

1. (10 points) Check whether the statement “ $\overline{A \cap B} = \overline{A} \cup \overline{B}$ for all sets A, B , ” is true or false for the specific sets $A = \{1, 2, 3\}, B = \{2, 4, 5\}, U = \{1, 2, 3, 4, 5, 6\}$.

This is just DeMorgan's law and it is true.

$$\overline{A \cap B} = \overline{\{2\}} = \{1, 3, 4, 5, 6\}.$$

$$\overline{A} \cup \overline{B} = \{4, 5, 6\} \cup \{1, 3, 6\} = \{1, 3, 4, 5, 6\}.$$

2. (10 points) Write the following using set builder notation:

1. Set of all odd numbers.
2. Set of all irrational numbers.

Solution:

1. $O = \{x \in \mathbb{N} \mid x = 2n + 1, n \in \mathbb{N}\}$ OR $O = \{x \in \mathbb{N} \mid 2 \text{ does not divide } n\}$
2. $I = \{x \in \mathbb{R} \mid x \notin \mathbb{Q}\}$

3. (10 points) Write the negative of the following:

1. e^x is continuous and differentiable.
2. An increasing function could be continuous or discontinuous.

Solution:

1. e^x is either discontinuous or not differentiable.
2. An increasing function cannot be continuous and discontinuous.