

Lesson Element – 11.02c Venn Diagrams

Instructions and answers for teachers

These instructions should accompany the OCR resource 'Lesson Element – 11.02c Venn Diagrams' activity which supports OCR GCSE (9–1) Mathematics.

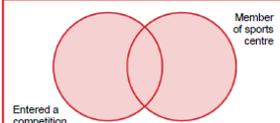
GCSE (9–1)
MATHEMATICS

Lesson Element – 11.02c Venn Diagrams

Task 1 – Shading Venn diagrams

A group of athletes were asked whether or not they were members of the local sports centre. They were also asked if they had entered a competition this month.

Working in pairs or as individuals match up each Venn diagram with the correct statement.



Member of sports centre

Entered a competition

Members of the sports centre who have entered a competition this month.

May 2015

OCR

The Activity:

This resource comprises of 3 tasks.



This activity offers an opportunity for English skills development.



This activity offers an opportunity for maths skills development.

Associated materials:

'11.02c Venn Diagrams' Lesson Element learner activity sheet.

Suggested timings:

Task 1: 20-30 minutes **Task 3:** 20-30 minutes

Task 2: 20-30 minutes



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Rationale

All learners at GCSE are expected to be able to use a Venn diagram to enumerate sets, and use this to calculate related probabilities. Similarly, they should be able to construct a Venn diagram to classify outcomes and calculate probabilities. It is imperative that they become familiar with the language and set notation used when describing different scenarios in Venn diagrams. In addition, higher tier learners are now expected to be able to construct Venn diagrams to solve conditional probability problems, although this is not covered in this resource.

Assumed Knowledge

Learners should have already met simple set notation to describe a set of numbers or objects and the conventions of Venn diagrams. In Venn diagrams, it is assumed that learners can:

- Shade a Venn diagram to match a worded description.
- Describe in words what a shaded Venn diagram represents in the context given.
- Determine the position of an object or a number in a Venn diagram depending on which set or sets it belongs to.
- Use a Venn diagram to calculate related probabilities.

Possible Misconceptions

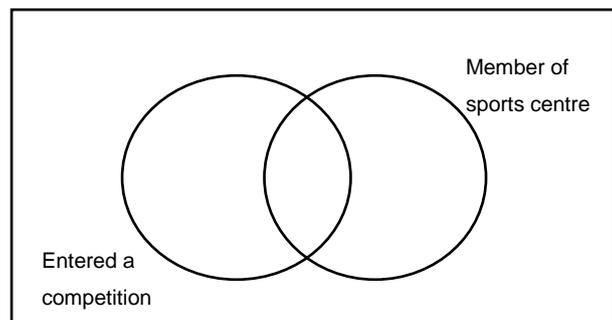
- Learners may have difficulty identifying the correct region of a Venn diagram when there are two events occurring and the descriptive statement does not explicitly use the words “and” or “or”. Learners must be able to distinguish between situations where two events both occur (intersection) and when one or the other event occurs (union).
- Learners struggle to identify an intersection region when shading more than one descriptive statement. Encourage learners to shade each statement in a different direction, so that the common shading will be revealed as cross hatch shading.
- When calculating probabilities from Venn diagrams, learners may be able to extract the correct number of favourable outcomes from a diagram but then use the incorrect total number of outcomes when writing the probability as a fraction.



Task 1 – Shading Venn diagrams

The objective of this task is to develop learners' ability to translate between written information, and information presented as regions on a Venn diagram.

A group of athletes were asked whether or not they were members of the local sports centre. They were also asked if they had entered a competition this month.



Set of cards to be cut out and shuffled. Working in pairs or as individuals match up each shaded Venn diagram with the correct statement.

