MATHEMATICS

Unit 1

OPERATIONS ON SETS

EXERCISE 1.1

1. How many subsets can be made of the following sets? Find these subsets. Also indicate proper and improper subsets.

(i) {0}

Sol. { }, {0} = 2

(ii) = {0, 1}

Sol. { }, {0}, {1}, {0,1} = 4

(iii) {7, – 11}

Sol: {}, {7}, {–11}, {7, –11} Four

(iv) = {4, 8, 12}

Sol. { }, {4}, {8}, {12}, {4,8}, {4,12}, {8,12}, {4,8,12} = 8

(v) N = {1, 2, 3, 4}

Sol. { }, {1}, {2}, {3}, {4}, {1,2}, {1, 3} {1,4}, {2,3}, {2,4}, {3,4}, {1,2,3}, {1,2,4}, {2, 3, 4} {1,3,4} {1,2,3,4} = 16

(vi) Q = {± 1, ± 2}

Sol. { }, {1}, {–1}, {2}, {–2}, {1, –1}, {1,2}, {1, –2} {–1, –2}, {2, –1}, {2, –2}, {1, –1, 2}, {1, 1, –2}, {–1,2,–2}, {1, –1, 2, –2} = 16

(vii) R {x|x∈P∧5≤13}

Sol. R={5,7,9,11,13}
{ }, {5}, {7}, {11}, {13}, {5,7}, {5,11}, {5,13}, {7,11}, {7,13}, {11,13}, {5,7,13}, {5,11,13}, {7,11,13} {5,7,11}, {5,7,11,13} = 32

(viii) f = {x∈E ∧12 <x <20

Sol: f {10,12,14,16,18}
{}, {10}, {12}. {14}, {16}, {18}, {10,12},{10,14},{10,16}, {10,18}, {12,14}, {12,16}, {12,18}, {14,16}, {14,18}, {16,18}, {10,12,14}, {10,12,16}, {10,12,18}, {12,14,16}, {12,14,18}, {14,16,18}, {10,12,16}, {10,12,18}, {12,16,18}, {14,10,16},{16,10,14}, {16,10,18}, {18,14,10}, {18,10,16}, {10,12,14,16,18} 32

(ix) G = { } Sol: {}

(x) {ϕ, {a}} Sol: {}, {ϕ}, {a}, {o, a}
All are proper subsets.

1. How many subsets can be made of the following sets? Find also these subsets. Find also thee subsets.

(ix) u = Sol. { }

(viii) E = {x/x∈ E ∧ 2 < x < 10}
{ }, {4}, {6}, {8}, {4,8}, {6,8} {4,6,8}

2. Find power sets of the following sets:

(i) A = {a, b, c}

Sol. P(A) = {{ }, {a}, {b}, {c}, {a, b}, {a,c}, {b, c}, {a, b, c}}

(ii) Z = {a, e, i, o, u}

Sol. P(Z) = {{ϕ }, {a}, {e}, {i}, {o}, {u}, {a,e}, {a,i}, {a,o}, {a,u}, {e,i}, {e,o}, {e,u}, {i,o}, {i,u}, {o,u}, {a,e,i}, {a,e,o}, {a,e,u}, {a,i,o}, {a,i,u}, {a,o,u}, {e,i,o}, {e,i,u}, {e,o,u}, {i,o,u}, {a,e,i,o}, {a,e,i,u}, {a,e,o,u}, {a,i,o,u},{e,i,o,u}, {a,e,i,o,u}}

(iii) T = {+, –,×, ÷}

Sol. P(Z) = {{ },{+},{–},{×},{÷}, {+,–}, {+,×},{+,÷},{–,×},{–,÷},{×,÷},{+,–,×}, {+,–,÷},{+,×,÷},{–,×,÷},{+,–,×,÷}

(iv) Q = {0} Sol. P(Q) = {{ },{0}

(v) K = {–1, –2, 0, 1, 2}

Sol. P(K) ={{ }, {–1}, {0}, {1}, {2}, {–1,–2},{–1,0}{–1,1},{–1,2},{–2,0}, {–2,1},{–2,2},{0,1},{0,2},{1,2},{–1,–2, 0},{–1,–2,1},{–1,–2,2},{–1,0,1},{–1,0,2 },{–1,1,2},{–2,0,1},{–2,0,2},{–2,1,2},{0 ,1,2},{–1,–2,0,1},{–1,–2,0,2}, {–1,–2,1,2},{–1,0,1,2},{–2,0,1,2}, {–1,–2,0,1,2}}

3. Find the complement of the following sets:

U = {0, 1, 3, 5, 7, 9, 11, 13, 15}

(i) K = {11}
{K′ = {0,1,3,5,7,9,13,15}

(ii) L = {3, 5, 7}
L′ = {0,1,9,11,13,15}

(iii) M = {1, 3, 5, 7, 9}
M′ = {0,11,13,15}

(iv) N = {}
N′ = {0,1,3,5,7,9,11,13,15}

(v) O = {0, 1, 3}
O′ = {5,7,9,11,13}

(vi) P = {1, 3}
P′ = {0,5,7,9,11,13,15}

5. If A = {1, 3, 5, 7, 9}, B = {0, 4, 8, 12, 16, 20} and {0,1,2,4} Verify the following:

(i) **A∪B = B∪A**

Sol. LHS

A = {1,3,5,7,9}, B = {0,4,8,12,16,20}

A∪B = {1,3,5,7,9} ∪ {0,4,8,12,16,20}

= {1,3,5,7,9,0,4,8,12,16,20}

= {0,1,3,4,5,7,8,9,12,16,20}

RHS

B∪A = {0,4,12,16,20} ∪ {1,3,5,7}

= {0,4,8,12,16,20,1,35,7}

= {0,1,3,4,5,7,8,9,12,16,20}

LHS = RHS

A∪B = B∪A

(ii) **A∩B = B∩A**

Sol. A = {1,3,5,7,9}, B = {0,4,8,12,16,20}

A∩B = {1,3,5,7,9} ∩ {0,4,8,12,16,20}

= { }

R.H.S

B∩A = {0,4,12,16,20} ∩ {1,3,5,7} = { }

LHS = RHS

A∩B = B∩A

(iii) **C∪(A∪B) = (C∪A)∪B**

Sol. LHS

A = {1,3,5,7,9}, B = {0,4,8,12,16,20}

A∪B = {1,3,5,7,9} ∪ {0,4,8,12,16,20}

= {0,1,3,4,5,7,8,9,12,16,20}

C∪(A∪B) = {0,1,2,4} ∪ {0,1,3,4,5,7, 8, 9, 12, 16, 20}

= {0,1,2,3,4,5,7,8,9,12,16,20}

RHS

(C∪A)∪B

C∪A = {0,1,2,4} ∪ {1,3,5,7,9}

= {0,1,2,3,4,5,7,9}

(C∪A) ∪B = {0,1,2,3,4,5,7,9} ∪ {0,4,8,12,16,20}

= {0,1,2,3,4,5,7,8,9,12,16,20}

LHS = RHS

C∪(A∪B) = (C∪A)∪B

(iv) **B∩(C∩A) = (B∩C)∩A**

Sol. LHS

A = {1,3,5,7,9}, B = {0,4,8,12,16}

C = {0,1,2,4}

C∩A = {0,1,2,4} ∩ {1,3,5,7} = {1}

B∩(C∩A) = {0,4,8,12,16,20}∩{1} = { }

(B∩C)∩A = {0,4,8,12,16,20}∩{0,1,2,4} = {0,4}

(B∩C)∩A = ?

{0,4} ∩ {1,3,5,7,9} = { }

LHS = RHS

B∩(C)∩A = (B∩C)∩A

x = {2,4,6,8,10}, y = {−4,−3,−2,−1}

Z = {0,4,8}

4. **Verify the following:**

x = {2,4,6,8,10}, y = {−4,−3,−2,−1}, z = {0,4,8}

(i) **x∪(y∩z) = (x∪y)∩(x∪z)**

Sol. LHS

x∪(y∩z) = ?

(y∩z) = {−4,−3,−2,−1}∩{0,4,8} = { }

x∪(y∩z) = {2,4,6,8,10} ∪ { }

= {2,4,6,8,10}

RHS

(x∪y)∩(x∪z)

x∪y = {2,4,6,8,10}, y = {−4,−3,−2,−1}

= {−4,−3,−2,−1,2,4,6,8,10}

x∪z = {2,4,6,8,10} ∪ {0,4,8}

= {0,2,4,6,8,10}

(x∪y)∩(x∪z) = {-4,-3,-2,-1,2,4,6,8,10} ∩ {0,2,4,6,8,10}

= {2,4,6,8,10}

LHS = RHS

x∪(y∩z) = (x∪y)∩(x∪z)

(ii) **x∩(y∪z) = (x∩y) ∪ (x∩z)**

Sol. LHS

x∩(y∪z)

(y∪z) = {−4,−3,−2,−1} ∪ {0,4,8}

= {−4,−3,−2,−1,0,4,8}

x∩(y∪z) = {2,4,6,8,10}∩{−4,−3,−2,−1, 0,4,8}

= {4, 8}

(x∩y) ∪ (x∩z)

(x∩y) = {2,4,6,8,10} ∩ {−4,−3,−2,−1} = { }

(x∩z) = {2,4,6,8,10} ∩ {0,4,8} = {4,8}

(x∩y) ∪ (x∩z) = { } ∪ {4,8} = {4,8}

LHS = RHS

x∩(y∪z) = (x∩y) ∪x∩z)

5. **State and verify the De-Morgan's Laws when**

U = First 20 positive integers

A = Set of 1st 5 even numbers

B = Set of 1st 5 prime numbers

U = {1,2,3,4,5…..20}

A = {2,4,6,8,10}

B = {1,3,5,7,9}

Sol. Laws of De-Morgon

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

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

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

$= \{1,2,3,4,\ldots\ldots 10\}$

$(A \cup B)' = \{1,2,3,4,5\ldots.20\} / \{1,2,3,..10\}$

$= \{11,12,13,14,\ldots\ldots\ldots 20\}$

RHS

$A' \cap B'$

$A' = U/A$

$= \{1,2,3,4,5\ldots 20\} / \{2,4,6,8,10\}$

$= \{1,3,5,7,9,11,12,13,14\ldots\ldots 20\}$

$B' = U/B$

$= \{1,2,3,4,5\ldots 20\} / \{1,3,5,7,9\}$

$= \{2,4,6,8,10,11,12,13\ldots\ldots 20\}$

LHS = RHS

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

(ii) U = First 50 natural numbers

A = {2, 4, 6, 8……..50}

Sol. A = {1,2,3,4,5……..50}

A = {2,4,6,8,……...50}

B = {1,3,5,7,9,11,13,…39}

LHS

$(A \cup B)'$

$(A \cup B) = \{2,4,6,8,\ldots\ldots\ldots 50\} \cup \{1,3,5,7,9,11,13,\ldots 39\}$

$= \{1,2,3,4,5,6\ldots.40,42,44,46\ldots..50\}$

$(A \cup B)' = \{1,2,3,4,\ldots\ldots\ldots 50\} / \{1,2,3,4\ldots\ldots\ldots\ldots 40,42,44,46,48,50\}$

$= \{41,43,45,47,49\}$

RHS

$A' \cap B'$

$A' = \{1,2,3\ldots\ldots\ldots 50\} / \{2,4,6,8\ldots 50\}$

$= \{1,3,5,7,9\ldots\ldots\ldots\ldots\ldots 49\}$

$B' = \{1,2,3\ldots\ldots\ldots 50\} / \{1,3,5,7\ldots..39\}$

$= \{40,41,42,43,\ldots 49\} \cap \{40,41,\ldots.50\}$

$= \{41,43,45,47,49\}$

LHS = RHS

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

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EXERCISE 1.2

(1) If A = {2,8,12},
B = {10,12,16}, C = {6,12,18}
Use Venn diagrams to represent.

(i) **$A \cup (B \cup C)$**

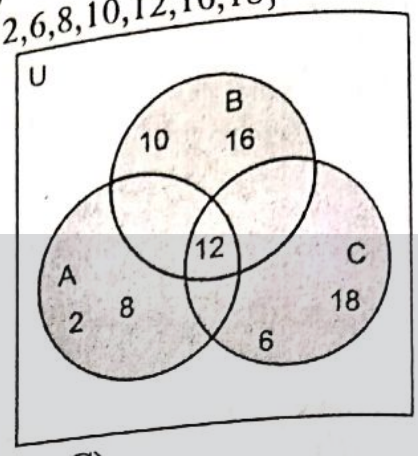
Sol.

$(B \cup C) = \{10,12,16\} \cup \{6,12,18\}$

$= \{6,10,12,16,18\}$

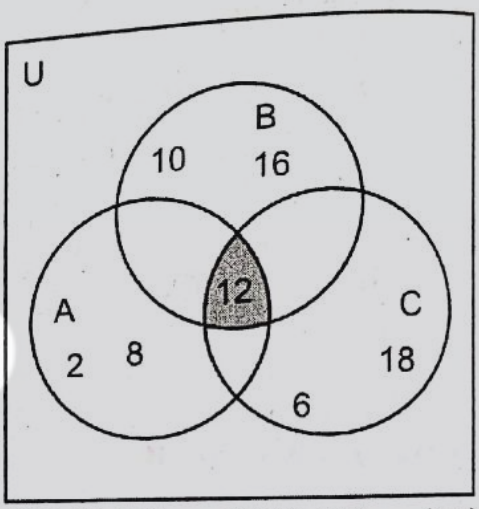
$A \cup (B \cup C) = \{2,8,12\} \cup \{6,10,12,16,18\}$

$= \{2,6,8,10,12,16,18\}$



(ii) **$A \cap (B \cap C)$**

Sol.



