

EXERCISES FOR SET THEORY

Problem 1 Find a verbal description for $O = \{2n - 1 \mid n \in \mathbb{N}\}$

O is the odd natural numbers.

Problem 2 Find a roster description for $X = \{z^2 \mid z \in \mathbb{Z}\}$

$X = \{0, 1, 4, 9, 16, \dots\}$

Problem 3 Let $A = \left\{-3, -1.02, -\frac{3}{5}, 0.57, 1.\overline{23}, \sqrt{3}, 5.2020020002\dots, \frac{20}{10}, 117\right\}$

1. List the elements of A which are natural numbers.

$\frac{20}{10} = 2$ and 117

2. List the elements of A which are irrational numbers.

$\sqrt{3}$ and 5.2020020002

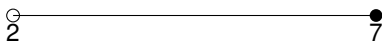
3. Find $A \cap \mathbb{Z}$

$\left\{-3, \frac{20}{10}, 117\right\}$

4. Find $A \cap \mathbb{Q}$

$\left\{-3, -1.02, -\frac{3}{5}, 0.57, 1.\overline{23}, \frac{20}{10}, 117\right\}$

Problem 4 Fill in the chart below.

Set of Real Numbers	Interval Notation	Region on the Real Number Line
$\{x \mid -1 \leq x < 5\}$		
	$[0, 3)$	
		
$\{x \mid -5 < x \leq 0\}$		
	$(-3, 3)$	
		
$\{x \mid x \leq 3\}$		
	$(-\infty, 9)$	
		
$\{x \mid x \geq -3\}$		

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Question 5 In these problems, find the indicated intersection or union and simplify if possible. Express your answers in interval notation.

Problem 5.1 $(-1, 5] \cap [0, 8)$

$[0, 5]$

Problem 5.2 $(-1, 1) \cup [0, 6]$

$(-1, 6]$

Problem 5.3 $(-\infty, 4] \cap (0, \infty)$

$(0, 4]$

Problem 5.4 $(-\infty, 0) \cap [1, 5]$

$\emptyset$

Problem 5.5 $(-\infty, 0) \cup [1, 5]$

$(-\infty, 0) \cup [1, 5]$

Problem 5.6 $(-\infty, 5] \cap [5, 8)$

$\{5\}$

Question 6 In Exercises ?? - ??, write the set using interval notation.

Problem 6.1 $\{x \mid x \neq 5\}$

$(-\infty, 5) \cup (5, \infty)$

Problem 6.2 $\{x \mid x \neq -1\}$

$(-\infty, -1) \cup (-1, \infty)$

Problem 6.3 $\{x \mid x \neq -3, 4\}$

$(-\infty, -3) \cup (-3, 4) \cup (4, \infty)$

Problem 6.4 $\{x \mid x \neq 0, 2\}$

$(-\infty, 0) \cup (0, 2) \cup (2, \infty)$

Problem 6.5 $\{x \mid x \neq 2, -2\}$

$(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$

Problem 6.6 $\{x \mid x \neq 0, \pm 4\}$

$(-\infty, -4) \cup (-4, 0) \cup (0, 4) \cup (4, \infty)$

Problem 6.7 $\{x \mid x \leq -1 \text{ or } x \geq 1\}$

$(-\infty, -1] \cup [1, \infty)$

Problem 6.8 $\{x \mid x < 3 \text{ and } x \geq 2\}$

$[2, 3)$

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Problem 6.9 $\{x \mid x \leq -3 \text{ or } x > 0\}$

$(-\infty, -3] \cup (0, \infty)$

Problem 6.10 $\{x \mid x \leq 2 \text{ and } x > 3\}$

$\emptyset$

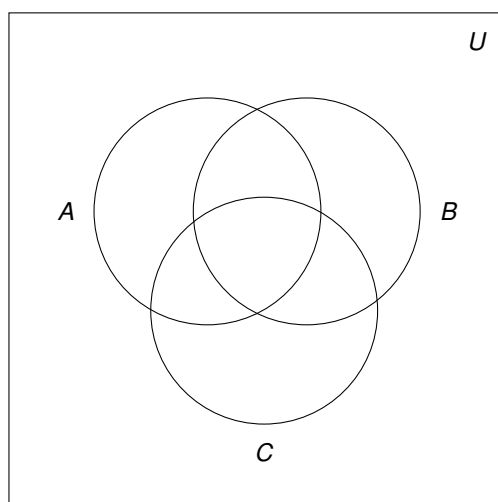
Problem 6.11 $\{x \mid x > 2 \text{ or } x = \pm 1\}$

$\{-1\} \cup \{1\} \cup (2, \infty)$

Problem 6.12 $\{x \mid 3 < x < 13 \text{ and } x \neq 4\}$

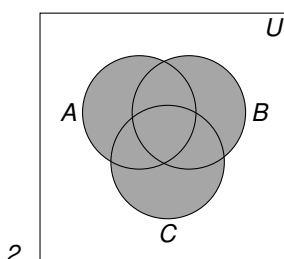
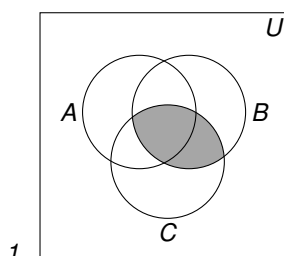
$(3, 4) \cup (4, 13)$

Question 7 For Exercises ?? - ??, use the blank Venn Diagram below with A , B , and C in it as a guide to help you shade the following sets.

