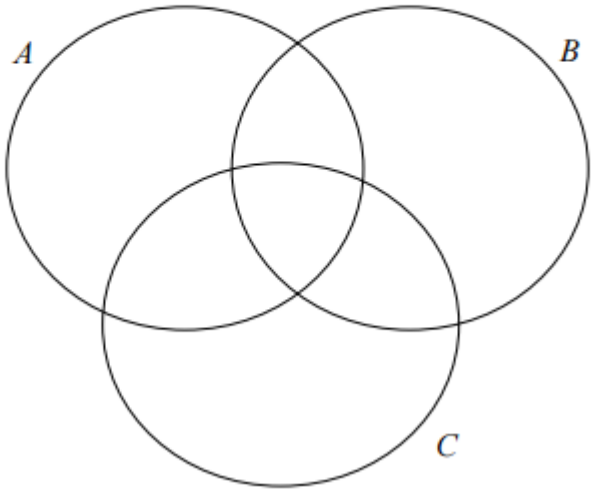
The sets A, B, and C are as follows:

$$A = \{1, 2, 3, 5, 6, 7\} \qquad B = \{2, 3, 4, 5, 8, 9\} \qquad C = \{1, 4, 5, 10\}.$$

(a) Complete the Venn diagram below.



(b) List the elements of each of the following sets.

$A \cup B =$ _____

$A \setminus C =$ _____

$A \cup (B \cap C) =$ _____

(c) Complete the following identity.

$$A \cup (B \cap C) = (A \cup B) \cap (\_\_\_\_\_)$$

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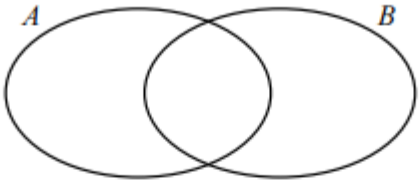
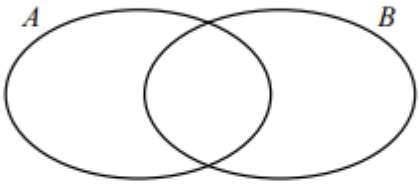
Question 2 **(Suggested maximum time: 5 minut**

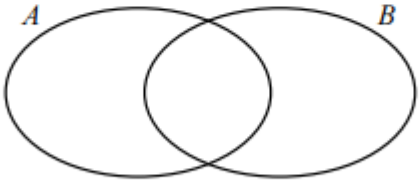
(a) On the Venn diagram below, **shade in** the region that represents $A \cap B$.



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



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



(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***.

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

Question 5 **(Suggested maximum time: 5 minutes)**

(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.

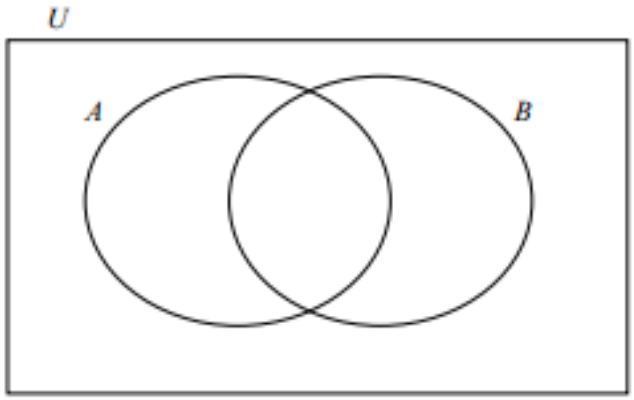
(b) The sets U, A, and B are defined as follows:

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

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.



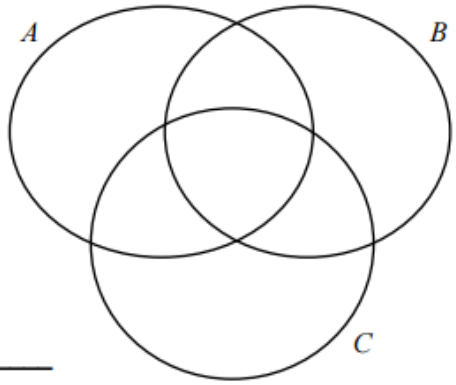
(ii) Using your Venn diagram, find the smallest number that is both a multiple of 2 **and** a multiple of 3 (the least common multiple).

Question 3 **(Suggested maximum time: 10 minutes)**

(a) The sets A, B, and C are as follows:

$A = \{2, 3, 4, 5, 6\}$, $B = \{2, 4, 6, 8, 10\}$, and $C = \{1, 4, 8, 12, 14\}$.