$(B \cap C) = \{10,12,16\} \cap \{6,12,18\} = \{12\}$

$A \cap (B \cap C) = \{12\} \cap \{6,12,18\}$

$= \{12\}$

(iii) **$A \cup (B \cap C)$**

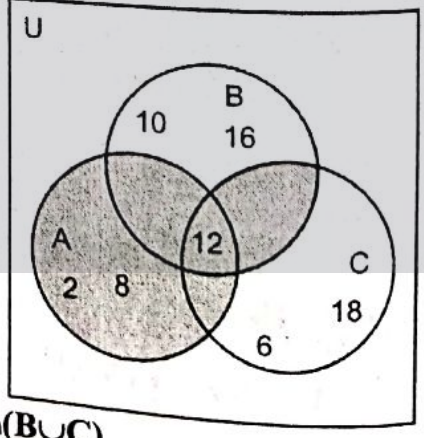
Sol. $(B \cap C) = \{10,12,16\} \cap \{6,12,18\}$

$(B \cap C) = \{2,8,12\} \cap \{6,12,18\}$

$= \{12\}$

$A \cup (B \cap C) = \{2,8,12\} \cup \{12\}$

$= \{2,8,12\}$



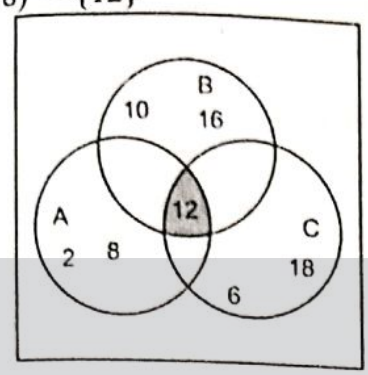
(iv) **$A \cap (B \cup C)$**

Sol. $(B \cup C) = \{10,12,16\} \cup \{6,12,18\}$

$(B \cup C) = \{6,10,12,16,18\}$

$A \cap (B \cup C) = \{2,8,12\} \cap \{6,10,12,16,18\}$

18) = {12}



(2) **If**

A = {1,2,3,4,5}

B = {10,12,16}

C = {6,12,18}

Use Venn diagrams to verify

(i) **A∪(B∪C) = A∪B)∪C**

Sol. LHS

A∪(B∪C) ={4,5,6,7,8} ∪ {5,8,9,10,11}

={4,5,6,7,8,9,10,11}

A∪(B∪C) ={1,2,3,4,5} ∪ {4,5,6,7,8,9,10,11}

={1,2,3,4,5,6,7,8,9,10,11}

RHS

(A∪B)∪C

(A∪B)={1,2,3,4,5} ∪ {4,5,6,7,8}

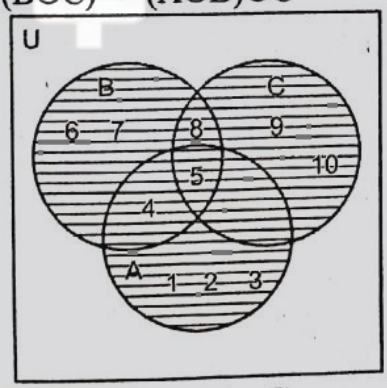
={1,2,3,4,5,6,7,8}

(A∪B)∪C={1,2,3,4,5,6,7,8}∪ {5,8,9,10,11}

={1,2,3,4,5,6,7,8,9,10,11}

LHS = RHS

A∪(B∪C) = (A∪B)∪C



(ii) **A∩(B∩C) = (A∩B)∩C**

Sol.

LHS A∩(B(B∩C)

(B∩C)={4,5,6,7,8} ∩ {5,8,9,10,11}

={5,8}

A∩(B∩C) ={1,2,3,4,5} ∩ {5,8} {5}

RHS

(A∩B)∩C

(A∩B)={1,2,3,4,5} ∩ {4,5,6,7,8}

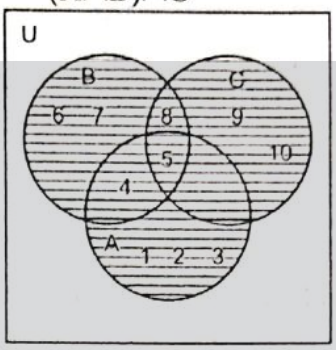
={4,5}

(A∩B)∩C ={4,5}∩ {5,8,9,10,11}

{5}

LHS = RHS

A∩(B∩C) = (A∩B)∩C



(iii) **A∪(B∩C) = (A∪B)∩C**

Sol. LHS

A∪(B∩C)

(B∩C)={4,5,6,7,8} ∩ {5,8,9,10,11}

={5,8}

A∪(B∩C) ={1,2,3,4,5} ∪ {5,8}

={1,2,3,4,5,8}

RHS

(A∪B)∩C

(A∪B)={1,2,3,4,5} ∪ {4,5,6,7,8}

={1,2,3,4,5,6,7,8}

(A∪B)∩C ={1,2,3,4,5,6,7,8} ∩ {5,8,9,10,11}

={5,8}

LHS = RHS

A∪(B∩C) = (A∪B)∩C

(iv) **A∩(B∪C) = (A∩B)∩C**

Sol. LHS

(B∪C)={4,5,6,7,8} ∪ {5,8,9,10,11}

={4,5,6,7,8,9,10,11}

A∩(B∪C) ={1,2,3,4,5} ∩ {4,5,6,7,8,9,10,11}

={4,5} RHS

(A∩B)∪(A∩C)

(A∩B){1,2,3,4,5} ∩ {4,5,6,7,8} = {4,5}

(A∩B)∪(A∩C)

{4,5} ∪ {5} = {4,5}

LHS = RHS

A∩(B∪C) = (A∩B)∪A∩C

(3) **For the sets**

A = {0,2,4,6,8,12}

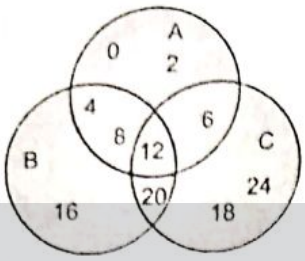
B = {4,8,12,16,20}

C = {6,12,18,24,20}

Use Venn diagrams to represent.

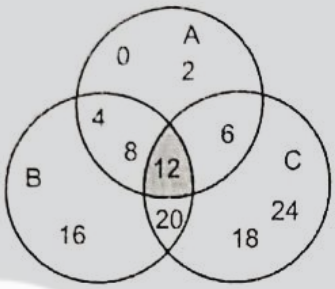
(i) **A∪(B∪C)**

Sol.



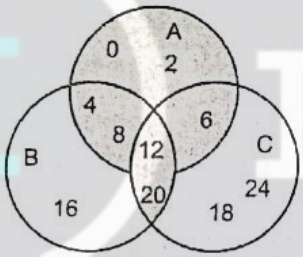
(ii) $A \cap (B \cap C)$

Sol.



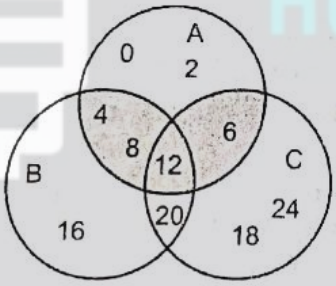
(iii) $A \cup (B \cap C)$

Sol.



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

Sol.



4. If

$A = \{1,3,5,7,9,11,13,15$

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

$C = \{7,8,9,10,11,12\}$

then prove that

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

Sol. $A \cup (B \cup C)$

$(B \cup C) = \{1,2,3,4,5,6,7\} \cup \{7,8,9,10,11,12\}$

$= \{1,2,3,4,5,6,7.....12\}$

$A \cup (B \cup C) = \{1,3,5,7,9,11,13,15\} \cup \{1,2,3,4,5,6,.....12\}$

$= \{1,2,3,4,5.....13,15\}$

RHS

$(A \cup B) \cup C$

$(A \cup B) = \{1,3,5,7,9,11,13,15\} \cup \{1,2,3,4,5,6,7\}$

$= \{1,2,3,4,5,6,7,9,11,13,15\}$

$(A \cup B) \cup C = \{1,2,3,4,5,6,7,9,11,13\} \cup \{7,8,9,11,11,12\}$

$= \{1,2,3,4,5,6,7....13,15\}$

LHS = RHS

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

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

Sol. LHS

$A \cap (B \cap C)$

$(B \cap C) = \{1,2,3,4,5,6,7\} \cap \{7,8,9,10,11,12\} = \{7\}$

$A \cap (B \cap C) = \{1,3,5,7,9,11,13,15\} \cap \{7\} = \{7\}$

RHS

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

$(A \cap B) = \{1,3,5,7,9,11,13,15\} \cap \{1,2,3,4,5,6,7\}$

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

$(A \cap B) \cap C = \{1,3,5,7\} \cap \{7,8,9,10,11,13\}\{7\}$

$= \{7\}$

LHS = RHS

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

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

Sol. LHS $A \cup (B \cap C)$

$(B \cap C) = \{1,2,3,4,5,6,7\} \cap \{7,8,9,10,11,12\}$

$= \{7\}$

$A \cup (B \cap C) = \{1,3,5,7,9,11,13,15\} \cap \{7\}$

$= \{1,3,5,7,9,11,13,15\}$

RHS

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

$(A \cup B) = \{1,3,5,7,9,11,13,15\} \cup \{1,2,3,4,5,6,7\}$

$= \{1,2,3,4,5,6,7,9,11,13,15\}$

$(A \cup C) = \{1,3,5,7,9,11,13,15\} \cup \{7,8,9,10,11,12\}$

$\{1,3,5,7,8,9,11,12,13,15\}$

$(A \cup B) \cap (A \cup C) = \{1,2,3,7,9,11,13,15\} \cap \{1,3,5,7,9,11,12,13,15\}$

$= \{1,3,5,7,9,11,13,15\}$

LHS = RHS

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

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

Sol. LHS $A \cap (B \cup C)$

$(B \cup C) = \{1,2,3,4,5,6,7\} \cup$

{7,8,9,10,11,12}
= {1,2,3,4,5,6,7,8,9,10....12}

$A \cap (B \cup C)$ = {1,3,5,7,9,11,13,15} ∩ {1,2,3,4,5,6,7,8.....12}
= {1,3,5,7,9,11}

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

$(A \cap B)$ = {1,3,5,7,9,11,13,15} ∩ {1,2,3,4,5,6,7}
= {1,3,5,7}

$(A \cap C)$ = {1,3,5,7,9,11,13,15} ∩ {7,8,9,10,11,12} = {7,9,11}

$(A \cap B) \cup (A \cap C)$ = {1,3,5,7} ∩ {7,9,11}
= {1,3,5,7,9,11}

LHS = RHS

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

REVIEW EXERCISE 1

1. Fill in the blanks with suitable words.

(i) A ____ is a collection of distinct objects.

(ii) 'W' represents the set of _____ numbers.

(iii) A set that contains all subsets of a given set is called _____

(iv) In _____ of sets, common elements are taken.

(v) Subtraction of a set from universal set is called _____

Ans. (i) set (ii) Whole numbers
(iii) Power set (iv) Intersection
(v) compliment.

2. Choose the correct answer.

(i) {0, ±1, ±2, ±3, . . .} is called set of:
(a) Natural numbers
(b) Whole numbers
(c) Prime numbers (d) Integers

(ii) Number of elements in the power set of {3, 4, 5, 6} will be:
(a) 5 (b) 10
(c) 16 (d) 32

(iii) $a \in A$ stands for:
(a) a is a member of A.
(b) a subset of A.
(c) a is not member of A
(d) a is less tan A.

(iv) According to De-Morgan's law, $(A \cup B)' =$ _____.
(a) $A' \cup B'$ (b) $A' \cap B'$
(c) $(A \cap B)'$ (d) $A \cap B'$

(v) Distributive property of union over intersection is represented by:
(a) $A \cap (B \cup C) = (A \cap B) \cup (A \cup C)$
(b) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
(c) $A \cap (B \cup C) = (A \cap B) \cup C$
(d) $A \cup (B \cap C) = (A \cup B) \cap C$

(vi) The sets A={a, b, c} and B = {c, b, a} are:
(a) infinite sets (b) equal sets
(c) singleton sets
(d) disjoint sets

Ans.

