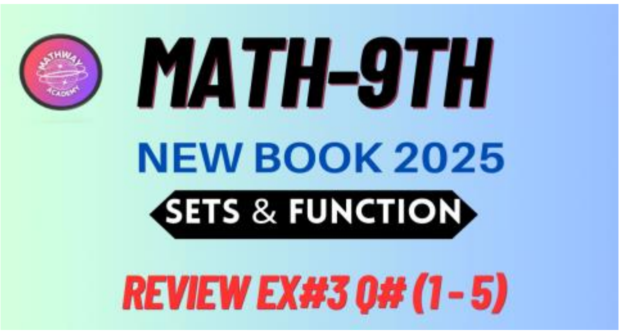
9 EX REVIEW 3

Saturday, April 26, 2025 6:53 PM



Review exercise 3

1. Four options are given against each statement. Encircle the correct option.

(i) The set builder form of the set $\{1, \frac{1}{3}, \frac{1}{5}, \frac{1}{7}, \ldots\}$ is:

(a) $\{x|x = \frac{1}{n}, n \in W\}$
(b) $\{x|x = \dfrac{1}{2n+1}, n \in W\}$
(c) $\{x|x = \dfrac{1}{n+1}, n \in W\}$
(d) $\{x|x = 2n+1, n \in W\}$

(ii) If $A = \{\ \}$, then $P(A)$ is:

(a) $\{\ \}$
(b) $\{\ 1\ \}$
(c) $\{\{\ \}\}$
(d) $\emptyset$

(iii) If $U = \{1, 2, 3, 4, 5\}, A = \{1, 2, 3\} and\ B = \{3, 4, 5\}, then$ find $U - (A \cap B)$ is:

(a) $\{1, 2, 4, 5\}$
(b) $\{2, 3\}$
(c) $\{1, 3, 4, 5\}$
(d) $\{1, 2, 3\}$

$A \cap B = \{3\}$

$\{1, 2, 3, 4, 5\} - \{3\}$

$\{1, 2, 4, 5\}$

(iv) If A and B are overlapping sets, then $n(A - B)$ is equal to

(a) $n(A)$
(b) $n(B)$
(c) $A \cap B$
(d) $n(A) - (A \cap B)$

n

(v) If $A \subseteq B$ and $B - A \neq \phi$, then $n(B - A)$ is equal to

(a) 0

(b) $n(B)$

(c) $n(A)$ `

(d) $n(B) - n(A)$

(vi) If $n(A \cup B) = 50, n(A) = 30$ and $n(B) = 35$, then $n(A \cap B) =$:

(a) 23

(b) 15

(c) 9

(d) 40

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$
$$50 = 30 + 35 - n(A \cap B)$$
$$50 = 65 - n(A \cap B)$$
$$n(A \cap B) = 65 - 50$$
$$= 15$$

(vii) If $A = \{1, 2, 3, 4\}$ and $B = \{x, y, z\}$, then cartesian product of A and B contains exactly _________ elements.

(a) 13

(b) 12

(c) 10

(d) 6

$$n(A \times B) = \{ \quad \} \times \{ \quad \}$$
$$= 4 \times 3$$
$$= 12$$

(viii) If $f(x) = x^2 - 3x + 2$, then the value of $f(a + 1)$ is equal to:

(a) $a + 1$

(b) $a^2 + 1$

(c) $a^2 + 2a + 1$

(d) $a^2 - a$

$$f(a+1) = (a+1)^2 - 3(a+1) + 2$$
$$= a^2 + 2a + 1 - 3a - 3 + 2$$
$$= a^2 - a + \cancel{1} - \cancel{1}$$

(ix) Given that $f(x) = 3x + 1$, if $f(x) = 28$, then the value of x is:

(a) 9

(b) 27

(c) 3

(d) 18

$$f(x) = 28$$
$$3x + 1 = 28$$
$$3x = 28 - 1$$
$$3x = 27$$
$$x = \frac{\cancel{27}}{3}$$
$$x = 9$$

(x) Let $A = \{1, 2, 3\}$ and $B = \{a, b\}$ two non-empty sets and $f : A \to B$ be a

(x) Let $A = \{1, 2, 3\}$ and $B = \{a, b\}$ two non-empty sets and $f: A \to B$ be a function defined as $f = \{(1, a), (2, b), (3, b)\}$, then which of the following statement is true?

