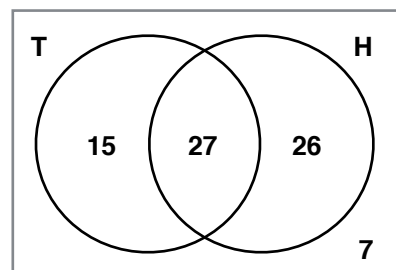


Solving Problems using Venn Diagrams

Starter

1. The Venn diagram alongside shows the number of people in a sporting club who play tennis (T) and hockey (H).



Find the number of people:

- in the club
- who play hockey
- who play both sports
- who play neither sport
- who play at least one sport
- who play tennis but not hockey

Working: (a) Add the numbers in the Venn diagram: $15 + 27 + 26 + 7 = 75$

(b) $27 + 26 = 53$

(c) Look for the intersection (overlap): 27

(d) Look for the number outside the circles: 7

(e) Either $15 + 27 + 26 = 68$ or $75 - 7 = 68$

(f) Look in the T circle — the 27 also play hockey so answer is 15

2. Consider the Venn diagram from question 1. If a person is chosen at random what is the **probability** they:

- | | |
|--------------------------------|----------------------------------|
| (a) play tennis and hockey | (b) do not play tennis or hockey |
| (c) play hockey but not tennis | (d) do not play hockey |

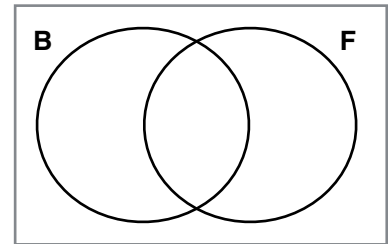
Working: (a) $P(\text{T and H}) = \frac{27}{75} = \frac{9}{25}$

(b) $P(\text{not T or H}) = \frac{7}{75}$

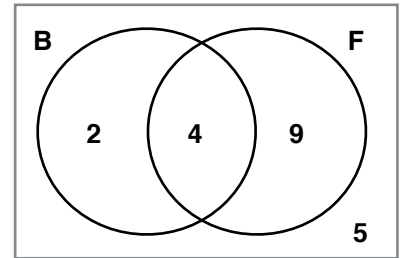
(c) $P(\text{H but not T}) = \frac{26}{75}$ *look in the H circle, 26 only play H*

(d) Do not play hockey = $15 + 7 = 22$ so $P(\text{not H}) = \frac{22}{75}$

3. In a group of **20 boys**:
 6 have blue eyes.
 13 have fair hair.
 4 have fair hair and blue eyes.
 5 have neither blue eyes nor fair hair.
- (a) Copy and complete the Venn Diagram with this information.
- (b) How many boys have blue eyes but not fair hair?



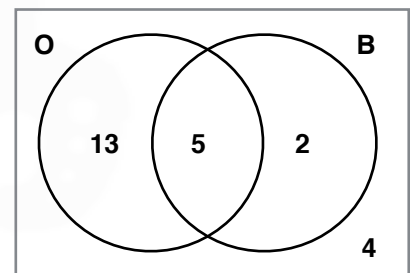
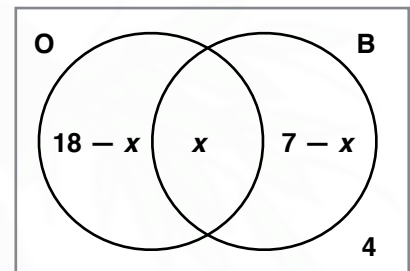
- Working:**
- (a) The 5 can go outside the circles.
 4 goes in the intersection (overlap)
 6 have blue eyes — 4 of these also have fair hair so 2 goes in B but outside F
 13 have fair hair — 4 also have blue eyes so 9 goes in F but outside B
- (b) 2 have blue eyes but no fair hair



E.g. 1 In a group of 24 girls, 18 like oranges, 7 like bananas and 4 like neither oranges nor bananas.

