Sets – JCOL

Sets

Checklist	Completed	Revisit
▶ 2023 JCOL – Question 3	☐	☐
▶ 2022 JCOL – Question 5	☐	☐
▶ 2020 Sample JCOL – Question 5	☐	☐
▶ 2019 JCOL Paper 1 – Question 9 (a)	☐	☐
▶ 2018 JCOL Paper 1 – Question 9	☐	☐
▶ 2017 JCOL Paper 1 – Question 2	☐	☐
▶ 2016 JCOL Paper 1 – Question 2	☐	☐
▶ 2015 JCOL Paper 1 – Question 2	☐	☐
▶ 2015 JCOL Sample Paper 1 – Question 1	☐	☐
▶ 2014 JCOL Paper 1 – Question 5	☐	☐
▶ 2014 JCOL Paper 1 – Question 6	☐	☐
▶ 2013 JCOL Paper 1 – Question 4	☐	☐
▶ 2013 JCOL Paper 1 – Question 5	☐	☐
▶ 2012 JCOL Paper 1 – Question 6	☐	☐

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In a survey of a group of 155 students on take-away food:

> 75 said they like Chinese food (C)
> 41 said they like Indian food (I)
> 20 said they like both.

(a) Complete the Venn diagram below to show this information.

U (155)

C I

55

59

(b) How many students in the group like Chinese food **only?**

(c) Explain what the following statement means, in the context of this survey, where C' is the complement of the set C:

$$\#(C') = 80$$

6 students in a class (U) were asked if they ran (R) or cycled (C) during the midterm break.

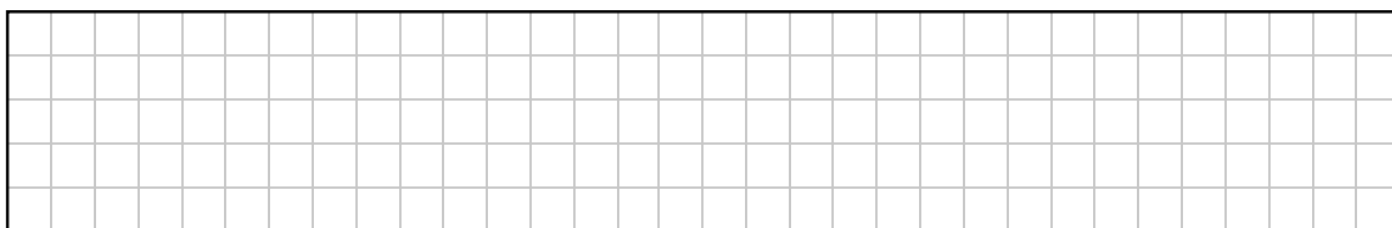The Venn diagram shows their responses.
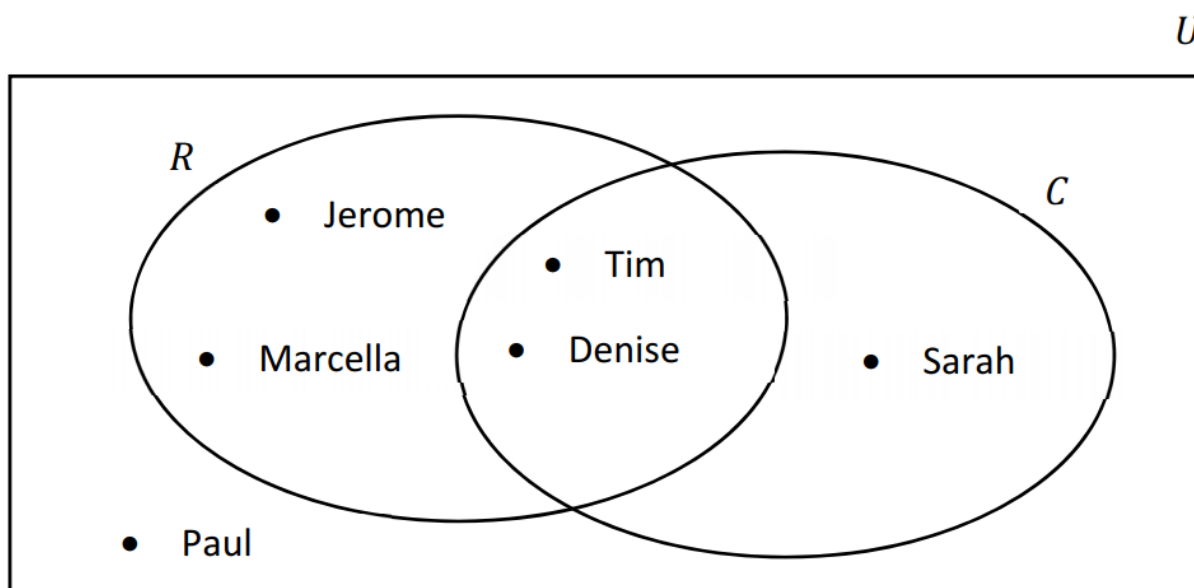
(a) Name one student who **ran** during the midterm break.