(i)	(d)	(ii)	(c)	(iii)	(a)	(iv)	(b)
(v)	(b)	(vi)	(b)				

3. For the sets
A = {a,b,c,d,e}
B = {c,d,e,b}
C = {e,f,g,b} verify the following.

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

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

Sol: $A \cup B$ = {a,b,c,d,e} ∪ {c,d,e,b} = {a,b,c,d,e}
$A \cup C$ = {a,b,c,d,e} ∪ {e,f,g,b} = {a,b,c,d,e,f,g,h}
$(A \cup B) \cap (A \cup C)$
= {a,b,c,d,e} ∩ {a, b, c, d, c, f, g, h,}
= {1, b, c, d, e}
$= (B \cap C)$ = {}c,d,e,f} ∩ [e,f,g,h} = {e,f}
$A \cup (B \cap C)$ = {a,b,c,d,e} {e,f}
= {a,b,c,d,e,f}

(ii) $A \cap (B \cup C)$
$B \cup C$ = {c,d,e,f} {e,f,g,h} = {c,d,e,f,g,h}
$A \cap (B \cup C)$ = {a,b,c,d,e} ∩ {c} = {c,d,e,f}
$A \cap B$ = {a,b,c,d,e,f} {c,d,e,f}= {e,f}
$A \cap C$ = {a,b,c,d,e,f} {e,f,g,h} = {e,f}
$(A \cap B) \cup (A \cap C)$ = {e,f} ∪ {e,f} = {e,f}

4. If A = {1,3,6,10}, B = {3,6,9,12}. Find $A \cap B$, $A \cup B$

Sol: A={1,3,6,10}, B={3,6,9,12}

(i) $A \cap B$ {1,3,6,10} ∩ {}3,6,9,12} = {3,6}

(ii) $A \cup B$ = {1,3,6,10} ∪ {3,6,9,12} = {1,3,6,9,10,12}

5. Prove Commutative properties for A= {2,3,4,5,6}, B={5,6,7,8}

A = {2,3,4,5,6}, B = {5,6,7,8} verify the following
(i) AUB = BUA
(ii) $A \cap B = B \cap A$

Sol. $(A\cup B) = (B\cup A)$

$(A\cup B) = \{2,3,4,5,6\} \cup \{5,6,7,8\}$
$= \{2,3,4,5,6,7,8\}$

$(B\cup A) = \{5,6,7,8\} \cup \{2,3,4,5,6\}$
$= \{2,3,4,5,6,7,8\}$

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

$a\cap b = B\cap A$

$A\cup B = \{2,3,4,5,6\}\cap\{5,6,7,8\} = \{5,6\}$

LHS

$A\cap B = \{2,3,4,5,6\}\cap\{5,6,7,8\} = \{5,6\}$

RHS

$B\cap A = \{5,6,7,8\}\cap\{2,3,4,5,6\}$
$= \{5,6\}$

6. For the sets.

$A = \{1,2,3,4,5,6\}$, $B = \{5,6,7,8\}$
$C = \{2,4,6,8,10\}$
Verify the following
(i) $A\cup(B\cup C) = (A\cup B)\cup C$
(ii) $A\cap(B\cap C) = (A\cap B)\cap C$

Sol. Associative Property of Union and Intersection

(i) $A\cup(B\cup C) = (A\cup B)\cup C$
(ii) $A\cap(B\cap C) = (A\cap B)\cap C$
(i) LHS

$(B\cup C) = \{5,6,7,8\} \cup \{2,4,6,8,10\}$
$= \{2,4,5,6,7,8,10\}$

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

RHS

$(A\cup B)\cup C$

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

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

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

(ii) LHS

$A\cap(B\cap C)$

$B\cap C = \{5,6,7,8\} \cap \{2,4,6,8,10\}$
$= \{6,8\}$

$A\cap(B\cap C) = \{1,2,3,4,5,6\} \cap \{6,8\}$
$= \{6\}$

RHS

$(A\cap B)\cap C$

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

$(A\cap B)\cap C = \{5,6\} \cap \{2,4,6,8,10\}$
$= \{6\}$

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

7. Prove De-Morgan's Law using given sets:

$A = \{1,2,3\}$, $B = \{2,4,5\}$ $c = \{1,5,6\}$
$U = \{1,2,3,4,5,6\}$

De Morgon's Laws:

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

$A\cup B = \{1,2,3\} \cup \{2,4,5\}$
$= \{1,2,3,4,5\}$

$(A\cup B)' = \{1,2,3,4,5,6\} / \{1,2,3,4,5\} = \{6\}$

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

$A' = \{1,2,3,4,5,6\} / \{1,2,3\}$
$= \{4,5,6\}$

$B' = \{1,2,3,4,5,6\} / \{2,4,5\}$
$= \{1,3,6\}$

$A'\cap B' = \{4,5,6\} / \{1,3,6\} = \{6\}$

(ii)

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

$(A\cap B)' = \{1,2,3,4,5,6\} / \{2\}$
$= \{1,3,4,5,6\}$

$A' = \{1,2,3,4,5,6\} / \{1,2,3\} = \{4,5,6\}$

$B' = \{1,2,3,4,5,6\} / \{2,4,5\} = \{1,3,6\}$

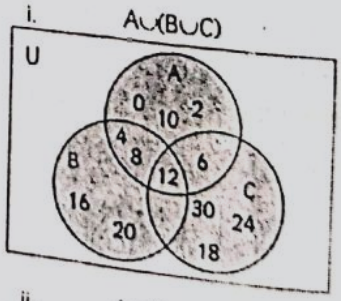
$A'\cup B' = \{4,5,6\} \cup \{1,3,6\} = \{1,3,4,5,6\}$

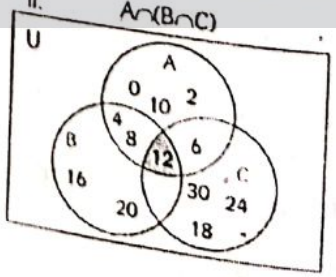
$(A\cap B)' = A'\cup B'$

8. $A=\{0,2,4,6,8,10,12\}$
$B=\{4,8,12,16,16,20\}$,
$=\{6,12,18,24,30\}$
Use venn diagram to represent

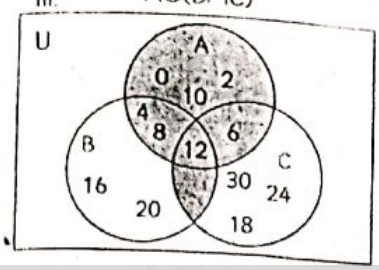
Sol: $A=\{0,2,4,6,8,10,12\}$
$B=\{4,8,112,16,16,20\}$, $=\{6,12,18,24,30\}$

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

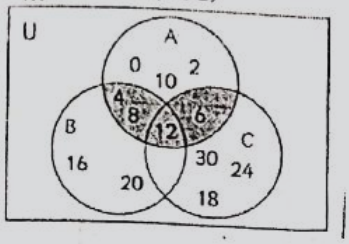




iii. $A \cup (B \cap C)$



iv. $A \cap (B \cup C)$



Unit 2

REAL NUMBERS

EXERCISE 2.1

Q. 1. Separate rational and irrational numbers:

(i) 0.010010001000001……Irrational number
(ii) −6 Rational number
(iii) 2.45 Rational number
(iv) $\sqrt{3}$ Irrational number
(v) $5\frac{3}{4}$ Rational number
(vi) $\frac{-11}{3}$ Rational number
(vii) 1.732 Rational number
(viii) 6.920920920……..Irrational number

Q. 2. Write two rational and three irrational numbers that are between 3 and 4.

Sol. Rational number
3.0101, 3.001001, 3.5757
Irrational number
$\sqrt{11}, \sqrt{13}, \sqrt{15}$

3. Express the following rational numbers as decimal.

(i) $\frac{17}{10}$ **Sol:** $\frac{17}{10} = 1.7$

(ii) $\frac{37}{30}$ **Sol:** $\frac{37}{30} = 1.2333\ldots$

(iii) $\frac{21}{25}$ **Sol:** $\frac{21}{25} = 0.084$

(iv) $\frac{6}{140}$ **Sol:** $\frac{6}{140} = 0.042857\ldots$

(ii) (iv) Are terminating repeating decimals.

EXERCISE 2.2

1. Fill in the boxes:

(i) 1^2 = ...
Sol. 1^2 = $1 \times 1 = 1$
(ii) 5^2 = 1+□+□+4+5+□+3+2+1
Sol. 5^2 =1+2+3+4+5+4+3+2+1
(iii) 6^2 = □+□+3+4+□+□+5+□ + □+□+1
Sol. 6^2 =1+2+3+4+5+6+5+4+3 +2+1
(iv) 9^2 = 1+2+3+4+5+6+7+8+9+□ □+□+□+□+□+□+□+□+ □
Sol. 9^2 =1+2+3+4+5+6+7+8+9 7+5+4+3+2+5+4+3+2+1

2. Find squares of the following:

(i) 17
Sol. $(17)^2 = 17 \times 17 = 289$
(ii) 21
Sol. $(21)^2 = 21 \times 21 = 441$
(iii) 101
Sol. $(101)^2 = 101 \times 101 = 10201$
(iv) 225
Sol. $(225)^2 = 225 \times 225 = 50625$
(v) 700
Sol. $(700)^2 = 700 \times 700 = 490000$
(vi) 999
Sol. $(999)^2 = 999 \times 999 = 998001$

3. In the following identify the numbers which are perfect square.

(i) 700 **Sol:** 700 not perfect square
(ii) 1600 **Sol:** $\sqrt{1600}$ = perfect square
(iii) 64000
Sol: $\sqrt{6400}$ = not perfect square
(iv) 81000 **Sol:** 81000
(v) 22500
Sol: $\sqrt{22500}$ = perfect square
Ans. ii, v, vi are perfect square.

EXERCISE 2.3

Q. 1. Find the square roots of the following:
(i) 5184

Sol. $\sqrt{5184}$

$$\begin{array}{r|l} & 72 \\ 7 & 5184 \\ & 49 \\ \hline 142 & 284 \\ & 284 \\ \hline & \end{array}$$

$\sqrt{5184} = 72$

(ii) **103041** **Sol:** $\sqrt{103041}$

$$\begin{array}{r|l} & 321 \\ 3 & 103041 \\ & 9 \\ \hline 62 & 130 \\ & 124 \\ \hline 611 & 641 \\ & 611 \\ \hline & \end{array}$$

$= 321$ **Ans.**

(iii) **418609** **Sol.** $\sqrt{418609}$

$$\begin{array}{r|l} & 647 \\ 6 & 418609 \\ & 36 \\ \hline 124 & 586 \\ & 496 \\ \hline 1287 & 9009 \\ & 9009 \\ \hline & \end{array}$$

$\sqrt{418609} = 647$

(iv) $\frac{144}{256}$

Sol. $\sqrt{\frac{144}{256}} = ?$

$$\begin{array}{r|l} & 12 \\ 12 & 144 \\ & 144 \\ \hline & \end{array}$$

$$\begin{array}{r|l} & 16 \\ 16 & 256 \\ & 256 \\ \hline & \end{array}$$

$$\sqrt{\frac{144}{256}} = \frac{12}{16} = \frac{3}{4}$$

(v) $1\frac{24}{25}$

Sol. $\sqrt{1\frac{24}{25}} = \sqrt{\frac{49}{25}} = ?$

$$\sqrt{\frac{49}{25}} = \frac{7\times 7}{5\times 5} = \sqrt{\frac{7^2}{5^2}}$$

$$= \frac{7}{5} = 1\frac{2}{5}$$

(vi) $1\frac{19}{81}$

Sol. $\sqrt{1\frac{19}{81}} = \sqrt{\frac{100}{81}} = ?$

$$\frac{\sqrt{100}}{\sqrt{81}} = \sqrt{\frac{(10)^2}{(9)^2}}$$

$$\frac{10}{9} = 1\frac{1}{9}$$

(vii) **0.04**

Sol. $0.04 = \frac{4}{100}$

$$\sqrt{\frac{4}{100}} = \frac{\sqrt{4}}{\sqrt{100}}$$

$$\sqrt{\frac{(2)^2}{(10)^2}} = \frac{2}{10}$$

$= 0.2$

(viii) **6.25**

Sol. $\sqrt{6.25} = \sqrt{\frac{625}{100}}$

$$\frac{\sqrt{625}}{\sqrt{100}} = \sqrt{\frac{(25)^2}{(10)^2}}$$

$$\frac{25}{10} = 2.5$$

(ix) **2.56**

Sol: $\sqrt{2.56}$

$$\begin{array}{r|l} & 1.6 \\ 1 & 2.56 \\ & 1 \\ \hline 26 & 156 \\ & 156 \\ \hline & \end{array}$$

= 1.6 Ans.

Q. 2. Find the square root of the following non-perfect squares.

(i) $\sqrt{2}$

Sol:

	1.414
1	2.00
	1
24	100
	96
281	400
	281
2824	11900
	11296

$\sqrt{2} = 1.414$

(ii) $\sqrt{3}$

Sol:

	1.732
1	3
	1
27	200
	189
343	1100
	1039
3462	6100
	6924

$\sqrt{3} = 1.732$

iii) 3.5

Sol:

	1.8708
1	3.5
	1
28	250
	224
367	2600
	2569
3708	310000
	299264

$\sqrt{3.5} = 1.8708$

(iv) 6

Sol. $\sqrt{6} = ?$

	2.489
2	6.000000
	4
44	200
	176
484	2400
	1936
4889	46400
	44001
	2399

$\sqrt{6} = 2.449$

(v) 7

Sol. $\sqrt{7} = ?$

	2.645
2	7.000000
	4
46	300
	276
524	2400
	2096
5285	30400
	26425
	3975

$\sqrt{7} = 2.646$

3. Find the number of digits in solution of the following numbers:

$\sqrt{196}, \sqrt{5184}, \sqrt{418609}, \sqrt{15129}, \sqrt{25}$

Sol. $\sqrt{196} = 2$

$\sqrt{5184} = 3$

$\sqrt{418609} = 3$

$\sqrt{15129} = 3$

$\sqrt{25} = 1$

Q. 4. Find the least number which must be subtracted from 10908 to get a perfect square?

Sol.

	104
1	10908
	1
204	0908
	816
	92

Subtracting 92 the remaining number 10816 is square.

5. The area of a square park is 1225m^2. Find the length of its side.

Sol. Area = 1225 m^2

Length of side $= \sqrt{1225} = ?$

35

3	1225
	9
65	325
	325

$\sqrt{1225}$ = 35

Length of side = 35 m

6. The area of square field is 9216 sq. meter, find its perimeter= 4 × side)

Sol. Area of square side = $9216m^2$

	96
9	9216
	81
186	1116
	1116

Length of one side = $\sqrt{9216}$

= 96 m

Perimeter = 96 × 4

= 384m

Q. 7. Area of a square field is 14400 sq. meter. How much string is required for fixing the sides? What will be its cost at the rate of Rs. 50 per meter?

Sol. Area of square field = 14400 m2

1 side of square = $\sqrt{14400}$ = ?

	120
1	14400
	1
22	44
	44

Area of square field = $120\ m^2$

1 side of square = $\sqrt{14400}$ = ?

Perimeter of square field = 120×4

Total expenditure @ 50/- per meter

= 480 × 59

= Rs. 24000

EXERCISE 2.4

1. Which of the following numbers are not perfect cubes?

(i) 216

Sol.

	216
6	36
6	6

216 = 6 × 6 × 6 Perfect cube

(ii) 128

Sol.

