# Objective Questions

**Question 1.**
Mark the tick against the correct answer in the following:

Let A = {1, 2, 3} and let R = {(1, 1),
(2, 2), (3, 3), (1, 3), (3, 2), (1, 2)}. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. an equivalence relation

**Answer:**
Given set A = {1, 2, 3}

And R = {(1, 1), (2, 2), (3, 3), (1, 3), (3, 2), (1, 2)}

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) ∈ R for every a ∈ A

Symmetric

The relation is Symmetric if (a , b) ∈ R , then (b , a) ∈ R

Transitive

Relation is Transitive if (a , b) ∈ R & (b , c) ∈ R , then (a , c) ∈ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Since , $(1,1) \in R$ , $(2,2) \in R$ , $(3,3) \in R$

Therefore , R is reflexive ....... (1)

Check for symmetric

Since $(1,3) \in R$ but $(3,1) \notin R$

Therefore , R is not symmetric ....... (2)

Check for transitive

Here , $(1,3) \in R$ and $(3,2) \in R$ and $(1,2) \in R$

Therefore , R is transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (B)

**Question 2.**
Mark the tick against the correct answer in the following:

Let A = {a, b, c} and let R = {(a, a), (a, b), (b, a)}. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. an equivalence relation

**Answer:**
Given set A = {a, b, c}

And R = {(a, a), (a, b), (b, a)}

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) ∈ R for every a ∈ A

Symmetric

The relation is Symmetric if (a , b) ∈ R , then (b , a) ∈ R

Transitive

Relation is Transitive if (a , b) ∈ R & (b , c) ∈ R , then (a , c) ∈ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Since , (b,b) ∉ R and (c,c) ∉ R

Therefore , R is not reflexive ....... (1)

Check for symmetric

Since , (a,b) ∈ R and (b,a) ∈ R

Therefore , R is symmetric ....... (2)

Check for transitive

Here , (a,b) ∈ R and (b,a) ∈ R and (a,a) ∈ R

Therefore , R is transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (C)

**Question 3.**

Mark the tick against the correct answer in the following:

Let A = {1, 2, 3} and let R = {(1, 1),
(2, 2), (3, 3), (1, 2), (2, 1), (2, 3), (3, 2)}. Then, R is

A. reflexive and symmetric but not transitive

B. symmetric and transitive but not reflexive

C. reflexive and transitive but not symmetric

D. an equivalence relation

**Answer:**
Given set A = {1, 2, 3}

And R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 1), (2, 3), (3, 2)}

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) ∈ R for every a ∈ A

Symmetric

The relation is Symmetric if (a , b) ∈ R , then (b , a) ∈ R

Transitive

Relation is Transitive if (a , b) ∈ R & (b , c) ∈ R , then (a , c) ∈ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Since , (1,1) ∈ R , (2,2) ∈ R , (3,3) ∈ R

Therefore , R is reflexive ....... (1)

Check for symmetric

Since , $(1,2) \in R$ and $(2,1) \in R$

$(2,3) \in R$ and $(3,2) \in R$

Therefore , R is symmetric ....... (2)

Check for transitive

Here , $(1,2) \in R$ and $(2,3) \in R$ but $(1,3) \notin R$

Therefore , R is not transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (A)

**Question 4.**
Mark the tick against the correct answer in the following:

Let S be the set of all straight lines in a plane. Let R be a relation on S defined by $a\ R\ b \Leftrightarrow a \perp b$. Then, R is

A. reflexive but neither symmetric nor transitive

B. symmetric but neither reflexive nor transitive

C. transitive but neither reflexive nor symmetric

D. an equivalence relation

**Answer:**
According to the question ,

Given set S = {x, y, z}

And R = {(x, y), (y, z), (x, z) , (y, x), (z, y), (z, x)}

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) $\in$ R for every a $\in$ A

Symmetric

The relation is Symmetric if (a , b) $\in$ R , then (b , a) $\in$ R

Transitive

Relation is Transitive if (a , b) $\in$ R & (b , c) $\in$ R , then (a , c) $\in$ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Since , (x,x) $\notin$ R , (y,y) $\notin$ R , (z,z) $\notin$ R

Therefore , R is not reflexive ....... (1)