(i) Complete the Venn diagram.



(ii) List the elements of each of the following sets:

$A \cap B =$ _____

$B \setminus (A \cap C) =$ _____

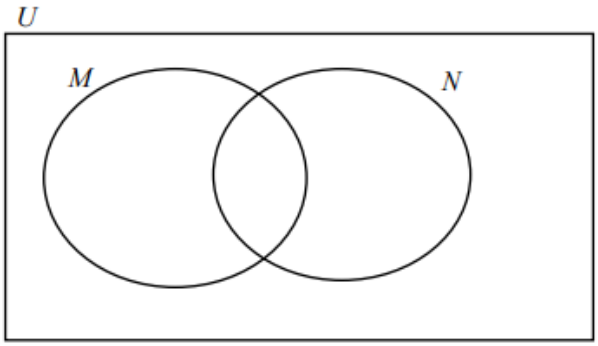
$(B \setminus A) \cup (B \setminus C) =$ _____

(iii) Write down a null set, in terms of A, B, and C. _____

(b) In a table quiz, 100 questions were asked. Team M answered 72 questions correctly. Team N answered 38 questions correctly.

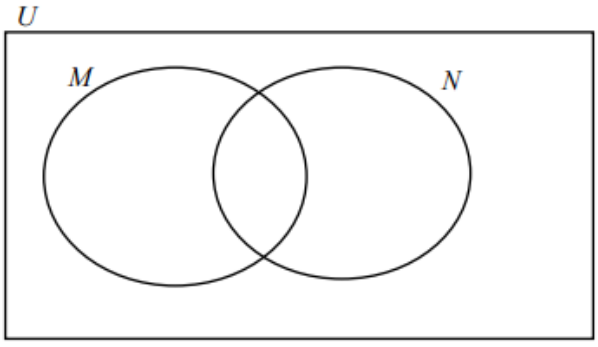
(i) Find, with the aid of the Venn diagram, the minimum number of questions answered correctly by both teams.

Minimum =



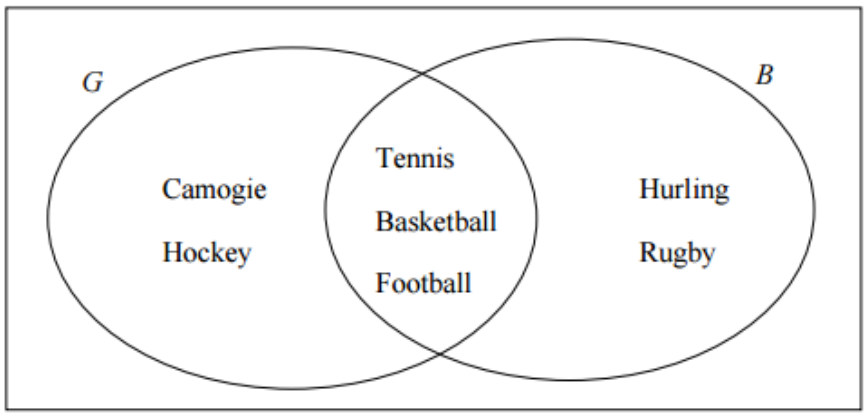
(ii) Find, with the aid of the Venn diagram, the maximum number of questions answered correctly by both teams.

Maximum =



Question 4 **(Suggested maximum time: 5 minutes)**

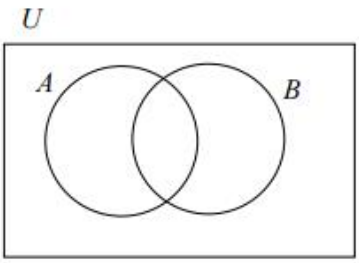
The sports played by a set of girls G and a set of boys B in a Limerick school are shown in the Venn diagram.



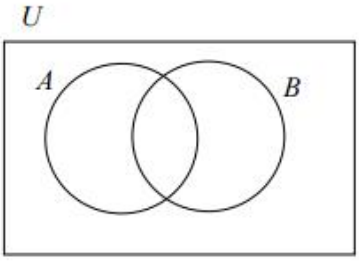
(a) Describe the region of the diagram where camogie and hockey are located.

