Relations & Functions

Cartesian product of sets: (A X B)

- ordered pair (a, b) != (b, a)
- a ∈ A, b ∈ B

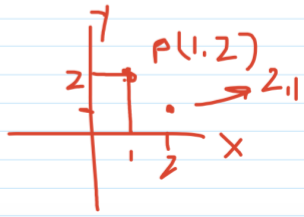
A = {1, 2}
B = {3, 4, 5}
A x B = {(1, 3), (1, 4), (1, 5), (2, 3), (2, 4), (2, 5)}

AXB = {(a, b) | a ∈ A, b ∈ B}

A = {}
B = {1, 2}

A x B = Φ = { }

Ex - Suppose we have to design number plates of vehicles
A = {KA, TN, DL}
B = {01, 02, 03}
AxB = {(KA, 01),(KA, 02),(KA, 03),
(TN, 01),(TN, 02),(TN, 03),
(DL, 01),(DL, 02),(DL, 03)}



A = {1, 2, 3}
B = {4, 5}
All the points formed in 2D space would be given by Cartesian products of sets A and B
i.e, AXB = {(1,4), (1,5), (2,4),(2,5),(3,4),(3,5)}

☆ Two ordered pairs are equal, if and only if the corresponding first elements are equal, and also corresponding 2nd elements are equal.

ex - (x + 1, y-2) = (3,1). Find x and y.

x + 1 = 3
=> x = 2
y-2 = 1
=> y = 3

ex(NCERT):

$(x/3 + 1, y - 2/3) = (5/3, 1/3)$

$\frac{x}{3} + 1 = \frac{5}{3}$

$\frac{x+3}{3} = \frac{5}{3}$

$\Rightarrow x = 2$

$y = 1$

$y - \frac{2}{3} = \frac{1}{3} + \frac{2}{3} = 1$

2 3

$2 + 3 = 6$

$n(A) = x$

$n(B) = y$

$n(A \times B) = xy$

$A = Z^+ = \{0, 1, 2, \ldots\}$

$B = \{2, 3\}$

$A \times B \times C = \{(a, b, c) : a \in A, b \in B, c \in C\}$

ex-

$A = \{1, 2\}$ 2

$B = \{3, 4\}$ 2

$C = \{5\}$ 1

$2 + 2 + 1 = 4$

$A \times B \times C = \{(1, 3, 5), (1, 4, 5), (2, 3, 5), (2, 4, 5)\}$

Find $A \times (B \cup C)$

$A \times (B \cap C)$

$B \cup C = \{3, 4, 5\}$

$A = \{1, 2\}$

$\{1, 2\} \times \{3, 4, 5\} = \{(1, 3), (1, 4), (1,5), (2, 3), (2, 4), (2,5)\}$

ex(NCERT):

Let A = {1, 2}, B = {3, 4}.

1. Write A X B.
2. How many subsets will AX B have ? List them

$n(A) = k$

$n(P(A)) = 2^k$

AXB = {(1, 3), (1, 4), (2, 3), (2,4)}

$n(A \times B) = 4$

$2^4 = 16$

{}, {(1,3)}, {(1,4)}, {(2,3)}, {(2,4)},

{(1,3), (1,4)}, {(1,3), (2,3)}, {(1,3), (2,4)}, {(1,4), (2,3)}, {(1,4), (2,4)}, {(2,3), (2,4)},

{(1,3), (1,4), (2,3)}, {(1,3), (1,4), (2,4)}, {(1,3), (2,3), (2,4)}, {(1,4),(2,3),(2,4)}

{(1,3), (1,4),(2,3),(2,4)}

$= 16$

ex(NCERT):

The Cartesian product AXA has 9 elements. Among which 2 elements are (-1,0) and (0,1). Find set A, and remaining elements of A X A.

$n(AXA) = 9$

$n(A) \cdot n(A) = 9$

$[n(A)]^2 = 9$

$n(A) = 3$

$A = \{-1, 0, 1\}$

AxA = {(-1, -1), (-1,0), (-1,1),

(0, -1), (0, 0), (0,1),

(1, -1), (1,0), (1,1)}