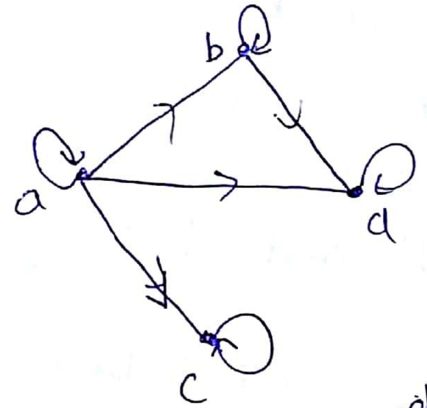
Order of Relation :-

There are two orders of relation

① Partial Order :- A Relation R in a set A is Called partial order relation in P iff R is reflexive, anti-Symmetric, and transitive. The order pair <A, R> is a partially ordered set, or a poset. The relation R is said to be a partial order on A.

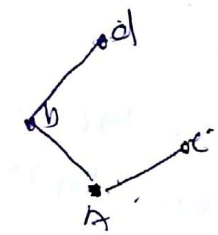
Ex. $A = \{a, b, c, d\}$



R

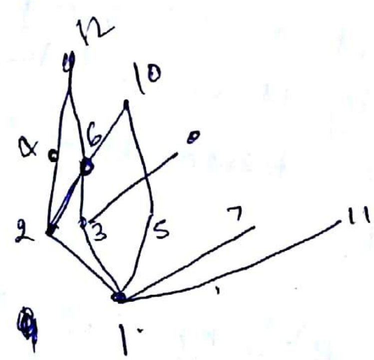
<a,b>
<a,c>
<b,d>
<a,d>
<a,a>
<b,b>
<c,c>
<d,d>

Ex



$A = \{1, 2, 3, -- 12\}$

aRb if a divides b



this is the Poset diagram or Hass diagram

Ex :-

let $X = \{2, 3, 6, 12, 24, 36\}$ and relation ≤ be st $x \leq y$ if x divides y. Draw Hass diagram.

Closure of Relation

Reflexive closure :- if the relation R is not Reflexive, we add necessary elements to the relation then we to make it reflexive.

Ex set A = {a, b, c}

$R = \{(a,b), (a,c) (c,c)\}$

The relation is not reflexive
To make it reflexive we add link (a,a) and (b,b)

$R(r) = R \cup I_A$

The reflexive closure of relation R is obtained by union of R and Identity relation I_A on the set A.

Symmetric closure :- Let R be a relation on A which is not symmetric and R^{-1} be inverse relation R then symmetric closure R^* is defined as of R on A

$R^* = R \cup R^{-1}$

Transitive closure :- The relation obtained by adding the least number of order pair to endure transitivity is called the transitive closure of relation. The transitive closure of R is denoted by R^+.

$R^+ = R \cup R^2 \cup R^3 \ldots \cup R^m$

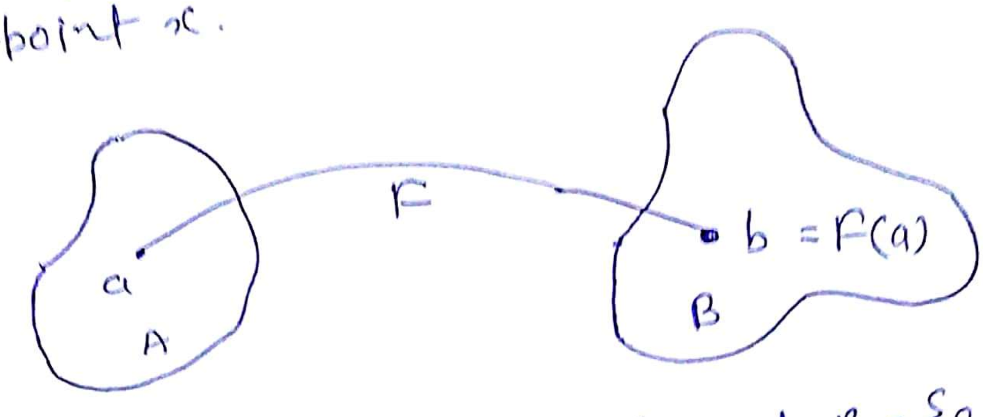
Ex: Let $A = \{1, 2, 3, 4\}$ and $R = \{(1,2), (2,3), (3,4)\}$ be a relation on A. Find transitive closure R^+.

Funch

Function:- If A and B are non-empty set the a rule f, under which to every element x on the set A there corresponds one and only one elements on set B. then the rule f is called the function from A to B. it is denoted by

$f: A \to B$

$f(x)$ is called value of function f at point x.



Example:- let $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c, d\}$

and let $f = \{(1,a), (2,a), (3,d), (4,c)\}$

hence we have

$f(1) = a$
$f(2) = a$
$f(3) = d$
$f(4) = c$

since each set $f(n)$ is a single value f is a function.

Classification of function

1. **Real function :-** A function $f: A \to B$ is called real valued if the image of every element of A under f is real valued if $f(x) \in R \ \forall x \in A$ or $y = f(x)$

Called a polynomial funch.

④ Rational functions :-

$$f: A \to R;\ f(x) = \frac{P(x)}{R(x)}$$

$P(x)$ and $R(x)$ are polynomial funⁿ

$A = \{x : x \in R \text{ such that } R(x) \neq 0\}$

⑤ Signum funⁿ :→

The funⁿ is defined by

$$f(x) = \begin{cases} \frac{|x|}{x} & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}$$

$$f(x) = \begin{cases} 1 & \text{when } x > 0 \\ 0 & \text{when } x = 0 \\ -1 & \text{when } x < 0 \end{cases}$$

$D_f = R$ and $R_f = [-1, 0, 1]$

Tybes of function

① Real function

$f: A \to B$ is called real valued if image of every element of A under f is a real number

if $f(x) \in R, \forall x \in A$ or $y = f(x)$

~~the $y^2 = 4ax$ and $x^2 = 4ay$~~ are functions as they contains two dependent variable

y is debendent varriable and x is indebendent varriable

~~$y^2 = 4ax$~~

② modulus function

$F: R \to R$

$$f(x) = |x| \begin{cases} x & \text{if } x \geq 0 \\ -x & x < 0 \end{cases}$$

f(x) is called modulas function

$R_f = \{|x| ; x \in R\}$ set of non negative no.

③ Polynomial funⁿ :-

if $f: R \to R$, st

$f(x) = a_0 + a_1 x + a_2 x^2 + \ldots a_n x^n$

where n ∈ N ...

① Let $A = \{a_1 a_2 a_3\}$ $B = \{b_1 b_2 b_3\}$, $C = \{c_1 c_2\}$
$D = \{d_1 d_2 d_3 d_4\}$ Consider the following four funn

(a) $f_1 = \{(a_1 b_2), (a_2 b_3), (a_3 b_1)\}$ (b) $f_2 = \{(a_1 d_2)(a_2 a_1)(a_3 d_1)\}$
$f_3 = \{(b_1 c_1)(b_2 c_2)(b_3 c_1)\}$ (f_4) $= \{(d_1 b_1)(d_2 b_2)(d_3 b_1)\}$

Operation on Real valued funn

① addition: $(f+g)x = f(x) + g(x)$, $f+g$ will be defined only for those values of x for which both f and g are defined $D(f+g) = D_f \cup D_g$

(ii) subtraction: $(f-g)x = f(x) - g(x)$

(iii) multiplicat: $(fg)x = f(x)\, g(x)$

(iv) Division : $\left(\frac{f}{g}\right)x = \frac{f(x)}{g(x)}$

(Ex) Let $X = \{a, b, c\}$. Define $f: X \to X$ st
$f = \{(a,b), (b,a) (c,c)\}$

find f^4

(Ex) Let f and g be two funn
$f(x) = \sqrt{x-1}$ and $g(x) = \sqrt{4-x^2}$