	128
2	64
2	32
2	16
2	8
2	4

128 = 2×2×2×2×2×2×2

Not perfect cube

(iii) 1000

Sol.

10	1000
10	100
	10

1000 = 10×10×10

Perfect cube

(iv) 100

Sol. 100 = 10 × 10

Not perfect cube

(v) 46656

Sol.

2	46656
2	23328
2	11664
2	5832
2	2916
2	1458
3	729
3	240
3	81
3	27
	9

46656 = 2×2×2×2×2×2×
3×3×3×3×3×3

36 = 2×2×3×3

Not perfect cube

2. Find cube of the following:

(i) 16

Sol. 16×16×16 = 4096

(ii) 20

Sol. 20×20×20 = 8000

iii) 55

Sol: $(55)^3 = 55×55×55 = 16375$

iv) 75

Sol: $(75)^3 = 75×75×75 = 4121875$

(v) 12

Sol: $(12)^3 = 12×12×12 = 1728$

(vi) –15

Sol. $-15\times-15\times-15 = -3375$

(vii) -8

Sol. $-8\times-8\times-8 = -512$

(viii) $\frac{1}{17}$ Sol. $\frac{1}{17}\times\frac{1}{17}\times\frac{1}{17}=\frac{1}{4913}$

(ix) $\frac{3}{19}$ Sol. $\frac{3\times3\times3}{19\times19\times19}=\frac{27}{6859}$

(x) $\frac{5}{13}$ Sol: $\frac{5\times5\times5}{13\times13\times13}=\frac{125}{2397}$

3. Find cube root of the following numbers:

(i) **2197**

Sol.

$\sqrt[3]{2197} = \sqrt[3]{13\times13\times13}$

$= 13$

(ii) **5832**

Sol: $5832 = \sqrt[3]{5832}$

$18\times18\times18 = 5832$

(iii) **3375**

Sol: $3375 = \sqrt[3]{3375}$

$15\times15\times15 = 3375$

(iv) **8000**

Sol.

$\sqrt[3]{8000} = \sqrt[3]{20\times20\times20}$

$= 20$

(v) **−1331**

Sol. $\sqrt[3]{-1331}$

$\sqrt[3]{-11\times-11\times-11}$

$-9261 = -21\times-21\times-21$

(vi) **−9261**

Sol.

$-9261 = -21\times-21\times-21$

$\sqrt[3]{-21\times-21\times-21} = (-21)^{3\times1/3}$

$= -21$

(vii) **6859**

Sol: $6859 = \sqrt[3]{6859}$

$19\times19\times19 = 6859$

(viii) $\frac{125}{4096}$

Sol. $\sqrt[3]{\frac{125}{4096}} = \frac{5\times5\times5}{16\times16\times16} =$

$\sqrt[3]{\frac{5^3}{16^3}} = \frac{5^{3\times\frac{1}{3}}}{16^{3\times\frac{1}{3}}}$

$= \frac{5}{16}$

(ix) $\frac{27}{2744}$

Sol: $\frac{27}{2744} = \sqrt[3]{\frac{27}{2744}}$

$\frac{3\times3\times3}{14\times14\times14}=\frac{27}{2744}$

$\sqrt[3]{\frac{27}{2744}} = \frac{3}{14}$

(x) $\frac{1}{729}$

Sol. $\sqrt[3]{\frac{1}{729}} = \sqrt[3]{\left(\frac{1}{9}\right)^3} = \left(\frac{1}{9}\right)^{3\times\frac{1}{3}} = \frac{1}{9}$

4. (i) Find the value of $\sqrt[3]{1000}$

(ii) Find the value of $\sqrt[3]{-125}$

(i) $\sqrt[3]{1000}$

Sol. $\sqrt[3]{1000} = \sqrt[3]{10^3}$

$= \sqrt[3]{10\times10\times10} = 10^{3\times\frac{1}{3}}$

(ii) $\sqrt[3]{-125}$

Sol. $\sqrt[3]{-125} = \sqrt[3]{-125}$

$= \sqrt[3]{-5\times-5\times-5} = -5^{3\times\frac{1}{3}} = -5$

5. If $a^3 = 729$, what is a?

$a^3 = 729$

Sol. $\sqrt[3]{a^3} = \sqrt[3]{729}$

$= \sqrt[3]{9\times9\times9} = a^{3\times\frac{1}{3}} = 9^{3\times\frac{1}{3}}$

$a = 9$

REVIEW EXERCISE 2

1. Fill in the blanks:

(i) A rational number is such number that ca n be written in the form of _____

(ii) Union of rational and irrational numbers is _____ number.

(iii) Square of 25 is _____.

(iv) In case of rational numbers, denominator cannot be _____.
(v) Cube root of 125 is _____.
(vi) Perfect squares have _____ number of zeros at end.
(vii) There are _____ methods of finding a square root.
(viii) The product of three identical numbers is referred to as _____
(ix) Cube root of 343 is _____.
(x) Cube and cube root are ___ of each other.

Ans. (i) $\frac{P}{Q}$
(ii) Real numbers
(iii) $(25)2 = 625$
(iv) 0 (v) $\sqrt[3]{125} = \sqrt[3]{5\times5\times5} = 5$
(vi) 2 (vi) 2 (vii) Cube
(viii) $\sqrt[3]{343} = \sqrt[3]{7\times7\times7} = 7$
(ix) Inverse (x)

Q. 2. Tick the right answer:

(i) $Q \cup Q' =$ _____
(a) W (b) N
(c) R (d) Z

(ii) 0.333..... is called _____ decimal.
(a) Non-recurring
(b) Terminating
(c) Recurring (d) None

(iii) $\pi =$ _____
(a) 0.21539... (b) 0.31415...
(c) 3A415... (d) 2.1539...

(iv) The squared 16 is:
(a) 4 (b) 8
(c) 160 (d) 256

(v) "$\sqrt{}$" is called:
(a) Cube root (b) Summation
(c) Radical symbol (d) Phi

(vi) $6^3 =$ _____ **is called:**
(a) 6 (b) 18
(c) 36 (d) 216

(vii) Which of the following is a perfect square?
(a) 99 (b) 120
(c) 169m (d) 288

(viii) $\sqrt{3\times3} =$ _____.
(a) 1 (b) 3
(c) 9 (d) 0

(ix) The cubed of a proper fraction is always ____ the original fraction.
(a) Greater than (b) Smaller than
(c) Equal to (d) None

(x) Which of the following is a perfect cube?
(a) 64.25 (b) 36
(c) 49 (d) 64

(xi) Which number is an irrational number?
(a) $\frac{1}{2}$ (b) $\sqrt{2}$
(c) -2 (d) 2

(xii) Which statement is false?
(a) all integers are rational numbers.
(b) every whole number is a natural number
(c) all natural numbers are integers.
(d) every real number is either a rational or irrational number

Ans.

(i)	(c)	(ii)	(c)	(iii)	(c)	(iv)	(d)
(v)	(c)	(vi)	(d)	(vii)	(c)	(viii)	(b)
(ix)	(b)	(x)	(d)				

3. Separate rational and irrational numbers from the following:

(i) -12 (ii) $\sqrt{5}$
(iii) $\frac{5}{3}$ (iv) $-3\sqrt{5}$
(v) $\sqrt{5/3}$ (vi) $\sqrt{121}$
(vii) $3\sqrt{9}$ (viii) $-\frac{2}{9}$

Sol. (i) -12 Rational
(ii) $\sqrt{5}$ Irrational
(iii) $\frac{5}{3}$ Rational
(iv) $-3\sqrt{5}$ Irrational
(v) $\sqrt{\frac{-5}{3}}$ Irrational
(vi) $\sqrt{121}$ Irrational
(vii) $3\sqrt{9}$ Irrational
(viii) $-\frac{2}{9}$ Rational

Q.4. Find squares of the following:
(i) 3 (ii) 9
(iii) 11 (iv) 13

(v) 17

Sol.

(i) $(3)^2 = 9$ (ii) $(9)^2 = 81$

(iii) $(11)^2 = 121$ (iv) $(13)^2 = 169$

(v) $(17)^2 = 289$

Q. 5. Find square root of the following:

(i) $\sqrt{256} = 16$

(ii) $\sqrt{196} = 14$

(iii) $\sqrt{225} = 15$

(iv) $\sqrt{121} = 11$

(v) $\sqrt{144} = 12$

Q. 6. Find cubes of the following:

(i) 2 (ii) 5

(iii) 7 (iv) 11

(v) 14

Sol.

(i) $(2)^3 = 8$

(ii) $(5)^3 = 125$

(iii) $(7)^3 = 343$

(iv) $(14)^3 = 2744$

Q. 7. Find cube-root of the following:

(i) 64 (ii) 216

(iii) 512 (iv) 729

(v) 1728

Sol.

(i) $\sqrt[3]{64} = 4^{3\times\frac{1}{3}} = 4$

(ii) $\sqrt[3]{216} = 6^{3\times\frac{1}{3}} = 6$

(iii) $\sqrt[3]{512} = 8^{3\times\frac{1}{3}} = 8$

(iv) $\sqrt[3]{729} = 9^{3\times\frac{1}{3}} = 9$

(v) $\sqrt[3]{1728} = 12^{3\times\frac{1}{3}} = 12$

Unit 3

NUMBERS SYSTEM

EXERCISE 3.1

Q. 1. Convert the following into binary system:

(i) 7

Sol.

2	7
2	3 – 1
6	1 – 1

7 = $(111)_2$

(ii) 127

Sol.

2	127
2	63 – 1
2	31 – 1
2	15 – 1
2	7 – 1
2	3 – 1
2	1 – 1

127 = $(1111111)_2$

(iii) 72

Sol.

2	72
2	36–0
2	18–0
2	9–0
2	4–1
2	2–0
	1–0

72 = $(1001000)_2$

(iv) 689

Sol.

2	689
2	344 – 1
2	172 – 0
2	86 – 0
2	43 – 0
2	21 – 1
2	10 – 1
2	5 – 0
2	2 – 1
	1 – 0

689 = $(1010110001)_2$

(v) 58

Sol.

2	58
2	29 – 0
2	14 – 1
2	7 – 0
2	3 – 1
2	1 – 1

58 = $(111010)_2$

Q. 2. Convert the following into decimal system:

(i) $(11)_2$

Sol. $(11)_2 = 1\times2^1+1\times2^0$
$= 2+1$
$= 3$

(ii) $(1001)_2$

Sol. $(1001)_2 = 1\times2^3+0\times2^2+0\times2^1+1\times2^0$
$= 8+0+0+1$
$= (1001)_2 = 9$

(iii) $(101)_2$

Sol. $(101)_2 = 1\times2^2+0\times2^1+1\times2^0$
$= 4+0+1$
$= 5$

(iv) $(10101)_2$

Sol.
$(10101)_2 = 1\times2^4+0\times2^3+1\times2^2+0\times2^1+1\times2^0$
$= 16+0+4+0+1$
$= 21$

(v) $(110)_2$

Sol. $(110)_2 = 1\times2^2+1\times2^1+0\times2^0$
$= 4+2+0$
$= 6$

Q. 3. Convert the following into a system with base 5:

(i) 18

Sol.

5	18
	3–3

$18 = (33)_5$

(ii) 574

Sol.

5	574
5	114–4
5	22 – 4
	4 – 2

$574 = (4244)_5$

(iii) 699 **Sol.**

5	699
5	139 – 4
5	27 – 4
5	5 – 2
	1 – 0

$699 = (10244)_5$

(iv) 4890 **Sol.**

5	4890
5	978–0
5	195–3
5	39–0
5	7–4
	1–2

$4890 = (124030)_5$

Q. 4. Convert the following into decimal system:

(i) $(4213)_5$ **Sol.**

$(4213)_5 = 4\times5^3+2\times5^2+1\times5^1+3\times5^0$
$= 500 + 50 + 5 + 3 = 558$

(ii) $(24241)_5$

Sol. $(24241)_5$
$= 2\times5^4+4\times5^3+2\times5^2+4\times5^1+1\times5^0$
$= 1250 +500 + 50 +20+1$
$= 1821$

(iii) $(4433)_5$

Sol. $(4433)_5$
$= 4\times5^3+4\times5^2+3\times5^1+3\times5^0$
$= 500+100 + 15 + 3$
$= 618$

(iii) $(443341)_5$

Sol. $(443341)_5$
$= 4\times5^5+4\times5^4+3\times5^3+3\times5^2+4\times5^1+1\times5^0$
$= 12600+2500 + 375 + 75 + 20 + 1$
$= 15471$

(iv) $(42424)_5$

Sol. $(42424)_5$
$= 4\times5^4+2\times5^2+4\times5^2+2\times5^1+4\times5^0$
$= 4\times625 + 2\times75 + 4\times25 + 2\times5 + 4\times1$
$= 2500+150+100+10+4$
$= 2764$

Q.5. Convert the following into octa system.

(i) 9874 **Sol.**

8	9874
8	1234–2
8	154–2
8	19–2
	2–3

$9874 = (23222)_8$

(ii) 98712 **Sol.**

8	98712
8	12339–0
8	1542–3
8	192–6
8	24–0
	3–0

$98712 = (300630)_8$

(iii) 879874 **Sol.**

8	879874
8	109984–2
8	13748–0

8	1718–4
8	214–6
8	26–6
	3–2

879874 $= (3266402)_8$

(iv) **997874** **Sol.**

8	997874
8	124734–2
8	15591–6
8	1948–7
8	118–4
8	14–6
	1–6

997874 = $(1664762)_8$

Q.6. Convert into decimal system.