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

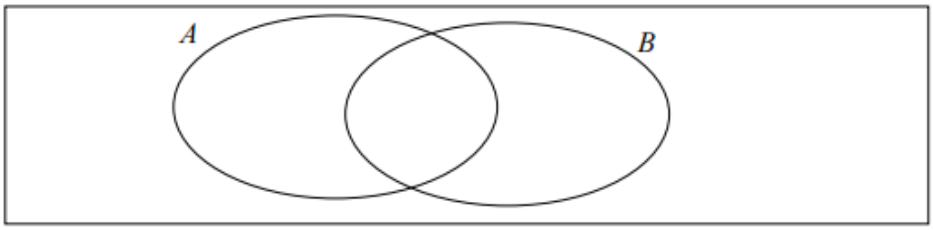
(c) **(i)** In the Venn diagram, shade the set $A \cup B$.



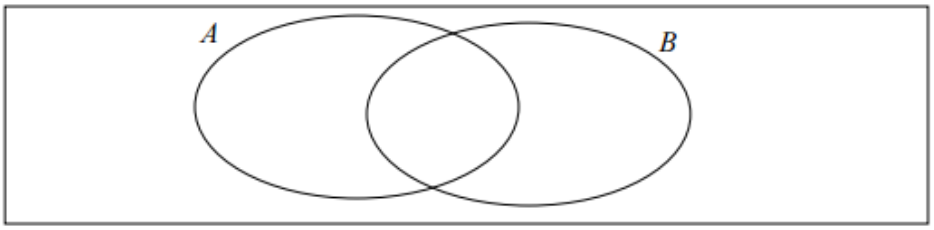
(ii) In the Venn diagram, shade the set $(A \cup B)'$, where $(A \cup B)'$ is the complement of $A \cup B$.



1. **(a)** **(i)** Using the Venn diagram below, shade in the region that represents $A \cap B$.



(ii) Using the Venn diagram below, shade in the region that represents $B \setminus A$.

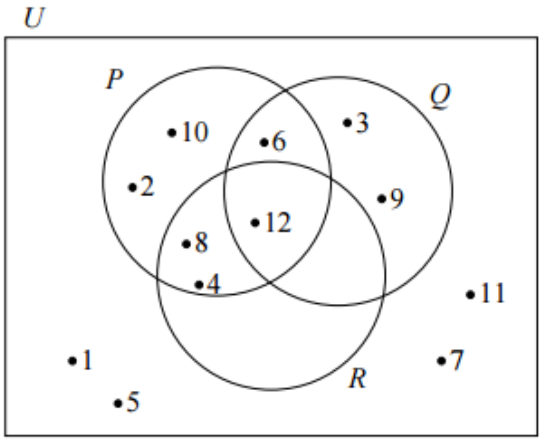


(b) U is the universal set.

$P = \{2, 4, 6, 8, 10, 12\}$ is the set of multiples of 2 less than 13.

$Q = \{3, 6, 9, 12\}$ is the set of multiples of 3 less than 13.

$R = \{4, 8, 12\}$ is the set of multiples of 4 less than 13.



(i) List the elements of $Q \cup R$.

(ii) List the elements of P', the complement of the set P.

(iii) Write down $\#R$.

(iv) What is the lowest common multiple of 2, 3 and 4?

(c) A survey was carried out in a class to find which of the films A, B or C the students had seen.

The following data was collected:

42% saw film A	41% saw film B	45% saw film C
12% saw both A and B	18% saw both B and C	15% saw both A and C

15% saw none of these films.

(i) ✍ Represent this information on a Venn diagram.

(ii) ✍ What percentage of the students in the class saw all three films?

(iii) ✍ What percentage of the students in the class saw two or more of the films?

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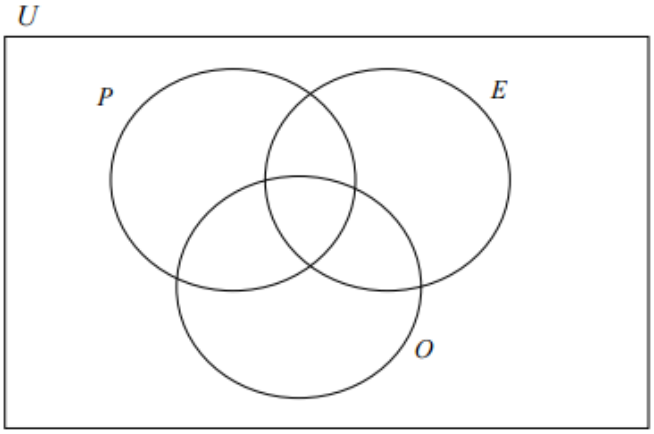
Question 2 **(Suggested maximum time: 5 minutes)**

$U = \{1, 2, 3, ..., 12\}$. P is the set of prime numbers less than 12. E is the set of even numbers less than 12. O is the set of odd numbers less than 12.