Alternative activities

- Form of “snap”. One player has the Venn diagram cards; the other player has the statement cards. Players take it in turns to put their card on the top as in “snap”. When a Venn diagram card and statement card match the first person to shout “snap” wins the pile of cards. The game is over once a player has all the cards.
- “Find the pair”. All cards are laid out face down on the table. Players take it in turns to pick two cards – if the cards match they win them and put them to one side, otherwise they are returned face down. The player with the most matching cards at the end of the game is the winner.
- A “Call my Bluff” variation. Players take it in turns to show the others what they say is a match of Venn diagram and statement. The others have to decide whether the match is true or not. With this variation you can make up some quite creative situations!

Design your own set of Venn diagram cards – perhaps with three sets, but care needs to be taken with the wording.

How many different shaded diagrams can you describe?

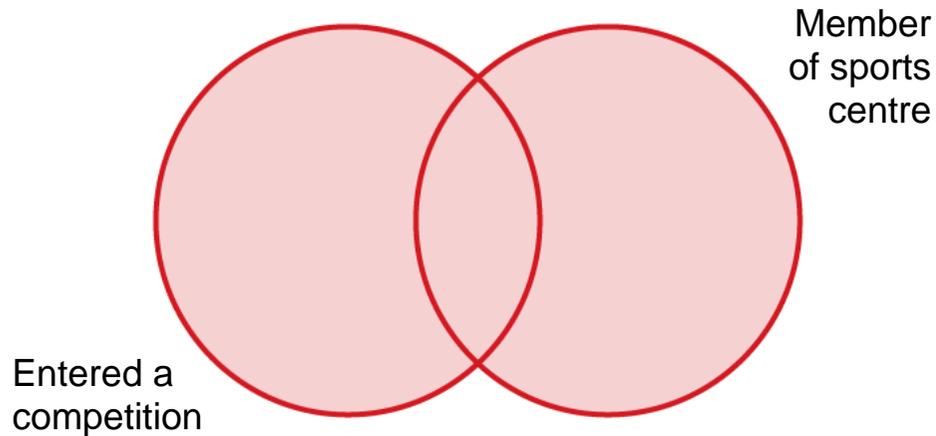


The correct answers are given below:



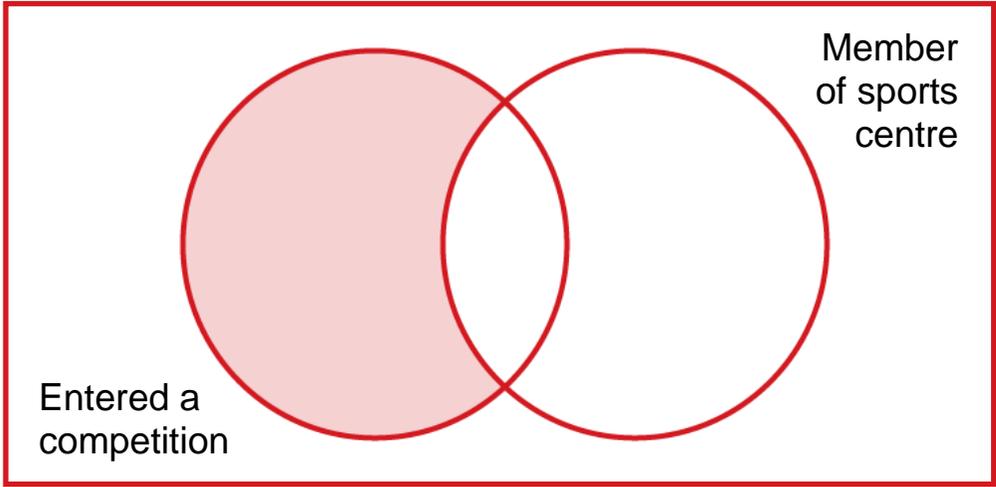
A group of athletes were asked whether or not they were members of the local sports centre. They were also asked if they had entered a competition this month.

Working in pairs or as individuals match up each Venn diagram with the correct statement.