(a) f is injective
(b) f is surjective
(c) f is bijective
(d) f is into only

2. Write each of the following sets in tabular forms:

(i) $\{x | x = 2n, n \in N\}$

$= \{2, 4, 6, 8, \ldots\}$

(ii) $\{x | x = 2m + 1, m \in N\}$

$= \{3, 5, 7, 9, \ldots\}$

(iii) $\{x | x = 11n, n \in W \wedge n < 11\}$

$= \{0, 11, 22, 33, 44, 55, 66, 77, 88, 99, 110\}$

(iv) $\{x | x \in E \wedge 4 < x < 6\}$

$= \{\ \}$

(v) $\{x | x \in O \wedge 5 \leq x < 7\}$

$= \{5\}$

(vi) $\{x | x \in Q \wedge x^2 = 2\}$

$= \{\ \}$

$x^2 = 2$

$x = \pm\sqrt{2}$

$x^2 = 2$

$x = \pm\sqrt{2}$

$\in Q'$

$= \{ \quad \}$

(vii) $\{x | x \in Q \wedge x = -x\}$

$= \{0\}$

(viii) $\{x | x \in R \wedge x \notin Q'\}$

$R = Q \cup Q'$

$= Q$

3. Let $U = \{1, 2, 3, 4, 5, 6,7, 8, 9, 10\}, A = \{2, 4, 6, 8, 10\}, B = \{1, 2, 3, 4, 5\}$ *and* $C = \{1, 3, 5,7, 9\}$ list the members of each of the following sets:

(i) A'

$= U - A$

$= \{1,2,3,4,5,6,7,8,9,10\} - \{2,4,6,8,10\}$

$= \{1,3,5,7,9\}$

(ii) B'

$= U - B$

$= \{1,2,3,4,5,6,7,8,9,10\} - \{1,2,3,4,5\}$

$= \{6,7,8,9,10\}$

(iii) $A \cup B$

$= \{2,4,6,8,10\} \cup \{1,2,3,4,5\}$

$= \{1,2,3,4,5,6,8,10\}$

(iv) $A - B$

$= \{2,4,6,8,10\} - \{1,2,3,4,5\}$

$= \{6,8,10\}$

(v) $A \cap C$

$= \{2,4,6,8,10\} \cap \{1,3,5,7,9\}$

(vi) $A' \cup C'$ $= \{ \quad \}$

$A' = U - A = \{1,2,3,4,5,6,7,8,9,10\} - \{2,4,6,8,10\}$
$= \{1,3,5,7,9\}$

$C' = U - C = \{1,2,3,4,5,6,7,8,9,10\} - \{1,3,5,7,9\}$
$= \{2,4,6,8,10\}$

(vii) $A' \cup C'$

$A' \cup C' = \{1,3,5,7,9\} \cup \{2,4,6,8,10\}$
$= \{1,2,3,4,5,6,7,8,9,10\}$

(viii) U'

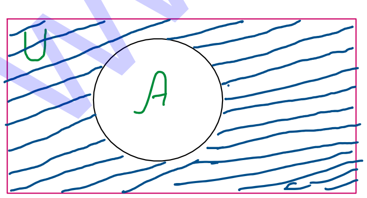
$A' = U - A = \{1,2,3,4,5,6,7,8,9,10\} - \{2,4,6,8,10\}$
$= \{1,3,5,7,9\}$