Check for symmetric

Since , (x,y) $\in$ R and (y,x) $\in$ R

(z,y) $\in$ R and (y,z) $\in$ R

(x,z) $\in$ R and (z,x) $\in$ R

Therefore , R is symmetric ....... (2)

Check for transitive

Here , (x,y) $\in$ R and (y,x) $\in$ R but (x,x) $\notin$ R

Therefore , R is not transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (B)

**Question 5.**
Mark the tick against the correct answer in the following:

Let S be the set of all straight lines in a plane. Let R be a relation on S defined by a R b ⇔ a || b. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. an equivalence relation

**Answer:**
According to the question ,

Given set S = {x, y, z}

And R = {(x, x), (y, y), (z, z)}

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) ∈ R for every a ∈ A

Symmetric

The relation is Symmetric if (a , b) ∈ R , then (b , a) ∈ R

Transitive

Relation is Transitive if (a , b) ∈ R & (b , c) ∈ R , then (a , c) ∈ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Since , $(x,x) \in R$ , $(y,y) \in R$ , $(z,z) \in R$

Therefore , R is reflexive ....... (1)

Check for symmetric

Since , $(x,x) \in R$ and $(x,x) \in R$

$(y,y) \in R$ and $(y,y) \in R$

$(z,z) \in R$ and $(z,z) \in R$

Therefore , R is symmetric ....... (2)

Check for transitive

Here , $(x,x) \in R$ and $(y,y) \in R$ and $(z,z) \in R$

Therefore , R is transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (D)

**Question 6.**
Mark the tick against the correct answer in the following:

Let Z be the set of all integers and let R be a relation on Z defined by a R b $\Leftrightarrow$ (a - b) is divisible by 3. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. an equivalence relation

**Answer:**
According to the question ,

Given set Z = {1, 2, 3 ,4 .....}

And R = {(a, b) : a,b $\in$ Z and (a-b) is divisible by 3}

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) $\in$ R for every a $\in$ A

Symmetric

The relation is Symmetric if (a , b) $\in$ R , then (b , a) $\in$ R

Transitive

Relation is Transitive if (a , b) $\in$ R & (b , c) $\in$ R , then (a , c) $\in$ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , (a,a)

(a - a) = 0 which is divisible by 3

(a,a) $\in$ R where a $\in$ Z

Therefore , R is reflexive ....... (1)

Check for symmetric

Consider , (a,b) $\in$ R

$\therefore$ (a - b) which is divisible by 3

- (a - b) which is divisible by 3

(since if 6 is divisible by 3 then -6 will also be divisible by 3)

∴ (b - a) which is divisible by 3 ⇒ (b,a) ∈ R

For any (a,b) ∈ R ; (b,a) ∈ R

Therefore , R is symmetric ……. (2)

Check for transitive

Consider , (a,b) ∈ R and (b,c) ∈ R

∴ (a - b) which is divisible by 3

and (b - c) which is divisible by 3

[ (a-b)+(b-c) ] is divisible by 3 ] (if 6 is divisible by 3 and 9 is divisible by 3 then 6+9 will also be divisible by 3)

∴ (a - c) which is divisible by 3 ⇒ (a,c) ∈ R

Therefore (a,b) ∈ R and (b,c) ∈ R then (a,c) ∈ R

Therefore , R is transitive ……. (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (D)

**Question 7.**
Mark the tick against the correct answer in the following:

Let R be a relation on the set N of all natural numbers, defined by a R b ⇔ a is a factor of b. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. an equivalence relation

**Answer:**
According to the question ,

Given set N = {1, 2, 3 ,4 .....}

And R = {(a, b) : a,b $\in$ N and a is a factor of b}

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) $\in$ R for every a $\in$ A

Symmetric

The relation is Symmetric if (a , b) $\in$ R , then (b , a) $\in$ R

Transitive

Relation is Transitive if (a , b) $\in$ R & (b , c) $\in$ R , then (a , c) $\in$ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , (a,a)

a is a factor of a

(2,2) , (3,3)... (a,a) where a $\in$ N

Therefore , R is reflexive ....... (1)

Check for symmetric

a R b ⇒ a is factor of b

b R a ⇒ b is factor of a as well

Ex _ (2,6) ∈ R

But (6,2) ∉ R

Therefore , R is not symmetric ....... (2)