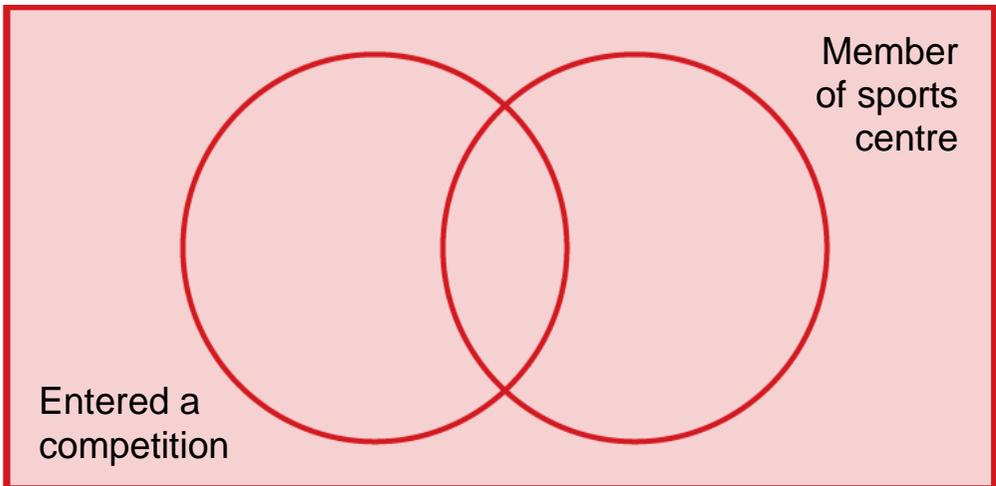


Athletes who are members of the sports centre or have entered a competition this month.



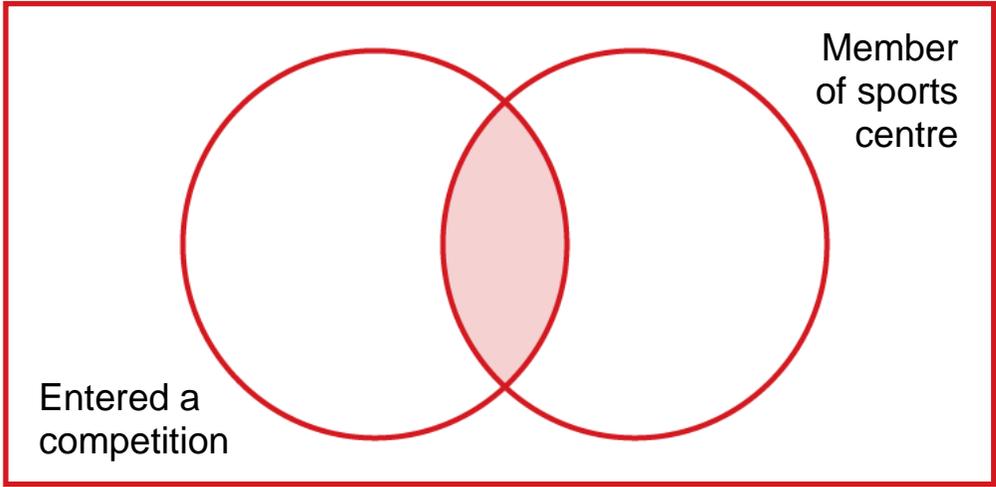


Athletes who have entered a competition this month, but are not members of the sports centre.

