as chocolates, liquorice allsorts, and so on, that come in a variety of types;

or

- other items suitable for sorting;
- Card set A – *Numbers*;
- Sheet 1 – *Sorting grid*;
- Sheet 2 – *Blank sorting grid*;
- Sheet 3 – *Two-way Venn diagram*;
- Sheet 4 – *Three-way Venn diagram*.

Notes

Suggested approach **Beginning the session**

As learners come into the room, ask them a question and sort them into groups according to their answer, for example ask them where they went on holiday and sort them into two groups according to whether they answer immediately or not. When all learners have arrived, ask them what the criterion for sorting was. Discuss and confirm learners' understanding of 'criterion'. If necessary, repeat sorting exercises using other questions and criteria until learners are clear. For example, put piles of chocolates (or an alternative that has variety such as biscuits or liquorice allsorts) on each table and ask learners how they could be sorted. Discuss criteria that could be used. These could include the shape of the item, its colour, the type of wrapper, and so on.

Put learners into pairs or small groups and give each pair a copy of Sheet 1 – *Sorting Grid* and a pile of chocolates. Explain that they are to take one sweet at a time and move it through the grid by answering the questions, until it reaches the bottom row.

When the learners have finished, ask the pairs to compare results with each other, that is, which sweets have ended up in which position. Ask them to describe the characteristics of each set of sweets. If there was something like a toffee in the pile then it will not have a route to go down; this makes an interesting discussion point.

Reviewing the learning

- Give learners something else (possibly of their own choice) to sort. This could be biscuits, shapes, adverts from magazines, coins or anything that has variety and is of interest to the learners. Ask them to construct a sorting grid for their items, using Sheet 2 – *Blank sorting grid*. When they have finished, ask them to pass it to another pair of learners for checking.
- Learners could be given a sorting grid with answers written in the bottom row and be asked to write in what the questions would be. This could be done using numbers, shapes or any type of object that has variety.

Working in groups

Ask learners to sit in pairs or small groups. Give each group Card set A – *Numbers*. Ask learners to sort the cards into two sets, using any binary criterion they choose (that is, the number either does or does not satisfy the criterion). Ask each pair to explain how they have sorted their cards, that is, the criterion they have used. Ask each pair to suggest another number they could add to one of the sets using the same criterion. Repeat the exercise, asking learners to use a different criterion and, again, to explain it and to suggest another number or numbers. They may have considered binary criteria such as these:

- numbers less than or more than 30;
- odd and not odd (even) numbers;
- prime and not prime;
- divisible and not divisible by 3;
- and so on.

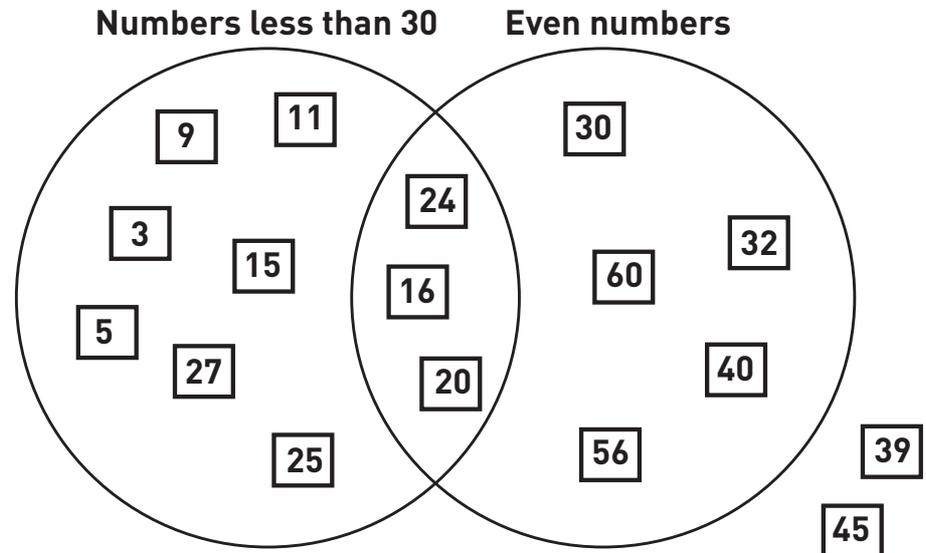
Next, still using Card set A – *Numbers*, ask the learners to sort according to two criteria – for example, (i) numbers less than 30, (ii) even numbers. Be careful not to ask them to put them into two groups as they will discover this is not necessarily what happens. As they are doing this listen to their discussions, but do not correct anything they say. When they realise that some numbers satisfy both criteria, and some neither, encourage them to explain how they could show this in their sorting.