(i) **$(76547)_8$**

Sol. $(76547)_8$

$= 7\times8^4+6\times8^3+5\times8^2+4\times8^1+7\times8^0$

$= 28672+3072+320+32+7$

$= 32103$

(ii) **$(741257)_8$**

Sol. $(741257)_8$

$= 7\times8^5+4\times8^4+1\times8^3+2\times8^2+5\times8^1+7\times8^0$

$= 229376+16384+=512+128+40+7$

$= 246447$

(iii) **$(754577)_8$**

Sol. $(754577)_8$

$= 7\times8^5+5\times8^4+4\times8^3+5\times8^2+7\times8^1+7\times8^0$

$= 229376+20480+=2048+270+56+7$

$= 252237$

(iv) **$(7567424)_8$**

Sol. $(7567424)_8$

$= 7\times8^6+5\times8^5+6\times8^4+7\times8^3+4\times8^2+2\times8^1+4\times8^0$

$= 1835008+163840+= 24576+3584+256+16+4$

$= 2027284$

EXERCISE 3.2

1. Solve the following:

(i) **$(11)_2 + (10)_2$** **Sol.**

$$\begin{array}{r} (11)_2 \\ +(10)_2 \\ \hline (101)_2 \end{array}$$

(ii) $(101)_2 + (110)_2$

Sol.

$$\begin{array}{r} (101)_2 \\ +(110)_2 \\ \hline (1011)_2 \end{array}$$

(iii) **$(111)_2 + (1001)_2$**

Sol.

$$\begin{array}{r} (111)_2 \\ +(1001)_2 \\ \hline (10000)_2 \end{array}$$

(iv) **$(1101)_2 + (11111)_2$**

Sol.

$$\begin{array}{r} (1101)_2 \\ +(11111)_2 \\ \hline (101100)_2 \end{array}$$

(v) **$(10001)_2 + (100111)_2$**

Sol.

$$\begin{array}{r} (10001)_2 \\ +(100111)_2 \\ \hline (111000)_2 \end{array}$$

(2) Evaluate:

(i) **$(11)_2 - (10)_2$**

Sol.

$$\begin{array}{r} (11)_2 \\ -(10)_2 \\ \hline (1)_2 \end{array}$$

(ii) **$(101)_2 - (100)_2$**

Sol.

$$\begin{array}{r} (101)_2 \\ -(100)_2 \\ \hline (1)_2 \end{array}$$

(iii) **$(11111)_2 - (1101)_2$**

Sol.

$$\begin{array}{r} (11111)_2 \\ -(1101)_2 \\ \hline (10010)_2 \end{array}$$

(iv) **$(1001)_2 - (111)_2$**

Sol.

$$\begin{array}{r} (1001)_2 \\ -(111)_2 \\ \hline (10)_2 \end{array}$$

(v) **$(110000)_2 - (1001)_2$**

Sol.

$$\begin{array}{r} (110000)_2 \\ -(1001)_2 \\ \hline (100111)_2 \end{array}$$

(3) Evaluate

(i) **$(101)_2 \times (101)_2$**

Sol.

$$\begin{array}{r} (101)_2 \\ -(101)_2 \\ \hline 101 \\ 000\times \\ 101\times \\ \hline \end{array}$$

11001

(ii) $(1101)_2 - (110)_2$

Sol.

$(1101)_2$
$(110)_2$
0000
1101×
1101×
$(1001110)_2$

(iii) $(10101)_2 \times (101)_2$

Sol.

$(10101)_2$
$\times (101)_2$
10101
00000×
10101×
$(1101001)_2$

(iv) $(11101)_2 \times (111)_2$

Sol.

$(11101)_2$
$\times (111)_2$
11101
11101×
11101×
$(11001011)_2$

(v) $(10101)_2 \times (100)_2$

Sol.

$(10101)_2$
$\times (100)_2$
00000
00000×
10101×
$(1010100)_2$

EXERCISE 3.3

1. Simplify:

(i) $(34)_5 + (44)_5$

Sol.

$(34)_5$
$+ (44)_5$
$(133)_5$

(ii) $(134)_5 + (431)_5$

Sol.

$(134)_5$
$+ (431)_5$
$(1120)_5$

(iii) $(2444)_5 + (4133)_5$

Sol.

$(2444)_5$
$+ (4133)_5$
$(12132)_5$

(iv) $(210342)_5 + (320144)_5$

Sol.

$(210342)_5$
$+ (320144)_5$
$(1031041)_5$

(v) $(433334)_5 + (410002)_5$

Sol.

$(433334)_5$
$+ (410002)_5$
$(1343341)_5$

2. Simplify:

(i) $(43)_5 - (14)_5$

Sol.

$(43)_5$
$- (14)_5$
$(24)_5$

(ii) $(431)_5 - (134)_5$

Sol.

$(431)_5$
$- (134)_5$
$(242)_5$

(iii) $(1422)_5 - (1043)_5$

Sol.

$(1422)_5$
$- (1043)_5$
$(324)_5$

EXERCISE 3.4

1. Simplify:

(i) $(63)_8 + (43)_8$

Sol.

$(63)_2$
$+ (43)_8$
$(126)_8$

(ii) $(77)_8 + (102)_8$

Sol.

$(77)_2$
$+ (102)_8$
$(201)_8$

(iii) $(374)_8 + (677)_8$

Sol.

$(374)_2$
$+ (677)_8$
$(1273)_8$

2. Solve

(i) $(64)_8 - (41)_8$

Sol.

$$\begin{array}{r} (64)_8 \\ (41)_8 \\ \hline (23)_8 \end{array}$$

(ii) $(661)_8 - (55)_8$

Sol.

$$\begin{array}{r} (661)_8 \\ -(55)_8 \\ \hline (604)_8 \end{array}$$

(iii) $(13615)_8 - (4726)_8$

Sol.

$$\begin{array}{r} (13615)_8 \\ -(4726)_8 \\ \hline (6667)_8 \end{array}$$

2. **Simplify:**

(i) $(64)_8 \times (41)_8$

Sol.

$$\begin{array}{r} (64)_8 \\ \times (41)_8 \\ \hline 64 \\ 320\ \times \\ \hline (3264)_2 \end{array}$$

(ii) $(411)_8 \times (76)_8$

Sol.

$$\begin{array}{r} (411)_8 \\ \times (76)_8 \\ \hline 3066 \\ 3477\ \times \\ \hline (40056)_8 \end{array}$$

(iii) $(555)_8 \times (444)_8$

Sol.

$$\begin{array}{r} (555)_8 \\ \times (444)_8 \\ \hline 2664 \\ 2664\times \\ \hline (320124)_8 \end{array}$$

EXERCISE 3.5

1. **Simplify and express the answer in decimal number systems.**

(i) $71 + (132)_5 + (1001)_2$

Sol. $71 + \{1\times5^2+3\times5^1+2\times5^0\} + \{1\times2^3+0\times2^2+0\times2^1+1\times2^0\} + 71 + 42 + 9 = 122$

(ii) $68 - (101)_2 + (10)_8$

Sol. $68 - \{1\times2^2+0\times2^1+1\times2^0\} + \{1\times8^1+0\times8^0\} + \{8\}$
$68 - 5 + 8 = 71$

(iii) $(1010)_2 - (43)_5 + (43)_8$

Sol. $\{1\times2^3+0\times2^2+1\times2^1+0\times2^0\} + \{4\times5^1+3\times5^0\} + \{4\times8^1+3\times8^0\}$
$\{8+0+2+0\} + \{20+3\} + \{32+3\}$
$10 + 23 + 35 = 68$

(iv) $(1011)_2 \times (44)_5 - (17)_8$

Sol. $\{1\times2^3+0\times2^2+1\times2^1+1\times2^0\} + \{-4\times5^1+4\times5^0\} - \{1\times8^1+7\times8^0\}$
$11 \times 24 - 15$
$264 - 15 = 249$

(v) $(1423)_5 \times (110001)_2 - (241)_5$

Sol. $\{1\times5^3+4\times5^2+2\times5^1+3\times5^0\} \times \{2^5\times1+2^4\times1+2^3\times0+2^2\times0+2^1\times0+2^0\times1\} - \{2\times5^2+4\times5^1+1\times5^0\}$
$\{125+100+10+3\} \times \{32+16+0+0+0+1\} - \{-50 + 20 + 1\}$
$= 238 \times 49 - 71$
$11662 - 71 = 11591$

(vi) $(101010)_2 \times (342)_5 - (43)_8$

Sol. $\{1\times2^5+0\times2^4+1\times2^3+0\times2^2+1\times2^1+0\times2^0\} \times \{3\times5^2+4\times5^1+2\times5^0\} \times \{4\times8^1+3\times8^0\}$
$\{32+0+8+0+2+0\} \times \{75+20+2\}$
$42 \times 97 \times 35 = 142590$

(vii) $\{(4431)_5 - (11101)_2\} \times \{(447)_8 - (441)_5\}$

Sol. $\{4\times5^3+4\times5^2+3\times5^1+1\times5^0\} - \{1\times2^4+1\times2^3+1\times2^2+0\times2^1+1\times2^0\} \times \{4\times8^2+4\times8^1+7\times8^0\} - \{4\times5^2+4\times5^1+1\times5^0\} - \{500+100+15+1\} - \{16+8+4+0+1\} \times \{256+32+7\} - \{100+20+1\}$
$= \{616-29\} \times \{295-121\}$
$= 587 \times 174 = 102138$

REVIEW EXERCISE 3

Q.1. Tick (✓) the correct answer.

(i) $(10)_2 + (10)_2 =$ _____

(a) $(10)_2$ (b) $(110)_2$
(c) $(100)_2$ (d) $(111)_2$

(ii) **"Four hundred and two" represents:**

(a) $(402)_5$ (b) $(402)_8$
(c) (402) (d) All of these

(iii) **In converting octal number to decimal number, each digit is multiplied with some power of:**

(a) 8 (b) 10
(c) 2 (d) 5

(iv) The third place value in base 5 number system is:
(a) 25 (b) 75
(c) 125 (d) 130

(v) To convert a decimal number into binary number, the number is divided with:
(a) 0 (b) 1
(c) 2 (d) 10

(vi) 10+3 in decimal will be ____ in base 5.
(a) $(13)_5$ (b) $(23)_5$
(c) $(20)_5$ (d) $(30)_5$

(vii) Number of digits used in base 5 number system are:
(a) 10 (b) 8
(c) 5 (d) 2

(viii) $5^2\times1+5^1\times2+5^0\times1$ = _____
(a) 36 (b) $(36)_5$
(c) 121 (d) 210

(viii) $5^2\times1+5^1\times2+5^0\times1$ = _____
(a) 36 (b) $(36)_5$
(c) 121 (d) 210

(ix) $(432)_5 - (234)_5$ = _____
(a) $(243)_5$ (b) $(143)_5$
(c) $(341)_5$ (d) $(241)_5$

(x) We write 9 in binary system as:
(a) $(1100)_2$ (b) $(1010)_2$
(c) $(1001)_2$ (d) $(1110)_2$

Ans.

(i)	(c)	(ii)	(c)	(iii)	(a)	(iv)	(c)
(v)	(c)	(vi)	(b)	(vii)	(c)	(viii)	(a)
(ix)	(b)	(x)	(c)				

Q.2. Fill in the blanks with suitable words:

(i) The number system with base 2 is called _____

(ii) $(85901)_{10}$ is known as _____

(iii) Binary system is based on '0' and _____

(iv) The equivalent of $(101)_2$ in decimal system is _____

(v) Commonly used number system is _____

(vi) $(303)_5$ = (_____)

(vii) Base 8 number system is also known as _____ number system.

(viii) $(523)_8$ = (_____)

(ix) In octal system 18 is written as _____

Ans. (i) Binary system
(ii) 8590 (iii) 1
(iv) 5
(v) Decimal
(vi) 78
(vii) Octal system
(viii) 339
(ix) 33

Q.3. Define the following:
(i) Binary system
(ii) System with base 5
(iii) Octal system
(iv) Decimal system

(i) Binary system

Ans. Binary System.
Number system formed by digits 0 and 1 is called binary system.

(ii) System with base 5

Ans. System with base 5
Number system formed by five digits (0.1.2.3.4) is called number system with 5.

(iii) Octal system

Ans. Octal System.
Number system formed b y eight digits (0,1,2,3,4,5,6,7) is called octal system.

(iv) Decimal system

Ans. Decimal System.
Number system by ten digits (0,1,2,3,4,5,6,7,8,9) is called decimal system.

Q.4. Convert following numbers into decimal numbers.
(i) $(10101)_2$ (ii) $(110001)_2$
(iii) $(2310)_5$ (iv) $(7216)_8$
(v) $(111010)_2$ (vi) $(4215)_5$
(vii) $(6523)_8$ (viii) $(110011)_2$

(i) $(10101)_2$
Sol. $1\times2^4+0\times2^3\times1\times2^2+0\times2^1+1\times2^0$
$16+0+4+0+1 = 21$

(ii) $(110001)_2$
Sol. $1\times2^5+1\times2^4\times0\times2^3+0\times2^2+0\times2^1+1\times2^0$
$32+16+0+0+0+1 = 49$

(iii) $(2310)_5$
Sol. $2\times5^3+3\times5^2+1\times5^1+0\times5^0$
$250 + 75 + 5 + 0 = 330$

(iv) $(7216)_8$
Sol. $7\times8^3+2\times8^2\times1\times8^1+6\times8^0$
$3584 + 128 + 8 + 0 = 3726$

(v) $(111010)_2$
Sol. $1\times2^5+1\times2^4+1\times2^3\times0\times2^2+1\times2^1+0\times2^0$
$32 + 16 + 8 + 0 + 2 + 0 = 58$

(vi) $(4215)_{10}$
Sol. $4\times10^3\times2\times10^2+1\times10^1+5\times10^0$
$4000 + 200 + 10 + 5 = 4215$

(vii) $(6523)_8$

Sol. $6\times8^3+5\times8^2+2\times8^1+3\times8^0$
$3072 + 320 + 16 + 3 = 3411$

(viii) $(110011)_2$
Sol. $1\times2^5+1\times2^4+0\times2^3+0\times2^2+1\times2^1+1\times2^0$
$32 + 16 + 0 + 0 + 2 + 1 = 51$

Q.5. Solve the following questions and write answers in all the four number systems.