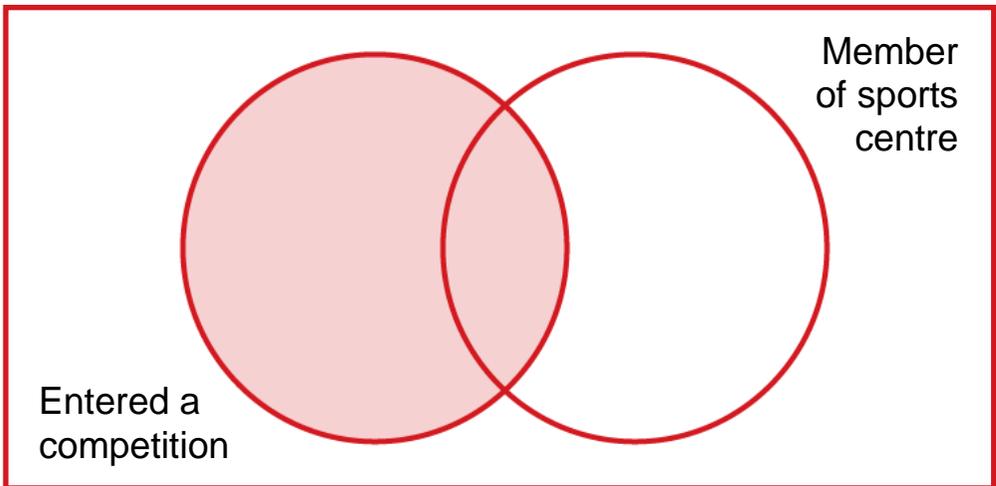


All of the athletes.



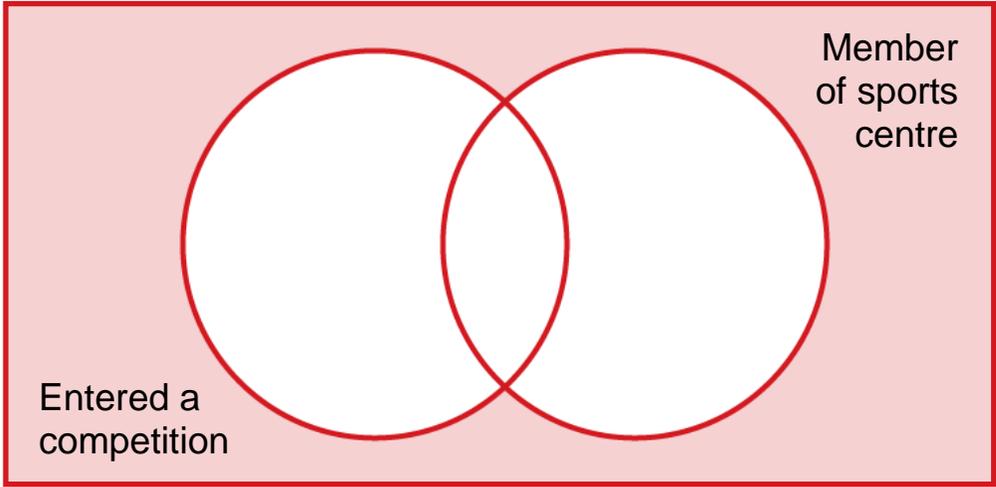


Members of the sports centre who have entered a competition this month.

