

**Part 1: True or False. Circle the correct answer.**

(10 points each)

T or F 1)  $1 \in \{1,2\}$

T or F 2)  $\{1\} \in \{1,2\}$

T or F 3)  $1 \subseteq \{1,2\}$

T or F 4)  $\{1\} \subseteq \{1,2\}$

T or F 5)  $1 \in \{1,2\} \times \{1,2\}$

T or F 6)  $\{1\} \in \{1,2\} \times \{1,2\}$

**Part 2: Definitions and Concepts**

For these problems let  $A = \{1,2,3,4\}$ ,  $B = \{3,4,5\}$ ,  $C = [3,5]$  and  $D = (4, \infty)$

(20 points each)

7) Find  $A \cap B$ .

8) Find  $A \cup B$

9) Find  $C \cap D$

10) Find  $C \cup D$

For these problems let  $A = \{1,2,3,4\}$ ,  $B = \{3,4,5\}$ ,  $C = [3,5]$  and  $D = (4, \infty)$   
(20 points each)

11) Find  $D - A$

12) Find  $B - A$

13) Draw a picture illustrating  $A \times C$ .

14) Draw a picture illustrating  $A \times B$ .

**Part 3: Proofs**

15) Below is a partial proof of the statement below. Finish the proof.

$$(A \cap B = A) \Rightarrow (A \subseteq B)$$

(100 points)

Line	Statements	Reasoning
(1)	$A \cap B = A$	Premise
(2)	Assume $x \in A$	
(3)	_____	_____
(4)	$x \in B$	_____
(5)	$A \subseteq B$	The implication formed from lines 2-4.

16) Prove the statement below.

$$\exists x \in \mathbb{R} \forall y \in \mathbb{R} (xy = 0)$$

(100 points)

17) Prove the statement below without referencing theorem T65.

If  $A \subseteq B$  and  $B \subseteq C$ , then  $A \subseteq C$

(100 points)

18) Prove the statement below.

$$(A - B) \cap B = \emptyset$$

(100 points)