Problems with three sets

📊 **T&T2 3.4 Solving...**

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Test Topics   **Mid term Revision.**

① **Coordinate Geometry**
Finding /Plotting points Pg 231
Mid point   Q3
Slope
Equation of the line

② Simultaneous Equations Pg 231 Q4

③ Sets
Pg 46
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Q2 + Q3

Sets

chapter **3**

**41** **Section 3.4 Solving problems using three sets**

Example 1

100 students were asked which of the three items – sweets (S), soft drinks (D) or crisps (C) – they had bought during a school outing.

6 students bought all three
41 students bought sweets
14 students bought crisps and a soft drink
12 students bought sweets and a soft drink

31 students bought crisps
23 students bought a soft drink only
15 students bought crisps and sweets

Illustrate this information on a Venn diagram and write down the number of students who bought
(i)   none of these items
(iii) two items only
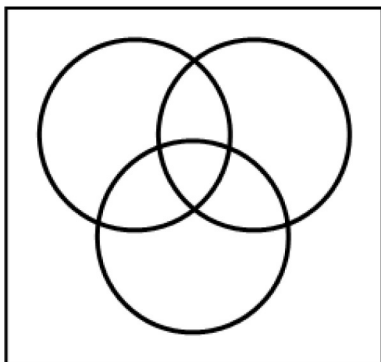
(ii)   sweets only
(iv)   one item only.
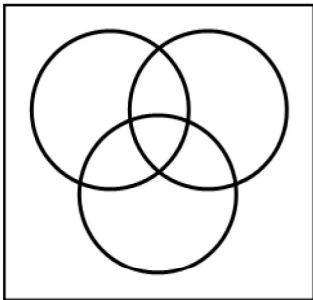
Example 2

There are 86 students taking languages in a school and all take at least one of the languages French, German and Spanish.
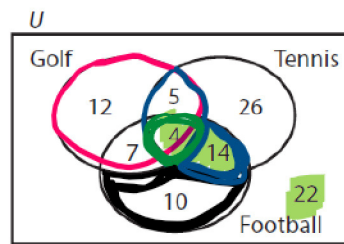
57 take French, 42 take German and 31 take Spanish.

If 25 take French and German, 17 take French and Spanish and 5 take German and Spanish, find how many students take all three languages.

Exercise 3.4

1. The Venn diagram on the right shows the results of a survey of a number of adults to find out which of the games golf, tennis or football, if any, they play.

From the diagram, find the number of people who play

  (i)   golf $12 + 7 + 4 + 5 = 28$

 (ii)   both golf and tennis $5 + 4 = 9$ $G \cap T$

(iii)   all three games 4 $G \cap T \cap F$

(iv)   football only 10 $F \setminus (G \cup T)$

 (v)   none of these games 22 $(G \cup T \cup F)'$

(vi)   both football and tennis $14 + 4 = 18$ $F \cap T$

(vii)   both tennis and football but not golf. 14 $(T \cap F) \setminus G$

What was the total number of people surveyed?

$12 + 5 + 4 + 7 + 14 + 10 + 26 + 22 = 100$ people.

C/W Pg 43 Q2

2. In a language school, all students attending study one or more of the three languages French, English and German.

85 students study French, 60 study English and 25 study German.

If 18 study both French and English, 10 study both French and German, 8 study both English and German and 5 study all three languages, illustrate this information by a Venn diagram and use it to find

  (i)   how many students attend the school $62 + 13 + 5 + 5 + 3 + 39 + 12 = 139$

 (ii)   how many students study one language only $62 + 39 + 12 = 113$

(iii)   how many students study both English and French but not German. 13
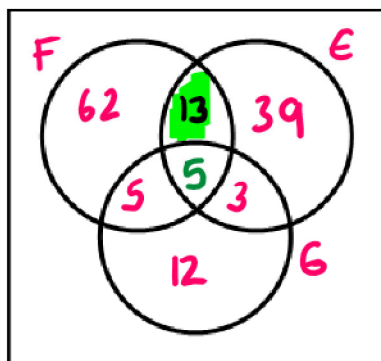

$F = 85 - (13 + 5 + 5) = 62$

$E = 60 - (13 + 5 + 3) = 39$

$G = 25 - (5 + 5 + 3) = 12$

3. At a road checkpoint, 100 cars were examined for defective tyres, brakes and lights. It was found that 12 had defective tyres, 9 had defective brakes, 13 had defective lights, 6 had defective lights and brakes, 7 had defective lights and tyres, 6 had defective tyres and brakes while 4 cars had all three defects.