Answer:

(b) Explain what the following statement means, in terms of the students in the class:

$$\#C = 3$$

(c) Name one student who is region $R \cap C$ in the Venn diagram.

Answer:

(d) One student is picked at random from the six students in the Venn diagram.
    Write down the probability that this student **ran** during the midterm break.

Answer:

Kate carried out a survey on the students in her year (U) to see how many study French (F) or German (G). Her results are shown in the Venn diagram below, where $x \in \mathbb{N}$.

(a) How many students study German but **not** French?

(b) In **total**, how many students study French? Give your answer in terms of x.

(c) Complete the sentence below correctly:

"$3x$ students study _____ ."

(d) Explain what the following statement means, in the context of Kate's survey:

$$\# (F \setminus G) = 68$$

(e)   One student is picked at random from the $3x + 25$ students who study German.

Write down the **probability** that this student also studies French.
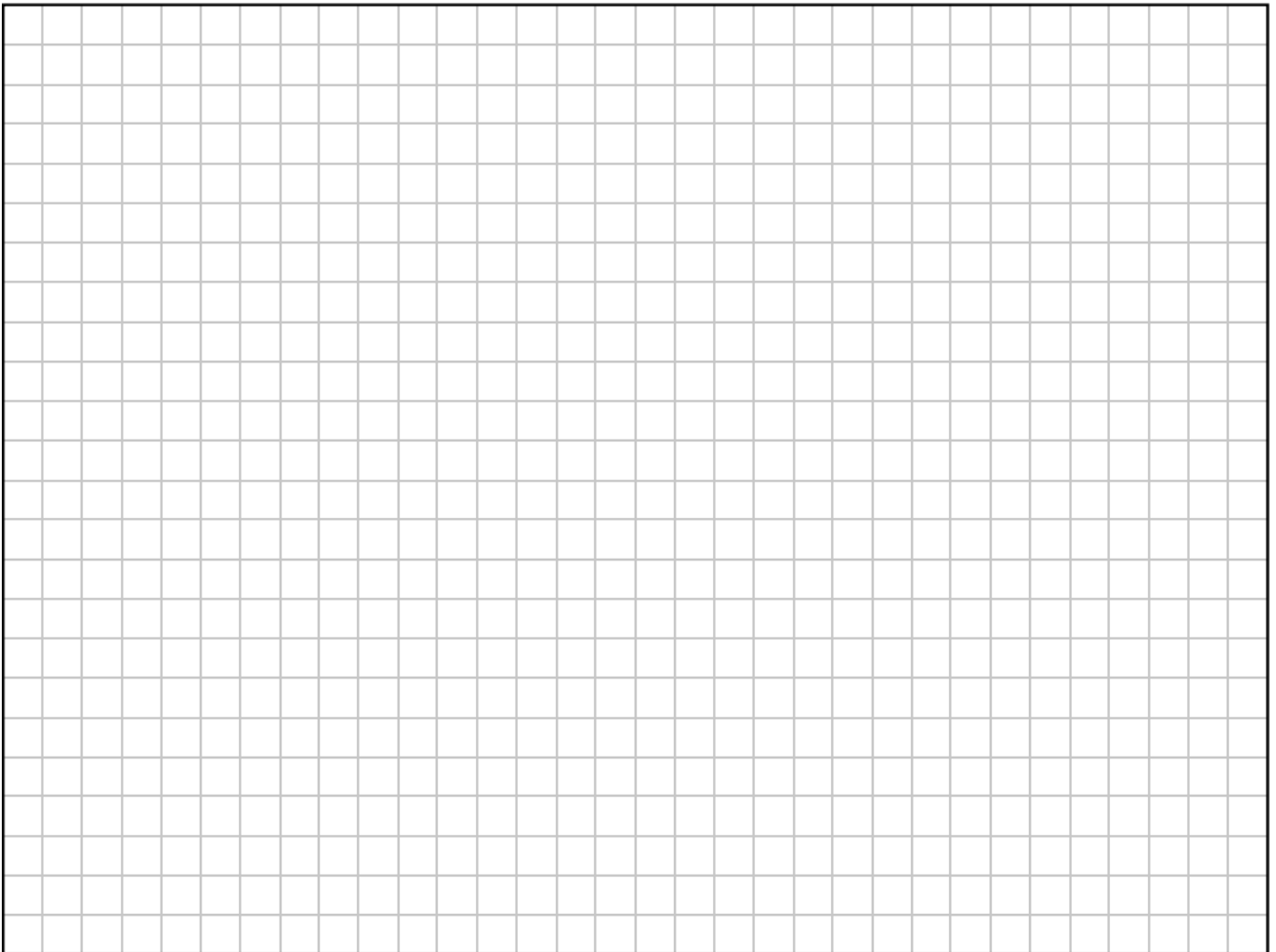
Give your answer as a fraction, in terms of x.