$A' \cup C = \{1,3,5,7,9\} \cup \{1,3,5,7,9\}$
$= \{1,3,5,7,9\}$

$U' = U - U = \{1,2,3,\ldots 10\} - \{1,2,3,\ldots 10\}$
$= \{\ \}$

4. Using Venn diagrams, if necessary, find the single sets equal to the following:
   (i) A'

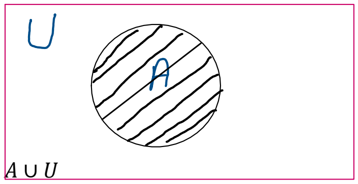
$= U - A$



(ii) $A \cap U$

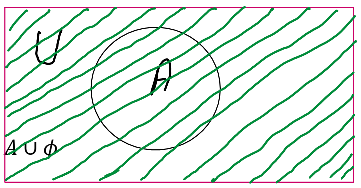
$= A$

$= A$



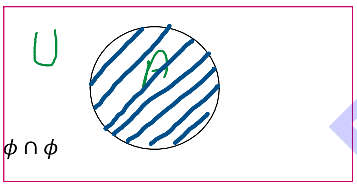
(iii) $A \cup U$

$= U$



(iv) $A \cup \phi$

$= A$

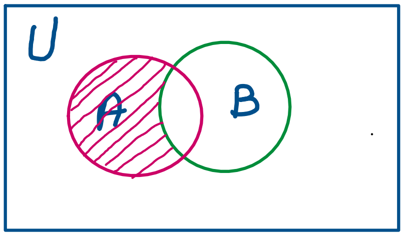


(v) $\phi \cap \phi$

$= \phi$

5. Use Venn diagrams to verify the following:

(i) $A - B = A \cup B'$

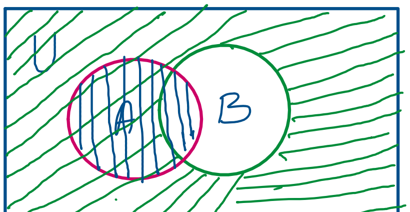


$L.H.S = A - B$

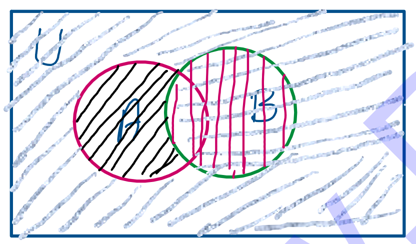
$=$

$R.H.S = A \cup B' =$

$B' = U - B$

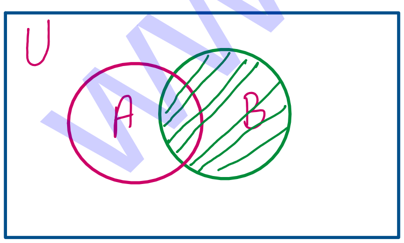


(ii) $(A - B)' \cap B = B$



$L.H.S = (A - B)' \cap B$

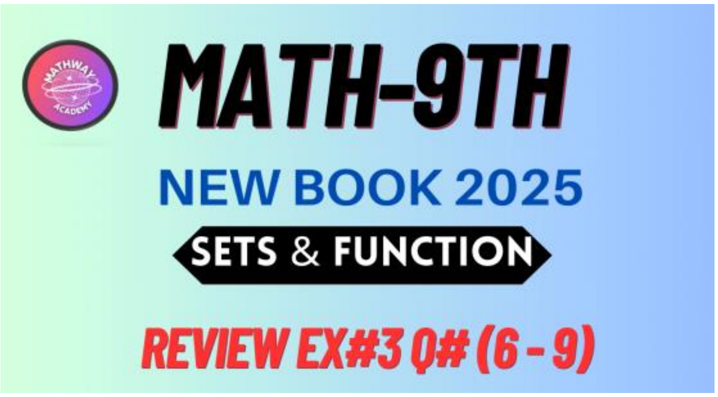
$=$



$R.H.S = B$

$=$

………………………………..



Review exercise 3

6. Verify the properties for the sets A, B and C given below:
   i. Associativity of union

(a) $A = \{1, 2, 3, 4\}, B = \{3, 4, 5, 6, 7, 8\}, C = \{5, 6, 7, 9, 10\}$

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

L.H.S $= (A \cup B) \cup C$

$= (\{1,2,3,4\} \cup \{3,4,5,6,7,8\}) \cup \{5,6,7,9,10\}$

$= \{1,2,3,4,5,6,7,8\} \cup \{5,6,7,9,10\}$

$= \{1,2,3,4,5,6,7,8,9,10\}$

R.H.S $= A \cup (B \cup C)$

$= \{1,2,3,4\} \cup (\{3,4,5,6,7,8\} \cup \{5,6,7,9,10\})$

$= \{1,2,3,4\} \cup \{3,4,5,6,7,8,9,10\}$

$= \{1,2,3,4,5,6,7,8,9,10\}$

L.H.S = R.H.S

(b) $A = \emptyset, B = \{0\}, C = \{0, 1, 2\}$

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

$(\{\ \} \cup \{0\}) \cup \{0,1,2\} = \{\ \} \cup (\{0\} \cup \{0,1,2\})$

$\{0\} \cup \{0,1,2\} = \{\ \} \cup \{0,1,2\}$

$\{0\} \cup \{0,1,2\} = \{\ \} \cup \{0,1,2\}$
$\{0,1,2\} = \{0,1,2\}$
L.H.S = R.H.S