Represent this information by a Venn diagram and find
  (i) the number of cars which had defective brakes only
  (ii) the number of cars which had two defects only $2+2+3=7$
  (iii) the number of cars which had defective tyres and brakes but not defective lights 2
 (iv) the number of cars with no defect. $100-19=81$
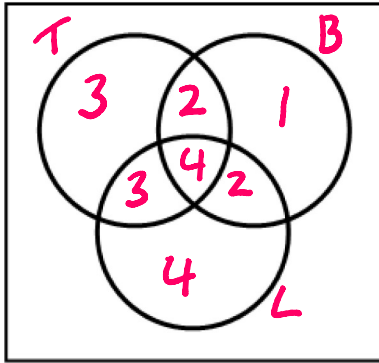
H/W

4. At the end of a touring holiday, 90 US tourists were asked which of the three cities – Dublin, Cork or Galway – they had visited.

60 had visited Dublin, 18 had visited Cork and 50 had visited Galway.

30 visited both Dublin and Galway; 10 visited both Dublin and Cork; 6 visited both Cork and Galway.

If 4 had visited all three cities, find how many tourists
  (i) visited Cork only 6
  (ii) visited both Dublin and Galway but not Cork 26
 (iii) visited none of the three cities.
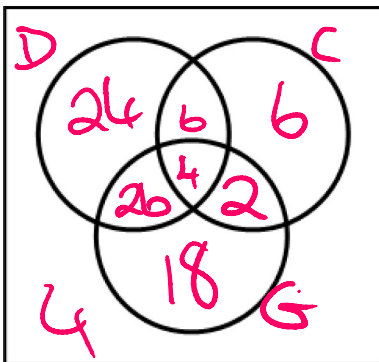
$90-86=4$

5. 100 people were asked which of the papers – *Times*, *Mail* or *Independent* – they had bought on the previous Sunday.

The results showed that 32 people had bought the *Times*, 48 had bought the *Independent* and 35 had bought the *Mail*.

It was found also that 12 people bought both the *Independent* and *Times*, 11 bought both the *Times* and *Mail*, 13 bought both the *Independent* and *Mail*, while 5 people bought all three papers.

Illustrate this information on a Venn diagram and then answer these questions:

  (i)   How many people bought none of these 3 papers?

  (ii) How many people bought the *Times* only?

  (iii) How many people bought the *Independent* and *Mail* but not the *Times*?

  (iv) How many people bought two papers only?
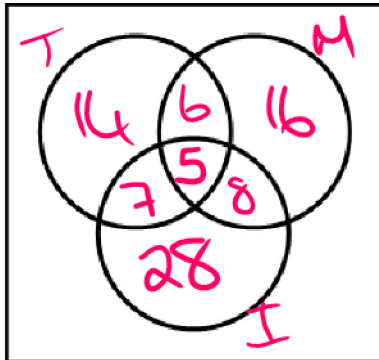
$$U = 100$$

(i) $100 - 84 = 16$

(ii) 14

(iii) 8

(iv) $7 + 8 + 6 = 21$

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6. A survey was taken of 54 students, each of whom was studying one or more of the 3 subjects *A*, *B* and *C*.

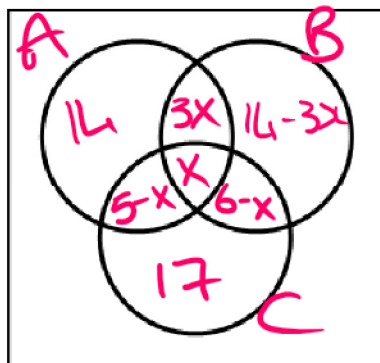6 students studied *B* and *C*. ✓

5 students studied *A* and *C*.

3 times as many students studied *A* and *B* as studied all 3 subjects.

20 students altogether studied *B*.

17 students studied *C* only and 14 students studied *A* only.

Using *x* to represent those students who studied all 3 subjects, illustrate the above information on a Venn diagram.

Hence find the value of *x*.

$$B = 20 - (6 - x + x + 3x)$$

$$20 - 6 + x - x - 3x$$

$$14 - 3x$$

$$54 = 14 + 3x + x + 5 - x + 14 - 3x + 6 - x + 17$$

$$56 + x = 54$$

$$x = 2$$

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7. In a survey, 100 people were asked which of three magazines – *A*, *B* and *C* – they had read on the previous day.

It was found that 29 people read *A*, 40 people read *B* and 38 people read *C*.

Also, 10 people read *A* and *B* but not *C*

          12 people read *B* and *C* but not *A*

           7 people read *A* and *C* but not *B*

7. In a survey, 100 people were asked which of three magazines – A, B and C – they had read on the previous day.

It was found that 29 people read A, 40 people read B and 38 people read C.