$$\text{Probability} = \frac{}{}$$

(f)   Kate finds out that there are 141 students in total in her year.

She writes the following equation in x:

$$68 + 3x + 25 + x = 141$$

Work out the value of x.

A school team orders t-shirts and half zips.

Jill, Mike, Ted, and Gary order **t-shirts** (T).

Jill and Alice order **half zips** (Z).
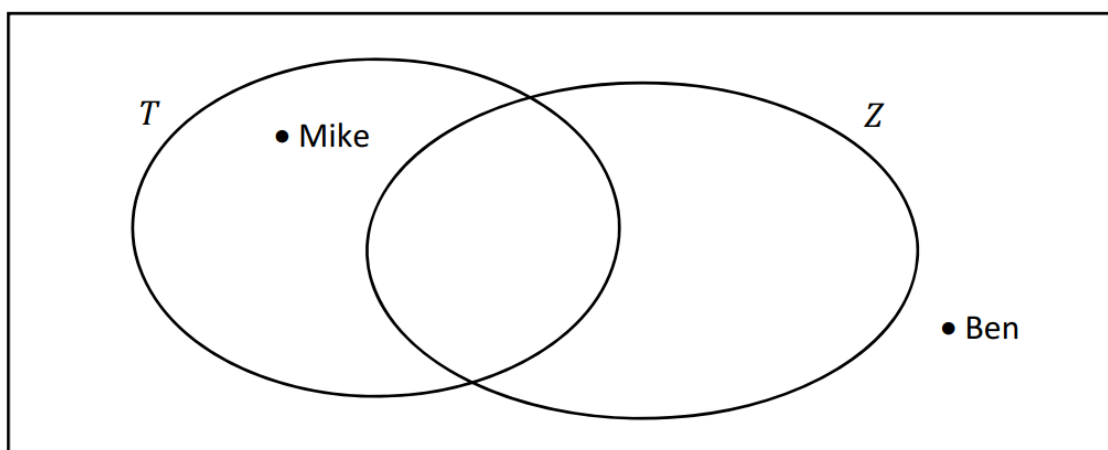
Ben and Zena **don't order either**.

