

2. RELATIONS

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Class: VIII, MATHEMATICS
FOUNDATION⁺ SOLUTIONS

2025-26

TEACHING TASK JEE MAINS LEVEL

01. $x^2 - 5x + 6 = 0 \Rightarrow (x-2)(x-3) = 0 \Rightarrow x = 2, 3$
 $\therefore A = \{2, 3\}, B = \{2, 4\}, C = \{4, 5\}$
 $\therefore B \cap C = \{4\}$
 $A \times (B \cap C) = \{2, 3\} \times \{4\} = \{(2, 4), (3, 4)\}$
Ans: A

02. $A \times (B \cup C) = (A \times B) \cup (A \times C)$
 $= (A \cup B) \times (A \cup C)$
Ans: C

03. $n(A) = n \Rightarrow n(A \times A) = n^2$
No. of Relations on A = $2^{n^2} - 1$
Ans: B

04. $A = \{1, 2, 3\}; (1, 1), (2, 2), (3, 3) \in R$
hence, R is reflexive
 $(2, 1) \in R \Rightarrow (1, 2) \notin R$
hence, R is not symmetric
 $(2, 1), (1, 3) \in R \Rightarrow (2, 3) \notin R$
Ans: A

05. $A = \{1, 2, 3\}$, $R = \{(1, 1), (2, 2), (3, 3)\}$ (2)
 $\forall a \in A, (a, a) \in R$
 $\therefore R$ is reflexive relation, also symmetric and transitive relation
 Ans: ~~B~~ D

06. $(1, 2) \in R, (2, 2) \in R \Rightarrow (1, 2) \in R$
 $\therefore R$ is transitive
 Ans: C

07. $c \in A \Rightarrow (c, c) \notin R$
 $\therefore R$ is not reflexive
 Ans: D

08. $(2, 4) \in R \Rightarrow (4, 2) \in R$
 $(4, 6) \in R \Rightarrow (6, 4) \in R$
 $\therefore R$ is symmetric
 Ans: B

09. $A = \{a, b, c\}$
 Ans: B

10. $R = \{(1, 2), (2, 3), (3, 4), (4, 5), (5, 6)\}$
 Domain of $R = \{1, 2, 3, 4, 5\}$
 Ans: A

JEE ADVANCED LEVEL

01. $A \times B = \{(a, 2), (b, 3), (c, 2), (d, 3), (e, 2)\}$
 $\therefore A = \{a, b, c, d, e\}$, $B = \{2, 3\}$
 $\therefore n(A) = 5, n(B) = 2$
 Ans: A, B, C, D

02. Clearly, "is perpendicular to" is not equivalence relation (Reflexive, transitive fails)
 Ans: A, B, D

03

$$R = \{(11, 8), (12, 9), (13, 10)\}$$

$$R^{-1} = \{(8, 11), (9, 12), (10, 13)\}$$

Statement I: Conceptual (True)

Statement II: Conceptual (True) Ans: A

04

Statement I: Here the elements in the set A should be mentioned. So, statement I is false.

Statement II: Conceptual (True) Ans: C

05

Assertion: Conceptual (True)

Reason: Conceptual (True) Ans: A

06

Assertion: Conceptual (True)

Reason: Conceptual (True) Ans: A

07

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

Ans: A

08

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

Ans: C

09

$$\text{Domain of } R = \{1, 2, 3, 4\}$$

Ans: A

10

$$\text{Domain of } R = \{-1, 1, 2, 3\}$$

$$\text{Given } y = x^2$$

$$\therefore \text{Range of } R = \{1, 4, 9\}$$

Ans: D

11.

$$y = x^2 + \frac{1}{x^2 + 1}$$

(4)