(i) $(565)_8 + (23314)_5 - (10010100)_2$
Sol. $(565)_8 = 5\times8^2+6\times8^1\times5\times8^0$
$= 320 + 48 + 5$
$= 373$

$(23314)_5$
$= 2\times5^4+3\times5^3+3\times5^2+1\times5^1+4\times5^0$
$= 1250+375+75+5+4$
$= 1709$

$(10010001)_2 = 1\times2^9+0\times2^7+0\times2^6+1\times$
$2^5+0\times2^4+1\times2^3+0\times2^2+$
$0\times2^1+1\times2^0$
$= 256+0+0+32+0+$
$8+0+1 = 297$

$373 + 1709 - 297 = 1785$

8	1785
8	223–1
8	27–7
8	3–3

$= 3371$

5	1785
5	357–0
5	71–2
5	14–1
	2–4

$1785 = (24120)_5$

2	1785
2	892–1
2	446–0
2	223–0
2	111–1
2	55–1
2	27–1
2	13–1
2	6–1
2	3–0
	1–1

$1785 = (11011111001)_2$

(ii) $(3214)_5+(100101001)_2+(6532)_8$
Sol. $(3214)_5 = 3\times8^3+2\times8^2+1\times8^1+4\times8^0$
$= 1536+128+8+4 = 1676$

$(100101021)_2 = 1\times2^8+0\times2^7+0\times2^6+1\times$
$2^5+0\times2^4+1\times2^3+0\times2^2+$
$0\times2^1+1\times2^0$
$= 256+0+0+32+0+8+0$
$0 + 0 + 1 = 297$

$(6532)_8 = 6\times8^3+5\times8^2+3\times8^1+2\times8^0$
$= 3072+320+24+2 = 3418$

$1676 + 297 + 3418 = 5391$

$5391 =$

5	5391
5	1078–1
5	215–3
5	43–0
5	8–3
	1–3

$= (133031)_5$

$5391 =$

2	5391
2	2695–1
2	1347–1
2	673–1
2	336–1
2	168–0
2	84–0
2	42–0
2	21–0
2	10–1
2	5–0
2	2–1
	1–0

$= (1010100001111)_2$

$5391 =$

8	5991
8	748 – 7
8	93 – 4
8	11 – 5
	1 – 3

$= (13547)_8$

Unit 4

FINANCIAL ARITHMETIC

EXERCISE 4.1

1. 10 composers compose a book of 75 pages in 5 days. In how many days will the same composers compose a book of 45 pages?

Sol.

Writers	Pages	Days
10	75	5
10	45	□

Writers = 10 : 10 :: 5 : □

Pages = 75 : 45

□ = $\frac{10 \times 45 \times 5}{10 \times 75}$

30 days

Q. 2. Wheat costing Rs. 480 is needed for 8 members for 20 days. What is the cost of wheat required for 12 members for 15 days?

Members	Days	Cost
8	20	480
12	15	□

Member = 8 : 12 :: 480 : □

Days = 20 : 15

□ = $\frac{12 \times 15 \times 480}{8 \times 20}$

Rs. 540

Q. 3. The hostel charges Rs. 6300 for 35 students for 24 days, in how many days will the hostel charges be Rs. 3375 for 25 students.

Sol.

Students	Charges	Days
35	6300	24
25	3375	□

Students = 25 : 35 :: 24 : □

Charges = 6300 : 3375

□ = $\frac{35 \times 3375 \times 24}{25 \times 6300}$

18 days

Q. 4. Murtaza and Faraz started a business of furniture. They invested amount of Rs. 64000 each. Sagheer joined them after 4 months and invested Rs. 48000. After one year they earned profit of Rs. 100000. Find the share of each partner.

Sol. Investment of Murtaza

= 12 × 7400 = Rs. 888000

Investment of Faraz

= 12 × 7400 = Rs. 888000

Investment of Sagheer

= 8 × 48000 = Rs. 384000

Murtaza	Faraz	Sagheer
8888000	8888000	384000
111	111	68

Sum of ratio: = 11 +111+68 = 290

Share of Murtaza = $\frac{100000 \times 11}{290}$ = Rs. 40000

Share of Faraz = $\frac{100000 \times 11}{290}$ = Rs. 40000

Share of Sagheer = $\frac{100000 \times 68}{290}$ = Rs. 2000

Q.5. Three brothers started a business of bricks and cement. Their ratio of investment was 2:3:4. If they earned profit of Rs. 72000, then find the share of each brother.

Sol. Total profit = Rs. 72000

Ratio in investment = 2 : 3 : 4

Sum of ratio = 2+3+4 = 9

Share of 1st brother = $\frac{72000 \times 2}{9}$

= Rs. 16000

Share of 2nd brother = $\frac{72000 \times 4}{9}$

= Rs. 24000

Share of 3rd brother = $\frac{72000 \times 4}{9}$

= Rs. 32000

Q. 6. Distribute Rs. 80,000 among Majid, Sajid and Sultan in such a awy that Majid gets 4 times of Sajid and Sajid gets 3 times of sultan.

Sol.

Sultan	Sajid	Majid
1	1×3=3	4×3=12

Sum of ratios = 1+3+12=16

Share of Sultan = $\frac{80000}{16} \times 1$ = Rs. 5000

Share of Sajid = $\frac{80000}{16} \times 3$ = Rs. 1500

Share of Majid = $\frac{80000 \times 12}{16}$ = Rs. 60000

Q. 7. Younas left property of Rs. 250000 for his 2 sons and one daughter. If each

son gets 2 times of a daughter, then find the share of each.

Sol.

Son	Daughter
2	1

2 : 1

2× 2 : 1 × 1

4 : 1

Sum of ratios= 4 + 1 = 5

Total property = Rs. 250,000

$$\text{Share of son} = \frac{25000}{5} \times 2 = \text{Rs. } 100000$$

$$\text{Share of daughter} = \frac{25000 \times 51}{5} = \text{Rs. } 50,000$$

EXERCISE 4.2

1. If Rs.10,000 is invested for 6 years at 16% then how much markup will be earned?

Sol: Amount invested = Rs.10,000

Period = 6 years

Rate = 16%

$$\text{Mark up} = \frac{10,000 \times 16 \times 6}{100}$$

= Rs. 9600

2. Find the principal, if the amount of markup for 5 years at 5% is Rs.5550.

Sol: Markup= Rs 5550

Period = 5 year

Rate = 5 %

$$\text{Principal} = \frac{5550 \times 10}{5 \times 5}$$

= Rs. 22,200

3. If 152 Pakistani Rupees (PKR) are to one UK pound then how many Pounds can be obtained for Rs.697072?

Sol: Rs 152 Pakistani rupees = 1 UK Pound

$$\text{Rs 69702 Pakistani rupees} = \frac{697072}{152}$$

= Rs 5600

4. Ali went to a money exchanger. He wants to exchange 35 US dollars into PKR. If the rate of exchange of one US dollar is Rs. 110 then how many rupees will he get?

Sol: 1 US dollar = Rs 110

35 US dollars = 110×35 = Rs 3850

5. If one KSA Royal is equal to 18 PRK then how many KSA Royals are equal to Rs. 17,046?

Sol: 18 PKR = 1 KSA Reyal

$$17046 \text{ PKR} = \frac{17046}{18}$$

= 947 KSA

6. Mr. Shehzad wants to exchange PKR. 50,000 to US dollars. How many dollars will he receive? (1 US Dollar is 110 PKR).

Sol: 110PKR = 1 US dollar

50,000

$$\frac{50000}{110} = 454.60 \text{ US dollars}$$

7. Convert 735 £ into PKR. (1 UK pound is 152 PKR).

Sol: 1 UK Pound = Rs 152

735 £ = Rs 735 × 152 = Rs 53420

8. Convert €1205 into PKR. (1 Euro is 95 PKR).

Sol: 1 Euro = Rs 95

1205 Euro = 120× 95 = Rs 114475

EXERCISE 4.3

Q.1. Find the profit/loss percentage if;

(i) Cost price = Rs, 570, Sale price = Rs. 750

(ii) Cost price = Rs. 850, Sale price = Rs. 975

(iii) Cost price = Rs. 655, Sale price = Rs. 400

Sol. Cost price = Rs. 570

Sale price = Rs.750

Profit =Rs. 750 – 570

= Rs.180

$$\text{Profit \%} = \frac{180 \times 100}{570}$$

= 32%

(ii)

Sol. Cost price = Rs. 850

Sale price = Rs. 975

Profit =Rs. 975 – 850

= Rs.125

$$\text{Profit \%} = \frac{125 \times 100}{850}$$

= 14.71%

(iii) Cost price = Rs. 655

Sale price = Rs. 400
Profit = Rs. 655 – 400 = Rs.255

$$\text{Profit\%} = \frac{255\times100}{655} = 39\%$$

Q. 2. Find the % discount if;

(i) Marked Price = Rs 850
Sale Pirce = Rs 765
Discount = 850 – 765 = Rs 85

$$\% \text{ discount} = \frac{85}{850}\times100 = 10\%$$

(ii) Marked Price = Rs 675
Sale Price = Rs 573.75
Discount = Rs 675 – 573.5 = 101.25

$$\text{Discount} = \frac{101.25\times100}{675}$$

(iii) Marked Price = Rs 240
Sale Price = Rs 236
Discount = Rs 240 – Rs 236 = 4

$$\text{Discount \%} = \frac{4}{240}\times 100$$

$$= \frac{10}{6} = 1\frac{4}{6} = 1\frac{2}{3}\%$$

3. The cost price a sofa set is Rs.20000 and its sale price is Rs. 25000. Find profit or loss percentage.

Sol: cost price = Rs 20000
Sale price = Rs 25000
Profit = Rs 25000 – Rs 2000 = Rs 5000

$$\text{Profit \%} \frac{5000\times100}{20000} = 25\%$$

4. If written price of a basket is Rs. 50 and a sales man offers Rs.2.50 discount on it. Find % discount.

Sol: Marked Price = Rs 50
Discount = Rs 2.50

$$\text{Discount \%} = \frac{2.50\times100}{50} = 5\%$$

5. Estimate what percent discount will receive if Nazia buys the microscope kit advertised below.

Sol: Marked Price = 700.95
Sale Price = 600.95
Discount = 700.95 – 600.95 – Rs 100

$$\text{Discount \%} = \frac{100\times100}{700.95} = 14\%$$

EXERCISE 4.4

Q.1 If the amount of premium calculated as;
Yearly premium = @ 4.5% of policy:
Half Yearly Premium = @ 52% of yearly premium
Quarterly premium = @ 27% of yearly premium
Monthly premium = @ 9% of yearly premium
Policy fee = @ 0.25%
then tell the total amount payable to the company for Rs.100,000.

Sol. Amount of policy = Rs. 100,000

$$\text{Annual} = \frac{100000}{100}\times\frac{45}{10} = 4500$$

$$\text{Policy fee @ 0.25\%} = \frac{100000}{100}\times\frac{25}{10} = 4500$$

Annual premium = Rs.4500+250 = Rs.4750

$$\text{Half premium} = \frac{100000\times52}{100} = \frac{4750\times52}{100}$$

= Rs.2470

$$\text{Quarterly premium} = \frac{4750\times27}{100}$$

= Rs.1282.50

$$\text{Monthly premium} = \frac{4750\times9}{100} = \frac{855}{2}$$

= Rs.427.50

Total amount payable = Rs.4750+2470+1282.50=427.50 = Rs.8930

Q.2. Sol:
Principal amount = Rs 500,000

$$\text{Annual Premium} = 4.5\% = \frac{500\times4.5}{100}$$

$$\text{Fee} = 0.25\% = \frac{500{,}000}{100}\times\frac{25}{100}$$

Annual Premium = Rs22500+1250 = Rs 33750

Q.3.
Sol:
Motor cycle Price = Rs 50,000
Rate of insurance = 4.5%

$$\text{Amount of insurance} = \frac{50{,}000\times45}{100\times10} = \text{Rs } 2250$$

Amount payable = Rs 50,000 + Rs 2250 = Rs.52250

Q.4. The value of motor car is Rs.850,000 and the rate of Premium @ 5.5% for 5 years. Find the total amount of Premium, if depreciated @ 12 % yearly.

Sol.

Value of car = Rs. 850000

1st premium $= \frac{850000 \times 5.5}{100 \times 10}$

= Rs.46750

Depreciation $= \frac{850000 \times 12}{100}$

= Rs.102000

New value of car = 850000–102000

= Rs.748000

Premium = Rs.748000

2nd premium 5.5% $= \frac{74800 \times 55}{100 \times 10}$ = Rs. 41140

Depreciation $= \frac{74800 \times 12}{100}$ = Rs.89760

Value after dep. = 748000 – 89760

= Rs.658290

3rd premium @ 5.5% $= \frac{658290 \times 55}{100 \times 10}$

= Rs.36105.95

Depreciation 12% $= \frac{658290 \times 12}{100}$

= Rs.7899480

Value after dep. = 658290–78994.80

= Rs.579245.20

4th premium @ 5.5% $= \frac{579245 \times 20}{55 \times 100 \times 100 \times 10}$

= Rs.31858.48

Depreciation 12% $.= \frac{57924520 \times 12}{100 \times 100}$

= Rs.69509.424

Value after dep. = 57924520–69509.42

= Rs.509735.78

5th premium @ 5.5% $= \frac{509735.78 \times 55}{100 \times 100}$

= Rs.28035.47

Total payable

= 46750 + 41140 + 36105.85 + 31858.48+28035.47

= 183889.80

Q.5. Tanveer got an insurance policy for his shop at the rate of 3.3%. He paid an amount of Rs. 10800 as the 1st premium of one year. What is the price of Tanveer's shop if he paid Rs. 150 as service charges?