Check for transitive

a R b ⇒ a is factor of b

b R c ⇒ b is a factor of c

a R c ⇒ b is a factor of c also

Ex _(2,6) , (6,18)

∴ (2,18) ∈ R

Therefore , R is transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (B)

**Question 8.**
Mark the tick against the correct answer in the following:

Let Z be the set of all integers and let R be a relation on Z defined by a R b ⇔ a≥ b. Then, R is

A. symmetric and transitive but not reflexive

B. reflexive and symmetric but not transitive

C. reflexive and transitive but not symmetric

D. an equivalence relation

**Answer:**
According to the question ,

Given set Z = {1, 2, 3 ,4 .....}

And R = {(a, b) : a,b $\in$ Z and a $\geq$ b}

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) $\in$ R for every a $\in$ A

Symmetric

The relation is Symmetric if (a , b) $\in$ R , then (b , a) $\in$ R

Transitive

Relation is Transitive if (a , b) $\in$ R & (b , c) $\in$ R , then (a , c) $\in$ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , (a,a) (b,b)

$\therefore$ a $\geq$ a and b $\geq$ b which is always true.

Therefore , R is reflexive ....... (1)

Check for symmetric

a R b ⇒ a ≥ b

b R a ⇒ b ≥ a

Both cannot be true.

Ex _ If a=2 and b=1

∴ 2 ≥ 1 is true but 1 ≥ 2 which is false.

Therefore , R is not symmetric ....... (2)

Check for transitive

a R b ⇒ a ≥ b

b R c ⇒ b ≥ c

∴ a ≥ c

Ex _a=5 , b=4 and c=2

∴ 5≥4 , 4≥2 and hence 5≥2

Therefore , R is transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (C)

**Question 9.**
Mark the tick against the correct answer in the following:

Let S be the set of all real numbers and let R be a relation on S defined by a R b ⇔ |a| ≤ b. Then, R is

A. reflexive but neither symmetric nor transitive

B. symmetric but neither reflexive nor transitive

C. transitive but neither reflexive nor symmetric

D. none of these

**Answer:**
According to the question ,

Given set S = {.......,-2,-1,0,1,2 .....}

And R = {(a, b) : a,b $\in$ S and |a| $\leq$ b }

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) $\in$ R for every a $\in$ A

Symmetric

The relation is Symmetric if (a , b) $\in$ R , then (b , a) $\in$ R

Transitive

Relation is Transitive if (a , b) $\in$ R & (b , c) $\in$ R , then (a , c) $\in$ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , (a,a)

$\therefore$ |a| $\leq$ a and which is not always true.

Ex_if a=-2

$\therefore$ |-2| $\leq$ -2 $\Rightarrow$ 2 $\leq$ -2 which is false.

Therefore , R is not reflexive ....... (1)

Check for symmetric

a R b ⇒ |a| ≤ b

b R a ⇒ |b| ≤ a

Both cannot be true.

Ex _ If a=-2 and b=-1

∴ 2 ≤ -1 is false and 1 ≤ -2 which is also false.

Therefore , R is not symmetric ....... (2)

Check for transitive

a R b ⇒ |a| ≤ b

b R c ⇒ |b| ≤ c

∴ |a| ≤ c

Ex _a=-5 , b= 7 and c=9

∴ 5 ≤ 7 , 7 ≤ 9 and hence 5 ≤ 9

Therefore , R is transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (C)

**Question 10.**
Mark the tick against the correct answer in the following:

Let S be the set of all real numbers and let R be a relation on S, defined by a R b ⇔ |a – b| ≤ 1. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. an equivalence relation

**Answer:**
According to the question ,

Given set S = {.......,-2,-1,0,1,2 .....}

And R = {(a, b) : a,b ∈ S and |a – b| ≤ 1 }

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) ∈ R for every a ∈ A

Symmetric

The relation is Symmetric if (a , b) ∈ R , then (b , a) ∈ R

Transitive

Relation is Transitive if (a , b) ∈ R & (b , c) ∈ R , then (a , c) ∈ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , (a,a)

∴ |a – a| ≤ 1 and which is always true.

Ex_if a=2

∴ $|2-2| \leq 1 \Rightarrow 0 \leq 1$ which is true.