$(c) \quad A = N, B = Z, C = Q$

$(A \cup B) \cup C = A \cup (B \cup C)$
$(N \cup Z) \cup Q = N \cup (Z \cup Q)$
$Z \cup Q = N \cup Q$
$Q = Q$
L.H.S = R.H.S

Ii. Associativity of intersection

(a) $A = \{1, 2, 3, 4\}, B = \{3, 4, 5, 6, 7, 8\}, C = \{5, 6, 7, 9, 10\}$

$(A \cap B) \cap C = A \cap (B \cap C)$

L.H.S $= (A \cap B) \cap C$
$= (\{1,2,3,4\} \cap \{3,4,5,6,7,8\}) \cap \{5,6,7,9,10\}$
$= \{3,4\} \cap \{5,6,7,9,10\}$
$= \{\ \}$

$= \{3,4\} \cap \{5,6,7,9,10\}$

$= \{\ \}$

$R.H.S = A \cap (B \cap C)$

$= \{1,2,3,4\} \cap (\{3,4,5,6,7,8\} \cap \{5,6,7,9,10\})$

$= \{1,2,3,4\} \cap \{5,6,7\}$

$= \{\ \}$

$L.H.S = R.H.S$

(b) $A = \emptyset, B = \{0\}, C = \{0, 1, 2\}$

$(A \cap B) \cap C = A \cap (B \cap C)$

$(\{\ \} \cap \{0\}) \cap \{0,1,2\} = \{\ \} \cap (\{0\} \cap \{0,1,2\})$

$\{\ \} \cap \{0,1,2\} = \{\ \} \cap \{0\}$

$\{\ \} = \{\ \}$

$L.H.S = R.H.S$

(c) $A = N, B = Z, C = Q$

$(A \cap B) \cap C = A \cap (B \cap C)$

$(N \cap Z) \cap Q = N \cap (Z \cap Q)$

$N \cap Q = N \cap Z$

$N = N$

$L.H.S = R.H.S$

Iii. Distributivity of Union over intersection.

(a) $A = \{1, 2, 3, 4\}, B = \{3, 4, 5, 6, 7, 8\}, C = \{5, 6, 7, 9, 10\}$

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$L.H.S = A \cup (B \cap C)$

$= \{1, 2, 3, 4\} \cup (\{3, 4, 5, 6, 7, 8\} \cap \{5, 6, 7, 9, 10\}$

$= \{1, 2, 3, 4\} \cup \{5, 6, 7\}$

$= \{1, 2, 3, 4, 5, 6, 7\}$ ✓

$R.H.S = (A \cup B) \cap (A \cup C)$

$= (\{1, 2, 3, 4\} \cup \{3, 4, 5, 6, 7, 8\}) \cap (\{1, 2, 3, 4\} \cup \{5, 6, 7, 9, 10\})$

$= \{1, 2, 3, 4, 5, 6, 7, 8\} \cap \{1, 2, 3, 4, 5, 6, 7, 9, 10\}$

$= \{1, 2, 3, 4, 5, 6, 7\}$ ✓

(b) $A = \emptyset, B = \{0\}, C = \{0, 1, 2\}$ $L.H.S = R.H.S$

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$\{\ \} \cup (\{0\} \cap \{0, 1, 2\}) = (\{\ \} \cup \{0\}) \cap (\{\ \} \cup \{0, 1, 2\})$

$\{\ \} \cup \{0\} = \{0\} \cap \{0, 1, 2\}$

$\{0\} = \{0\}$

$L.H.S = R.H.S$

(c) $A = N, B = Z, C = Q$

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$N \cup (Z \cap Q) = (N \cup Z) \cap (N \cup Q)$

$N \cup Z = Z \cap Q$

$N \cup (Z \cap Q) = (N \cup Z) \cap (N \cup Q)$

$N \cup Z = Z \cap Q$

$Z = Z$

L.H.S = R.HS

Iv. Distributivity of intersection over union

(a) $A = \{1, 2, 3, 4\}, B = \{3, 4, 5, 6, 7, 8\}, C = \{5, 6, 7, 9, 10\}$

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

L.H.S = $A \cap (B \cup C)$

$= \{1, 2, 3, 4\} \cap (\{3, 4, 5, 6, 7, 8\} \cup \{5, 6, 7, 9, 10\})$

$= \{1, 2, 3, 4\} \cap \{3, 4, 5, 6, 7, 8, 9, 10\}$

$= \{3, 4\}$ ✓

R.H.S = $(A \cap B) \cup (A \cap C)$

$= (\{1, 2, 3, 4\} \cap \{3, 4, 5, 6, 7, 8\}) \cup (\{1, 2, 3, 4\} \cap \{5, 6, 7, 9, 10\})$