(i) Complete the Venn diagram below to show this information, where:

U is the whole team (the universal set)

T is the set of people ordering t-shirts

Z is the set of people ordering half zips.

t-shirt	half zip

(ii) In total, how many students are on the team?   Answer:

(iii) Write each term from the following list into the correct space in the table below, to match each description to the correct term in set notation. Z' is the complement of Z.

$$Z \setminus T \qquad T \cap Z \qquad Z'$$

	Description	Set notation
1	The students who order **both** t-shirts **and** half zips	
2	The students who order half zips but **not** t-shirts	
3	The students who do **not** order half zips	

(a) The Venn diagram below shows the sets A and B.

List the elements of each of the following sets.

(i) $A =$ {   }

(ii) $A \cap B =$ {   }

(iii) $B \backslash A =$ {   }

(b) Tom says: "$P \cap Q$ is a **subset** of P, for any two sets P and Q."

State whether Tom's statement is always true, sometimes true, or never true.

Tick (✓) **one** box only. **Justify** your answer.

Justification:

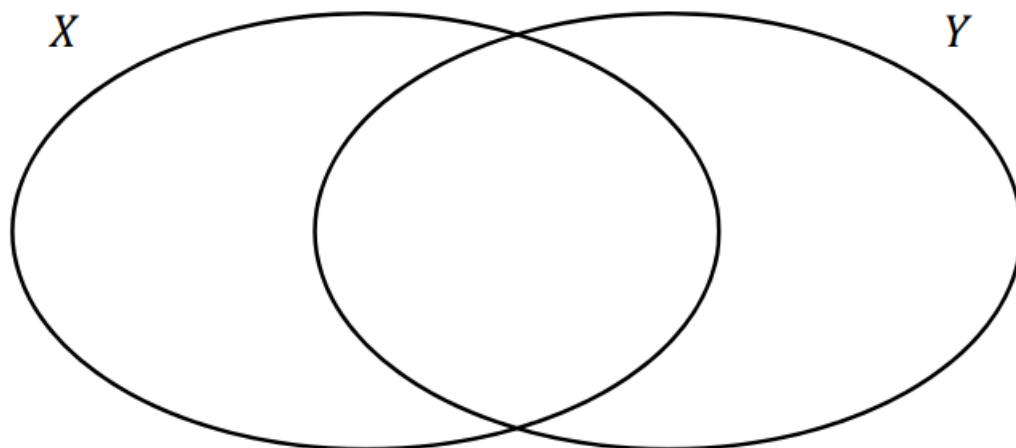(a)   Fill in the Venn diagram below, given that:

$$X = \{\, N,\ I,\ C,\ O,\ L,\ A \,\}$$

$$Y = \{\, S,\ O,\ P,\ H,\ I,\ A \,\}.$$

X   Y

(b)   Write down a **subset** of X that has 2 elements, and that is also a subset of Y.

Answer = $\{$, $\}$

(c)   Write down a **subset** of X that has 2 elements, and that is **not** a subset of Y.

Answer = $\{$, $\}$

(d)   Complete the table.

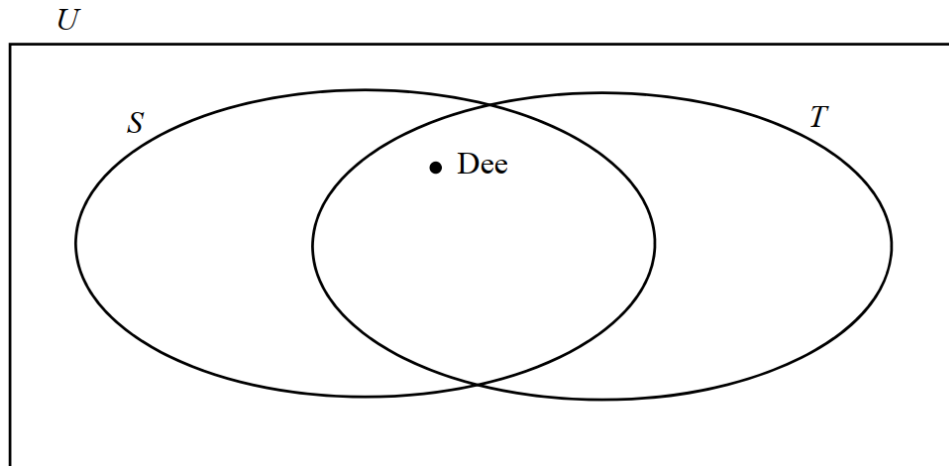|	English	Set Notation
Statement 1	Letters in both X **and** Y.	$X \cap Y$
Statement 2		$X \backslash Y$
Statement 3	Letters in X **or** Y **or both**.	