Therefore , R is reflexive ....... (1)

Check for symmetric

a R b ⇒ $|a - b| \leq 1$

b R a ⇒ $|b - a| \leq 1$

Both can be true.

Ex _ If a=2 and b=1

∴ $|2 - 1| \leq 1$ is true and $|1-2| \leq 1$ which is also true.

Therefore , R is symmetric ....... (2)

Check for transitive

a R b ⇒ $|a - b| \leq 1$

b R c ⇒ $|b - c| \leq 1$

∴$|a - c| \leq 1$ will not always be true

Ex _a=-5 , b= -6 and c= -7

∴ $|6-5| \leq 1$ , $|7 - 6| \leq 1$ are true But $|7 - 5| \leq 1$ is false.

Therefore , R is not transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (A)

**Question 11.**

Mark the tick against the correct answer in the following:

Let S be the set of all real numbers and let R be a relation on S, defined by a R b ⇔ (1 + ab) > 0. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. none of these

**Answer:**
According to the question ,

Given set S = {.......,-2,-1,0,1,2 .....}

And R = {(a, b) : a,b ∈ S and (1 + ab) > 0 }

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) ∈ R for every a ∈ A

Symmetric

The relation is Symmetric if (a , b) ∈ R , then (b , a) ∈ R

Transitive

Relation is Transitive if (a , b) ∈ R & (b , c) ∈ R , then (a , c) ∈ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , (a,a)

∴ $(1 + a\times a) > 0$ which is always true because $a\times a$ will always be positive.

Ex_if a=2

∴ $(1 + 4) > 0 \Rightarrow (5) > 0$ which is true.

Therefore , R is reflexive ....... (1)

Check for symmetric

$a\ R\ b \Rightarrow (1 + ab) > 0$

$b\ R\ a \Rightarrow (1 + ba) > 0$

Both the equation are the same and therefore will always be true.

Ex _ If a=2 and b=1

∴ $(1 + 2\times1) > 0$ is true and $(1+1\times2) >$ which is also true.

Therefore , R is symmetric ....... (2)

Check for transitive

$a\ R\ b \Rightarrow (1 + ab) > 0$

$b\ R\ c \Rightarrow (1 + bc) > 0$

∴$(1 + ac) > 0$ will not always be true

Ex _a=-1 , b= 0 and c= 2

∴ $(1 + -1\times0) > 0$ , $(1 + 0\times2) > 0$ are true

But $(1 + -1\times2) > 0$ is false.

Therefore , R is not transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (A)

**Question 12.**
Mark the tick against the correct answer in the following:

Let S be the set of all triangles in a plane and let R be a relation on S defined by $\Delta_1$ S $\Delta_2 \Leftrightarrow \Delta_1 \equiv A_2$. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. an equivalence relation

**Answer:**
According to the question ,

Given set S = {...All triangles in plane....}

And R = {($\Delta_1$ , $\Delta_2$) : $\Delta_1$ , $\Delta_2 \in$ S and $\Delta_1 \equiv \Delta_2$}

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) ∈ R for every a ∈ A

Symmetric

The relation is Symmetric if (a , b) ∈ R , then (b , a) ∈ R

Transitive

Relation is Transitive if (a , b) ∈ R & (b , c) ∈ R , then (a , c) ∈ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , $(\Delta_1, \Delta_1)$

$\therefore$ We know every triangle is congruent to itself.

$(\Delta_1, \Delta_1) \in R$ all $\Delta_1 \in S$

Therefore , R is reflexive ....... (1)

Check for symmetric

$(\Delta_1 , \Delta_2) \in R$ then $\Delta_1$ is congruent to $\Delta_2$

$(\Delta_2 , \Delta_1) \in R$ then $\Delta_2$ is congruent to $\Delta_1$

Both the equation are the same and therefore will always be true.