Sol.

1st premium of one year = Rs. 10800

Service charges = Rs. 150

Actual premium = 10800 – 150

= Rs. 10650

If paid 3.3 then value of shop = Rs. 100

If paid Rs. 10650 then value of shop

= Rs. 10650

$= \frac{100 \times 10650 \times 10}{33}$ = Rs. 322700

6.

Sol:

Cost Price = Rs 1,250,000

Rate of insurance = 4.5%

Amount of insurance $= \frac{1{,}250 \times 4.5}{100 \times 10}$ = Rs 56250

EXERCISE 4.5

Q. 1. Using following income tax calculation table. Find o tax for followings.

Upto 80,000	0%
80,000 to 150,000	7.5%
150,000 to 300,000.	12.5%
300,000 to 400,000	20%
400,000 to 700,000	25%
Above 700,000	35%

No.	monthly income	Year income	Rebate	Taxable Income	Tax
1	Rs.23500	282000	80000	202000	25250
2	Rs.24400	292000	80000	212800	26600
3	Rs.50000	60000	80000	520000	130000
4	75000	900000	80000	820000	287000
5	90000	1080000	80000	1000000	350000

REVIEW EXERCISE 4

Q.1. Fill in the blanks.

(i) Relationship between two or more ratios is called _____

(ii) ATM stands for _____

(iii) _____ is the installment of insurance to be paid.

(iv) The income of a person after different deduction is called _____

(v) _____ is the amount of income from which tax is exempted.

Ans. (i) Proportion
(ii) Automatic teller machine
(iii) Premium (iv) Net income
(v) Rebate

Q.2. Tick ✓ the correct answer.

(i) If increase in one quantity produces decrease in the other quantity this is called _____

(a) Ratio
(b) Direct proportion
✓ (c) Inverse proportion
(d) None

(ii) How many types of bank accounts are there?

(a) 3 (b) 4
✓ (c) 5 (d) 6

(iii) Concession that sales-man offers on written price of

(a) Profit (b) Markup ✓
(c) Concession (d) Discount

(iv) Institution that concerns with business loans and deposited etc. is called _____.

(a) University (b) Post office
(c) Stock exchange (d) Bank ✓

(v) (Sales price – Cost price) = _____

(a) Loss (b) Bonus
(c) Premium (d) Profit ✓

Q.3. Write short answers of the following:

(i) Name different types of deposits of commercial banks.
(ii) Write the names of types of bank accounts.
(iii) Define cheque, pay order, demand draft.
(iv) What are credit and debit cards?
(v) What are OD, RF and DF?

Ans. Types of Deposits:

(a) Current Account:

An account which permits to deposits and withdrawal money as and when client wishes. Client has the right to issue cheques as many times as he/ she wishes.

(b) PLS Saving Account:

Profit and Loss saving account that shows gross and net profit or loss at the end of an accounting period withdrawal are allowed.

(c) PLS Terms Deposit/Fixed Deposit Account:

In this account money is deposited for a fixed time and withdrawals are not allowed during this period.

(d) Foreign Currency Account:

It is an account in which foreign currency is deposited or withdrawn.

(ii) Write the names of types of bank accounts.

(a) Fixed Deposit:

Fixed deposit refers to a type of deposit which can be drawn on the expiry of a specific period. This type of deposit is paid at a higher rate of interest.

(b) Current Deposit:

Current deposit refers to a type of deposit which can be drawn at any time and in any amount. Generally current account deposits are not paid any rate of interest, however, a very low rate of interest is paid if there is a condition that deposit amount will never fall a certain limit.

(c) Saving Bank Deposit:

The deposits encourage saving among the people. These deposits carry comparatively higher rate of interest but it is lower than fixed deposits.

(d) Profit and Loss Accounts (PLS):

An account compiled at the end of an accounting period to show gross and net profit or low.

(iii) Define cheque, pay order, demand draft.

Ans. Pay order is an instrument that a banker issues after receiving funds from customs, hence the payee assured of receiving the funds on presenting P.O. Pay Order is also known as banker's cheque because it is issued b y the bank and payable locally only. It means that pay order is not issued to a customer who is outside of the city.

(iv) What are credit and debit cards?

Ans. Credit Card:

A credit card is a thin plastic card that contains identification information such as a signature or picture, and authorizes the person named on it to charge purchases or services to his account. It allows its holder to buy goods and services based on the holder's promise to pay for th3ese goods and services. The issuer of the card grants a line of credit to the customer

from which the user can borrow money for payment to a merchant or as a cash advance to the user.

Debit Card: A debit card is a plastic card issued by banks to customer. The card allows instant purchase, removing the correct balance from the user's attached bank account. Debit cards are distinct from credit cards in that they allow purchase based on available funds in the account to be deducted immediately, instead of using a line of credit that can be repaid at a later time.

(v) **What are OD, RF and DF?**

Ans. OD (Over Draft)

Over draft is one sort of offering credit by the account providers, in that withdrawals are permitted exceeding available balance of the bank account. An overdraft occurs when withdrawals from a bank account exceed the available balance.

R.R. (Running finance): Running finance is nothing but the finance offerings by financial institutions against mortgages (a loan to purchase a property). It works under the working capital finance. Specially, the running finance is a credit facility established for a specific time limit at variable interest rates. The running finance is implemented by means of allowing the overdraft facility and the corresponding amount is determined by the repaying capacity of the borrower.

DF (Demand Finance): Finance or a loan that is repayable whenever required or recalled by the lender prior to maturity date is called demand finance (DF).

(vi) List the transaction that can be made through an ATM machine.

(vii) Define the terms "Maturity" and "Premium".

(viii) What is the difference between gross income and net income?

(vi) List the transaction that can be made through an ATM machine.

Ans. Following are the transactions made through ATM (Automatic Teller Machine).

(i) **Withdrawals:** Withdrawals are allowed through A.T.M. from a user's saving or checking accounts.

(ii) **Deposits:** Deposits are also allowed to be made to both checking and saving accounts. These deposit functions usually require cash or cheques in envelopes, and can sometimes be accomplished by credit card.

Pay order: Pay order is an instrument that a banker issues after receiving funds from customer, hence the payee assured of receiving the funds on presenting P.O. Pay Order is also known as banker's cheque because it is issued b y the bank and payable locally only. It means that pay order is not issued to a customer who is outside of the city.

(vi) ATM machine.

Ans. Following are the transactions made through ATM (Automatic Teller Machine).

Ans. Credit Card:

A credit card is a thin plastic card that contains identification information such as a signature or picture, and authorizes the person named on it to charge purchases or services to his account. It allows its holder to buy goods and services based on the holder's promise to pay for th3ese goods and services. The issuer of the card grants a line of credit to the customer from which the user can borrow money for payment to a merchant or as a cash advance to the user.

Debit Card: A debit card is a plastic card issued by banks to customer. The card allows instant purchase, removing the correct balance from the user's attached bank account. Debit cards are distinct from credit cards in that they allow purchase based on available funds in the account to be deducted immediately, instead of using a line of credit that can be repaid at a later time.

(iii) Define cheque, pay order, demand draft.

Ans. Pay order is an instrument that a banker issues after receiving funds from customer, hence the payee assured of receiving the funds on presenting P.O. Pay Order is also known as banker's cheque because it is issued b y the bank and payable locally only. It means that pay order is not issued to a customer who is outside of the city.

4. Sol:

40 kg : 30 persons = 10 days

320 kg 80 persons = x

Ratio

Kg = 40 : 320 :: 10 : x

Persons = 8 : 30

$$x = \frac{320 \times 30 \times 10}{40 \times 8} = 300 \text{ days}$$

5.

Sol: 3 years mark up = Rs 1800

$$1 \text{ year mark up} = \frac{1800}{3}$$

$$\text{Rate of mark up} = \frac{600 \times 100}{30{,}000}$$

$= 2\%$

6. Sol:

Grass income = Rs 360,000

Rebute = Rs 80,000

Taxable amount

= 360,000 – 80,000 = Rs 280,000

$$\text{Amount of tax @ Rs } 7.5\% = \frac{7.5 \times 280{,}000}{10 \times 10}$$

= Rs 20,000

7.

Sol:

Rs. 13 = 1 yuan

$$\text{Rs. } 10{,}000 = \frac{10000}{10} = 768 \text{ yuans}$$

8.

Sol: Cost price of car = Rs 35,000

Sale Price = Rs 40250

Profit = Rs 40250 – 35000 = Rs 5250

$$\text{Profit \%} = \frac{5250 \times 100}{35000} = 15\%$$

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Unit 5

POLYNOMIALS

EXERCISE 5.1

Q. 1. Separate monomial, binomial and trinomial expressions.

Nominal = $15, 14b^2$

Binomial = $\sqrt{2}+2, 2a+y, x^2+y$

Trinomial = $\frac{1}{2}x+\frac{2}{3}y+5, 3x+4y+z$

Q.2. Write the degree of the following polynomials:

Sol.

	Polynomials	Degrees
(1)	$8xy$	2
(2)	$2y+8$	1
(3)	$2b^2c^3$	5
(4)	$6x^3+7y^5+z^6$	6
(5)	$ax^2+byz+az^3$	3
(6)	$8x+3x^2+5y$	2

Q.3. Match polynomial

(i) $5x + 2$ quadratic

(ii) $3x2 + 5x - 7$ linear

(iii) $4x4 - 3x2 - 9$ cubic

(iv) $9x2y - 7x$ biquadratic

Sol:

(i) $5x + 2$ linear

(ii) $3x2 + 5x - 7$ cubic

(iii) $4x4 - 3x2 - 9$ quardratic

(iv) $9x2y - 7x$ biquadratic

EXERCISE 5.2

1. Add the polynomials:

(i) $x^3-2x^2y+y^2$, $4x^3+2xy^2+6x^2y$, $-5x^3+2y^2-4x^2y$

Sol.

$$\begin{array}{r} x^3 - 2x^2y + y^3 \\ +4x^3 + 6x^2y + 2xy^2 \\ \hline -5x^3 - 4x^2y + 2y^2 \\ \hline y^3 + 2xy^2 + 2y^2 \end{array}$$

(ii) $5a^2-7ab+3b^2-4b^2-3ab-2a^2-3$, $-a^2-b^2-6ab+7$

Sol.

$$\begin{array}{r} 5a^2 - 7ab + 3b^2 \\ -2a^2 - 3ab - 4b^2 - 3 \\ \hline -a^2 - 6ab - b^2 + 7 \\ \hline 2a^2 - 16ab - 2b^2 + 4 \end{array}$$

(iii) $x^2 - 2x + 4, x + 2, x^2 - 2$

Sol.

$$\begin{array}{r} x^2 - 2x + 4 \\ + x + 2 \\ \hline x^2 - 2 \\ \hline 2x^2 - x + 4 \end{array}$$

2. Find P+Q+R when

Sol.

$$\begin{array}{rl} P = & a^4 - 3a^3b + 4a^2b^2 - 5b^3 \\ Q = & 3a^4 + 7a^3b - 2a^2b^2 \\ R = & -6a^4 - 2a^3b + 2a^2b^2 - 4ab^3 \\ \hline P+Q+R = & -2a^4+2a^3b+4a^2b^2-5b^3-ab^3 \end{array}$$

3. Subtract:

(i) $3x^4 + 5x^2 + 2x$ from $2x^4+2x^2+2x^3-2x-1$

Sol. $2x^4 + 2x^2 + 2x^3 - 2x - 1$
$-3x^4 \pm 5x^3 \quad \pm 2x$
$-x^4 - 3x^3 + 2x^2 - 4x + 1$

$3a^4 - 7a^3b + 6a^2b^2 + 5ab^3 + 6b^4$

(ii) $5ab^3 + 6b^4 - a^4 + 7a^3b - 8a^2b^2 + 7$

Sol. $-a^4 + 7a^3b - 8a^2b^2 + 5ab^3 + 6b^4 + 7$
$-a^4 - 7a^3b + 6a^2b^2 \pm 5ab^3 + 6b^4$
$-2a^4 + 14a^3b - 14a^2b^2 \quad + 7$

(iii) Subtract $2x^2 - 2x + 4$ from $x^2 - 3x + 4$

Sol. $x^2 - 3x + 4$
$-2x^2 \mp 2x \pm 4$
$-x^2 \quad -x$

Q.4. The sum of two polynomials is $3x^3 + 3x + 7y + 4xy$. If one polynomial is $4xy + 3x^3$ then find the other.

Sol. $3x^2 + 3x + 4xy + 7y$
$-3x^2 \quad \pm 4xy$
$3x + 7y$

Q. 5. Multiply the following:

(i) $(x^3 - 19x - 30)(x + 3)$

Sol. $x^3 - 19x - 30$
$x + 3$
$x^4 - 19x^2 - 30x$
$+3x^3 \quad - 57x - 90$
$x^4 + 3x^3 - 19x^2 - 87x - 90$

(ii) $(x^2 - xy + y^2)(x^2 + xy + y^2)$

Sol. $x^2 - xy + y^2$
$x^2 + xy + y^2$
$x^4 - x^3y + x^2y^2$
$+ x^3y + x^2y^2 + xy^3$
$x^2y^2 - xy^3 + y4$
$x^4 + 3x^2y^2 + y^4$

(iii) $(a+b+c)(a^2+b^2+c^2-ab-bc-ca)$

Sol. $a^2 + b^2 + c^2 - ab - bc - ca$
$a + b + c$
$a^3 + ab^2 + ac^2 - a^2b - abc - a^2c$
$+ a^2b - abc - b^2c + b - hc^2 - c^3 + b^3$
$a^2c - abc + b^2c - bc^2 - c^2a + c^3$
$a^3 + ab - ab^2 + a^2c - 3abc - a^2c + b^3 - c^3$
$= a^3 + b^3 + c^3 - abc$

Q. 6. Divide the following:

Sol.

