Topic : .... Date. : .... Page No. : ....

XII SOLUTIONS of "WORKSHEET NO: 1" ①

RELATION & FUNCTION

Ans 1 → $A = \{1, 2, 3\}$ $R = \{(1,1)\ (2,2)\ (3,3)\ (1,2)\ (2,3)\}$

It is reflexive since for each $a \in A$, $(a,a) \in R$

It is not symmetric since $(1,2) \in R$ but $(2,1) \notin R$

It is not transitive since $(1,2) \in R$ & $(2,3) \in R$ but $(1,3) \notin R$

Ans

Ans 2 → $R = \{(L_1, L_2) : L_1 \text{ is } \perp^r \text{ to } L_2\}$

Symmetric: let $(L_1, L_2) \in R$

$\Rightarrow L_1 \perp L_2$

$\Rightarrow L_2 \perp L_1$

$\Rightarrow (L_2, L_1) \in R$ $\therefore$ R is symmetric

Transitive: let $(L_1, L_2) \in R$ & $(L_2, L_3) \in R$

$\Rightarrow L_1 \perp L_2$ and $L_2 \perp L_3$

but $L_1 \parallel L_3$

$\Rightarrow (L_1, L_3) \notin R$ $\therefore$ R is not transitive

Reflexive: Since any line cannot $\perp^r$ to itself

$\therefore (L_1, L_1) \notin R$

$\therefore$ R is not Reflexive. Ans

Ans 3 → $A = \{1, 2, 3, \ldots 14\}$ $R = \{(x, y) : 3x - y = 0\}$

$R = \{(1,3)\ (2,6)\ (3,9)\ (4,12)\}$

It is not reflexive since $1 \in A$ but $(1,1) \notin R$

It is not symmetric since $(1,3) \in R$ but $(3,1) \notin R$

It is not transitive since $(1,3) \in R$ & $(3,9) \in R$ but $(1,9) \notin R$

Ans

CLASSTIME

XII Solution R & F worksheet No 1 (2)

Ans 4 → $A = \{1, 2, 3, 4, 5, 6\}$

$R = \{(x, y) : y \text{ is divisible by } x\}$

$R = \{(1,1)\ (1,2)\ (1,3)\ (1,4)\ (1,5)\ (1,6)\ (2,2)\ (2,4)\ (2,6),$
$(3,3)\ (3,6)\ (4,4)\ (5,5),\ (6,6)\}$

R is reflexive since for each $a \in A$
$(a, a) \in R$

R is not symmetric since $(1,3) \in R$ but $(3,1) \notin R$

R is transitive for each $(a,b) \in R$ & $(b,c) \in R$
we have $(a,c) \in R$

Ans

Ans 5 → $R = \{(x,y) : y = x + 5;\ x < 4,\ x \in N,\ y \in N\}$

$R = \{(1,6)\ (2,7)\ (3,8)\}$

Clearly R is not reflexive & ~~Ex~~ symmetric
$1 \in N$ $(1,6) \in R$
but $(1,1) \notin R$ but $(6,1) \notin R$

R is transitive Ans

Ans 6 → (i) $R = \{(x, y) : x \text{ is a wife of } y\}$

not symmetric if $(x, y) \in R \Rightarrow x$ is a wife of y
then $(y, x) \notin R$ y can never be wife of x

not reflexive $(x, x) \notin R$ A wife cannot wife of itself

It ~~is~~ Transitive $R = \{(x, y)\} \longrightarrow$ single pair is always transitive.

Ans

XII solution R & F worksheet No: 1 (3)