$= \{3, 4\} \cup \{\ \}$

$= \{3, 4\}$ ✓

L.H.S = R.HS

(b) $A = \emptyset, B = \{0\}, C = \{0, 1, 2\}$

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$\{\ \} \cap (\{0\} \cup \{0, 1, 2\}) = (\{\ \} \cap \{0\}) \cup (\{\ \} \cap \{0, 1, 2\})$

$\{\ \} \cap \{0, 1, 2\} = \{\ \} \cup \{\ \}$

$\{\ \} = \{\ \}$

L.H.S = R.HS

(c) $A = N, B = Z, C = Q$

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$N \cap (Z \cup Q) = (N \cap Z) \cup (N \cap Q)$

$N \cap Q = N \cup N$

$N = N$

$L.H.S = R.H.S$

7. Verify De-Morgan's Laws for the following sets:
$U = \{1, 2, 3, \dots, 20\}, A = \{2, 4, 6, \dots, 20\}$ and $B = \{1, 3, 5, \dots, 19\}$

I) $(A \cup B)' = A' \cap B'$

II $(A \cap B)' = A' \cup B'$

(1) $(A \cup B)' = A' \cap B'$

$A \cup B = \{2, 4, 6, \dots, 20\} \cup \{1, 3, 5, \dots, 19\}$

$= \{1, 2, 3, \dots 20\}$

$L.H.S = (A \cup B)' = U - (A \cup B)$

$= \{1, 2, 3, \dots, 20\} - \{1, 2, 3, \dots 20\}$

$= \{\}$

$A' = U - A \quad = \{1, 2, 3, \dots, 20\} - \{2, 4, 6, \dots, 20\}$

$= \{1, 3, 5, \dots, 19$

$B' = U - B = \{1, 2, 3, \dots, 20\} - \{1, 3, 5, \dots, 19\}$

$B' = U - B = \{1, 2, 3, \cdots, 20\} - \{1, 3, 5, \cdots, 19\}$
$= \{2, 4, 6, \cdots, 20\}$

$R.H.S = A' \cap B'$
$= \{1, 3, 5, \cdots, 19\} \cap \{2, 4, 6, \cdots, 20\}$
$= \{\ \}$

$(A \cup B)' = A' \cap B'$

II $(A \cap B)' = A' \cup B'$

$R.H.S = A' \cup B'$
$= \{1, 3, 5, \cdots, 19\} \cup \{2, 4, 6, \cdots, 20\}$
$= \{1, 2, 3, 4, \cdots, 20\}$ ✓

$L.H.S = (A \cap B)'$

$A \cap B = \{2, 4, 6, \cdots, 20\} \cap \{1, 3, 5, \cdots, 20\}$
$= \{\ \}$

$L.H.S = (A \cap B)' = U - (A \cap B)$
$= \{1, 2, 3, \cdots, 20\} - \{\ \}$
$= \{1, 2, 3, \cdots, 20\}$ ✓

Hence Proved

8. Consider the set $P = \{x | x = 5m, m \in N\}$ and $Q = \{x | x = 2m, m \in N\}$.
   Find $P \cap Q$

$P = \{5, 10, 15, \cdots\}$

$Q = \{2, 4, 6, 8, \ldots,\}$

$P \cap Q = \{5, 10, 15, \cdots\} \cap \{2, 4, 6, \cdots\}$

$= \{10, 20, 30, 40, \cdots\}$

9. From suitable properties of union and intersection, deduce the following results:
   (i) $A \cap (A \cup B) = A \cup (A \cap B)$