When $x=0 \Rightarrow y=1$

When $x>0 \Rightarrow y>1$

hence, Range = $[1, \infty)$

Ans: D

12

$$b - \frac{2}{3} = \frac{1}{3} \Rightarrow b = 1$$

Ans: A

13

$$f(x) = ax^2 + bx + c$$

$$f(1) = a + b + c = 3 \rightarrow \textcircled{1}$$

$$f(-2) = 4a - 2b + c = 1 \rightarrow \textcircled{2}$$

$$f(3) = 9a + 3b + c = 4 \rightarrow \textcircled{3}$$

Now, $f(0) + f(1) + f(-2) + f(3) = 14$

$$\Rightarrow c + 3 + 1 + 4 = 14$$

$$\Rightarrow \boxed{c + 1 = 7} \rightarrow \textcircled{4}$$

$$\textcircled{3} \Rightarrow 9a + 3b + c = 4$$

$$\textcircled{2} \Rightarrow \begin{array}{r} -4a - 2b + c = 1 \\ \hline \end{array}$$

$$5a + 5b = 4 - 1$$

$$\Rightarrow a + b = \frac{4-1}{5}$$

$$\textcircled{1} \Rightarrow \frac{4-1}{5} + c = 3 \Rightarrow c = \frac{11-1}{5}$$

Now, $\textcircled{4} \Rightarrow \frac{11-1}{5} + 1 = 7 \Rightarrow 1 = 4$

Ans: 4

14. a) $= \Rightarrow$ Equivalence relation (5)
 b) $\perp \Rightarrow$ Symmetric relation
 c) $\subseteq \Rightarrow$ Reflexive relation, transitive relation
 d) $\parallel \Rightarrow$ Equivalence relation.
 Ans: t, q, (p, x), t

15 a) Given $R = \{(x, y) : x, y \in \mathbb{Z}, x^2 + y^2 \leq 8\}$

$$R = \{(0, -1), (0, 0), (0, 1), (1, 0), (1, 1), (1, -1), (2, 1), (2, 0), (2, -1)\}$$

$$\therefore \text{Range of } R = \{-1, 0, 1\}$$

$$\text{Domain of } R^{-1} = \{-1, 0, 1\}$$

b) $A = \{1, 2, 3\}$, $B = \{2, 3\}$

$$R = \{(x, y) \mid x + y \leq 5\}$$

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

c) $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6\}$

$$R = \{(x, y) \mid x \text{ divides } y\}$$

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

d) $R = \{(x, y) \mid x + y = 4\}$

$$R = \{(1, 3), (3, 1)\}$$

Ans: s, p, q, x

LEARNERS TASK (CUBS) (6)

01. $n(A) = 3, n(B) = 2 \Rightarrow n(A \times B) = 3 \times 2 = 6$ Ans: D

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

03. $n(A \times B) = 3 \times 3 = 9$ Ans: A

04. $x+1=4 \quad | \quad y+3=5$
 $\Rightarrow x=3 \quad | \quad \Rightarrow y=2$ Ans: B

05. $x+1=2 \quad | \quad y-1=3$
 $\Rightarrow x=1 \quad | \quad \Rightarrow y=4$ Ans: B

06. Domain of $R_1 = \{1, 2, 3, 4\}$ Ans: B

07. $R_1^{-1} = \{(1,1), (2,4), (3,9), (4,16)\}$ Ans: C

08. $n(A) = 2, n(B) = 3$
 No. of distinct relations = $2^{2 \times 3} = 2^6$ Ans: B

09. $n(A) = 2, n(B) = 3$
 No. of distinct relations = $2^{2 \times 3} = 64$ Ans: A

10. Conceptual Ans: D

JEE MAINS LEVEL

01. $B \cap C = \{4\}$
 $A \times (B \cap C) = \{1, 2, 3\} \times \{4\}$
 $= \{(1,4), (2,4), (3,4)\}$ Ans: D

02

$$\begin{aligned}(Y \times A) \cap (Y \times B) &= Y \times (A \cap B) \\ &= Y \times \phi \\ &= \phi\end{aligned}$$

