

IB Sets and Venn Diagram Questions-Package #1

1. U is the set of all the **positive** integers less than or equal to 12.
 A , B and C are subsets of U .

$$A = \{1, 2, 3, 4, 6, 12\}$$

$$B = \{\text{odd integers}\}$$

$$C = \{5, 6, 8\}$$

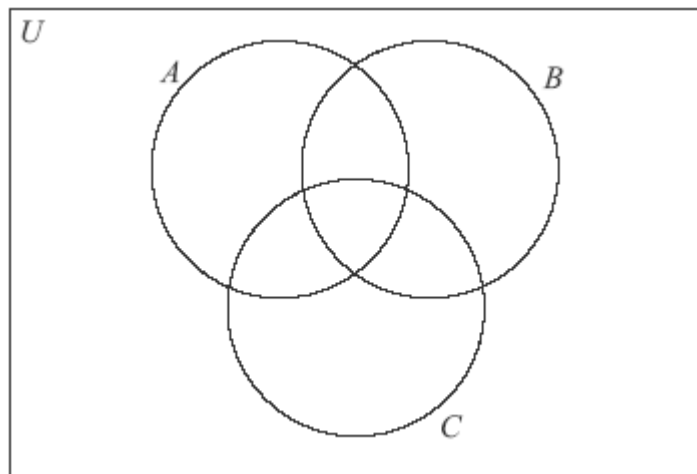
- (a) Write down the number of elements in $A \cap C$.

(1)

- (b) List the elements of B .

(1)

- (c) Complete the following Venn diagram with **all** the elements of U .



(4)

(Total 6 marks)

2. Let $U = \{-4, -\frac{2}{3}, 1, \pi, 13, 26.7, 69, 10^{33}\}$.

A is the set of all the integers in U .

B is the set of all the rational numbers in U .

- (a) List all the prime numbers contained in U .
- (b) List all the members of A .
- (c) List all the members of B .
- (d) List all the members of the set $A \cap B$.

(Total 8 marks)

3. Consider the numbers 5 , 0.5 , $\sqrt{5}$ and -5 . Complete the table below, showing which of the number sets, \mathbb{N} , \mathbb{R} and \mathbb{Q} these numbers belong to.

Answers:

	\mathbb{N}	\mathbb{R}	\mathbb{Q}
5			✓
0.5	✗		
$\sqrt{5}$	✗		
-5		✓	

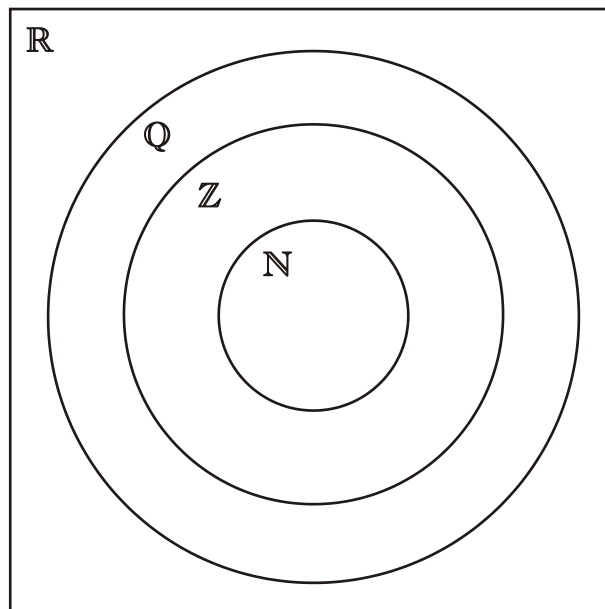
(Total 8 marks)

4. The Venn diagram below shows the universal set of real numbers \mathbb{R} and some of its important subsets:

\mathbb{Q} : the rational numbers,
 \mathbb{Z} : the integers,
 \mathbb{N} : the natural numbers.

Write the following numbers in the correct position in the diagram.