$L.H.S = A \cap (A \cup B)$

Distributive Law

$\because = (A \cap A) \cup (A \cap B)$

$\because A \cap A = A$

$= A \cup (A \cap B) = R.H.S$

(ii) $A \cup (A \cap B) = A \cap (A \cup B)$

$L.H.S = A \cup (A \cap B)$

Distributive property

$= (A \cup A) \cap (A \cup B)$

$\because A \cup A = A$

$= A \cap (A \cup B) = R.H.S$

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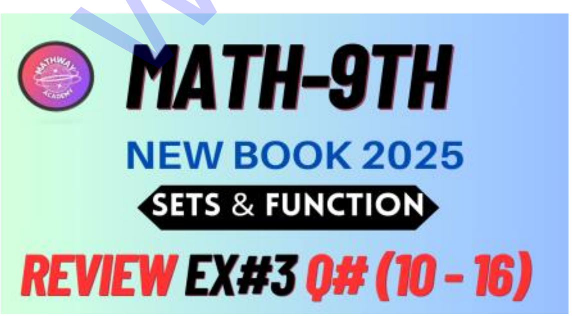

Review exercise 3

1. If $g(x) = 7x - 2$ and $s(x) = 8x^2 - 3$ find:

(i) $g(0)$

$g(x) = 7x - 2$

$g(0) = 7(0) - 2$

$= 0 - 2$

$= -2$

(ii) $g(-1)$

$g(x) = 7x - 2$

$g(-1) = 7(-1) - 2$

$= -7 - 2$

$= -9$ Ans

(iii) $g\left(-\frac{5}{3}\right)$

$g(x) = 7x - 2$

$g\left(-\frac{5}{3}\right) = 7\left(-\frac{5}{3}\right) - 2$

$= -\frac{35}{3} - 2 = \frac{-35 - 6}{3}$

$= \frac{-41}{3}$ Ans

(iv) $s(1)$

$s(x) = 8x^2 - 3$

$s(1) = 8(1)^2 - 3$

$= 8(1) - 3$

$= 8 - 3$

$= 5$ Ans

(v) $s(-9)$

$s(x) = 8x^2 - 3$

$s(-9) = 8(-9)^2 - 3$

$= 8(81) - 3$

$= 648 - 3$

$= 645$ Ans

(vi) $s\left(\frac{7}{2}\right)$

$s(x) = 8x^2 - 3$

$s\left(\frac{7}{2}\right) = 8\left(\frac{7}{2}\right)^2 - 3$

$= \overset{2}{\cancel{8}}\left(\frac{49}{\cancel{4}_1}\right) - 3$

$= 2(49) - 3$

$= 98 - 3$

$= 95$ Ans

11. Given that $f(x) = ax + b$, where a and b are constant numbers. If $f(-2) = 3$ and $f(4) = 10$, then find the values of a and b.

$f(x) = ax + b$

$f(-2) = 3$ $\quad$ $f(4) = 10$

$f(-2) = a(-2) + b$ $\quad$ $f(4) = a(4) + b$

$3 = -2a + b$ —(I) $\quad$ $10 = 4a + b$ —(II)

subtracting (I) & (II)

$10 = 4a + \cancel{b}$

$-3 = -2a + \cancel{b}$

$7 = 6a$

$\frac{7}{6} = a$ $\quad$ put in (I) $\quad$ $3 = -2\left(\frac{7}{6}\right) + b$

$3 = -\frac{7}{3} + b$

$3 + \frac{7}{3} = b$

$\frac{9+7}{3} = b$

$\boxed{a = \frac{7}{6}}$ Ans $\quad$ $\boxed{\frac{16}{3} = b}$

12. Consider the function defined by $k(x) = 7x - 5$. If $k(x) = 100$, find the value of x.

$K(x) = 7x - 5$ $\quad$ $K(x) = 100$

$7x - 5 = 100$

$7x = 100 + 5$

$7x = 105$

$x = \frac{105}{7}$

$x = 15$ Ans

13. Consider the function $g(x) = mx^2 + n$, where m and n are constant numbers. If $g(4) = 20$ and $g(0) = 5$, find the values of m and n.

$g(x) = mx^2 + n$

numbers. If $g(4) = 20$ and $g(0) = 5$, find the values of m and n.

$g(x) = mx^2 + n$

$g(4) = 20$

$g(4) = m(4)^2 + n$

$20 = m(16) + n$

$20 = 16m + n$ — ①

$g(0) = 5$

$g(0) = m(0)^2 + n$

$g(0) = m(0) + n$

$5 = 0 + n$

$\boxed{5 = n}$

put in ①

$20 = 16m + 5$

$20 - 5 = 16m$

$15 = 16m$

$\boxed{\frac{15}{16} = m}$

Ans

14. A shopping mall has 100 products from various categories labeled 1 to 100, representing the universal set U. The products are categorized as follows:

- Set A: Electronics, consisting of 30 products labeled from 1 to 30.
- Set B: Clothing comprises 25 products labeled from 31 to 55.
- Set C: Beauty Products, comprising 25 products labeled from 76 to 100.