Ans: D

03

$$\begin{aligned}A &= \{2, 3\}, \quad B = \{2\}, \quad C = \{4, 5\} \\ (A - B) \times (B - C) &= \{3\} \times \{2\} \\ &= \{(3, 2)\}\end{aligned}$$

Ans: D

04

$$n(A) = 2$$

No. of relations from A to A = $2^{2 \times 2} = 16$

Ans: B

05

Not Symmetric, since $(2, 3) \in R \Rightarrow (3, 2) \notin R$

Ans: A

06.

$$n(A \times B) = n(A) \times n(B) = 3 \times 3 = 9$$

Ans: A

07

Domain of $R = \{1, 2, 3, \dots, 14\}$

Ans: C

08

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

$$\therefore A = \{1, 2, 3, 4\}$$

$3 \in A \Rightarrow (3, 3) \notin R \Rightarrow R$ is not reflexive

$(3, 1) \in R, (1, 3) \in R \Rightarrow R$ is symmetric

$$(2, 4) \in R, (4, 2) \in R \Rightarrow (2, 2) \in R$$

$$(3, 1) \in R, (1, 3) \in R \Rightarrow (3, 3) \notin R \Rightarrow R \text{ is}$$

Not transitive

Ans: B

09

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

This is anti-symmetric relation, but not symmetric
Ans: B

10

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

$$R = \{(1, 2)\}, \text{ here } (1, 2) \in R, \text{ but } (2, 1) \notin R.$$

$$R = \{(1, 1)\}, \text{ clearly it is anti-symmetric}$$

but not transitive
Ans: D

ADVANCED LEVEL

01

$$(a, b) \in R \Leftrightarrow 1 + ab > 0$$

$$\text{Reflexive} \Rightarrow (a, a) \Leftrightarrow 1 + a \cdot a > 0$$

$$1 + a^2 > 0 \text{ (True)}$$

$$\text{Symmetric} \Rightarrow (a, b) \Leftrightarrow 1 + ab > 0$$

$$\Rightarrow 1 + ba > 0$$

$$\Rightarrow (b, a) \in R \text{ (True)}$$

$$\text{Transitive} \Rightarrow (a, b), (b, c) \in R$$

$$\Rightarrow 1 + ab > 0, 1 + bc > 0 \Rightarrow \text{It is not}$$

necessarily prove that $1 + ac > 0$

$\therefore R$ is not transitive

Ans: A, B

02

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

Clearly R is equivalence relation Ans:

A, B, C, D

- 03 Statement I: ' $\parallel$ ' is an equivalence relation (9)
 Statement II: Conceptual (True) Ans. A
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- 04 Statement I: Every reflexive relation is symmetric (True)
 Statement II: Every symmetric relation is transitive (need not be) (False) Ans: C
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- 05 Assertion: Conceptual (True)
 Reason: Conceptual (True) Ans. A
-
- 06 Assertion: Conceptual (True)
 Reason: Conceptual (True) Ans. A
-
07. $n(A \times B) = n(A) \times n(B) = 3 \times 3 = 9$ Ans: A
-
- 08 $n(A \times B \times C) = 4 \times 0 \times 6 = 0$ Ans: B
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- 09 $A \times B =$ Infinite set Ans: B
-
- 10 $A = \{1, 2, 3\}$, $R_1 = \{(1,1), (2,2), (3,3), (1,2), (2,3), (1,3)\}$.
 R_1 is Reflexive, transitive and anti-symmetric Ans. D

11. $A = \{1, 2, 3\}$, $R_3 = \{(1,1), (2,2), (3,3), (1,2), (2,3), (1,3)\}$. (10)
 R_3 is reflexive, transitive and antisymmetric
 Ans: D

12. $A = \{1, 2, 3, 4\}$
 $A \times A = \{(2,1), (3,1), (3,2), (4,1), (4,2), (4,3)\}$
 Ans: 6

13. Given $A = \{1, 2, 3\}$
 $A \times A = \{(1,1), (1,2), \dots, (3,3)\}$
 Reflexive relations $= \{(1,1), (2,2), (3,3)\}$
 Addition pairs $= \{(1,2), (2,1), (1,3), (3,1), (2,3), (3,2)\}$
Total possible relations
 For each of these 6 ordered pairs, we have 2 choices, (include or) Exclude
 Total reflexive relations $= 2^6 = 64$ Ans: 64

14. a) $A \times (B \cup C) = (A \times B) \cup (A \times C)$
 b) $A \times (B \cap C) = (A \times B) \cap (A \times C)$
 c) $A \subseteq B$ and $C \subseteq D$
 $\Rightarrow A \times C \subseteq B \times D$

$$d) (A \times B) \cup (A \times C) = A \times (B \cup C)$$

(11)

Ans: x, t, s, v

15 a) $R_1 = \{(1,1), (2,2), (3,3), (1,2), (2,1)\} \rightarrow$ Reflexive

b) $R_2 = \{(1,2), (2,3), (1,3)\} \rightarrow$ transitive

c) $R_3 = \{(a,b), (b,a)\} \rightarrow$ symmetric

d) $R_4 = \{(a,a), (b,b), (c,c), (a,b), (b,c), (a,c), (c,b)\} \rightarrow$ transitive

Ans: p, t, v, t

ADDITIONAL PRACTICE QUESTIONS

01 $A = \{1, 2, 3, \dots, 8, 9, 10\}$

$$R = \{x + 2y = 10\}$$

$$R = \{(2,4), (4,3), (6,2), (8,1)\}$$

Domain of $R = \{2, 4, 6, 8\}$

Ans: B

02 $R = \{(2,1), (3,1)\}$

$\therefore$ Range of $R = \{1\}$

Ans: C

03 Domain of $R = \{-1, 1, -2, 3\}$

Ans: D

04 "Congruent" $\rightarrow$ Equivalence Relation

Ans: D

05

 $<$ (less than) is transitive relation (12)

Ans: C

06

 $" \text{ is factor of } " \rightarrow$ Reflexive, anti-symmetric, transitive

Ans: D

07

$$R = \{ (x, \frac{1}{x}) : 0 < x < 6 \}$$

 Domain of $R = \{ 1, 2, 3, 4, 5 \}$

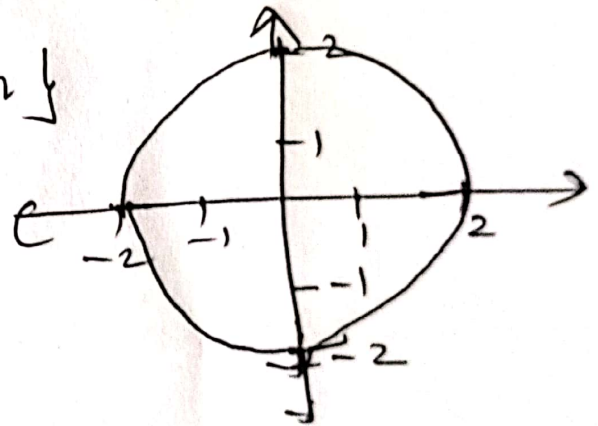
Ans: B

08

$$R = \{ x^2 + y^2 \leq 4 \}$$

$$R = \{ (0,0), (1,0), (-1,0), (0,1), (0,-1), (2,0), (0,2), (-2,0), (0,-2) \}$$

$$\text{Domain} = \{ -2, -1, 0, 1, 2 \}$$



Ans: C

09

$$R = \{ (2,3), (2,7), (3,7), (3,10), (4,13), (4,17), (5,13), (5,17) \}$$

 Domain of $R = \{ 2, 3, 4, 5 \}$

Ans: D

10

$$R = \{ (8,1), (9,2), (10,3), (11,4), (12,5), (13,6) \}$$

$$\text{Sum} = 1 + 2 + 3 + 4 + 5 + 6 = 21$$

Ans: B

 $\Rightarrow$ THE END $\Leftarrow$