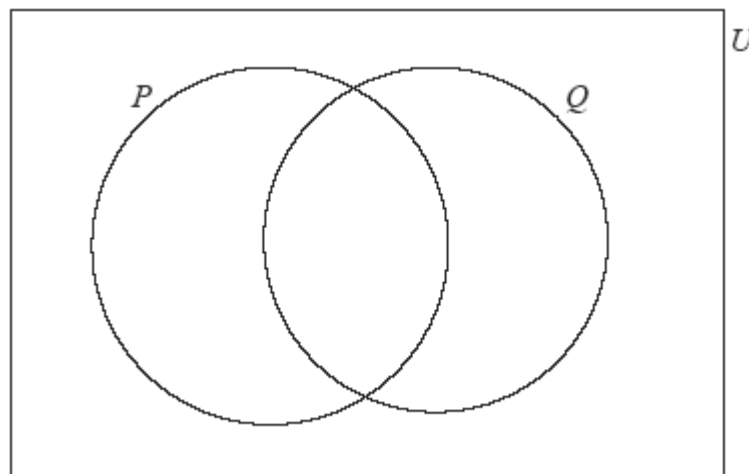
$$-1, 1, \pi, \frac{7}{16}, 3.333\dot{3}, \sqrt{3}.$$



(Total 6 marks)

5. The sets P , Q and U are defined as

$U = \{\text{Real Numbers}\}$, $P = \{\text{Positive Numbers}\}$ and $Q = \{\text{Rational Numbers}\}$.



Write down in the correct region on the Venn diagram the numbers

$\frac{22}{7}$, 5×10^{-2} , $\sin(60^\circ)$, 0 , $\sqrt[3]{-8}$, $-\pi$

(Total 6 marks)

6. Consider the universal set $U = \{x \in \mathbb{N} \mid 3 < x < 13\}$, and the subsets $A = \{\text{multiples of 3}\}$ and $B = \{4, 6, 12\}$.

(a) List the elements of the following sets.

(i) A

(ii) $A \cap B'$

(2)

(b) Write down one element of $(A \cup B)'$.

(2)

(c) One of the statements in the table below is false. Indicate with an **X** which statement is false. Give a reason for your answer.

$n(A \cup B) = 4$	
$15 \in A'$	
$A \subset A \cup B$	

(2)

(Total 6 marks)

7. The universal set U is the set of integers from 1 to 20 inclusive.

A and B are subsets of U where:

A is the set of even numbers between 7 and 17.

B is the set of multiples of 3.

List the elements of the following sets:

(a) A ;

(1)

(b) B ;

(1)

(c) $A \cup B$;

(2)

(d) $A \cap B'$.

(2)

(Total 6 marks)

8. The universal set U is defined as the set of positive integers less than 10. The subsets A and B are defined as:

$A = \{\text{integers that are multiples of 3}\}$

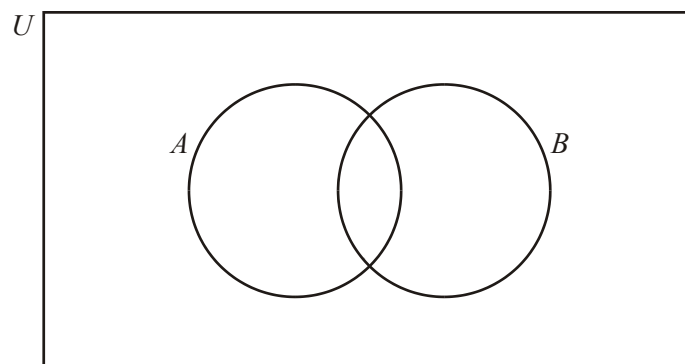
$B = \{\text{integers that are factors of 30}\}$

(a) List the elements of

(i) A ;

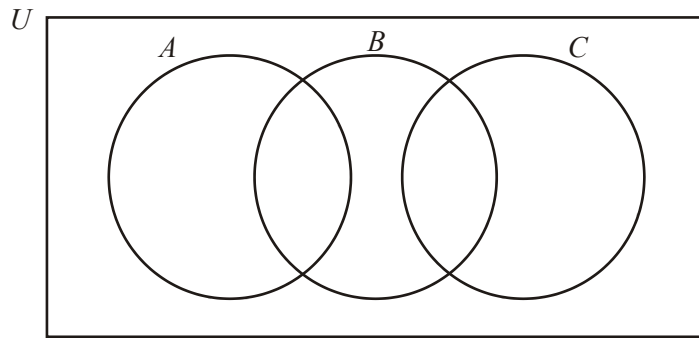
(ii) B .