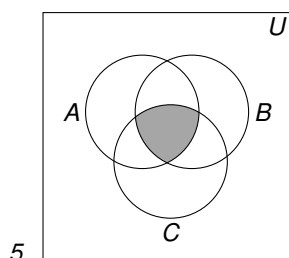
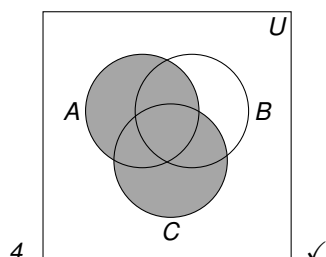
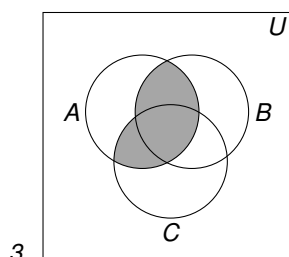


Problem 7.1 $A \cup C$

Multiple Choice:

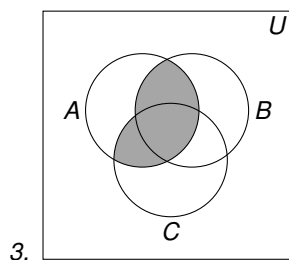
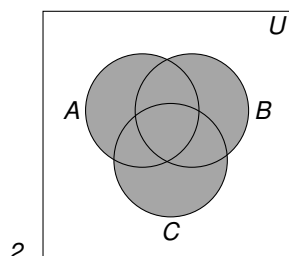
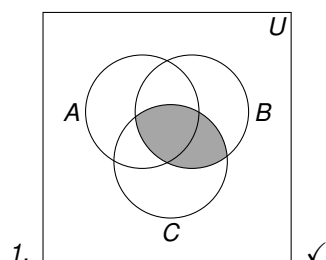


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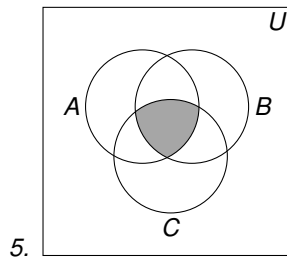
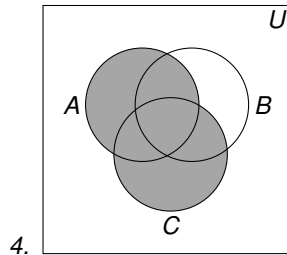


Problem 7.2 $B \cap C$

Multiple Choice:

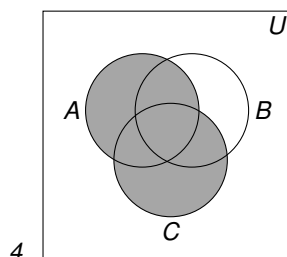
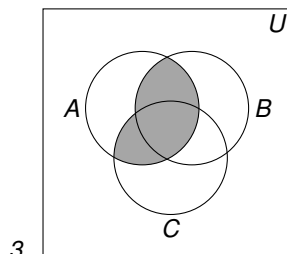
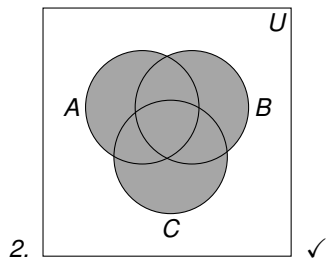
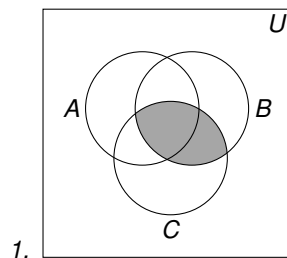


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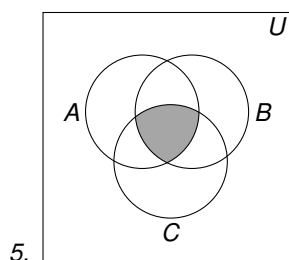


Problem 7.3 $(A \cup B) \cup C$

Multiple Choice:

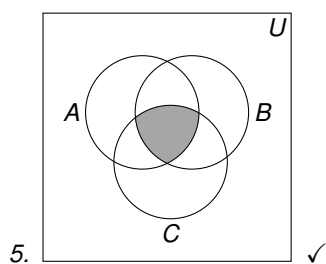
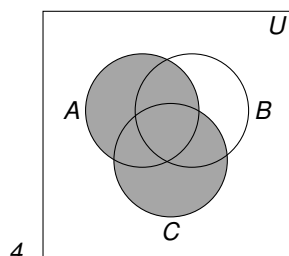
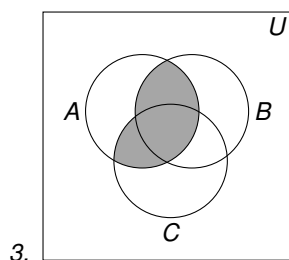
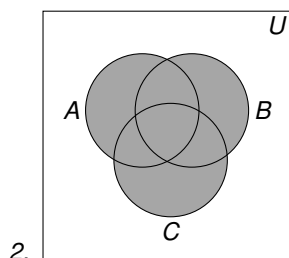
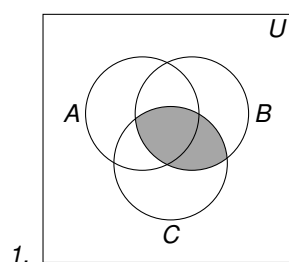


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Problem 7.4 $(A \cap B) \cap C$

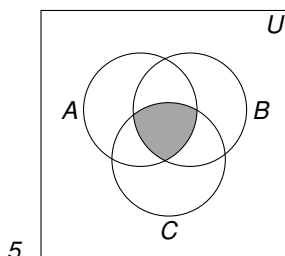
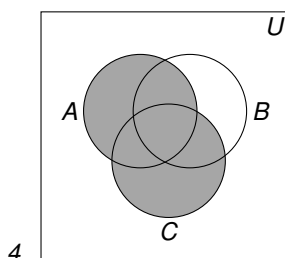
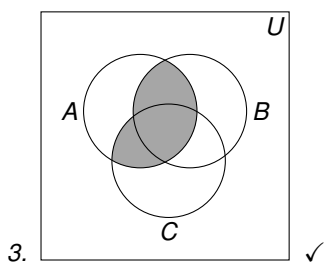
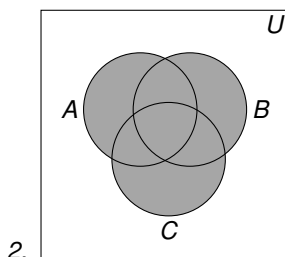
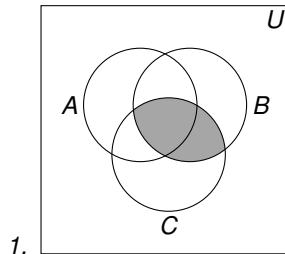
Multiple Choice:



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Problem 7.5 $A \cap (B \cup C)$

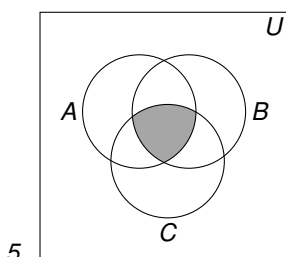
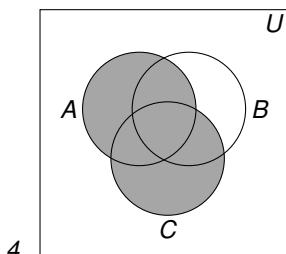
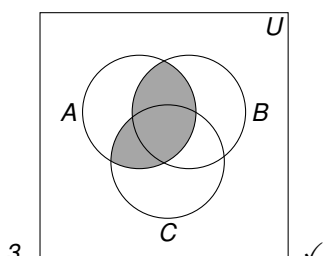
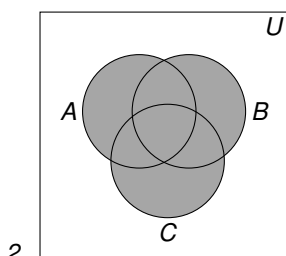
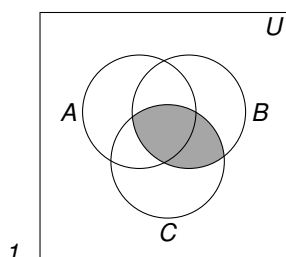
Multiple Choice:



Problem 7.6 $(A \cap B) \cup (A \cap C)$

Multiple Choice:

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Problem 8 Explain how your answers to problems ?? and ?? show $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$. Phrased differently, this shows ‘intersection distributes over union.’ Discuss with your classmates if ‘union’ distributes over ‘intersection.’ Use a Venn Diagram to support your answer.

Problem 9 Show that $A \subseteq B$ if and only if $A \cup B = B$.

Problem 10 Let $A = \{1, 3, 5, 7, 9\}$, $B = \{2, 4, 6, 8, 10\}$, $C = \{1, 6, 9\}$ and $D = \{2, 7, 10\}$. Draw one Venn Diagram that shows all four of these sets. What sort of difficulties do you encounter?