(a) Represent these sets on the Venn diagram.



(b) Name any set on this diagram (after part **(a)** has been completed) that is a null set.

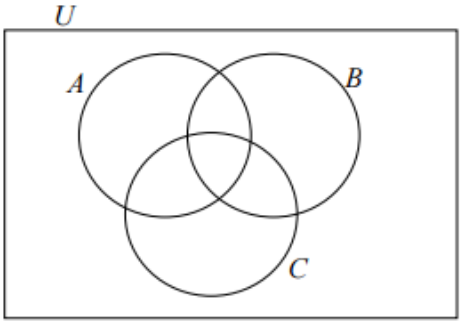
(c) If a number is drawn at random from **set *P***, what is the probability that it is even?

JC PM HL 2013

Question 3 **(Suggested maximum time: 15 minutes)**

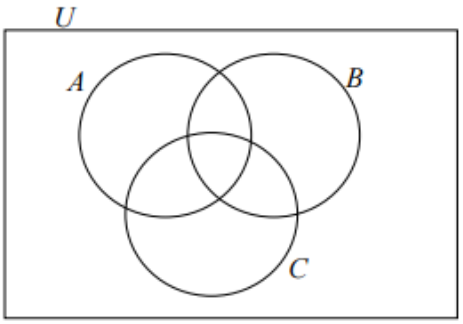
(a) For diagrams **(i)** and **(ii)** below, shade in the named region.

(i)



$A \cap B \cap C$

(ii)



$(A \cap B) \setminus C$

(b) The box on the right contains six statements, (**note**: P', is the complement of a set P).

A number of the statements are incorrect.

Write down one incorrect statement.

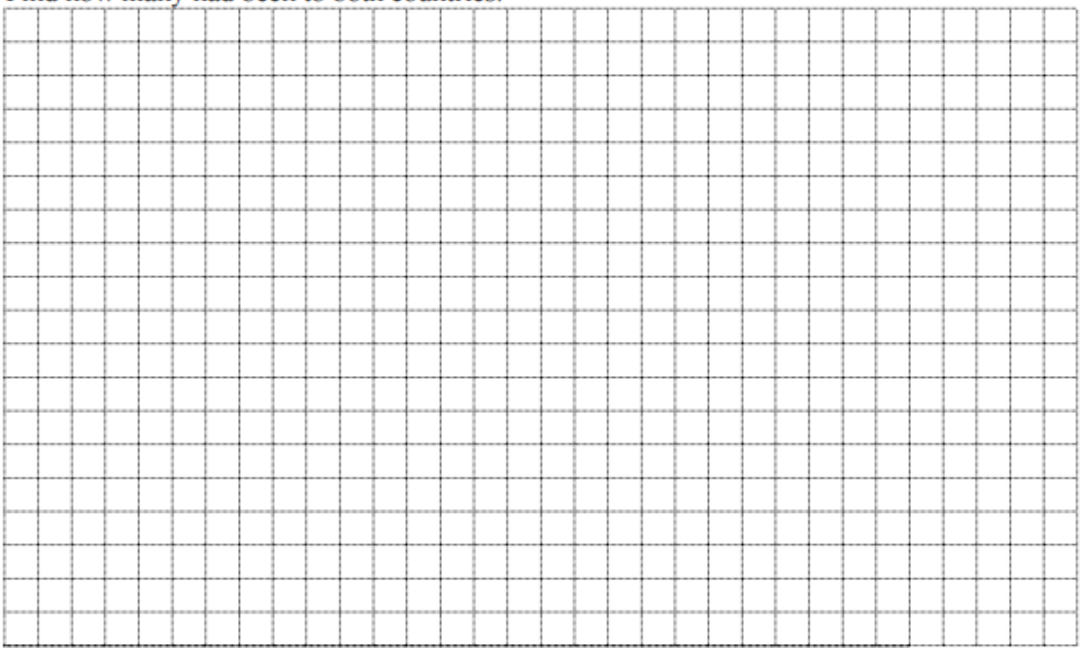
_____

Statements	
(i)	$A \cup B = B \cup A$
(ii)	$(A \cup B) \cup C = A \cup (B \cup C)$
(iii)	$(A \setminus B) \setminus C = A \setminus (B \setminus C)$
(iv)	$(A \cap B)' = U \setminus (A \cap B)$
(v)	$A \setminus B = B \setminus A$
(vi)	$B \setminus (A \cup C) = (B \cup C) \setminus A \setminus C$

Draw a diagram **or** give an example to explain your choice.