Dee, Máire, Ray, Evan, and Fiona all use Snapchat (S).

Dee, Máire, and Ray use Twitter (T).

Zach doesn't use Snapchat or Twitter.

(a)   Use this information to complete the Venn diagram below, where U is the universal set.

U

S   T

• Dee

(b)   List the elements of each of the following two sets, where $S\,'$ is the complement of the set S.
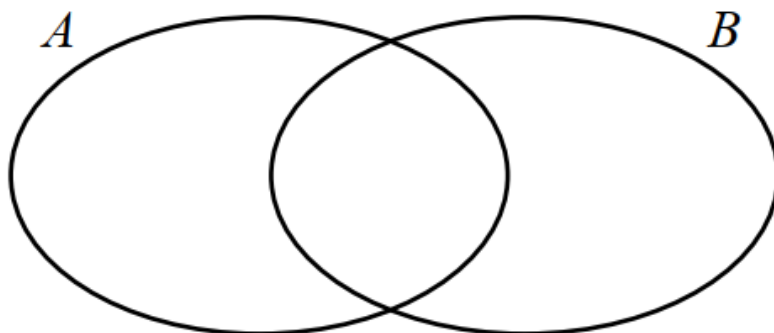
(i) $S \cap T =$

(ii) $S' =$

(c)   Put a tick (✓) in the correct box in each row of the table below, to show whether each statement is true or false.

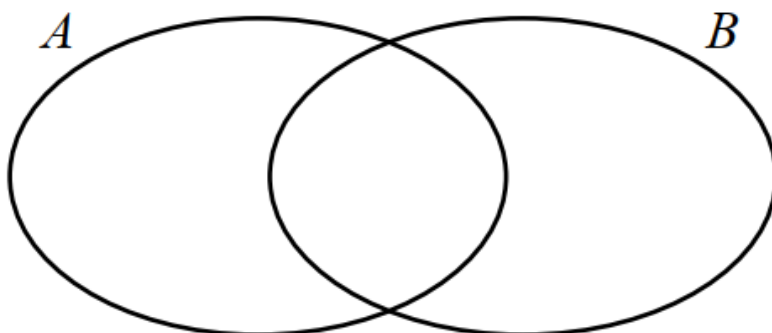| Statement	Tick **one** only for each statement	
	True	**False**
$\# S = 3$		
Dee $\in T$		
$S \cup T = T \cup S$		
$T \subset S$		
$S \setminus T = \{\,\}$		

(a)   On the Venn diagram below, shade in the region that represents $A \cap B$.

A B

(b)   On the Venn diagram below, shade in the region that represents $A \cup B$.

A B

(c)   On the Venn diagram below, shade in the region that represents $(A \cup B) \setminus (A \cap B)$.

A B

(d)   Put a tick (✓) in the correct box to show which of the following represents the elements that are **in A but not in B**.

$B \setminus A$ $A + B$ $A \setminus B$

☐   ☐   ☐

The set *S* is shown in the Venn diagram below. It has 5 elements.