(ii) Do yourself

Q No. 7 → $R = \{(a,b) : a \le b^2 ; a \in R, b \in R\}$

(1) not Symmetric

~~$(4,2) \in R$ since $4 \le 2^2$ but $(2,4) \notin R$ since~~

$(1,2) \in R$

since $1 \le 2^2$

but $(2,1) \notin R$

since $2 \nleq 1^2$

(2) not reflexive

$\frac{1}{2} \in R$ (Real number set)

but $\left(\frac{1}{2}, \frac{1}{2}\right) \notin R$ (Relation

since $\frac{1}{2} \nleq \left(\frac{1}{2}\right)^2$

(3) not transitive

$(16,4) \in R$ and $(4,2) \in R$

$\Rightarrow 16 \le 4^2$ and $4 \le 2^2$

but $(16,2) \notin R$

since $16 \nleq 2^2$ Ans

Q No 8 → $A = \{1,2,3,4,5,6\}$ $R = \{(a,b) : b = a+1\}$

(1) not Symmetric since $(1,2) \in R$

as $2 = 1+1$

but $(2,1) \notin R$

since $1 \neq 2+1$

(2) not Reflexive $1 \in A$

but $(1,1) \notin R$

since $1 \neq 1+1$

(3) Transitive $(1,2) \in R$ & $(2,3) \in R$

since $2 = 1+1$ & $3 = 2+1$

but $(1,3) \notin R$

since $3 \neq 1+1$ Ans

Topic : .... Date. : .... Page No. : ....

XII R&F worksheet No: 1 (4)

Ans 9 → $R = \{(a,b) : a \le b,\ a \in R\ \&\ b \in R\}$

not symmetric $(1,2) \in R$

since $1 \le 2$

but $(2,1) \notin R$

since $2 \nleq 1$

Transitive let $(a,b) \in R$ & $(b,c) \in R$

$\Rightarrow a \le b$ and $b \le c$

$\Rightarrow a \le c$

$\Rightarrow (a,c) \in R$ $\therefore$ R is transitive

Reflexive for each $a \in R$ (set of real nos)

$a \le a$

$\therefore (a,a) \in R$ (Relation)

$\therefore$ R is reflexive **Ans.**

Ans 10 → $R = \{(T_1, T_2) : T_1$ is similar to $T_2\}$

Symmetric let $(T_1, T_2) \in R$

$\Rightarrow T_1 \sim T_2$

$\Rightarrow T_2 \sim T_1$

$\Rightarrow (T_2, T_1) \in R$ $\therefore$ R is symmetric

Transitive. let $(T_1, T_2) \in R$ & $(T_2, T_3) \in R$

$\Rightarrow T_1 \sim T_2$ and $T_2 \sim T_3$

$\Rightarrow T_1 \sim T_3$

$\Rightarrow (T_1, T_3) \in R$

$\therefore$ R is transitive

Reflexive for each $T_1 \in R$

$T_1 \sim T_1$

$\Rightarrow (T_1, T_1) \in R$

$\therefore$ R is reflexive

XII Solutions R&F (worksheet No 1)

$\therefore$ R is an equivalence relation

(ii) T_1 & T_3 are related to each other

Since $\frac{3}{6} = \frac{4}{8} = \frac{5}{10}$ are in same ratio

$\therefore T_1$ & T_3 are similar

Ans 11 → $R = \{(P, Q): OP = OQ$, O is the origin$\}$

Symmetric let $(P, Q) \in R$

$\Rightarrow OP = OQ$

$\Rightarrow OQ = OP$

$\Rightarrow (Q, P) \in R$ $\therefore$ R is symmetric

Transitive let $(P, Q) \in R$ & $(Q, S) \in R$

$\Rightarrow OP = OQ$ & $OQ = OS$

$\Rightarrow OP = OS$

$\Rightarrow (P, S) \in R$ $\therefore$ R is transitive

Reflexive for each $P \in A$ (given set)