Whole group discussion

Ask one group to show everyone how they sorted according to their chosen two criteria. Encourage other learners to question them on their representation. Discuss until everyone is clear that some numbers satisfy only one of the criteria, some both, and some neither. If you need to you could help shape the thinking by asking:

- How did you decide where on the table to put each number?
- How many groups did you think you would end up with?
- Did anything surprise you about this task?
- What problems did you have?
- How did you solve them?

You should explain that what they have done is discovered Venn diagrams. Show them, if they have not represented it exactly like this, that their solution could be put into a diagram of two overlapping circles like this:



You could ask further questions such as:

- Give a definition for the numbers in the overlap section. Add some more.
- Give a definition of the numbers which fall outside the circles. Add some more.
- Give a description for the numbers in the left hand circle which are not in the overlap. Add some more.

In this way learners will be able to write down descriptions of each set within the Venn diagram. In a two-way diagram there will be four such sets. This gives them the opportunity to use their existing knowledge about types of numbers. For example, in the Venn diagram above, numbers in the intersection set could be described as 'even numbers less than 30'. When they have put all the numbers in place there may be some intersections that have no number (depending on which criteria they have chosen). Ask them to think of a number that could go there, or to give an explanation as to why there cannot be a number there.

Working in groups

Next, ask the pairs of learners to either choose two more criteria and repeat the exercise, or choose three criteria and create a three-way Venn diagram to sort the numbers in Card set A. They may find it helpful to use either Sheet 3 – *Two-way Venn diagram* or Sheet 4 – *Three-way Venn diagram* to help with the sorting.

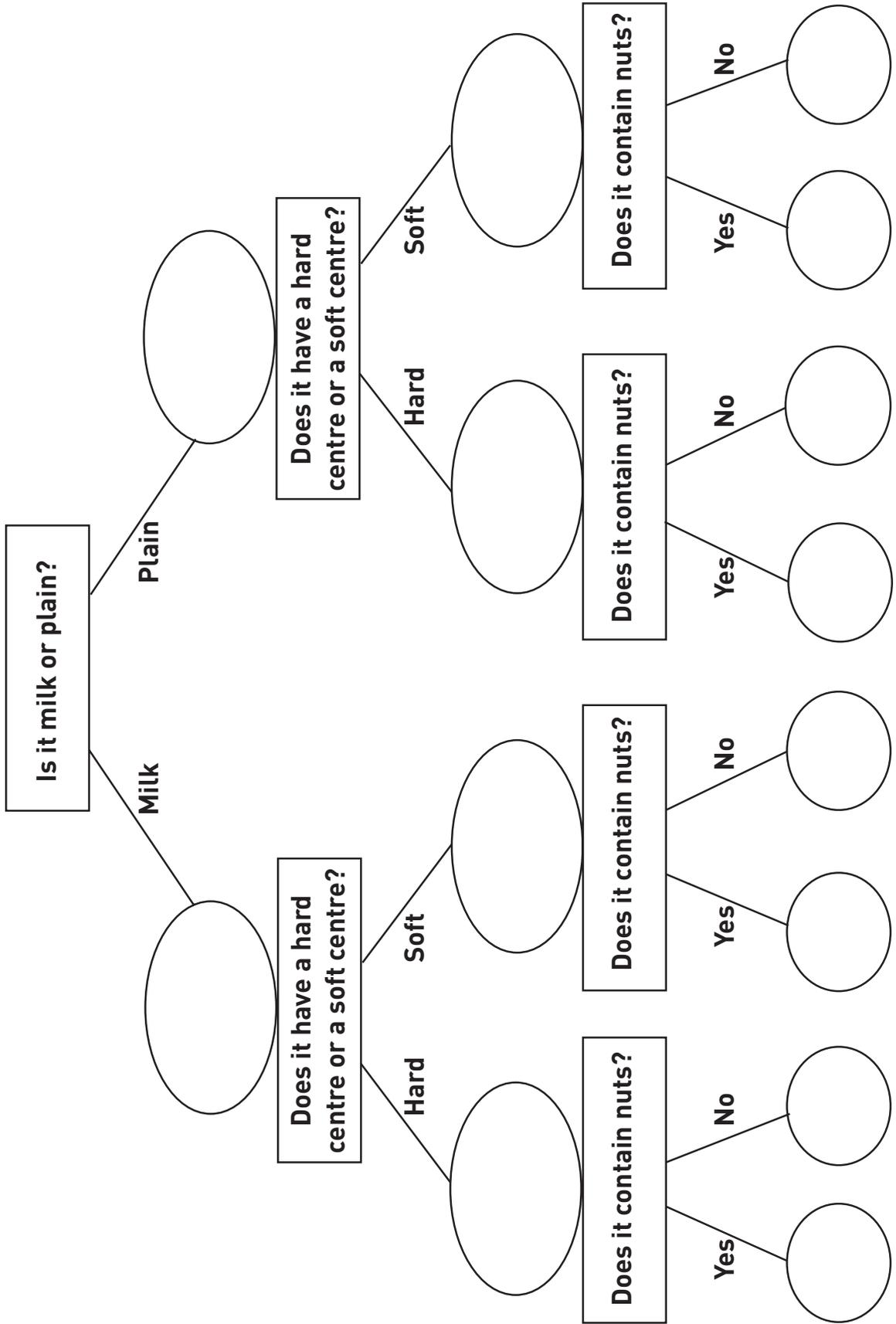
If they choose the second option they may again have the problem of what to do with numbers that fit more than one of their sets.