Some students are asked to write down **subsets** of *S* that have **3 elements** each.
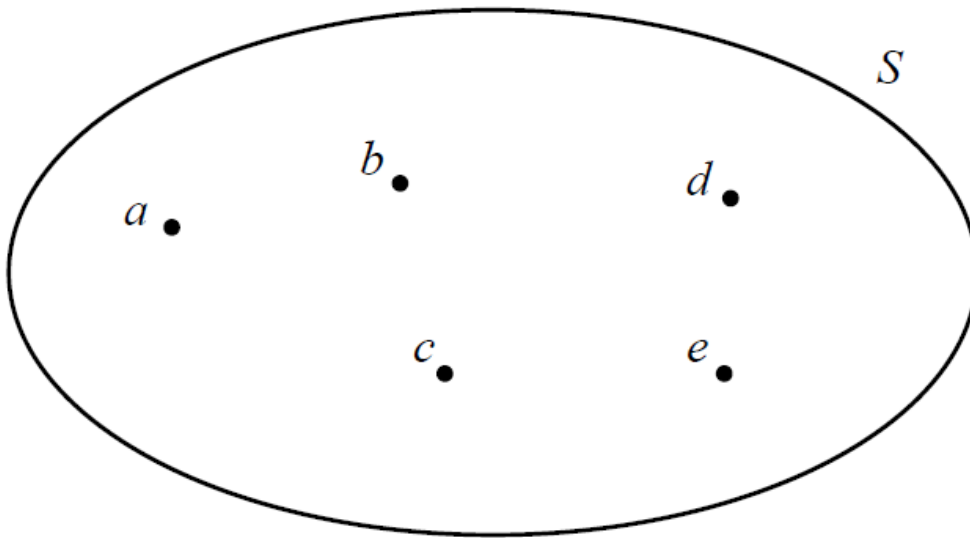
Eoin writes down the subset {*a*, *c*, *d* }.

Write down **two more subsets** of *S* that have 3 elements each.

Subset 1 = { , , }

Subset 2 = { , , }

Cliodhna writes down {*a*, *b*, *w*}.
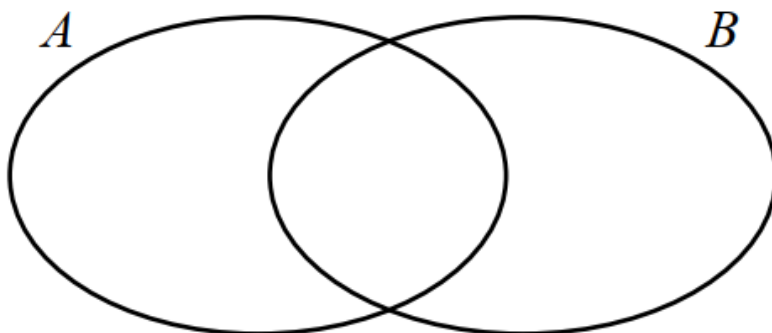
Explain why this is **not** a subset of *S*.

