Section 1.2: Introduction to sets - Continued.

There are three ways to define a set:

1) Word description
2) Set-builder form
3) Roster form

Word Description: Simply using words to describe the elements of a set. There may be more than one correct way to define a set using a word description.

It will be helpful if we remember the definition of Natural numbers when we complete the next few examples.

The set of Natural numbers is a set you should be familiar with. The set of Natural numbers is often assigned the letter N, and it contains integers greater than 0.

N = set of Natural numbers = {1,2,3,4,5…}

Example: Write a word description of the set: A = {1,2,3,4,5}

Answer 1: A is the set of Natural numbers between 1 and 5 inclusive.

Answer 2: A is the set of Natural numbers less than 6.

Both word descriptions are equal to the set A = {1,2,3,4,5}

There are many correct answers. When asked for a word description we only need to give one of many possible correct answers.

***Example*:** Write a word description of the set: A = {4,5,6,7…}

Answer 1: A is the set of Natural numbers greater than or equal to 4.

Answer 2: A is the set of Natural numbers greater than 3.

Both word descriptions produce the set A = {4,5,6,7…}

Homework #1 – 8. Write a word description of each set

1) D = {2, 3, 4, …}
2) B = {4,5,6 …}
3) A = {1,2,3,4,5,6,7}
4) E = {5,6,7,8,9,10}
5) D = {Bashful, Doc, Dopey, Grumpy, Happy, Sleepy, Sneezy}
6) B = {California, Oregon, Washington}
7) V = {a, e, i, o, u}
8) T = {1,4,9,16,25,36,…}

Set-Builder Form: A set denoted in formal set builder notation has three parts contained inside set braces:
1) variable
2) vertical bar separator (or a colon)
3) logical predicate.

There is a variable written to the left of a vertical bar separator, and a rule (predicate) to the right of the vertical bar separator. These three parts are contained in curly brackets.

This is an example of a set defined using set-builder notation.

A = {x | x is a natural number, x<3}

Or equivalently

A = {x | x ∈ N, x<3}

- In this notation the curly braces are set braces.
- x is a variable, meaning it may take on a variety of values.
- The vertical bar stands for the phrase "with the property that."
- A comma in this context means "and."

I would read this as: Set A equals the set of all values for x with the property that x is a Natural numbers and x is less than 3.

That's quite an involved description of set. I translated the symbols directly to get the description. There are better ways to describe set A.

Here is a better word description for set A: A is the set of Natural numbers that are less than 3.

It has the same meaning as the direct translation, but it is easier to understand.

Example: Write in set-builder notation: A = {2,3,4,5…}

Start by creating the left side and the vertical bar that is required. I usually put an x before the vertical bar, unless the problem is worded in such a way that another letter makes sense.

A= {x |

Next I need to figure out what to write after the vertical bar. The set A represents all natural numbers that are greater than or equal to 2. I need to represent all natural numbers greater than or equal to 2 as the "logical predicate". There are many correct ways to finish this problem off. Here are two correct answers. There are other correct answers.

A= {x | x is a Natural number and x is greater than 1}

Here is another correct answer:

A= {x | x is a Natural number and x is greater than or equal to 2}

Here is another correct answer:

A= {x | x ∈ N, x ≥ 2}

Here is another correct answer:

A= {x | x ∈ N, x> 1}

There are many correct answers. Your answer is correct as long as it has the correct form, and the description yields the desired set.

Example: Write in set-builder notation: A = the set of natural numbers between 3 and 7 exclusive.

Start by creating the left side and the vertical bar that is required. I usually put an x before the vertical bar, unless the problem is worded in such a way that another letter makes sense.

A= {x |

Next I need to figure out what to write after the vertical bar. I know A represents the numbers 4,5 and 6.

When x is between 2 numbers, I need to write x between the two numbers (imagine that), and there need to be less than or less than or equal signs between the numbers and the x. Both of these sets represent the numbers 4,5,6.

A= {x | x ∈ $N, 3 < x < 7$} (x is between 3 and 7 and doesn't include the 3 or 7 because there is no "or equal")

A= {x | x ∈ $N, 4 \leq x \leq 6$} (x is between 4 and 6 and it includes the 4 and 6 because of the equal)

Homework #9 – 16: Write the sets in set-builder form. (There are many correct answers.)

9) D = {2, 3, 4, …}

10) A = {3,4,5,6…}

11) A = {1,2,3,4,5,6,7}

12) B = {1,2,3,4,5,6}

13) P = set of natural numbers between 3 and 11 inclusive

14) P = set of natural numbers between 4 and 9 inclusive

15) P = set of natural numbers between 3 and 11 exclusive

16) P = set of natural numbers between 4 and 9 exclusive

Roster, or **List Form**: Is a listing of all of the elements of the set using set braces.

Example: Write the set in roster form. A = the set of Natural numbers between 3 and 7 exclusive.

I need to figure out the elements of A, and then put them in set braces.

This set contains natural numbers between 3 and 7. It doesn't include the 3 nor the 7 because of the word exclusive.

Answer: A = {4,5,6}

Example: Write the set in roster form. A = the set of Natural numbers greater than 5.

This is an infinite set. I will need to use the … in my answer.

5 won't be in my answer. The key word in the problem would need to be "greater than or equal to" for 5 to be part of my answer.

Answer: A = {6,7,8…}

Example: Write the set in roster form. D = { m | m ∈ N, 4 ≤ m < 8}

This represents all Natural numbers between 4 and 8. It includes the 4 because of the "or equal" after the 4, but doesn't include the 8 as the less than before the 8 doesn't have the "or equal" part.

Answer: D ={4,5,6,7}

Example: Write the set in roster form. B = { x | x + 1 = 9 }

I need to solve x+1 = 9

I get 8.

Answer: B = {8}

Homework # 17 – 32. Write sets in roster form.

17) The set A of natural numbers between 5 and 10 inclusive.

18) The set A of even natural numbers between 5 and 10 inclusive.

19) The set A of even natural numbers greater than 4.

20) The set A of odd natural numbers greater than or equal to 5.

21) The set A of natural numbers greater than 4.

22) The set A of natural numbers greater than 5.

23) The set A of natural numbers that are negative.

24) The A set of natural numbers less than 0.

25) B = { k | k+1=6 }

26) B = { x | x – 3 = 5 }

27) C = { m | m is a natural number, m < 3}

28) C = { m | m is a natural number, $m \leq 3$}

29) D = { m | m ∈ N, 2 < m < 5}

30) D = { m | m ∈ N, $2 \leq m < 5$}

31) D = { m | m ∈ N, $2 < m \leq 5$}

32) D = { m | m ∈ N, 3 < m < 7}

Answers: 1) D equals the set of natural numbers greater than or equal to two.

3) A equals the set of natural numbers between 1 and 7 inclusive

5) D = the set of the seven dwarfs 7) V = the set of vowels

9) D = $\{x | x \in N, x \geq 2\}$ 11) A = { x | x is a Natural number and $1 \leq x \leq 7$ }

13) P = { x | x is a Natural number and $3 \leq x \leq 11$ }

15) P = { x | x is a Natural number and $3 < x < 11$ }

17) A = {5,6,7,8,9,10} 19) A = {6,8,10…} 21) A = {5,6,7…}

23) A = { } 25) B = {5} 27) C = {1,2} 29) D = {3,4} 31) D = {3,4,5}