Q # 1

- Commutative property of Union

$$A \cup B = B \cup A$$

- Commutative property of Intersection

$$A \cap B = B \cap A$$

See Example 1 at page 43

Q # 2:

i) Associativity of union.

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

ii) Associativity of intersection

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

iii) Distributivity of Union over intersection

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

iv) Distributivity of intersection over union

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

Do yourself

Q # 3:

De Morgan's Law

- $(A \cup B)' = A' \cap B'$
- $(A \cap B)' = A' \cup B'$

Do yourself

Q # 4

Same as Q # 3

Note:-
Question # 1 to 4 are not important question but you must know all these properties and De Morgan's law. Also you must know analytic proof of these properties and De Morgan's Law given at page 42. (Also by Venn Diagram)

Q # 5:

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

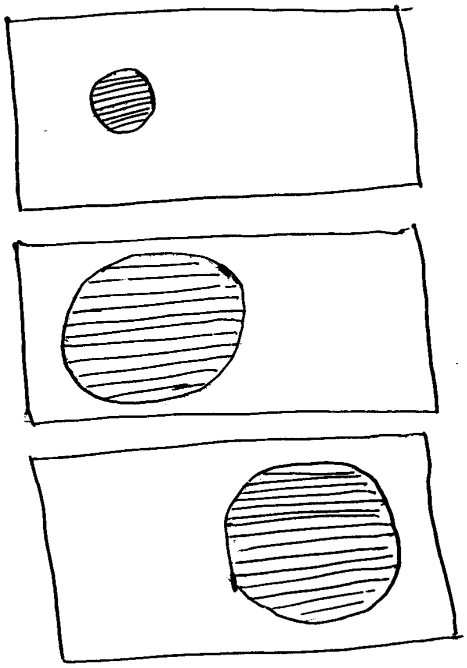
b) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

i)

A:

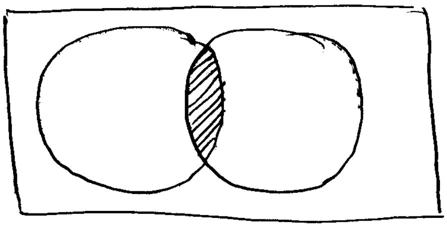
B:

C:

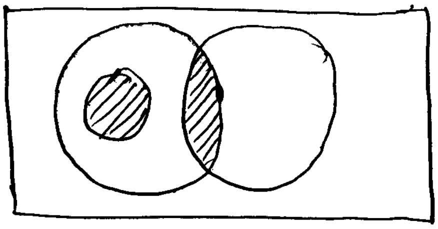


Proof of a)

$B \cap C$:



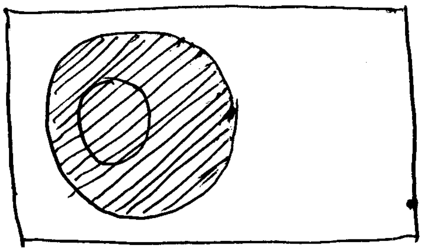
$A \cup (B \cap C)$:



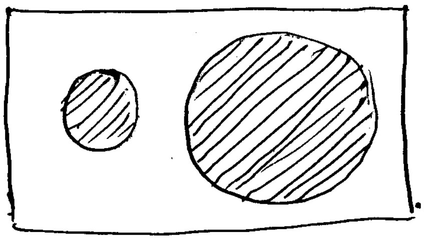
———— (i)

Now

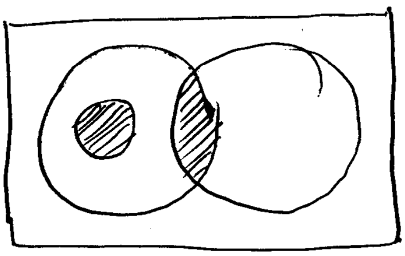
$A \cup B$:



$A \cup C$:



$(A \cup B) \cap (A \cup C)$:



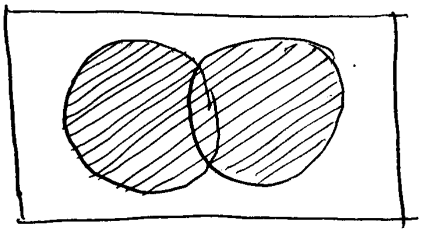
———— (ii)

From (i) and (ii)

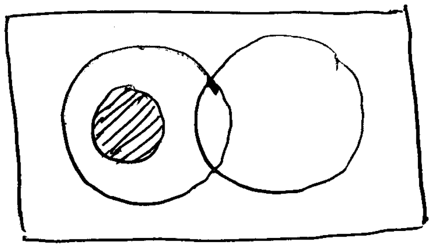
L.H.S = R.H.S

Proof of b)

$B \cup C$:

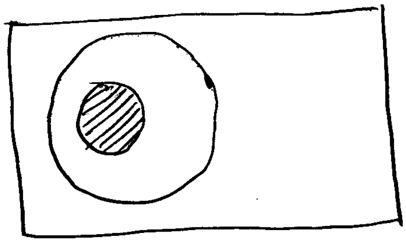


$A \cap (B \cup C)$:

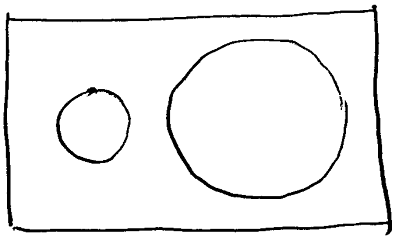


———— (iii)

$A \cap B$:

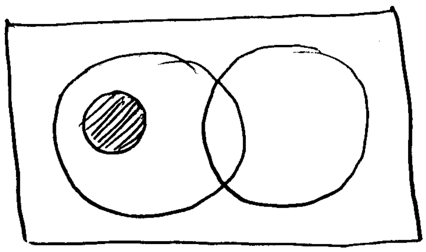


$A \cap C$:



$= \phi$

$(A \cap B) \cup (A \cap C)$:



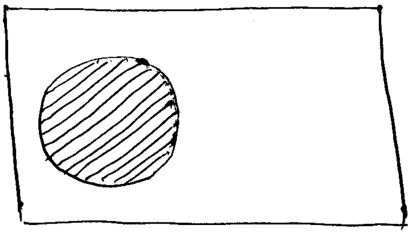
———— (iv)

From (iii) and (iv)

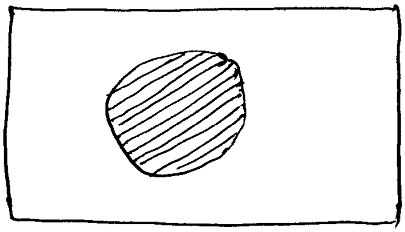
L.H.S = R.H.S.

ii)

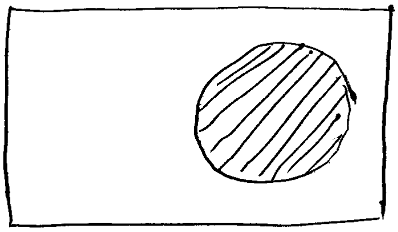
A:



B:

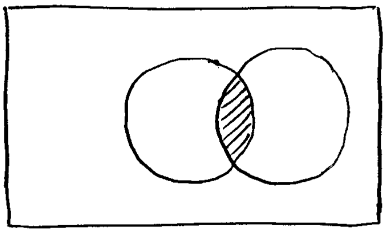


C:

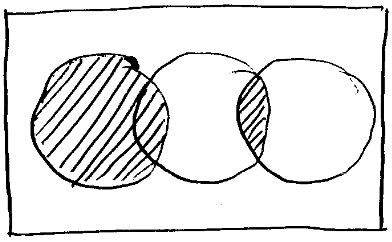


Proof of a)

$B \cap C$:



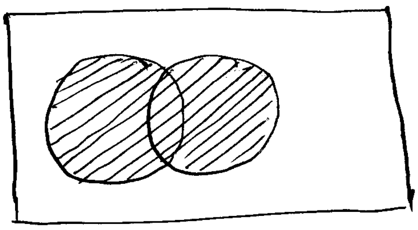
$A \cup (B \cap C)$:



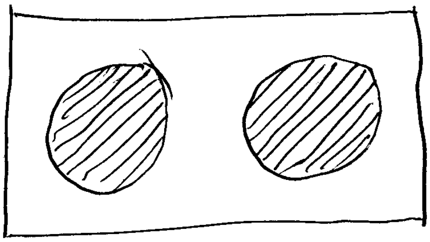
——— (v)

Now

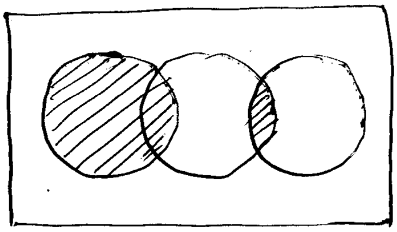
$A \cup B$:



$A \cup C$:



$(A \cup B) \cap (A \cup C)$:



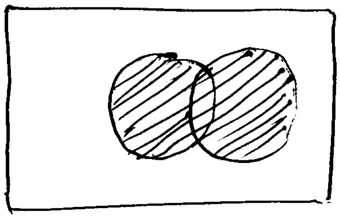
——— (vi)

From (v) and (vi)

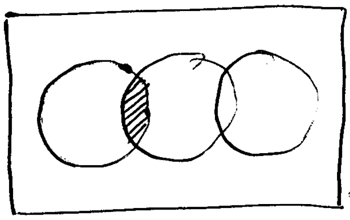
L.H.S = R.H.S

Proof of b)

$B \cup C$:



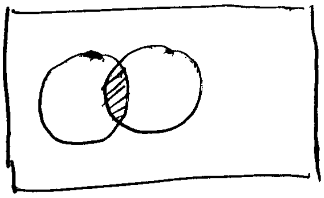
$A \cap (B \cup C)$:



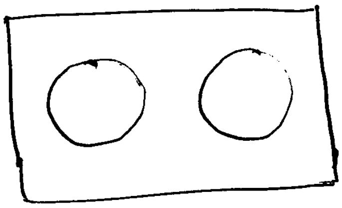
——— (vii)

Now

$A \cap B$:

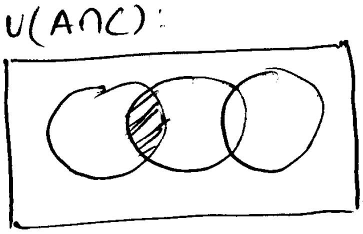


$A \cap C$:



$= \phi$

$(A \cap B) \cup (A \cap C)$:



——— (viii)

From (vii) & (viii)

L.H.S = R.H.S

Q # 6 : and 7 :

Do yourself [Very low standard]

Q # 8 :

i)

$$L.H.S = A\cap(A\cup B)$$

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

by distributivity of intersection over union

$$= A\cup(A\cap B) \quad \because A\cap A = A$$

$$= R.H.S$$

ii) $L.H.S = A\cup(A\cap B)$

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

by distributivity of union over intersection

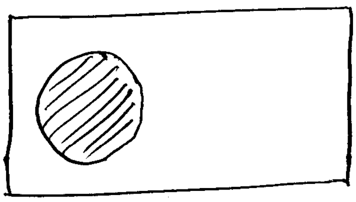
$$= A\cap(A\cup B) \quad \because A\cup A = A$$

$$= R.H.S$$

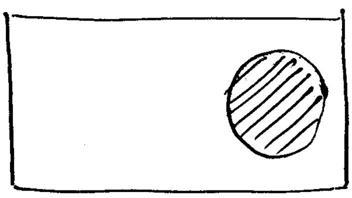
Q # 9

i) $A\cap B' = A$ if $A\cap B = \varnothing$ * Correction.

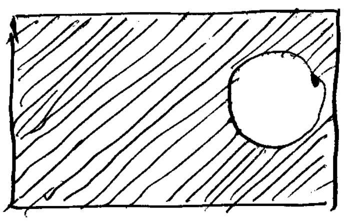
A :



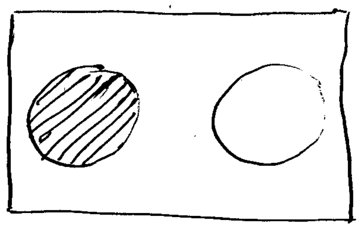
B :



B' :



$A\cap B'$:



$= A$

Q # 9 (ii), (iii), (ix)

Condition on A and B are not given in this question, so this is incomplete question or you have to discuss all cases

There are four cases:

a) $A\subseteq B$

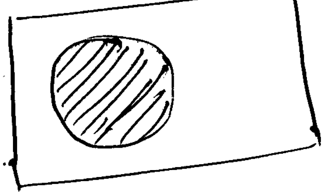
b) $B\subseteq A$

c) A and B are overlapping

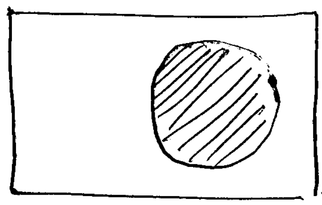
d) A and B are disjoind. i.e $A\cap B = \varnothing$.

Here I am going to solve only case c), you can solve other cases yourself.

A :

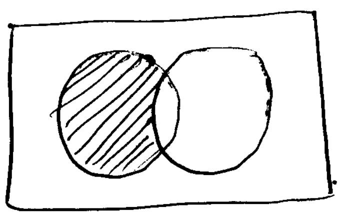


B :

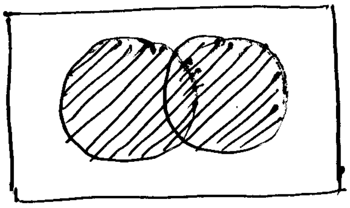


ii)

$A-B$:



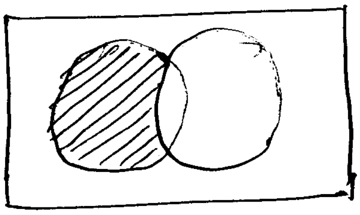
$(A-B)\cup B$:



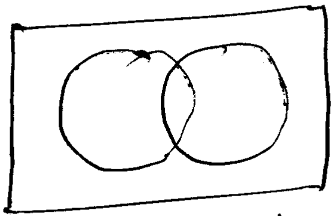
$= A\cup B$ proved

iii)

$A-B$:



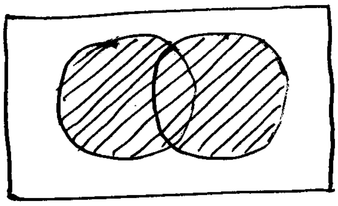
$(A-B)\cap B$:



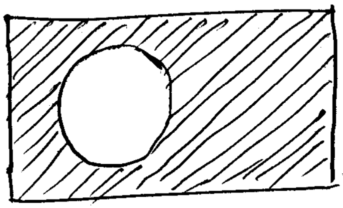
$= \phi$ proved

iv) *Correc

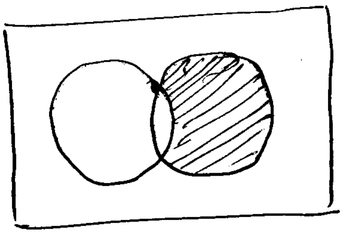
$A\cup B$:



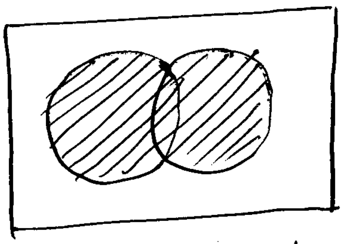
A' :



$A'\cap B$:



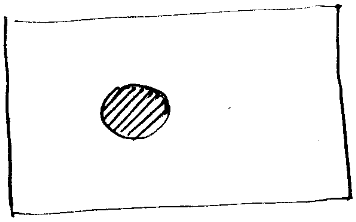
$A\cup(A'\cap B)$:



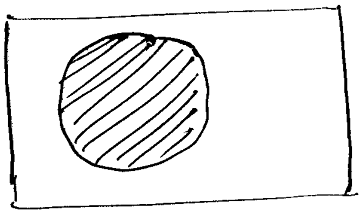
$= A\cup B$ proved

iv) with case a)

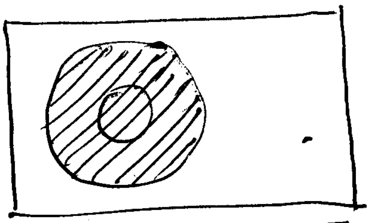
A :



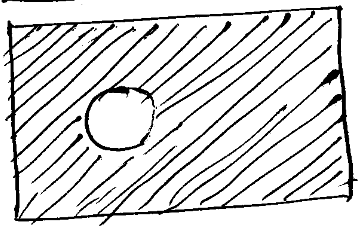
B :



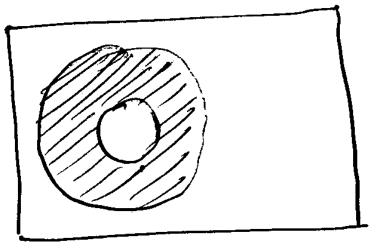
$A\cup B$:



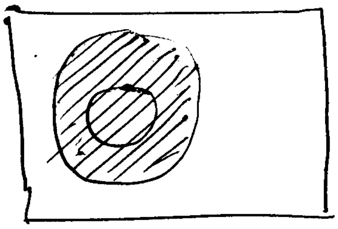
A' :



$A'\cap B$:



$A\cup(A'\cap B)$:



$= A\cup B$ proved

—: END :—