(a)   On the Venn diagram below, shade in the region that represents $A \cup B$.
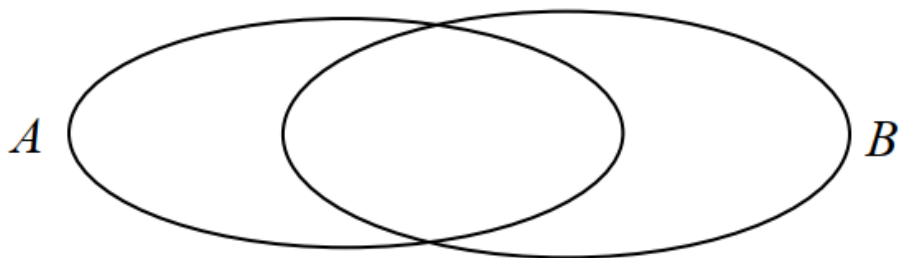
(b)   On the Venn diagram below, shade in the region that represents $A \cap B$.
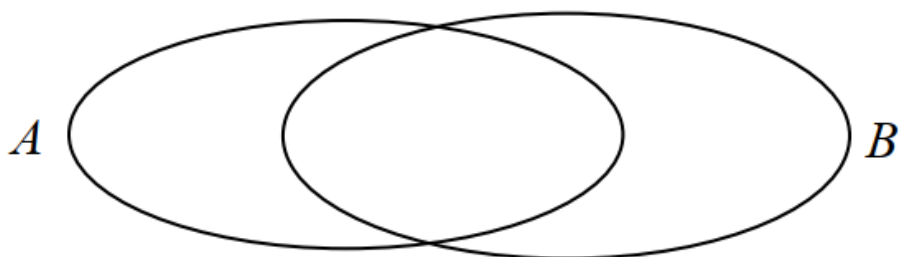
(c)   Using your answers to (a) and (b) above, or otherwise, shade in the region $(A \cup B) \setminus (A \setminus B)$.
       on the Venn diagram below.
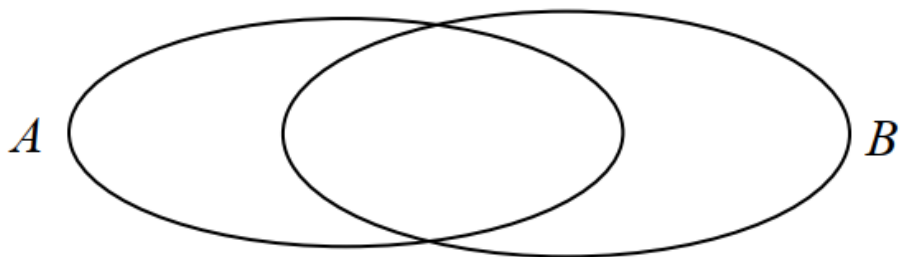
(d)   If A represents the students in a class who like fruit and B represents the students in the same
       class who like vegetables, write down what the set $A \setminus B$ represents.

(a)   John was asked to give an example of a set.

He said: "The set of good websites."

Explain why this is **not** a set.

(b)   The sets U, A and B are defined as follows:

$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

A is the set of multiples of 2, from 1 to 10 inclusive.

B is the set of multiples of 3, from 1 to 10 inclusive.

(i)   Use these sets to fill in the Venn diagram.

U

(ii)   Using your Venn diagram, find the smallest number that is both a multiple of 2 and a multiple of 3 (the least common multiple).

As part of a survey, 35 students were asked if they like Rihanna (R) or One Direction (D).

Some of the results are shown in the Venn diagram below.

(i) Complete the Venn diagram.

(ii) How many pupils liked One Direction?

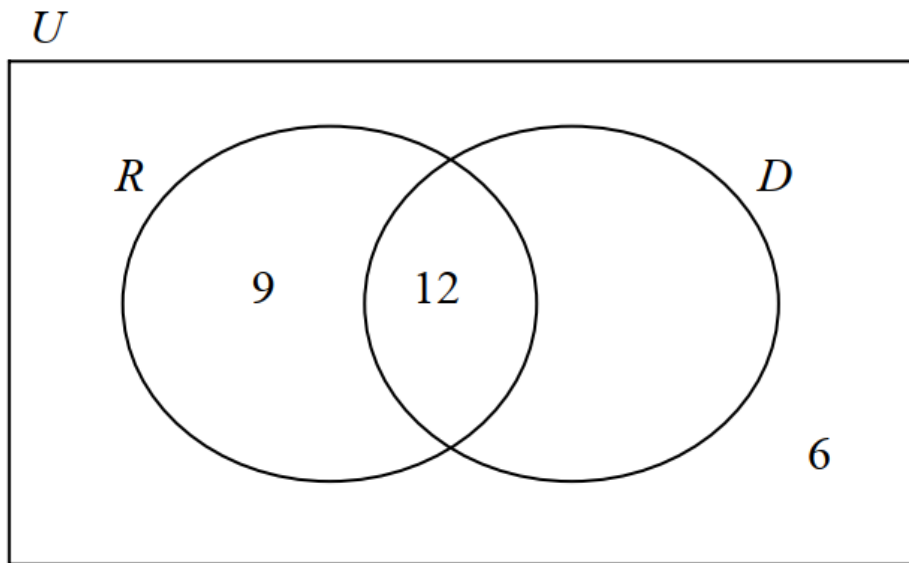**(iii)** Shade the region of the Venn diagram which represents $R \setminus D$.