Therefore , R is symmetric ....... (2)

Check for transitive

Let $\Delta_1, \Delta_2, \Delta_3 \in S$ such that $(\Delta_1, \Delta_2) \in R$ and $(\Delta_2, \Delta_3) \in R$

Then $(\Delta_1, \Delta_2) \in R$ and $(\Delta_2, \Delta_3) \in R$

$\Rightarrow \Delta_1$ is congruent to $\Delta_{2,}$ and $\Delta_2$ is congruent to $\Delta_3$

$\Rightarrow \Delta_1$ is congruent to $\Delta_3$

$\therefore (\Delta_1, \Delta_3) \in R$

Therefore , R is transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (D)

**Question 13.**
Mark the tick against the correct answer in the following:

Let S be the set of all real numbers and let R be a relation on S defined by a R b ⇔ $a^2 + b^2 = 1$. Then, R is

A. symmetric but neither reflexive nor transitive

B. reflexive but neither symmetric nor transitive

C. transitive but neither reflexive nor symmetric

D. none of these

**Answer:**
According to the question ,

Given set S = {.......,-2,-1,0,1,2 .....}

And R = {(a, b) : a,b ∈ S and $a^2 + b^2 = 1$ }

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) ∈ R for every a ∈ A

Symmetric

The relation is Symmetric if (a , b) ∈ R , then (b , a) ∈ R

Transitive

Relation is Transitive if (a , b) ∈ R & (b , c) ∈ R , then (a , c) ∈ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , (a,a)

$\therefore a^2 + a^2 = 1$ which is not always true

Ex_if a=2

$\therefore 2^2 + 2^2 = 1 \Rightarrow 4 + 4 = 1$ which is false.

Therefore , R is not reflexive ....... (1)

Check for symmetric

$a \text{ R } b \Rightarrow a^2 + b^2 = 1$

$b \text{ R } a \Rightarrow b^2 + a^2 = 1$

Both the equation are the same and therefore will always be true.

Therefore , R is symmetric ....... (2)

Check for transitive

$a \text{ R } b \Rightarrow a^2 + b^2 = 1$

$b \text{ R } c \Rightarrow b^2 + c^2 = 1$

$\therefore a^2 + c^2 = 1$ will not always be true

Ex _a=-1 , b= 0 and c= 1

$\therefore (-1)^2 + 0^2 = 1$ , $0^2 + 1^2 = 1$ are true

But $(-1)^2 + 1^2 = 1$ is false.

Therefore , R is not transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (A)

**Question 14.**
Mark the tick against the correct answer in the following:

Let R be a relation on N × N, defined by
(a, b) R (c, d) ⇔ a + d = b + c. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. an equivalence relation

**Answer:**
According to the question ,

R = {(a, b) , (c, d) : a + d = b + c }

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) ∈ R for every a ∈ A

Symmetric

The relation is Symmetric if (a , b) ∈ R , then (b , a) ∈ R

Transitive

Relation is Transitive if (a , b) ∈ R & (b , c) ∈ R , then (a , c) ∈ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , (a, b) R (a, b)

(a, b) R (a, b) $\Leftrightarrow$ a + b = a + b

which is always true .

Therefore , R is reflexive ....... (1)

Check for symmetric

(a, b) R (c, d) $\Leftrightarrow$ a + d = b + c

(c, d) R (a, b) $\Leftrightarrow$ c + b = d + a

Both the equation are the same and therefore will always be true.

Therefore , R is symmetric ....... (2)

Check for transitive

(a, b) R (c, d) $\Leftrightarrow$ a + d = b + c

(c, d) R (e, f) $\Leftrightarrow$ c + f = d + e

On adding these both equations we get , a + f = b + e

Also,

(a, b) R (e, f) $\Leftrightarrow$ a + f = b + e

$\therefore$ It will always be true

Therefore , R is transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (D)

**Question 15.**

Mark the tick against the correct answer in the following:

Let A be the set of all points in a plane and let O be the origin. Let R = {(P, Q) : OP = QQ}. Then, R is

A. reflexive and symmetric but not transitive

B. reflexive and transitive but not symmetric

C. symmetric and transitive but not reflexive

D. an equivalence relation

There is printing mistake in the question...

R should be R = {(P, Q) : OP = OQ}

Instead of R = {(P, Q) : OP = QQ}

**Answer:**
According to the question ,

O is the origin

R = {(P, Q) : OP = OQ }

*Formula*

For a relation R in set A

Reflexive

The relation is reflexive if (a , a) $\in$ R for every a $\in$ A

Symmetric

The relation is Symmetric if (a , b) $\in$ R , then (b , a) $\in$ R

Transitive

Relation is Transitive if (a , b) $\in$ R & (b , c) $\in$ R , then (a , c) $\in$ R

Equivalence

If the relation is reflexive , symmetric and transitive , it is an equivalence relation.

Check for reflexive

Consider , $(P , P) \in R \Leftrightarrow OP = OP$

which is always true .

Therefore , R is reflexive ....... (1)

Check for symmetric

$(P , Q) \in R \Leftrightarrow OP = OQ$

$(Q , P) \in R \Leftrightarrow OQ = OP$

Both the equation are the same and therefore will always be true.

Therefore , R is symmetric ....... (2)

Check for transitive

$(P , Q) \in R \Leftrightarrow OP = OQ$

$(Q , R) \in R \Leftrightarrow OQ = OR$

On adding these both equations, we get , $OP = OR$

Also,

$(P , R) \in R \Leftrightarrow OP = OR$

$\therefore$ It will always be true

Therefore , R is transitive ....... (3)

Now , according to the equations (1) , (2) , (3)

Correct option will be (D)

**Question 16.**
Mark the tick against the correct answer in the following:

Let Q be the set of all rational numbers, and * be the binary operation, defined by a * b = a + 2b, then

A. * is commutative but not associative

B. * is associative but not commutative

C. * is neither commutative nor associative

D. * is both commutative and associative

**Answer:**
According to the question ,

Q is set of all rarional numbers

R = {(a, b) : a * b = a + 2b }

*Formula*

* is commutative if a * b = b * a

* is associative if (a * b) * c = a * (b * c)

Check for commutative

Consider , a * b = a + 2b

And , b * a = b + 2a

Both equations will not always be true .

Therefore , * is not commutative ....... (1)

Check for associative

Consider , (a * b) * c = (a + 2b) * c = a+2b + 2c

And , a * (b * c) = a * (b+2c) = a+2(b+2c) = a+2b+4c

Both the equation are not the same and therefore will not always be true.

Therefore , * is not associative ……. (2)

Now , according to the equations (1) , (2)

Correct option will be (C)

**Question 17.**
Mark the tick against the correct answer in the following:

Let a * b = a + ab for all a, b $\in$ Q. Then,

A. * is not a binary composition

B. * is not commutative

C. * is commutative but not associative

D. * is both commutative and associative

**Answer:**
According to the question ,

Q = { a,b }

R = {(a, b) : a * b = a + ab }

*Formula*

* is commutative if a * b = b * a

* is associative if (a * b) * c = a * (b * c)

Check for commutative

Consider , a * b = a + ab

And , b * a = b + ba

Both equations will not always be true .

Therefore , * is not commutative ....... (1)

Check for associative

Consider , (a * b) * c = (a + ab) * c = a+ab + (a+ab)c=a+ab+ac+abc

And , a * (b * c) = a * (b+bc) = a+a(b+bc) = a+ab+abc

Both the equation are not the same and therefore will not always be true.

Therefore , * is not associative ....... (2)

Now , according to the equations (1) , (2)

Correct option will be (B)

**Question 18.**
Mark the tick against the correct answer in the following:

Let $Q^+$ be the set of all positive rationals. Then, the operation * on $Q^+$ defined by $a * b = \frac{ab}{2}$ for all a, b $\in Q^+$ is

A. commutative but not associative

B. associative but not commutative

C. neither commutative nor associative

D. both commutative and associative

**Answer:**
According to the question ,

Q = { Positive rationals }

R = {(a, b) : a * b = ab/2 }

*Formula*

* is commutative if a * b = b * a

* is associative if (a * b) * c = a * (b * c)

Check for commutative

Consider , a * b = ab/2

And , b * a = ba/2

Both equations are the same and will always true .

Therefore , * is commutative ....... (1)

Check for associative

Consider , (a * b) * c = (ab/2) * c = $\frac{\frac{ab}{2}\times c}{2}$ = abc/4

And , a * (b * c) = a * (bc/2) = $\frac{a\times\frac{bc}{2}}{2}$ = abc/4

Both the equation are the same and therefore will always be true.

Therefore , * is associative ....... (2)

Now , according to the equations (1) , (2)

Correct option will be (D)

**Question 19.**
Mark the tick against the correct answer in the following:

let Z be the set of all integers and let a * b = a – b + ab. Then, * is

A. commutative but not associative

B. associative but not commutative

C. neither commutative nor associative

D. both commutative and associative

**Answer:**
According to the question ,

Q = { All integers }

R = {(a, b) : a * b = a – b + ab }

*Formula*

* is commutative if a * b = b * a

* is associative if (a * b) * c = a * (b * c)

Check for commutative

Consider , a * b = a – b + ab

And , b * a = b – a + ba

Both equations are not the same and will not always be true .