When they have completed this task they could again write down descriptions for each of the four sets formed by the two-way, or each of the eight sets formed when completing the three-way Venn diagram.

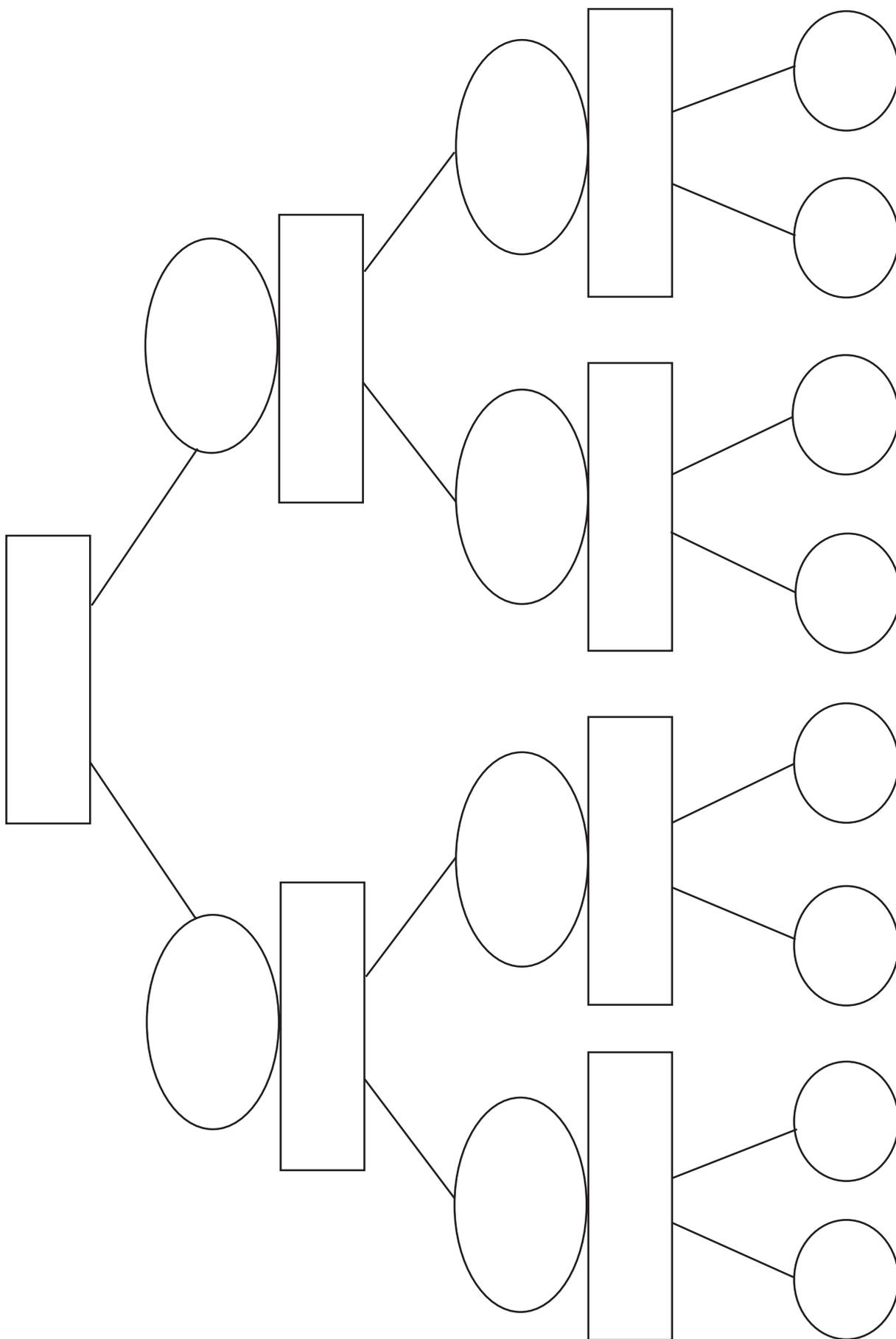
Reviewing the learning

Ask learners in pairs or small groups to think of their own items for sorting, and to use either a two-way or a three-way Venn diagram to do so. They may, for example, use characteristics of the members of their class, or a list of films, or a pile of coins. Listen as they discuss what two or three criteria they are going to select, and how to sort the items according to these. They could challenge other pairs or groups to work out what sorting criteria have been used.