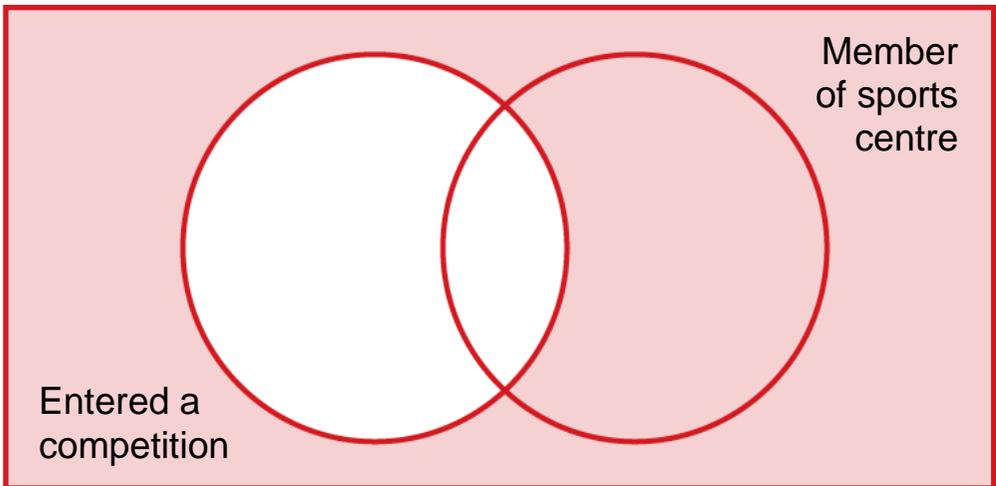


Athletes who have entered a competition this month.



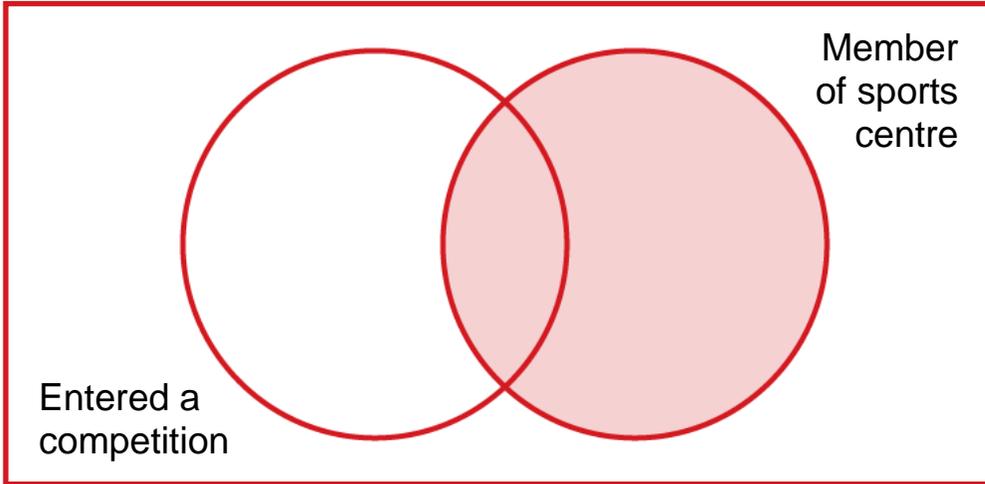


Athletes who are not members of the sports centre and have not entered a competition this month.

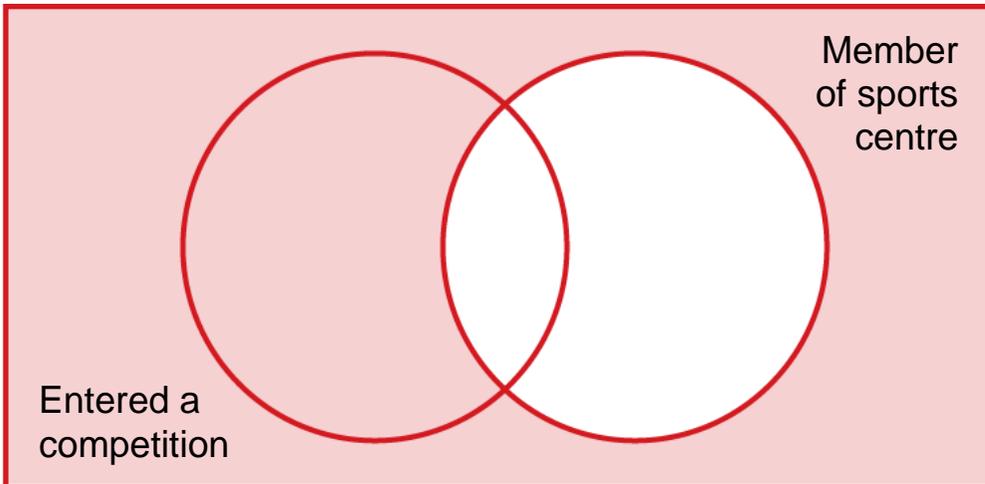


Athletes who have not entered a competition this month.