(b) Place the elements of A and B in the appropriate region in the Venn diagram below.



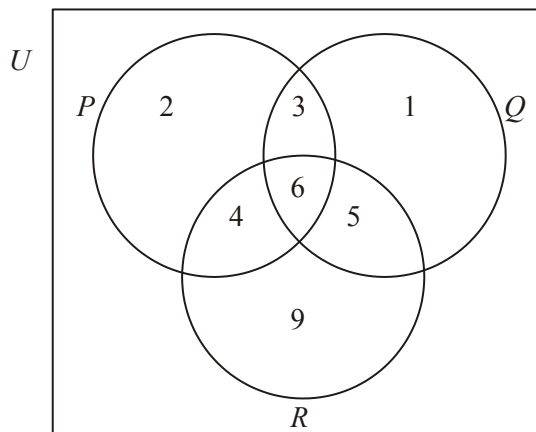
(Total 4 marks)

9. a) Shade $(A \cup B) \cap C'$ on the diagram below.



(2)

- (b) In the Venn diagram below, the number of elements in each region is given. Find $n((P \cap Q) \cup R)$.



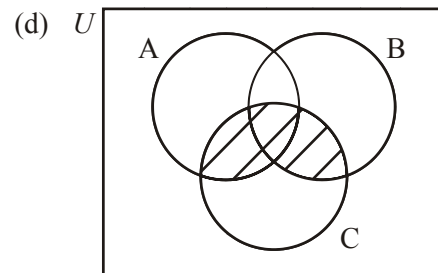
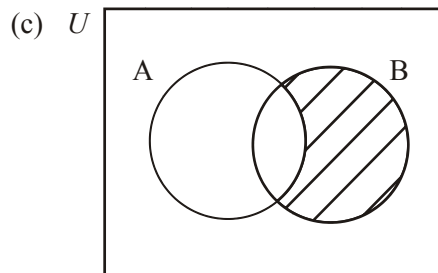
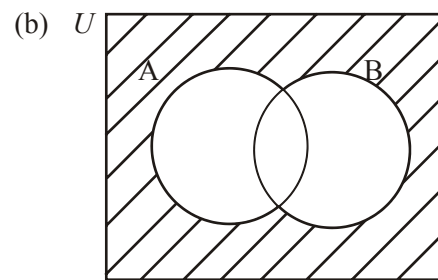
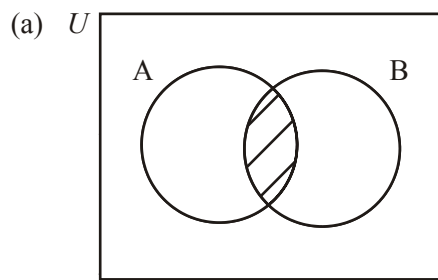
(2)

- (c) U is the set of positive integers, \mathbb{Z}^+ .
 E is the set of even numbers.
 M is the set of multiples of 3.

- (i) List the first six elements of the set M .
(ii) List the first six elements of the set $E' \cap M$.

(2)
(Total 6 marks)

10. Write down an expression to describe the shaded area on the following Venn diagrams:



(Total 8 marks)

ANSWERS-IB Sets and Venn Diagram-Package 1

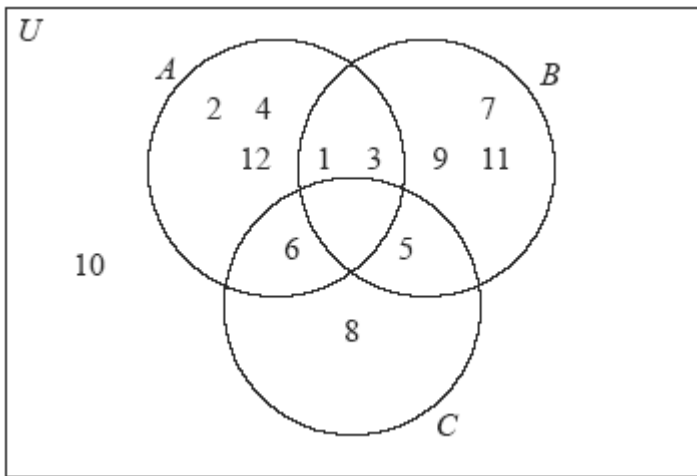
1. (a) 1 (one) (A1) (C1)

Note: 6, {6} or {1} earns no marks.