(iv) Describe in your own words what this shaded region represents.

The sports played by a set of girls G and a set of boys B in a Limerick school are shown in the Venn diagram.

G — Camogie, Hockey

Tennis, Basketball, Football

B — Hurling, Rugby

(a) Describe the region of the diagram where camogie and hockey are located.

(b) Describe the region of the diagram where tennis, basketball and football are located.

(c)

    (i) In the Venn diagram, shade the set $(A \cup B)$.

U

A B

    (ii) In the Venn diagram, shade the set $(A \cup B)'$ where $(A \cup B)'$ is the complement of $A \cup B$.

U

A B

$U = \{$Natural numbers from 1 to 10 inclusive $\}$ $K = \{$Factors of 6 $\}$ $L = \{$Even Numbers $\}$

(a)   Fill in the Venn diagram below:

U
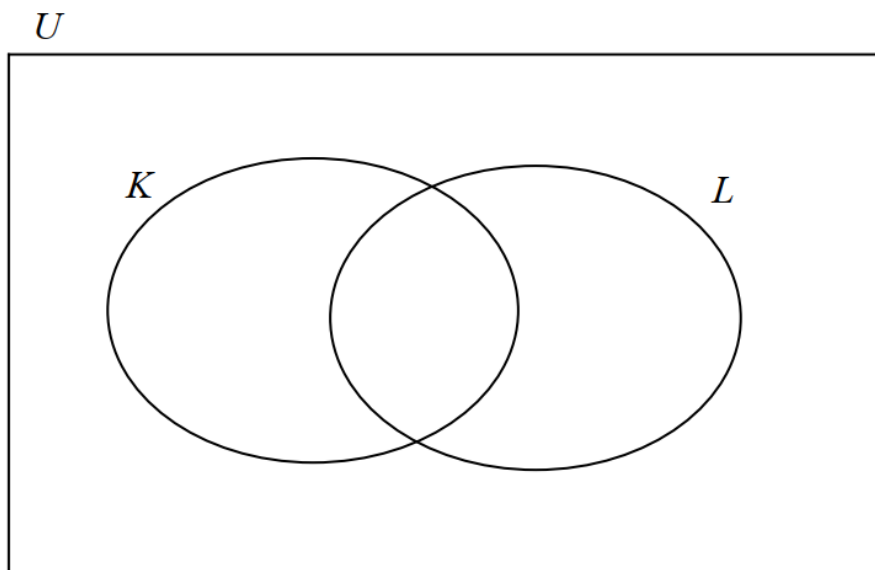
(b)   Use ✓ to indicate whether each of the following statements is true or false.

Give a reason for each answer.

(i) $K \cap L = \{\ \}$

True ☐   False ☐

Reason

(ii) $K \neq L$

True ☐   False ☐

Reason

(iii) $K \cup L = U$

True ☐   False ☐

Reason

The universal set, $U = \{1, 2, 3, 4, 5, 7, 10, 11, 13, 17, 19, 20\}$

A is the set of prime numbers between 1 and 20. B is the set of factors of 20.

(a) List the elements of the set A.

$A = \left\{ \quad , \quad , \quad , \quad , \quad , \quad , \quad \right\}$

(b) List the elements of the set B.

$B = \left\{ \quad , \quad , \quad , \quad , \quad \right\}$

(c) Fill in the Venn diagram below placing all elements of U in the correct regions.

(d) List the elements of $A \cap B$.

$A \cap B = \left\{ \quad \right\}$

(e) Complete the sentence below.
     If an element is in the region $A \cap B$, it has two properties: it is a prime number and it is

_____

(f) The number 16 is added to the universal set. Place 16 in the correct region in the Venn diagram in part (c) and explain why you placed it there.

Reason: