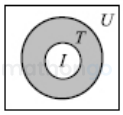
## ANSWER KEYS

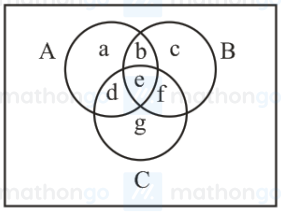
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1.** (2) | **2.** (3) | **3.** (4) | **4.** (3) | **5.** (4) | **6.** (4) | **7.** (1) | **8.** (3) |
| **9.** (3) | **10.** (1) | | | | | | |

**1.** **(2)** Given $T$ is a set of all Triangles and $I$ is the set of all isosceles triangles

Now, "some triangles are not isosceles" can be represented in venn diagram as




**2.** **(3)**




Given

$n(A) = 11 \Rightarrow a + b + d + e = 11$

$n(B) = 13 \Rightarrow b + c + e + f = 13$

$n(C) = 16 \Rightarrow d + e + f + g = 16$

$n(A \cap B) = 3 \Rightarrow b + e = 3$

$n(B \cap C) = 6 \Rightarrow e + f = 6$

$n(A \cap C) = 5 \Rightarrow d + e = 5$

$n(A \cap B \cap C) = 2 \Rightarrow e = 2$

Solving all equations, we get

$e = 2,\ d = 3,\ f = 4,\ b = 1,\ a = 5,\ c = 6,\ g = 7$

To find: $n[A^c \cap (B \Delta C)]$

$B \Delta C = b + c + d + g$

$A^c \cap (B \Delta C) = c + g$

$A^c \cap (B \Delta C) = c + g = 6 + 7 = 13$

**3.** **(4)**

Let, $M \rightarrow$Mathematics, $P \rightarrow$Physics, $C \rightarrow$Chemistry

Given that total students $= 200$

$n(M) = 120,\ n(P) = 90,\ n(C) = 60$

$n(M \cap P) = 50,\ n(M \cap C) = 50,\ n(P \cap C) = 43$

$n(M \cap P \cap C) = 38$

Required number of students taking exactly one subject is

$n(M) + n(P) + n(C) - 2n(M \cap P) - 2n(P \cap C) - 2n(M \cap C) + 3n(M \cap P \cap C)$

$= 120 + 90 + 60 - 2(50) - 2(50) - 2(43) + 3(38)$

$= 98$

**4.** **(3)**

Given set is $\{(a,\ b)\ : 2a^2 + 3b^2 = 35,\ \ a,\ b \in Z\}$

We can see that, $2(\pm 2)^2 + 3(\pm 3)^2 = 35$

and $2(\pm 4)^2 + 3(\pm 1)^2 = 35$

$\therefore$ Representation in the Roster form in terms of ordered pairs, $\{(2,\ 3), (2,\ -3), (-2,\ -3), (-2,\ 3),\ (4,\ 1),\ (4,\ -1), (-4,\ -1), (-4,\ 1)\}$

So there are 8 elements in the set.

$\therefore n = 8$ .

**5.** **(4)**

Here, the relation on set of positive real numbers is

$S = \left\{ \left(x, y\right) | \frac{y}{2} \leq x \leq 2y \right\}$

Let $(x, x) \in S$, then

$\frac{x}{2} \leq x \leq 2x$

$\Rightarrow xSx$

$S$ is reflexive.

Now, let $(x, y) \in S$ such that $xSy$

$\Rightarrow \frac{y}{2} \leq x \leq 2y$

$\because \frac{y}{2} \leq x$ and $x \leq 2y$

$\Rightarrow y \leq 2x$ and $\frac{x}{2} \leq y$

$\Rightarrow \frac{x}{2} \leq y \leq 2x$

$\Rightarrow ySx$

$S$ is symmetric.

Note that

$(3,4) \in S$ & $(4, 7) \in S$

but $(3,7) \notin S$

$S$ is not transitive.

**6.** **(4)**

$P = \{(a, b): \sec^2 a - \tan^2 b = 1\}$

$P = \{(a, a): \sec^2 a - \tan^2 a = 1\}$

its reflexive relation.

Now $P = \{(a, b): \sec^2 a - \tan^2 b = 1\}$

$\sec^2 a - \tan^2 b = 1$

$\Rightarrow \sec^2 a = 1 + \tan^2 b$

$\Rightarrow \sec^2 a = \sec^2 b$

$\Rightarrow |\sec\ a| = |\sec\ b|$

$\sec^2 a - \tan^2 b = 1$

$1 + \tan^2 a - \sec^2 b + 1 = 1$

$\sec^2 b - \tan^2 a = 1$

Hence, it is Symmetric.

If $|\sec\ a| = |\sec\ b|$ and $|\sec\ b| = |\sec\ c|$ then $|\sec\ a| = |\sec\ c| \Rightarrow$ transitive

So it is an equivalence relation.

**7.** **(1)** For any $a \in N$, we find that $a|a$, therefore $R$ is reflexive but $R$ is not transitive, because $aRb$ does not imply that $bRa$.

**8.** **(3)** Here $(3,\ 3),\ (6,\ 6),\ (9,\ 9),\ (12,\ 12)$, [Reflexive];

$(3,\ 6),\ (6,\ 12),\ (3,\ 12)$, [Transitive].

Hence, reflexive and transitive only.

**9.** **(3)** $\because (x,\ y) \in R \Rightarrow x^y = y^x$

$\therefore (x,\ x) \in R$ as $x^x = x^x\ \forall\ x \in I - \{0\}$

$\therefore R$ is reflexive

Now $(x,\ y) \in R \Rightarrow x^y = y^x \Rightarrow y^x = x^y$

$\Rightarrow (y,\ x) \in R\ \ \therefore R$ is symmetric

Now $\ (x,\ y) \in R \Rightarrow x^y = y^x$ and $(y,\ z) \in R \Rightarrow y^z = z^y$

$\because x^y = y^x \Rightarrow y = x^{\frac{y}{x}}$

$\Rightarrow y^z = z^x \Rightarrow \left(x^{\frac{y}{x}}\right)^z = z^x \Rightarrow x^{\frac{yz}{x}} = z^x$

$\Rightarrow x^{yz} = z^{x^2} \Rightarrow \left(x,\ z\right) \notin R$

$R$ is not transitive.

**10.** **(1)** R is a relation from $\{11, 12, 13\}$to $\{8, 10, 12\}$ defined by $y = x - 3 \Rightarrow x - y = 3$

$\therefore R\ =\ \{11,\ 8\}, \{13,\ 10\}$

Hence, $R^{-1} = \{8,\ 11\}; \{10,\ 13\}$