Members of the sports centre.



Athletes who are not members of the sports centre.



Task 2 – Membership of sets

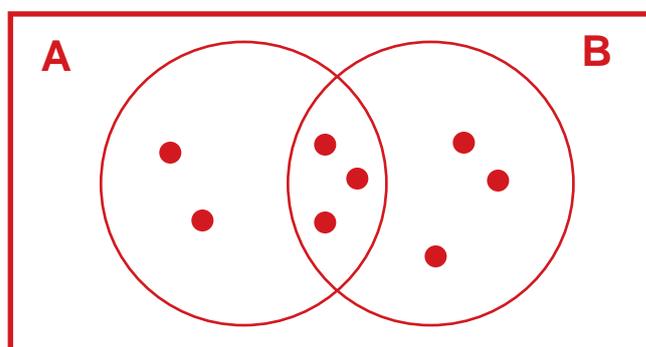
This task explores set membership and Venn diagrams, and is separated into two parts. The PowerPoint slide can be used to introduce the activity to the whole class, if required, although learners could start with the investigation and then the PowerPoint slide can be used as a plenary, if preferred. The objective of this task is to encourage learners to consider the interactions between individual elements of a set, and how the location of an element affects the totals in each region.

The correct answers to the PowerPoint slide are given below:

A and B are two sets. Each set contains dots.

In the example on the right:

- the number of dots in A is 5,
- the number of dots in B is 6,
- and the total number of dots in either A or B is 8.



(a) Which of these are possible to draw?

Draw the ones which are possible.

Dots in A	Dots in B	Dots in either A or B	Possible
3	4	8	No
3	6	8	Yes 2, 1, 5
3	9	8	No
6	7	8	Yes 1, 5, 2

(b) Using your findings from (a) and simple set notation, write a general rule in words to predict whether it is possible to draw the two sets.

$$\{\text{Dots in A}\} + \{\text{Dots in B}\} - \text{Dots in either A or B} = x.$$

The value of x must be positive **and** smaller or equal to the lower value of A or B for it to be possible to draw the two sets.

