<u>Question 7:</u>

Exercise 3.1.1

a) **True**, 27 is a multiple of 3

b) **False**, 27 is not a perfect square

c) **True**, 100 is a perfect square

d) **False**, neigher C or E contains all the elements from E and C

e) **True**, all elements in E are in A

f) **False**, all elements in A are not in E

g) **False**, the set of E is not an element in A

Exercise 3.1.2

a) **False**, 15 is not a set

b) **True**, 15 is a multiple of 3, {15} is a proper set of A

c) **True**, the empty set is a subset of every set

d) **True**, D = D

e) **False**, the null set is not an element of B

Exercise 3.1.5

b) **{x $\in \mathbb{Z}^+$: x is an integer multiple of 3}** This is an infinite set.

d) **{x $\in \mathbb{N}$: x = 10n, $0 \leq n \leq 100$}** This a finite set. Cardinality = 101

Exercise 3.2.1

a) **True**, 2 is an element of X

b) **True**, {2} is a subset of X

c) **False**, {2} is not an element of X

d) **False**, 3 is not an element of X

e) **True**, {1,2} is an element of X

f) **True**, {1,2} is a subset of X

g) **True**, {2,4} is a subset of X

h) **False**, {2,4} is not an element of X

i) **False**, the element 3 does not exist in X

j) **False**, {2,3} is not a subset of X

k) **False**, the cardinality of X is 6

Question 8:

Exercise 3.2.4

b)

|A| = 3, therefore the power set of A has 2^3 subsets, which is 8.

P(A) = {ø, {1},{2},{3},{1,2},{1,3},{2,3},{1,2,3}}

X is a element of P(A)

2 is an element of X

Therefore, X can be **{2},{1,2},{2,3},{1,2,3}**

Question 9:

Exercise 3.3.1

c) **{-3,1,17}**

d) **{-3,0,1,4,17,-5}**

e) the set is infinite. {0,4,-12,4,6, and odd integers}

Exercise 3.3.3

a)

i=2, n=5

$A_1 \cap A_2 \cap A_3 \cap A_4 \cap A_5$ (Because n=5)

A_2 = {1,2,4} (Because i = 2)

We need to know about A_1, A_3, A_4, A_5

A_1 = {1,1,1}

A_3 = {1,3,9}

A_4 = {1,4,16}

A_5 = {1,5,25}

Element that is in all sets is 1

Answer: **{1}**

b)

i = 2, n = 5

Same as above

Answer: **{1,2,3,4,5,9,16,25}**

e)

$n = 100$, $i = 1$

$C_1 \cap C_2 \cap C_3 \cap C_4 \ldots \cap C_{100}$

$C_1 = -1 \leq 1$

$C_2 = -2 \leq 1/2$

$C_3 = -3 \leq 1/3$

$C_4 = -4 \leq 1/4$

…

$C_{100} = -100 \leq 1/100$

The union consists of all the values that satisfy all $-n \leq 1/n$ for $n = 1$ to 100

f)

Same from above

However, there is not common value that satisfies all of the sets

The intersection of these sets is an empty set: **ø**

Exercise 3.3.4

b)

$A \cup B = \{a,b,c\}$

$P(A \cup B) =$ **{ø, {a}, {b}, {c}, {a,b}, {a,c}, {b,c}, {a,b,c}}**

d)

P(A) = {ø, {a}, {b}, {a,b}}

P(B) = {ø, {b}, {c}, {b,c}}

P(A) ∪ P(B) = **{ø, {a}, {b}, {c}, {a,b}, {b,c}}**

Question 10:

Exercise 3.5.1

b) **(tall,foam,whole)**

c) **{(foam, non-fat), (no-foam, non-fat), (foam, whole), (no-foam, whole)}**

Exercise 3.5.3

b) **True.** Because every integer is an element of Real number, therefore the square of every integer is also an element of the square of every real number.

c) **True.** because there are no elements that intersect in common.

e) **True.** Assume A X C = (x,y), x can be every element in A. B X C = (d,y) d can be every element in B. y=y, therefore y stays the same. And since A is a subset of B, every element in A should be in B. Therefore, every element for x should be in d as well. Therefore, the statement is true.

Exercise 3.5.6

d)

x= {0,00} y={1,11}

{01, 011, 001, 0011}

e)

x = {aa,ab} y = {a,aa}

{aaa, aaaa, aba, abaa}

Exercise 3.5.7

c)

A X B = (a,b), (a,c)

A X C = (a,a), (a,b), (a,d)

(a,b), (a,c), (a,a), (a,d)

f)

A X B = (a,b), (a,c)

P(A X B) = **{ø, {(a,b)}, {(a,c)}, {(a,b),(a,c)}}**

g)

P(A) = {ø, {a}}

P(B) = {ø, {b}, {c}, {b,c}}

P(A) X P(B) = **{(ø,ø), (ø, {b}), (ø, {c}), (ø, {b,c}), ({a}, ø), ({a}, {b}), ({a}, {c}), ({a}, {b,c})}**

Question 11:

Exercise 3.6.2

b)

$(B \cup A) \cap (\overline{B} \cup A)$	Beginning Expression
$((B \cup A) \cap \overline{B}) \cup ((B \cup A) \cap A)$	Distributive Law
$((\overline{B \cup A}) \cup \overline{\overline{B}}) \cup ((B \cup A) \cap A)$	De Morgan’s Law
$((\overline{B} \cap \overline{A}) \cup \overline{\overline{B}}) \cup ((B \cup A) \cap A)$	De Morgan’s Law
$((\overline{B} \cap \overline{A}) \cup B) \cup ((B \cup A) \cap A)$	Double Complement Law
$(B \cup (\overline{B} \cap \overline{A}) \cup ((B \cup A) \cap A)$	Commutative Law
$((B \cup \overline{B}) \cap (B \cup \overline{A})) \cup ((B \cup A) \cap A)$	Distributive law
$(ø \cap (B \cup \overline{A})) \cup ((B \cup A) \cap A)$	Complement Law
$Ø \cup ((B \cup A) \cap A)$	Domination Law
$((B \cup A) \cap A)$	Identity Law
$(A \cap (B \cup A))$	Commutative Law
A	Absorption Law

c)

$\overline{A \cap \overline{B}}$	Beginning Expression
$\overline{A} \cup \overline{\overline{B}}$	De Morgan’s Law

$\overline{A} \cup B$	Double Complement Law

Exercise 3.6.3

b)

A - (B ∩ A) = A

Proof:

Let's set A = {1,2} and B = {1}

(B ∩ A) = {1}

A - {1} = {2}

{2} ≠ A

Therefore, A - (B ∩ A) ≠ A

d)

(B - A) ∪ A = A

Let's set A = {1} and B = {1, 2}

(B - A) = {2}

{2} ∪ A

Ø ≠ A
Therefore, (B - A) ∪ A ≠ A

Exercise 3.6.4

b)

A ∩ (B - A)	Beginning Expression

$A \cap (B \cap \overline{A})$	Set Subtraction Law
$(A \cap \overline{A}) \cap B$	Associative Law
$\emptyset \cap B$	Complement law
$\emptyset$	Complement law

c)

$A \cup (B - A)$	Beginning Expression
$A \cup (B \cap \overline{A})$	Set Subtraction Law
$(A \cup B) \cap (A \cup \overline{A})$	Distributive Law
$(A \cup B) \cap U$	Complement Law
$A \cup B$	Identity Law