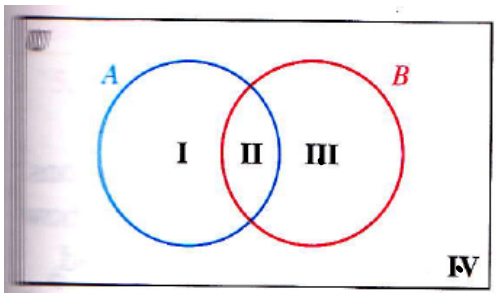
To determine whether set statements are equal we will use Venn diagrams by looking at general regions. If both statements represent the same regions of the Venn diagram, then the statements are equal for all sets A and B.



EXAMPLE 3 *Equality of Sets*

Determine whether $(A \cap B)' = A' \cup B'$ for all sets A and B.

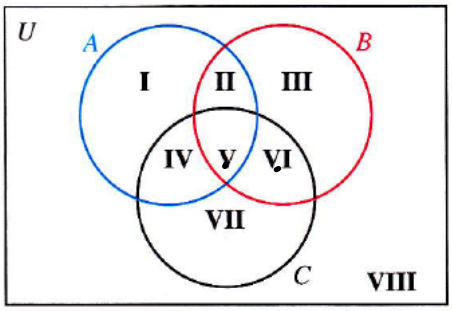
Find $(A \cap B)'$

Set	Corresponding Regions
$(A \cap B) = 2$	
$(A \cap B)' = 1\ 3\ 4$	

Find $A' \cup B'$

Set	Corresponding Regions
$A' = 3\ 4$	
$B' = 1\ 4$	
$A' \cup B' = 1\ 3\ 4$	

$=$



EXAMPLE 4 *Equality of Sets*

Determine whether $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ for all sets, A, B, and C.

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

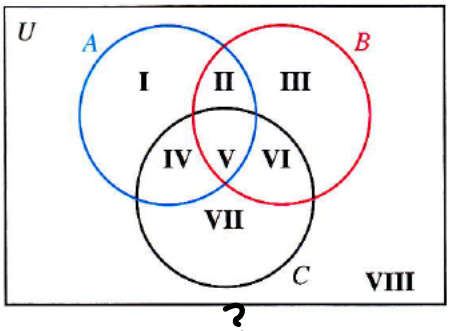
Set	Corresponding Regions
$A = 1\,2\,4\,5$	
$B \cap C = 5\,6$	
$1\,2\,4\,5\,6$	

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

Set	Corresponding Regions
$A \cup B = 1\,2\,3\,4\,5\,6$	
$A \cup C = 1\,2\,4\,5\,6\,7$	
$1\,2\,4\,5\,6$	

$=$

Determine whether the follow statement is true for all sets A, B and C.



$A \cup (B \cap C)' \stackrel{?}{=} A' \cap (B \cup C)$

$A = 1\ 2\ 4\ 5$

$B \cap C = 5\ 6$

$(B \cap C)' = 1\ 2\ 3\ 4\ 7\ 8$

$1\ 2\ 3\ 4\ 5\ 7\ 8$

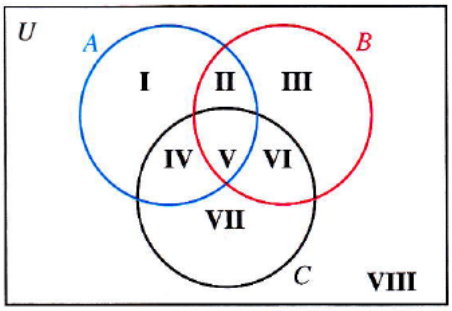
$A'\ 3\ 6\ 7\ 8$

$B \cup C = 2\ 3\ 4\ 5\ 6\ 7$

$3\ 6\ 7$

$\neq$

Determine whether the follow statement is true for all sets A, B and C



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

$A = 1\ 2\ 4\ 5$

$B \cap C = 5\ 6$

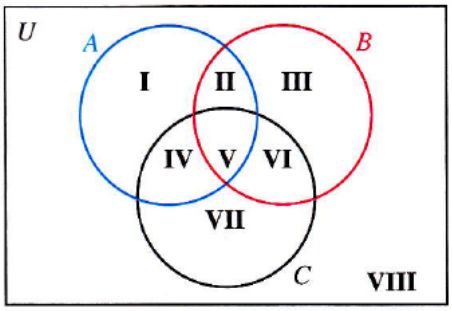
$1\ 2\ 4\ 5\ 6$

$1\ 2\ 3\ 4\ 5\ 6$

$1\ 2\ 4\ 5\ 6\ 7$

$= 1\ 2\ 4\ 5\ 6$

Determine whether the follow statement is true for all sets A, B and C



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

$A \cup B = 1\,2\,3\,4\,5\,6$

$B \cup C = 2\,3\,4\,5\,6\,7$

$2\,3\,4\,5\,6$ =

$B = 2\,3\,5\,6$

$A \cap C = 4\,5$

$2\,3\,4\,5\,6$

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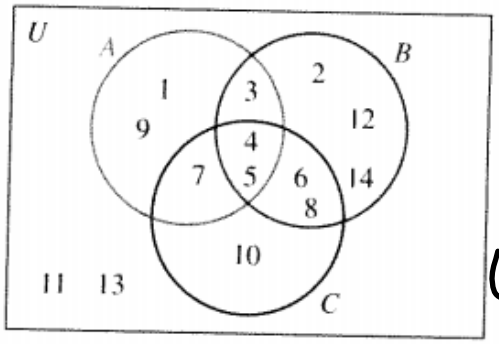
#65-77 odd



$(A \cup C)' = \{2, 11, 12, 13, 14\}$

$A \cap (B \cup C) = \{3, 4, 5, 7\}$

$A' = \{2, 6, 8, 10, 11, 12, 13, 14\}$

$(A \cup B \cup C)' = \{11, 13\}$

Figure 2.25

A

B

$A \cap B$ $\{3, 4, 5\}$

$(B \cap C)'$ $\{1, 2, 3, 7, 10, 11, 12, 14\}$

$A \cup B$ $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 14\}$

$(A \cup C)'$

A'

48. U

50. C

52. $A \cap C$ $\{4, 5, 7\}$

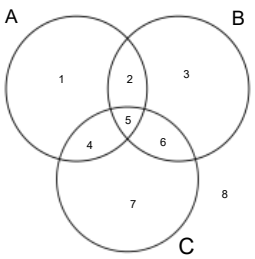
54. $A \cap B \cap C$ $\{4, 5\}$

56. $B \cup C$ $\{2, 3, 4, 5, 6, 7, 8, 10, 12, 14\}$

58. $A \cap (B \cup C)$

60. $(A \cup B \cup C)'$

Use the diagram to determine if the statement is true.



?

70. $A \cup (B \cap C)$, = $(B \cap C) \cup A$

A 1 2 4 5

B∩C 5 6

1 2 4 5 6

(B∩C) 5 6 ∪ 1 2 4 5

= 1 2 4 5 6

?

72. $A \cup (B \cap C)'$, = $A' \cap (B \cup C)$