(c) A group of 38 students were asked if they had ever been to France or Spain.
The number who had been to Spain only was 3 more than the number who had been to both countries.
Twice as many had been to France as Spain.
4 students had not been to either country.

Find how many had been to both countries.



Question 6 **(Suggested maximum time: 5 minutes)**

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.

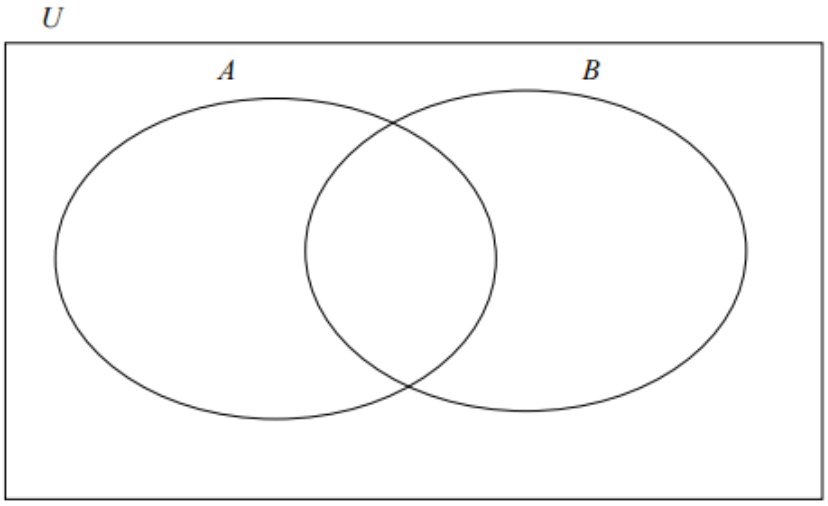
(a) List the elements of the set A.

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

(b) List the elements of the set B.

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

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



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

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

(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:

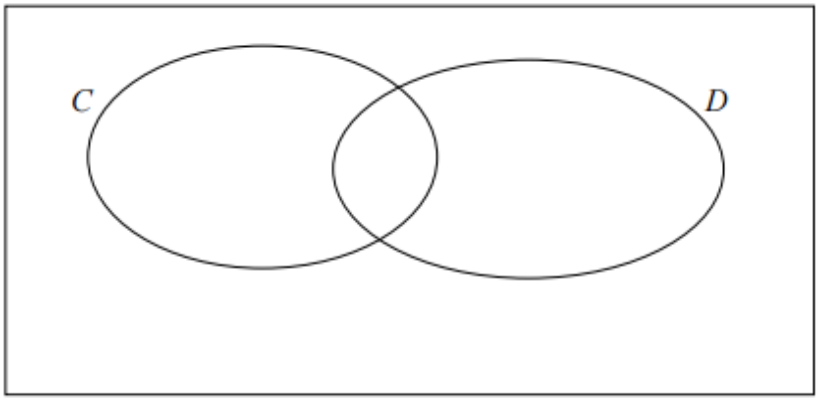
(c) In a survey, 60 households were asked if they had a cat (C) or a dog (D).

20 said they had a cat.

25 said they had a dog.

12 said they had both a cat and a dog.

(i) Represent this information in the Venn diagram below.



(ii) How many households had only a cat or a dog?

(iii) What percentage of households had neither a cat nor a dog?

(b) $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$ is the universal set.

$P = \{3, 5, 6, 8, 10\}$, $Q = \{2, 4, 6, 8, 10, 12\}$ and $R = \{2, 5, 6, 7, 9, 12\}$ are three subsets of U.

(i) Represent the above information on a Venn diagram.

Hence list the elements of:

(ii) $(P \cup Q \cup R)'$

(iii) $(P \cap Q) \setminus R$.

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(c) U is the universal set and P and Q are two subsets of U.

$\# U = 30$, $\# P = 16$ and $\# Q = 6$.

(i) ✍ Find with the aid of a Venn diagram the minimum value of $\# (P \cup Q)'$.

(ii) ✍ Find with the aid of a Venn diagram the maximum value of $\# (P \cup Q)'$.

$\# U = u$, $\# P = p$, $\# Q = q$ and $\# (P \cup Q)' = x$.

(iii) ✍ Show with the aid of a Venn diagram, that if $p > q$ and x is a maximum, then $u = p + x$.

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