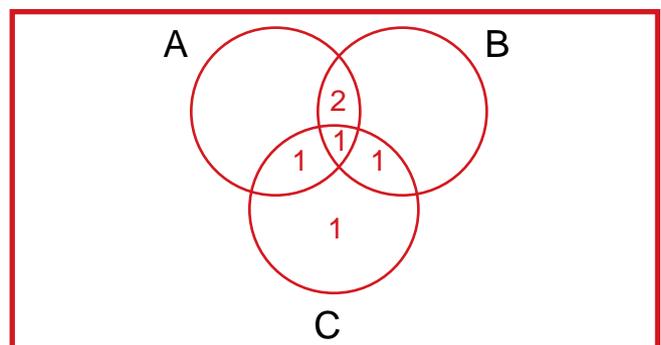
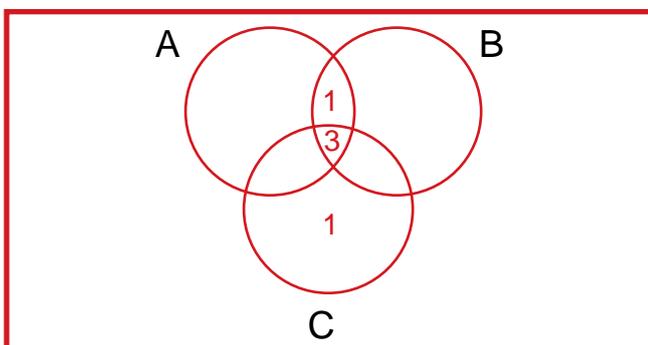
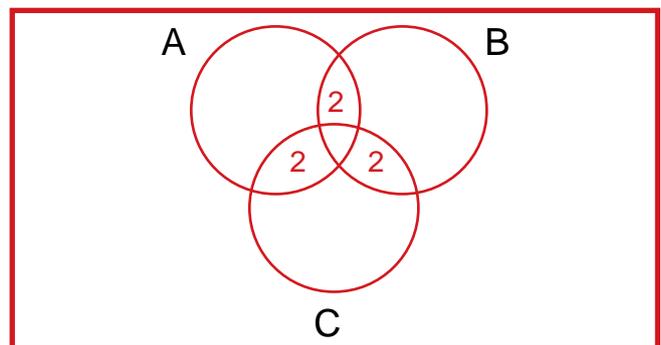
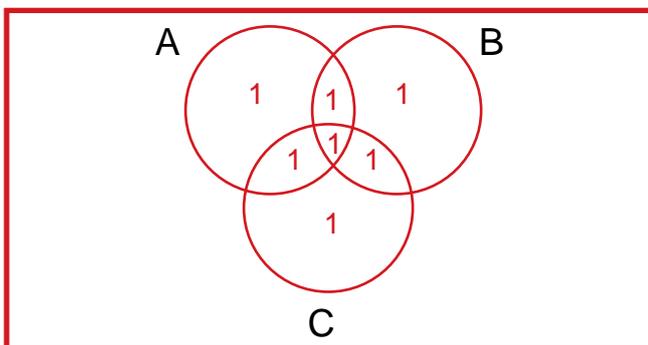
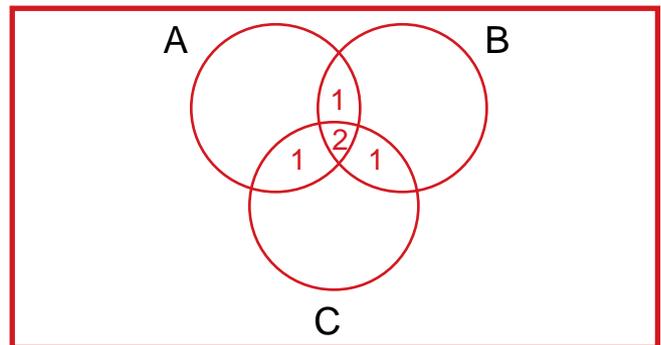
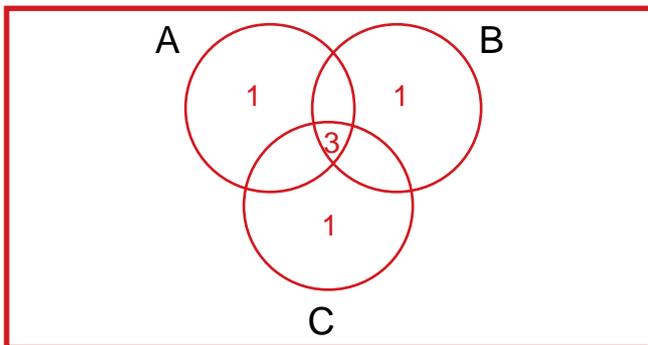
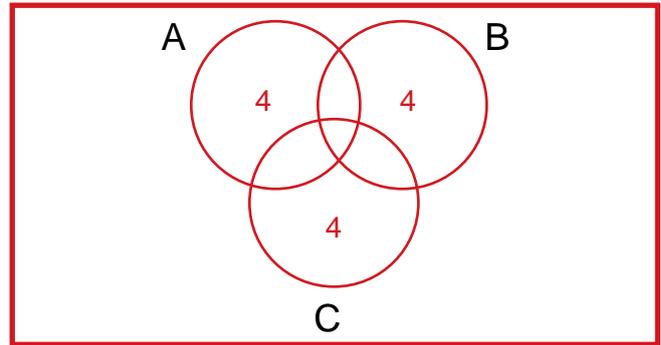
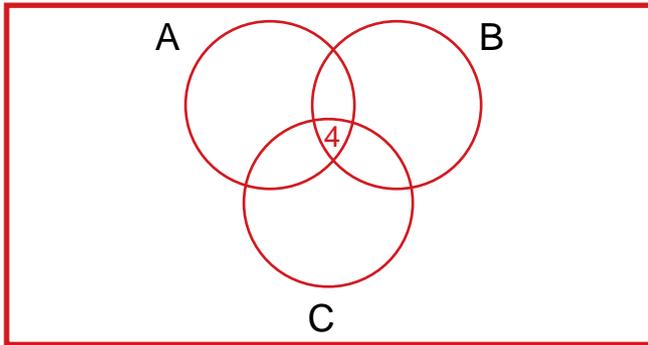
For the investigation, there are 8 blank Venn diagrams provided on the student sheet, however there are more than 8 possible arrangements when rotation is considered. Teachers may choose to give learners more than one copy of the sheet, or encourage them to draw any additional diagrams themselves.