- (b) 1, 3, 5, 7, 9, 11 (A1) (C1)

Note: Do not penalise if braces, parentheses or brackets are seen.

(c)



A1)(ft)(A1)(ft)(A1)(ft)

(A1)(
(C4)

Notes: Award (A1) for the empty set $A \cap B \cap C$.

Award (A1)(ft) for the correct placement of 6, 5, 1 and 3.

Award (A1)(ft) for the correct placement of 2, 4, 12, 7, 9, 11, 8.

Award (A1)(ft) for the correct placement of 10.

Follow through from part (b).

[6]

2. (a) The only prime number in U is 13. (A2) (C2)

Note: Award (A1) for {1, 13} and (A0) for any other answer.

- (b) $A = \{-4, 1, 13, 69, 10^{33}\}$ (A2) (C2)

- (c) $B = \{-4, -\frac{2}{3}, 1, 13, 26.7, 69, 10^{33}\}$ (A2) (C2)

- (d) $A \cap B = \{-4, 1, 13, 69, 10^{33}\} (= A)$ (A2) (C2)

Note: In (b) and (d) allow (A1) for correct membership with at most one missing or one incorrect entry. A list with no set brackets is acceptable.

In (c) allow at most one missing entry for (A1) but if π is present award (A0).

[8]

3.

	\mathbb{N}	\mathbb{R}	\mathbb{Q}
5	✓	✓	✓
0.5	✗	✓	✓
$\sqrt{5}$	✗	✓	✗
-5	✗	✓	✓

(A1)(A1) (C2)

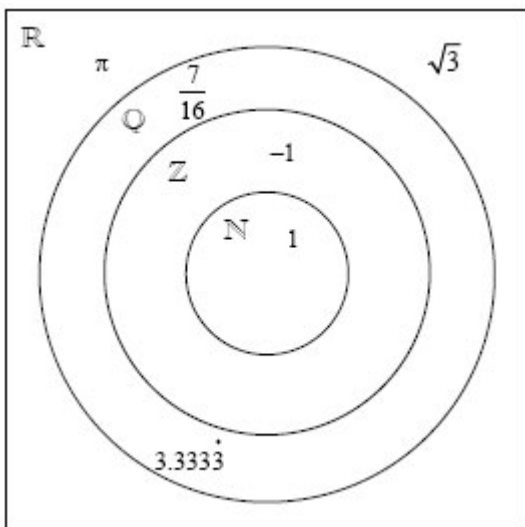
(A1)(A1) (C2)

(A1)(A1) (C2)

(A1)(A1) (C2)

[8]

4.



(A1) (A1)

(A1)

(A1)

(A1)

(A1)

(C6)

Notes: For any number entered exactly once, in the correct position, award (A1) if incorrect award (A0).

If all numbers entered in all regions award (A0).

If any number is entered in more than one region, penalize that number as follows:

(i) If none of the regions is correct award (A0)

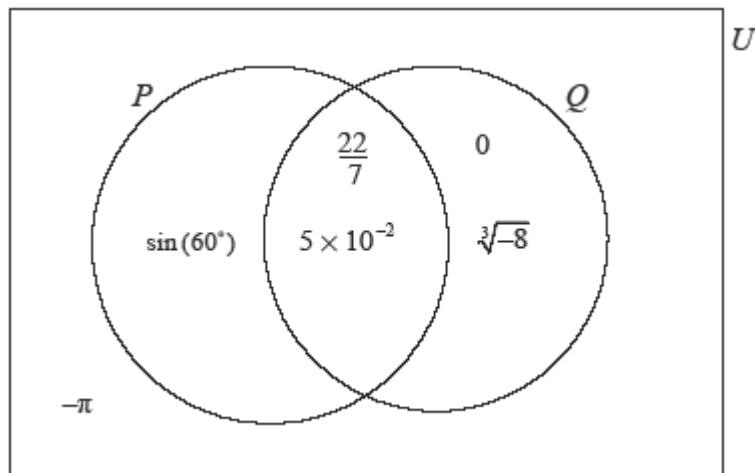
(ii) If one of the regions is correct but other appearances of that number are in the COMPLEMENT of the correct set, award (A0) the first time this is seen.