Sheet 1 - Sorting grid



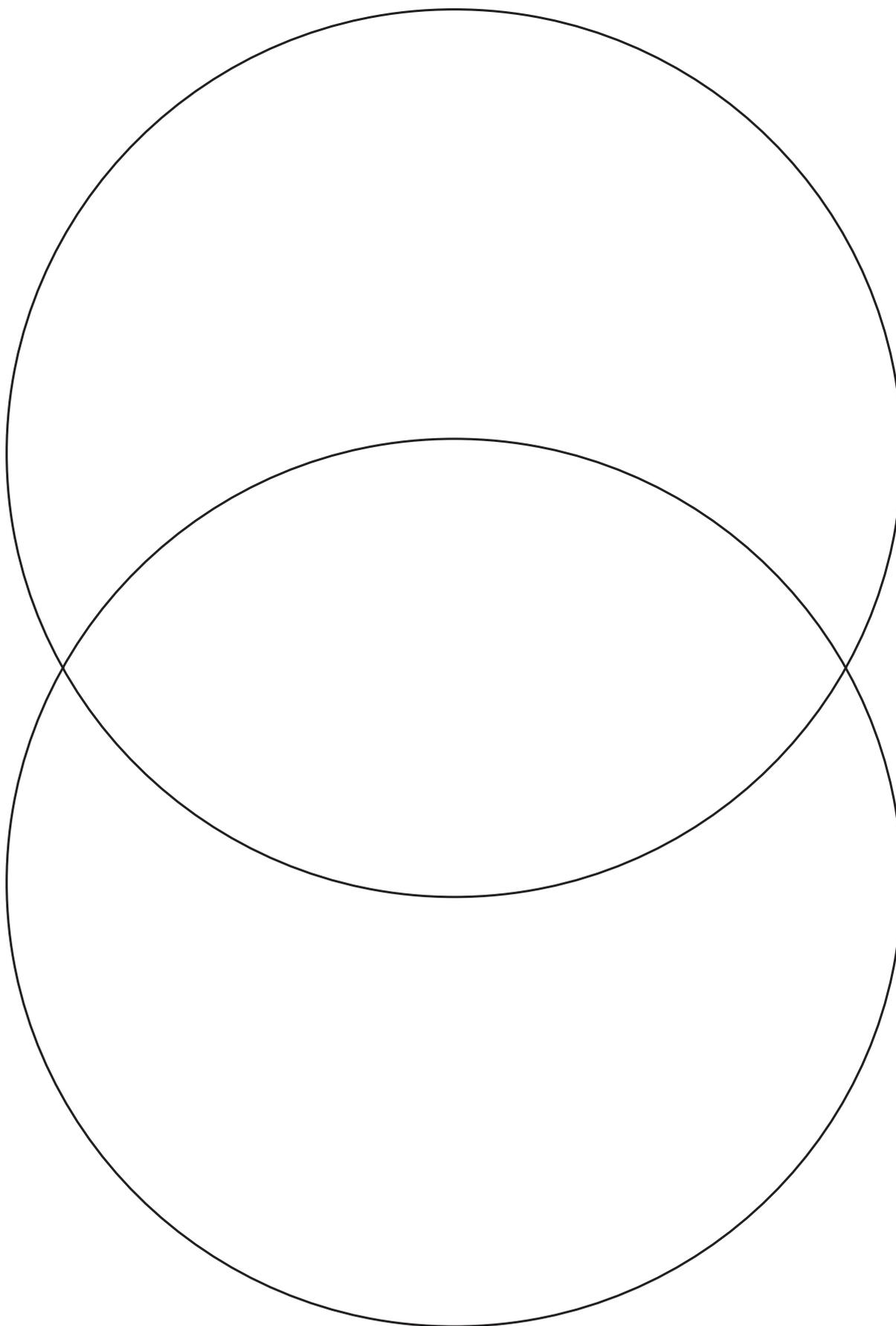
Sheet 2 - Blank sorting grid



Card set A – Numbers

3	5	56	42	45
12	18	15	30	32
39	31	24	27	25
60	9	16	40	20
23	11			

Sheet 3 – *Two-way Venn diagram*



Sheet 4 – Three-way Venn diagram