Write each set in tabular form, and find the union of all three sets.

$U = \{1, 2, 3, \cdots, 100\}$

$A = \{1, 2, 3, \cdots, 30\}$, $B = \{31, 32, 33, \cdots, 55\}$

$C = \{76, 77, 78, \cdots, 100\}$

$(A \cup B) \cup C = (\{1, 2, 3, \cdots, 30\} \cup \{31, 32, 33, \cdots, 55\}) \cup \{76, 77, 78, \cdots 100\}$

$= \{1, 2, 3, \cdots 55\} \cup \{76, 77, 78, \cdots, 100\}$

$= \{1, 2, 3, \cdots, 55, 76, 77, 78, \cdots 100\}$

15. Out of 180 students who appeared in the annual examination, 120 passed the math test, 90 passed the science test, and 60 passed both the math and

15. Out of 180 students who appeared in the annual examination, 120 passed the math test, 90 passed the science test, and 60 passed both the math and science tests.

Total students = 180

Let M denotes the students pass math test.
and S denotes the students pass the science test

$n(M) = 120$, $n(S) = 90$, $n(M \cap S) = 60$

(a) How many passed either the math or science test?

$$n(M \cup S) = n(M) + n(S) - n(M \cap S)$$
$$= 120 + 90 - 60$$
$$= 120 + 30$$
$$= 150$$

150 students pass either math or science

(b) How many did not pass either of the two tests?

$$n(M \cup S)' = n(U) - n(M \cup S)$$
$$= 180 - 150$$
$$= 30$$

(c) How many passed the science test but not the math test?

No. of students passed the science but not math test $= n(S) - n(M \cap S)$
$$= 90 - 60$$
$$= 30$$

(d) how many failed the science test?

$$n(S)' = n(U) - n(S)$$
$$= 180 - 90$$
$$= 90$$

16. in a software house of a city with 300 software developers, a survey was conducted to determine which programming languages are liked more. The survey revealed the following statistics:

- 150 developers like Python.
- 130 developers like Java.
- 120 developers like PHP.
- 70 developers like both Python and Java.
- 60 developers like both Python and PHP.
- 50 developers like both Java and PHP.
- 40 developers like all three languages: Python, java and PHP.

Let P, J & H are denoted the set of developers who like Python, Java and PHP.

$n(P) = 150$, $n(J) = 130$, $n(H) = 120$
$n(P \cap J) = 70$, $n(P \cap H) = 60$, $n(J \cap H) = 50$
$n(P \cap J \cap H) = 40$

(a) How many developers use at least one of these languages?

$$n(P \cup J \cup H) = n(P) + n(J) + n(H) - n(P \cap J) - n(J \cap H) - n(P \cap H) + n(P \cap J \cap H)$$
$$= 150 + 130 + 120 - 70 - 50 - 60 + 40$$
$$= 150 + 250 - 120 - 20$$
$$= 400 - 140 = 260$$

(b) How many developers use only one of these languages?

$$n(P \text{ only}) = n(P) - n(P \cap J) - n(P \cap H) + n(P \cap J \cap H)$$
$$= 150 - 70 - 60 + 40$$
$$= 20 + 40 = 60$$

$$n(J \text{ only}) = n(J) - n(P \cap J) - n(J \cap H) + n(P \cap J \cap H)$$

$$= 130 - 70 - 50 + 40$$
$$= 50$$

$$n(H\ only) = n(H) - n(H \cap P) - n(J \cap H) + n(P \cap J \cap H)$$
$$= 120 - 60 - 50 + 40$$
$$= 60 - 10$$
$$= 50$$

(c) How many developers do not use any of these languages?

$$n(\overline{P \cup J \cup H}) = n(U) - n(P \cup J \cup H)$$
$$= 300 - 260$$
$$= 40$$

(d) How many developers use only PHP?

$$n(H\ only) = n(H) - n(P \cap H) - n(J \cap H) + n(P \cap J \cap H)$$
$$= \ldots - 60 - 50 + 40$$

$$= 120 - 60 - 50 + 40$$

$$= 50 \text{ Ans}$$