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paper # Discrete Structure

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Question No. 1:

Solution:

Using formula

$a_n = a + (n-1)d$

Given that

$a_3 = 7$ $a_8 = 17$

$a_3 = a + (3-1)d = 7$

$a_8 = a + (8-1)d = 17$

therefore

$7 = a + 2d \rightarrow (1)$

$17 = a + 7d \rightarrow (2)$

Subtracting 1 from 2

$10 = 5d$

$d = 2$

put $d = 2$ in (1)

$7 = a + 2(2)$

$a = 3 \rightarrow$ Given

putting the value of a and d

$a_n = a + (n-1)d$
$a_3 = 3 + (n-1)2$

the value of 36^{th} terms

$a_{36} = a + (n-1)d$
$= 3 + (36-1)2$
$= 3 + 70$
$= \boxed{73 \text{ Ans}}$

Question No. 2:

Solution:

$f \circ g(x)$ and $g \circ f(x)$

$f \circ g(x) = 2(g(x)) + 3$
$= 2(-x^2 + 5) + 3$
$= -2x^2 + 10 + 3$
$= -2x^2 + 13$

→

$$gof(x) = -(2x+3)^2+5$$

$$= -(2x^2+3^2+5)$$

$$= -2x^2-9+5$$

$$= -2x^2-4$$

$$= -2(x^2+2)=0$$

$$= \frac{\cancel{-2}}{\cancel{-2}}(x^2+2) = \frac{0}{-2}$$

$$gof(x) = \boxed{(x^2+2)}$$ Ans

Question No. 3 :

Solution :

For $n=1$

R.H.S of $P(1) = \frac{1(1+1)(2(1)+1)}{6}$

$= \frac{(1)(2)(3)}{6} = \frac{6}{6} = 1$

Suppose $p(n)$ is true for $n \geq 1$

$1^2+2^2+3^2 \ldots +n^2 = \frac{n(n+1)(2n+1)}{6}$

R.H.S

To prove $(n+1)$ is true

$1^2+2^2+3^2 \ldots +(n+1)^2 = \frac{(n+1)((n+1)+1)(2(n+1)+1)}{6}$

$1^2+2^2+3^2 \ldots +(n+1)^2$

$= 1^2+2^2+3^2 \ldots +n^2+(n+1)^2$

$= \frac{n(n+1)(2n+1)}{6} + (n+1)^2$

→

$$= (n+1)\left[\frac{n(2n+1)}{6} + (n+1)\right]$$

$$= (n+1)\left[\frac{n(2n+1)+6(n+1)}{6}\right]$$

$$= \frac{(n+1)(n+2)(2n+3)}{6}$$

$$\boxed{= \frac{(n+1)(n+1+1)(2(n+1)+1)}{6}} \text{ Ans}$$

Question No. 4:

Ans):

Relations and its types:

Relation and its types concepts are one of the important topics of set theory. sets relations and functions al three are interlinked topics. sets denote the collection of ordered elements whears relation and function define the operations performed on sets.

Relation:

A relation in mathematics defines the relationship b/w two different sets of information

Types of relation:

there are 8 main types of relations which include.

1) Empty Relation
2) Universal Relation
3) identity Relation
4) inverse relation

5) Reflexive Relation
6) Symmetric Relation
7) transitive Relation

8) Equivalence Relation

1) **Empty Relation:** An empty relation is one in which there is no relation b/w any elements of a set. for example if set $A = \{1, 2, 3\}$ then one of the void relations can be $R = \{x, y\}$, where $\{x - y\} = 8$ for empty relation

$$R = \phi \subset A \times A$$

2) **Universal Relation:**

A Universal Relation is a type of relation in which every elements of a set is related to each other. Consider set $A = \{a, b, c\}$. Now one of the universal relations will be $R = \{x, y\}$ where $|x - y| \geq 0$. for universal Relation

$$R = A \times A$$

3) Identity Relation :- In an identity relation, every element of a set is related to itself only. for example in a set $A = \{a, b, c\}$, the identity relation will be $I = \{a,a\}, \{b,b\}, \{c,c\}$. for identity relation,

$$I = \{(a,a), a \in A\}$$

4) Inverse relation :- Inverse Relation is seen when a set has elements which are inverse pairs of anthor set. for example if set $A = \{(a,b), (c,d)\}$ then inverse relation will be $R = \{(b,a) (d,c)\}$ so for inversion relation

$$R = \{(b,a) : (a,b) \in R\}$$

5) Reflexive Relation :-

In a reflexive relation, every element maps to itself, for example consider a set $A = \{1,2\}$ Now an example of reflexive relation will be

$R = \{(1,1), (2,2), (1,2), (2,1)\}$. the reflexive relation is given by $(a,a) \in R$

6) Symmetric Relation:

In a Symmetric Relation, if $a=b$ is true then $b=a$ is also true. In other words, a relation R is symmetric only if $(b,a) \in R$ is true when $(a,b) \in R$. An example of symmetric relation will be

$R = \{(1,2)(2,1)\}$ for a Set $A = \{1,2\}$

for a Symmetric Relation,

$aRb \Rightarrow bRa, \forall a, b \in A$

7) Transitive Relation:

For transitive relation,

if $(x,y) \in R, (y,z) \in R$, then $(x,z) \in R$

for a transitive property.

aRb and $bRc \Rightarrow aRc \; \forall a,b,c \in A$

8) Equivalence Relation:

if a relation is reflexive, symmetric and transitive at the same time it is known as equivalence relation.

Question No. 5 :.

a):

Solution:.
there are 26 possible letters in the alphabet {a, b, c, ... z}
while there are 10 possible digits.

A license plate Contain 3 letters followed by 3 digits.

First letter 26 ways
Second letter 26 ways
Third letter 26 ways

First digit 10 ways
Second digit 10 ways
third digit 10 ways

Using multiplication Rule:

$$26 \times 26 \times 26 \times 10 \times 10 \times 10 =$$

$$26^3 \times 10^3 = \boxed{17,576,000}$$

$\boxed{17,576,000}$ No. plates are possible b):

Solution:

A license plate contains 3 letters followed by 3 digits. while the first letter needs to be A and the last digit needs to be 0.

First letter 1 way (needs to be A)
Second letter 26 ways
third letter 26 ways

First digit 10 ways
Second digit 10 ways
third digit 1 way (needs to be 0).

Using multiplication Rule

$1 \times 26 \times 26 \times 10 \times 10 \times 1 =$

$26^2 \times 10^2 = \boxed{67,600}$

→

Solution:

c):

A license plate contain 3 letters followed by 3 digits while the license plate start with PQR.

First letter 1 way (P)

~~First letter~~

Second letter 1 way (Q)

Third letter 1 way (R)

First digit 10 ways

Second digit 10 ways

third digit 10 ways

Using multiplication Rule

$$1 \times 1 \times 1 \times 10 \times 10 \times 10 = 10^3 = \boxed{1000}$$

Ans

there are 1000 possible license plate beginning with PQR.