- (a) Draw a Venn diagram to illustrate this information.
- (b) How many girls like both fruit?

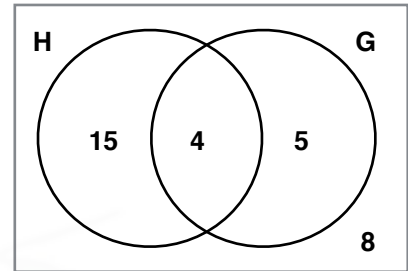
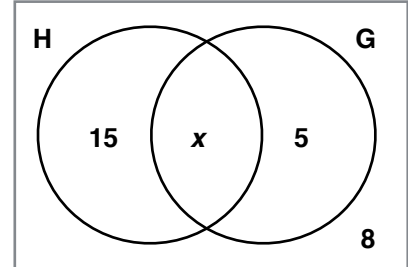
- Working:**
- (a) 4 goes outside the circles
- Let the overlap be x
 18 like oranges so $18 - x$ goes in O but outside B
 N.B. $18 - x + x = 18$
- 7 like oranges so $7 - x$ goes in B but outside O.
- There are 24 girls so:
 $18 - x + x + 7 - x + 4 = 24$
 $x = 5$
- (b) 5 girls like both fruit (intersection)



E.g. 2 24 out of class of 32 students study History or Geography, or both.
15 study History but not Geography. 5 study Geography but not History.

- (a) Draw a Venn diagram to illustrate this information.
(b) A student is chosen at random. Find the probability that the student:
(i) studies both History and Geography
(ii) does not study History

Working: (a) 15 = H but not G
5 = G but not H
Outside both circles = $32 - 24 = 8$
Let the intersection be x .
32 students in total:
 $15 + x + 5 + 8 = 32$
 $x = 4$

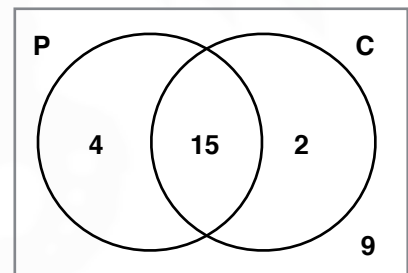


- (b) (i) $P(\text{H and G}) = \frac{4}{32} = \frac{1}{8}$
(ii) Not H = $5 + 8 = 13$
 $P(\text{not H}) = \frac{13}{32}$

E.g. 3 In a class of 30 students, 19 study Physics, 17 study Chemistry, and 15 study both of these subjects.

- (a) Display this information on a Venn diagram.
(b) Find the probability that a student chosen at random studies
(i) both subjects
(ii) at least one of the subjects
(ii) Physics but not Chemistry
(iv) exactly one of the subjects.

Working: (a) Intersection = 15 (study both)
19 study P so $19 - 15 = 4$
4 goes in P but outside C
17 study C so $17 - 15 = 2$
2 goes in C but outside P



Outside the circles = $30 - 4 - 15 - 2 = 9$

- (b) (i) $P(\text{both subjects}) = \frac{15}{30} = \frac{1}{2}$ *intersection*
(ii) $P(\text{at least one subject}) = \frac{4 + 15 + 2}{30} = \frac{21}{30} = \frac{7}{10}$
(iii) $P(\text{P but not C}) = \frac{4}{30} = \frac{2}{15}$
(iv) $P(\text{P or C but not both}) = \frac{4 + 2}{30} = \frac{6}{30} = \frac{1}{5}$

Exercise

Worksheet **Solving problems using Venn diagrams** Qu 1-3

9-1 class textbook: p246 M8.7 Qu 1-6 (Look at Qu 2 and 5 in class)

A*-G class textbook: No exercise

9-1 homework book: p84 M8.7 Qu 1-5

A*-G homework book: No exercise

Solving problems using Venn diagrams SOLUTIONS

Homework book answers (only available during a lockdown)