(iii) If one of the regions is correct but other appearances of that number are in a SUBSET of the correct set award (A0) the first time this is seen.

Apply each of (ii) and (iii) at most once and award ft marks when the error is seen repeatedly, however, (ii) and (iii) may not both be applied to the same number and if both these errors are present with more than one number involved, follow through cannot be used until both penalties have been applied.

[6]

5



A1)(A1) (A1)(

A1)(A1) (A1)(
(C6)

Note: Award (A1) for each number placed once in the correct region. Accept equivalent forms for numbers.

[6]

6. (a) (i) 6, 9, 12 (A1) (C1)

(ii) 9 (A1)(
ft) (C1)

Note: Follow through from their part (a)(i).

(b) any element from {5, 7, 8, 10, 11} (A1)(
A1)(ft) (C2)

Note: Award (A1)(ft) for finding $(A \cup B)$, follow through from their A. Award full marks if all correct elements of $(A \cup B)'$ are listed.

(c)

$n(A \cup B) = 4$	
$15 \in A'$	X
$A \subset A \cup B$	

$15 \notin U$ (R1)(
A1) (C2)

Notes: Accept correct reason in words. If the reason is incorrect, both marks are lost. Do not award (R0)(A1).

[6]

7. (a) $A = 8, 10, 12, 14, 16$ (A1) (C1)

(b) $B = 3, 6, 9, 12, 15, 18$ (A1) (C1)

(c) $A \cup B = 3, 6, 8, 9, 10, 12, 14, 15, 16, 18$ (A2)(ft) (C2)

Note: Award (A1) only if a single element is missing or a single extra element is present, (A0) otherwise.

(d) $B' = 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20$ (A1)(ft)

$A \cap B' = 8, 10, 14, 16$ (A1)(ft) (C2)

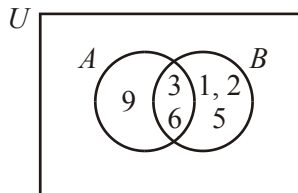
[6]

8. (a) (i) $A = \{3, 6, 9\}$ (A1) (C1)

(ii) $B = \{1, 2, 3, 5, 6\}$ (A1) (C1)

Note: Candidates must list all the elements and no extra elements for each (A1)

(b)

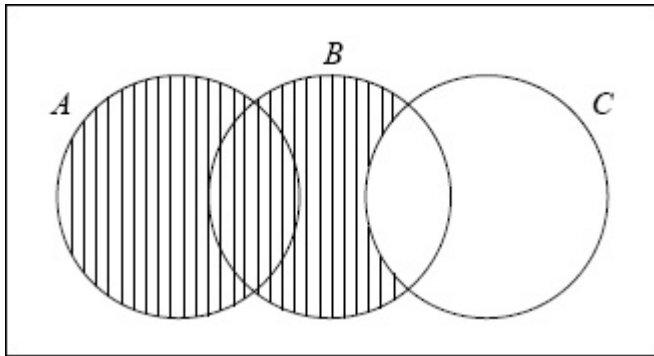


(A2) (C2)

*Notes: Follow through from (a).
Award (A1) for 3 and 6 in the intersection.
Award (A1) for other values correctly positioned*

[4]

9. (a)



not shading C or shading $A \cup B$
correct shading

(A1)

(A1) (C2)

(b) Identifying the correct 5 numbers 3, 4, 5, 6, 9
27

(A1)

(A1) (C2)

(c) (i) $M = \{3, 6, 9, 12, 15, 18\}$ brackets not required.

(A1)

(ii) $E' \cap M = \{3, 9, 15, 21, 27, 33\}$ (ft) from (i).

(A1)(ft) (C2)

[6]

10. (a) $A \cap B$

(A2)

(b) $(A \cup B)'$ or $A' \cap B'$

(A2)

(c) $A' \cap B$

(A2)

Note: Award (A1) for A' , (A1) for $\cap B$.