Section 1.2

A set is a collection or group of elements.

eg. if M = set of all Honda car models

then Fit M ie.

and Prius M ie.

Set roster notation (list of elements)

eg. set of factors of 8 = {1, 2, 4, 8}

set of integers from 5 to 20 =

set of integers greater than 5 =

Special sets

= set of all real numbers

= set of all *positive* real numbers

= set of all integers

= set of all *negative* integers

= set of all rational numbers (quotients of integers)

= set of all *non-negative* rational numbers (zero and all positive rational numbers)

Set equality

INFORMAL DEFINITION:

Given sets A and B, we say A and B are equal, or A = B,

ex. If A = {1, 2, 3} and B = {3, 1, 2}, then A B

If C = {0, 2, 4, 6} and D = {2, 4, 6}, then C D

A set can be an element of another set.

eg. Let K = {a, {b}}

a K {b} K {a} K b K

Set builder notation (specification of property}

A limitation of set roster notation is that for sets with many elements, you must either list all the elements, which would be impossible for sets with infinitely many elements, or you must use ellipsis, but the pattern of the elements may not be obvious

eg. {3, 4, 6, 8, 12, 14, …}

Given a set S, and a property P which may or may not be true for the individual elements of S, we can define a new set

which consists of exactly those elements of S for which P is true, ie. those elements of S which *satisfy* P.

eg. $\{x \in \mathbf{Z}^+ \mid -3 \leq x < 3\} =$

$\{x \in \mathbf{Z} \mid x = 6k$ for some integer $k\} =$

set of all positive integers which are 1 larger than a prime number =

set of all perfect squares =

Subsets

DEFINITION:

Given sets A and B, we say A is a subset of B, or

if and only if

Written more casually, if and only if

Other ways of reading :

NOTE: A is not a subset of B, or

if and only if

(or more symbolically)

ex. $\{1, 2\}$ $\{0, 1, 2, 3\}$

$\{0, 1, 2, 3\}$ $\{1, 2\}$

$\{1, 2, 4, 8\}$ $\{0, 1, 2, 3, 4, 5, 6, 7\}$

$\{x \in \mathbf{Z}^+ \mid x \text{ is prime}\}$ $\{x \in \mathbf{Z}^+ \mid x \text{ is odd}\}$

$\{4, 7\}$ $\{4, 7\}$

1 $\{1, 2\}$

$\{2\}$ $\{1, \{2\}\}$

Ordered Pairs; Cartesian Product of 2 Sets

DEFINITION:

Given elements a, b, c, d, we say (a, b) = (c, d) if and only if

eg. (1, 4) (4, 1)

(0, 2) $(\sin \pi, \sqrt{4})$

We can think of ordered pairs as special sets,
where the ordered pair (a, b) corresponds to the set $\{\{a\}, \{a, b\}\}$.

eg. (1, 4) corresponds to the set

(4, 1) corresponds to the set

(2, 2) corresponds to the set

$\{\{2, 5\}, \{5\}\}$ corresponds to the ordered pair

DEFINITION:

Given two sets A and B, the Cartesian product of A and B, or is

Written more casually, $A \times B$ is the set of all ordered pairs where

eg. Given $A = \{1, 3\}$ and $B = \{1, 2\}$

$A \times B =$

$B \times A =$

ex. Given $R = \{0, 4\}$ and $T = \{a, g, r\}$

$R \times R =$

$T \times R =$

The number of elements in the Cartesian product of 2 sets is

ex. Given $Q \times P = \{(a, t), (h, h), (h, e), (a, e), (a, h), (h, t)\}$

$P =$

$Q =$