**Applications of College Algebra**

**Chapter 2.2 Subsets**

**Subsets**

All the elements of one set are also elements of another set is called a subset.

Set A is a subset of B, expressed as A ⊆ B, if every elements in set A is also elements in set B.

**Example 1 – Using the Symbols ⊆ and ⊈**

A = {2, 4, 6}

B = {1, 2, 3, 4, 5, 6, 7}

A ⊆ B

C = {x| x is a letter in the word *proof*}

D = {x| x is a letter in the word *roof*}

C ⊈ B

**Using the Symbols ⊆ and ⊈**

1. A = {1,3,5,6,9,11}

B = {1, 3, 5, 7}

A \_\_\_\_B

1. A = {x| x is the letter is roof}

B = {x| x is the letter in proof}

A \_\_\_\_B

1. A = {x| x is a day of the week}

B = {Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday}

A \_\_\_B

Proper Set

If we know that set A is a subset of set B and we exclude the possibility of the set being equal, then set A is a proper subset of set B, written A ⊂ B. If set A is a subset of set B and sets A and B are not equal (A$\ne $B).

**Example 2 – Using the Symbols ⊆ and ⊂**

A = {1, 3}

B = {1, 3, 5}

A ⊆ B → A ⊂ B

C = {1, 2, 3}

D = {1, 2, 3}

C ⊆ D → C ⊄ D

A = {x| x is a person and x lives in San Francisco}

B = {x| x is a person and x lives in California}

A \_\_\_\_\_B

A = {2, 4, 6, 8}

B = {2, 8, 4, 6}

A \_\_\_\_\_B

**Using the Symbols ⊆ and ⊂**

Write ⊆, ⊂, or both in each blank to form a true statement:

1. A = {2, 4, 6, 8}

B = {2, 4, 6, 8, 10}

A \_\_\_\_\_ B

1. A = {x| x is a person and x lives in Page}

B = {x| x is a person and x lives in Arizona}

A \_\_\_\_\_ B

**Subsets and the Empty Subset**

The meaning of A ⊆ B leads to some interesting properties of the empty set.

Let A = { } and B = {1, 2, 3, 4, 5}. Is A ⊆ B?

A is not a subset of set B if there is at least an element in the set A that is not an element in set B. Because A is an empty set, which mean we cannot find an element in A that is not in B. Equivalently, ∅⊆ B.

1. For any set B, ∅⊆ B.
2. For any set B other than the empty set, ∅⊂ B.

**The Number of Subsets of a Given Set**

|  |  |  |  |
| --- | --- | --- | --- |
| **Set** | **Numbers of Elements** | **List of All Subsets** | **Number of Subsets** |
| { } | 0 | { } | 1 |
| {a} | 1 | {a}, { } | 2 |
| {a, b} | 2 |  {a, b}, {a}, {b}, { } | 4 |
| {a, b, c} | 3 | {a,b,c}, {a,b}, {a,c}, {b,c}, {a}, {b}, {c}, { } | 8 |

The number of subsets of a set with *n* elements is 2*n*

**Example Finding the Number of Subsets and Proper Subsets**

A = {a, b, c, d, } → 24 = 16 subsets and 15 proper subsets.

B = {x| x ∈ N and 9 $\leq $ x $\leq $ 15}

**Homework 1 – 67 Odds**