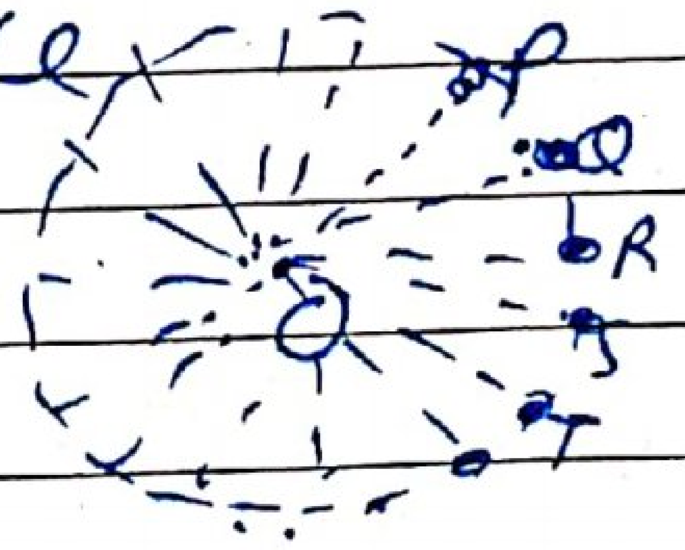
$OP = OP$

$\Rightarrow (P, P) \in R$ $\therefore$ R is reflexive

$\therefore$ R is an equivalence relation

(ii) All the points which are related to point P their distance from origin are as same as OP, and these distances act as the radius of the circle with origin as centre

$\therefore$ these points lie on the circle. **Ans**



Ans 12 → $A = \{0, 1, 2, 3, ---, 14\}$

$R = \{(a, b): |a-b|$ is multiple of $5\}$

XII Solutions (Worksheet No: 1) REF

Symmetric let $(a,b) \in R$

$\Rightarrow |a-b|$ is multiple of 5

$\Rightarrow |a-b| = 5\lambda$ --- $(\lambda \in Z)$

$\Rightarrow |b-a| = 5\lambda$ which is multiple of 5

$\Rightarrow (b,a) \in R$ $\therefore$ R is Symmetric

Transitive

let $(a,b) \in R$ and $(b,c) \in R$

$\Rightarrow |a-b| = 5\lambda$ and $|b-c| = 5k$ -- $(\lambda, k \in Z)$

$\Rightarrow a-b = \pm 5\lambda$ & $b-c = \pm 5k$

$\Rightarrow a-c = (a-b)+(b-c)$

$\Rightarrow a-c = \pm 5\lambda \pm 5k$

$\Rightarrow a-c = \pm 5(\lambda+k)$

$\Rightarrow |a-c| = 5|\lambda+k|$ which is multiple of 5

$\Rightarrow (a,c) \in R$

$\therefore$ R is transitive

Reflexive

for each $a \in A$

$|a-a| = 0$ which is multiple of 5

$\Rightarrow (a,a) \in R$

$\therefore$ R is reflexive

$\therefore$ R is an equivalence relation

(ii) Equivalence class $[4] = \{4, 9, 14\}$ Ans

Qu. 13 → $A = \{0,1,2,3\}$ & $R = \{(0,0)(0,1)(0,3)(1,0)(1,1)(2,2)(3,0)(3,3)\}$

R is reflexive for each $a \in A$ $(a,a) \in R$

R is symmetric for each $(a,b) \in R$ $(b,a) \in R$

R is not transitive since $(1,0) \in R$ & $(0,3) \in R$ but $(1,3) \notin R$ Ans

Topic : .... Date. : .... Page No. : ....

XI Solutions REF (worksheet No 1) (7)

R on N

Qns 14 → $R = \{(n, m) : n \text{ divides } m\}$ $\frac{m}{n}$ form

Symmetric Not. Since $(2,4) \in R$

as 2 divides 4

but $(4,2) \notin R$

since 4 does not divides 2

Reflexive for each $n \in N$

n always divides n

$\Rightarrow (n, n) \in R$ ∴ R is reflexive

Transitive let $(n, m) \in R$ & $(m, p) \in R$

⇒ n divides m & m divides p

$\Rightarrow \frac{m}{n} = \lambda$ & $\frac{p}{m} = k$ -- $(\lambda, k \in N)$

$\Rightarrow m = n\lambda$ & $p = mk$

$\Rightarrow p = (n\lambda)k$

$\Rightarrow \frac{p}{n} = \lambda k$

Clearly n divides p since λk is also a natural no.

∴ $(n, p) \in R$ ∴ R is transitive Ans

Qns 15 (i) aRb if $2a + 3b = 30$ & $a \in N$, $b \in N$

$R = \{(3,8)\ (6,6)\ (9,4)\ (12,2)\}$ Ans

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

$R = \{(a, b) : |a^2 - b^2| < 8\}$

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

CLASSTIME