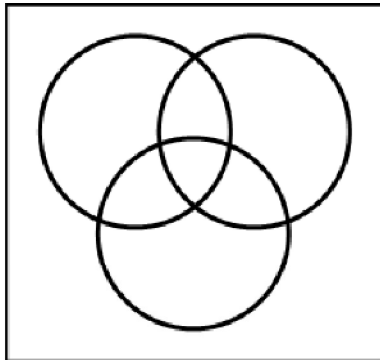Also, 10 people read A and B but not C

12 people read B and C but not A

7 people read A and C but not B

and 30 people did not read any of the three magazines.

Find (i) the number of people who read all three magazines

(ii) the number of people who read one magazine only.

8. 120 Junior Certificate Students took an examination in Maths, Science and French and all students passed in at least one subject. M represents those who passed in Maths, S those who passed in Science and F those who passed in French.
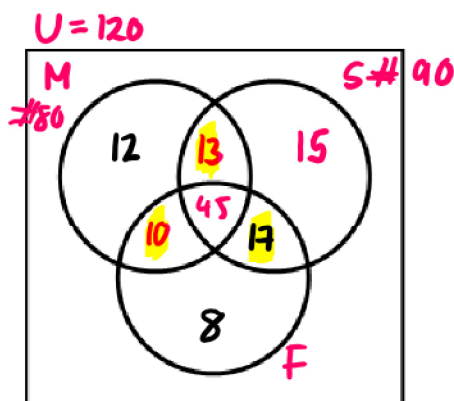
The following are the results of the examination:

$\#M = 80$, $\#S = 90$, $\#(M \cap S \cap F) = 45$, $\#(M \cap S) = 58$,

$\#(M \cap F) = 55$ and $\#[S \setminus (M \cup F)] = 15$

(i) How many students passed in Science only?

(ii) How many students passed in Science and French but failed Maths?

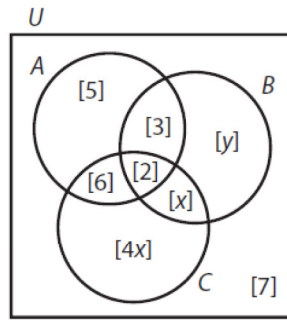(iii) How many students passed in two subjects only? $16 + 13 + 17 = 40$

$U = 120$

$90 = 15 + 13 + 45 + x$

$90 = 73 + x$

$-73 \mid 17 = x$ $\mid -73$

9. In the Venn diagram on the right, the numbers in the brackets represent the number of elements in each region.

If $\#(U) = 50$ and $\#(B) = 16$, find the value of x and the value of y.

10. A survey was taken of a group of 44 students, each of whom was studying one or more of the three subjects – History, Geography and Art.

28 studied History.

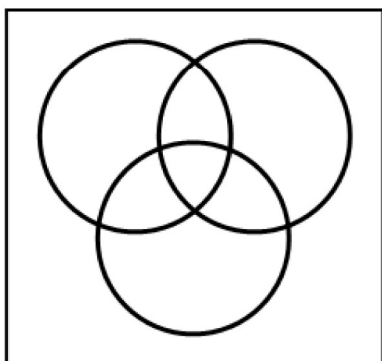30 students studied Geography.

22 students studied Art.

6 students studied History only.

15 students studied both History and Geography.

3 students studied all three subjects.

(i) Use a Venn diagram to find the number of students who studied History and Geography but not Art.

(ii) How many students studied History and Art but not Geography?

(iii) Find the number of students who studied Geography only.

(**Hint:** Let x represent the number of students who studied Geography and Art but not History.)
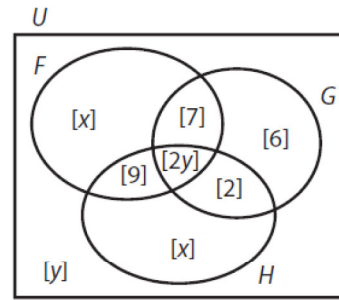
11. In the Venn Diagram on the right

$U = \{$students in a third-level college$\}$
$F = \{$students who study French$\}$
$G = \{$students who study Geography$\}$
$H = \{$students who study History$\}$.

The numbers of students in the various subsets are shown.

For example, 7 students study French and Geography but not History, and y students study none of these subjects.

Given that $\#(U) = 75$ and $\#(F) = 46$, calculate the value of x and the value of y.

Exercise 3.4

1. (i) 28   (ii) 9   (iii) 4   (iv) 10
(v) 22   (vi) 18   (vii) 14; 100
2. (i) 139   (ii) 113   (iii) 13
3. (i) 1   (ii) 7   (iii) 2   (iv) 81
4. (i) 6   (ii) 26   (iii) 4
5. (i) 16   (ii) 14   (iii) 8   (iv) 21
6. $x = 2$
7. (i) 8   (ii) 25
8. (i) 15   (ii) 17   (iii) 40
9. $x = 4, y = 7$
10. (i) 12   (ii) 7   (iii) 4
11. $x = 12, y = 9$