Alternatively, learners can complete this activity on whiteboards.



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Possible arrangements for the investigation are:



The last two diagrams can be rotated to each give two more arrangements.



Task 3 – Venn diagram puzzle

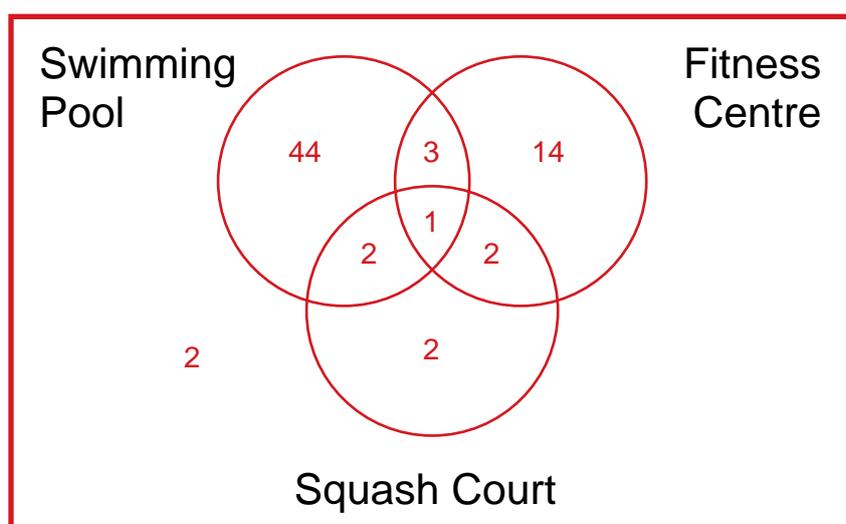
A sports centre took a survey of its customers leaving the centre one day.

The customers were asked which, if any, of the three facilities they had just used, choosing from swimming pool, squash courts and the fitness centre.

Challenge learners to determine the **least number of clues** needed to complete this Venn diagram with the correct numbers. Alternatively, shuffle the clues and take one clue at a time. Learners have to use the clues in the order that they are given to attempt to solve the puzzle. Both of these activities build on task 2 and can be carried out individually or in a small group. This third task explores the relationship between the total in each set and the numbers in the intersections further, as well as linking in related probabilities. More able learners could be directed to task 3 without the need to complete task 2.

The correct answer for the least number of clues is eight:

1. One customer used all three facilities.
2. The probability that a customer used all three facilities was $\frac{1}{70}$.
3. Two customers didn't use any of the three facilities.
4. 2 people used just the squash court.
5. 14 people used just the fitness centre.
6. 44 people used just the swimming pool.
7. The probability that a customer used the swimming pool and the squash court was the same as the probability that a customer used the squash court and the fitness centre.
8. 7 people used the squash court.



Learners could make up and test some similar puzzles using Venn diagrams.

Encourage imagination – but make sure that learners can solve their own puzzle!



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July 2015