Therefore , * is not commutative ……. (1)

Check for associative

Consider , (a * b) * c = (a – b + ab) * c

= a – b + ab – c +(a – b + ab)c

=a – b +ab – c +ac – bc + abc

And , a * (b * c) = a * (b – c + bc)

= a - (b – c + bc) + a(b – c + bc)

=a – b + c – bc + ab – ac + abc

Both the equation are not the same and therefore will not always be true.

Therefore , * is not associative ……. (2)

Now , according to the equations (1) , (2) Correct option will be (C)

**Question 20.**
Mark the tick against the correct answer in the following:

Let Z be the set of all integers. Then, the operation * on Z defined by

a * b = a + b - ab is

A. commutative but not associative

B. associative but not commutative

C. neither commutative nor associative

D. both commutative and associative

**Answer:**
According to the question ,

Q = { All integers }

R = {(a, b) : a * b = a + b - ab }

*Formula*

* is commutative if a * b = b * a

* is associative if (a * b) * c = a * (b * c)

Check for commutative

Consider , a * b = a + b - ab

And , b * a = b + a - ba

Both equations are the same and will always be true .

Therefore , * is commutative ……. (1)

Check for associative

Consider , (a * b) * c = (a + b - ab) * c

= a + b - ab + c -(a + b - ab)c

=a + b – ab + c – ac – bc + abc

And , a * (b * c) = a * (<u>b + c - bc</u>)

= a + (b + c - bc) - a(b + c - bc)

=a + b + c – bc - ab – ac + abc

Both the equation are the same and therefore will always be true.

Therefore , * is associative ....... (2)

Now , according to the equations (1) , (2)

Correct option will be (D)

**Question 21.**
Mark the tick against the correct answer in the following:

Let $Z^+$ be the set of all positive integers. Then, the operation * on $Z^+$ defined by a * b = $a^b$ is

A. commutative but not associative

B. associative but not commutative

C. neither commutative nor associative

D. both commutative and associative

**Answer:**
According to the question ,

Q = { All integers }

R = {(a, b) : a * b = $a^b$ }

*<u>Formula</u>*

* is commutative if a * b = b * a

* is associative if (a * b) * c = a * (b * c)

Check for commutative

Consider , a * b = $a^b$

And , b * a = $b^a$

Both equations are not the same and will not always be true .

Therefore , * is not commutative ....... (1)

Check for associative

Consider , (a * b) * c = ($a^b$) * c = $(a^b)^c$

And , a * (b * c) = a * ($b^c$)= $a^{(b^c)}$

Ex a=2 b=3 c=4

(a * b) * c = ($2^3$) * c = $(8)^4$

a * (b * c) = 2 * ($3^4$)= $2^{(81)}$

Both the equation are not the same and therefore will not always be true.

Therefore , * is not associative ....... (2)

Now , according to the equations (1) , (2)

Correct option will be (C)

**Question 22.**
Mark the tick against the correct answer in the following:

Define * on Q - {-1} by a * b= a + b + ab. Then, * on Q – {-1} is

A. commutative but not associative

B. associative but not commutative

C. neither commutative nor associative

D. both commutative and associative

**Answer:**
According to the question ,

R = {(a, b) : a * b = a + b + ab }

*Formula*

* is commutative if a * b = b * a

* is associative if (a * b) * c = a * (b * c)

Check for commutative

Consider , a * b = a + b + ab

And , b * a = b + a + ba

Both equations are same and will always be true .

Therefore , * is commutative ....... (1)

Check for associative

Consider , (a * b) * c = (a + b + ab) * c

= a + b + ab + c + (a + b + ab)c

=a + b + c + ab + ac + bc + abc

And , a * (b * c) = a * (b + c + bc)

= a + b + c + bc + a(b + c + bc)

=a +b + c + ab + bc + ac + abc

Both the equation are same and therefore will always be true.

Therefore , * is associative ……. (2)

Now , according to the equations (1) , (2)

Correct option will be (D)