(i) $(x^3 - 4x^2 + 5x - 2) \div (x - 2)$

$x - 2$ | $x^3 - 4x^2 + 5x - 2$ | $x^2 - 2x + 1$
$-x^3 - 2x^2$
$-2x^2 + 5x$
$\mp 2x^2 \pm 4x$
$x - 2$
$-x - 2 +$

(ii) $(x^3 - 6x^2 + 5x + 12) \div (x - 3)$

$x - 3$ | $x^3 - 6x^2 + 5x + 12$ | $x^2 - 3x - 4$
$-x^3 - 3x^2$
$-3x^2 + 5x$
$-3x^2 \pm 9x$
$-4x + 12$
$+4x \pm 12$

(iii) $(x^4 - x^3 - 9x + 9) \div (x - 1)$

$x - 1$ | $x^4 - x^3 - 9x + 9$ | $x^3 - 9$
$-x^4 \mp x^3$
$- 9x + 9$
$-9x \pm 9$
$+$
$x^3 - 9$ **Ans.**

(v) $(x^3 + 18x^2 + 180x + 800) \div (x + 8)$

$x + 8$ | $x^3 + 18x^2 + 180x + 800$ | $x^2 + 10x + 1$
$x^3 \pm 8x^2$
$10x^2 + 180x$
$-10x^2 \pm 80x$
$100x + 800$
$100x \pm 800$

Q.7.

Sol.

$2x + 3$ | $6x^2 + 5x + 2$ | $3x - 2$
$- x^2 \pm 9x$
$-4x + 2$
$-4x \pm 6$
-8

Quotient = $3x - 2$, Remainder = 8

REVIEW EXERCISE 5

Q.1. Fill in the blanks.

Ans. (i) Monomial (ii) Binomial
(iii) Monomial (iv) Binomial
(v) Binomial (vi) Trinomial
(viii) Trinomial

Q.2 Tick the correct answer.

(i) (b) (ii) (c) (iii) (b) (iv) (b)
(v) (c) (vi) (b) (vii) (a) (viii) (b)

Q.3. Write the degree of following polynomials:

(i) $2x^2y^2$ (ii) 9

(iii) $3x^2y^2 + 2x^5 - 9y^4$

(iv) $9x^2 + 5$

(v) $y^3 - xy^2 + x^2y^2 + x3$

(vi) $2 + x - y$

Ans. 1. (4) 2. (0) 3. (5) 4. (2) 5. (4) 6. (1)

Q.4. Solve the following:

(i) $(3x^3 + 9x - 19) + (12x + 2x^2 - x^3 + 10)$

Sol.
$$\begin{array}{r} 3x^2 + 9x - 19 \\ -x^3 + 2x^2 + 12x + 10 \\ \hline -x^3 + 5x^2 + 21x - 9 \end{array}$$

(ii) $(2a + 3b - 4c) + (3a - 2b) + (a - 2b + c)$

Sol.
$$\begin{array}{r} 2a + 3b - 4c \\ 3a - 2b \\ + a - 2b + c \\ \hline 6a - b - 3c \end{array}$$

(iii) $(x^3 - 5x^2 + 4x + 7) + (x^4 - 7x + 8)$

Sol.
$$\begin{array}{r} x^3 - 5x^2 + 4x - 7 \\ + x^4 - 7x + 8 \\ \hline x^4 + x^3 - 5x^2 - 3x + 1 \end{array}$$

(iv) $(a - 2b + bc) - (3a + 3b - 4c)$

Sol.
$$\begin{array}{r} (a - 2b + bc) \\ -3a \pm 3b \mp -4c \\ \hline 2a - 4b + 10c \end{array}$$

(v) $(4x^2 + 3x - 3) - (3x^2 - x - 1)$

Sol.
$$\begin{array}{r} 4x^2 + 3x - 3 \\ -3x^2 \mp x \mp -1 \\ \hline x^2 + 4x - 2 \end{array}$$

5. Solve the following:

(i) $(2x^2 + 3x + 9)(3x + 4x^3)$

Sol.
$$\begin{array}{r} 2x^2 + 3x + 9 \\ 3x + 4x^3 \\ \hline 6x^3 + 9x^2 + 27x \\ 8x^5 + 12x^4 + 36x^3 \\ \hline 8x^5 + 12x^4 + 42x^3 + 9x^2 + 27x \end{array}$$

(ii) $(3x^2 + 7x + 12)(x + 1)$

Sol.
$$\begin{array}{r} 3x^2 + 7x + 12 \\ x + 1 \\ \hline 3x^3 + 7x^2 + 12x \\ 3x^2 + 7x + 12 \\ \hline 3x^3 + 10x^2 + 19x + 12 \end{array}$$

(iii) $(5x^4 + 3x^3 + 7x^2 + 9x + 3)(2x + 2)$

Sol.
$$\begin{array}{r} 5x^4 + 3x^3 + 7x^2 + 9x + 3 \\ 2x + 2 \\ \hline 10x^5 + 6x^4 + 14x^3 + 18x^2 + 6x \\ 10x^4 + 6x^3 + 14x^2 + 18x + 6 \\ \hline 8x^5 + 16x^4 + 20x^3 + 32x^2 + 24x + 6 \end{array}$$

(iv) $(x^3 + x^2 + x + 1) \div (x + 1)$

$$\begin{array}{r|l} x^3 + x^2 + x + 1 & x + 1 \\ -x^3 \pm x^2 & \\ \hline x + 1 & \\ x + 1 & \\ \hline 0 & x^2 + 1 \end{array}$$

Ans.

(v) $(x^4 - 1) \div (x - 1)$

$$\begin{array}{r|l} x^4 - 1 & x^3 + x^2 + x + 1 \\ x^4 - x^3 & \\ \hline x^3 - 1 & \\ x^3 \mp x^2 & \\ \hline x^2 - 1 & \\ x^2 \mp x & \\ \hline x - 1 & \\ x \mp 1 & \\ \hline 0 & \end{array}$$

$x^3 + x^2 + x + 1$ Ans.

Q.7. What should be subtracted from $3x^2 + 3x + 1$ so that it becomes exactly divisible by $x + 1$.

Sol.
$$\begin{array}{r|l} 3x^2 + 3x + 1 & x + 1 \\ -3x^2 \pm 3x & \\ \hline 1 & 3x^2 + 3x + 1 \end{array}$$

Unit 6

FACTORIZATION

EXERCISE 6.1

1. Find the value of following by using appropriate formula.

(i) $(904)^2$

Sol. $904 = 900 + 4$

$(900+4)^2$

$(900)^2 + (4)^2 + 2\times4\times900$
$= 10000 + 16 - 7200$
$= 817216$ **Ans.**

(ii) $\mathbf{(1.02)^2}$

Sol. $(1.02)^2 = (1 + 0.02)^2$
$(1)^2 + (0.02)^2 + 2 \times 1 \times 0.2$
$= 1 + 0.004 + 0.04$
$= 1.0404$ **Ans.**

(iii) $\mathbf{(97)^2}$

Sol. $(97)^2 = (100 - 3)^2$
$(100)^2 + (3)^2 - 2 \times 100 \times 3$
$= 10000 + 9 - 600$
$= 9409$ **Ans.**

(iv) $\mathbf{(1005)^2}$

Sol. $(1005)^2 = (100 + 5)^2$
$(1000)^2 + (5)^2 + 2 \times 1000 \times 5$
$= 1000000 + 25 + 10000$
$= 1010025$ **Ans.**

(v) $\mathbf{(0.98)^2}$

Sol. $(0.98)^2 = (1 - 0.02)^2$
$(1)^2 + (0.02)^2 - 1 \times 2 \times 0.02$
$= 1 + 0.004 - 0.04$
$= 0.9604$ **Ans.**

(vi)

Sol: $(100)2 - (9)2$
$(100+19)\,(100-19)$
$= 119 \times 81 = 9639$

2. Find the value of following by using appropriate formula.

(i) $\mathbf{98 \times 98}$

Sol. $98\times98 = (98)^2$
$(98)^2 = (100 - 2)^2$
$= (100)^2 + (2)^2 - 2 \times 100\times2$
$= 10000 + 4 - 400$
$= 9604$ **Ans.**

(i) $\mathbf{102 \times 102}$

Sol. $102\times102 = (102)^2$
$= (100 + 2)^2 = (100)^2 + (2)^2$
$+ 2 \times 100 \times 2$
$= 10000 + 4 + 400$
$= 10404$ **Ans.**

(ii) $\mathbf{0.9 \times 0.9}$

Sol. $0.9\times0.9 = (0.9)^2$
$= (1-0.1)^2 = (1)^2 + (0.1)^2 - 2\times1\times0.1$
$= 1+0.01-0.2$
$= 0.81$ **Ans.**

(iii) $\mathbf{2.3 \times 2.3}$

Sol. $2.3\times2.3 = (2.3)^2$
$= (2+0.3)^2 = (2)^2 + (0.3)^2 + 2\times2\times0.3$
$= 4+0.09+1.2$
$= 5.29$ **Ans.**

(iv) $\mathbf{150 \times 150}$

Sol. $150\times150 = (150)^2$
$= (100+50)^2$
$= (100)^2 + (50)^2 + 2\times100\times50$
$= 10000 + 2500 + 10000$
$= 22500$ **Ans.**

(v) $\mathbf{1205 \times 1205}$

Sol. $1205\times1205 = (1205)^2$
$= (1200+5)^2 = (1200)^2 + 5(2) + 2$
$\times1200 \times 5$
$= 1440000+25+12000$
$= 1452025$ **Ans.**

(vi) $\mathbf{2403 \times 2483}$

Sol. $(2400+3)2 = (2400)2 + (3)2 + 2\times2400\times3$
$= 576000 + 9 + 4400$
$= 5775509$ **Ans.**

3. Find the value of $a^2 - b^2$ when

(i) $\mathbf{a + b = 4,\ a - b = 9}$

Sol. $a^2 - b^2 = (a + b)\,(a - b)$
By putting the values
$a^2 - b^2 = (4)\,(9)$
$= 36$ **Ans.**

(ii) $\mathbf{a - b = 7,\ a + b = 8}$

Sol. $a^2 - b^2 = (a + b)\,(a - b)$
By putting the values
$a^2 - b^2 = (8)\,(7)$
$= 56$ **Ans.**

(iii) $\mathbf{a - b = 5,\ a + b = 10}$

Sol. $a^2 - b^2 = (a + b)\,(a - b)$
By putting the values
$a^2 - b^2 = (10)\,(5)$
$= 50$ **Ans.**

4. Find a – b when

(i) $\mathbf{a^2 - b^2 = 24,\ a + b = 6}$

Sol. $(a + b)(a - b) = a^2 - b^2$
By putting the values
$(6)\,(a - b) = 24$
$6 \times \frac{a-b}{6} \quad \frac{24}{6}$
$a - b = 4$ **Ans.**

(ii) $\mathbf{a^2 - b^2 = 32,\ a + b = 8}$

Sol. $(a + b)(a - b) = a^2 - b^2$
By putting the values
$(8)\,(a - b) = 32$
$\frac{8(a-b)}{8} = \frac{32}{8}$

$a - b = 4$ Ans.

5. Find a+b = when

(i) $a^2 - b^2 = 35, a - b = 5$

Sol: $(a+b)(a-b) = a^2 - b^2$

$(a+b)(5) = 35$

$a + b = \frac{35}{5} = 7$

(ii) $a^2 - b^2 = 35, a - b = 7$

Sol. $(a+b)(a-b) = a^2 - b^2$

$(a+b) = (7) = 35$

$\frac{(a+b)(7)}{7} = \frac{35}{5}$

$a + b = 5$

6. **Find the value of $x^2 + \frac{1}{x^2}$ when**

(i) $x + \frac{1}{x} = 3$

Sol. $x + \frac{1}{x} = 3$

$x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2$

By putting the values

$x^2 + \frac{1}{x^2} = (3)^2 - 2$

$x^2 + \frac{1}{x^2} = 9 - 2$

$x^2 + \frac{1}{x^2} = 7$ **Ans.**

(ii) $x - \frac{1}{x^2} = 9$

Sol. $x + \frac{1}{x} = 9$

$x^2 + \frac{1}{x} = \left(x + \frac{1}{x}\right)^2 + 2$

By putting the values

$x^2 + \frac{1}{x^2} = (9)^2 - 2$

$x^2 + \frac{1}{x^2} = 81 + 2$

$x^2 + \frac{1}{x^2} = 83$ **Ans.**

(iii) $x + \frac{1}{x} = 15$

Sol. $x + \frac{1}{x} = 15$

$x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2$

By putting the values

$x^2 + \frac{1}{x^2} = (15)^2 - 2$

$x^2 + \frac{1}{x^2} = 225 - 2$

$x^2 + \frac{1}{x^2} = 223$ **Ans.**

(iv) $x\frac{1}{x} = 7$

Sol: $x\frac{1}{x} = 7$

$\left(x\frac{1}{x}\right)^2 = (7)^2$

$x2 + \frac{1}{x^2} + 2 = 49$

$x2 + \frac{1}{x^2} + 2 - 2 = 49 - 2$

$x2 + \frac{1}{x^2} = 47$

7. **Find the value of $x^4 + \frac{1}{x^2}$ when**

(i) $x + \frac{1}{x} = 7$

Sol. $x + \frac{1}{x} = 7$

$x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2$

By putting the values

$x^2 + \frac{1}{x^2} = (7)^2 - 2$

$x^2 + \frac{1}{x^2} = 49 - 2$

$x^2 + \frac{1}{x^2} = 47$

$$x^4+\frac{1}{x^2} = \left(x+\frac{1}{x}\right)^2 - 2$$

$$x^4+\frac{1}{x^4} = (47)^2 - 2$$

$$x^4+\frac{1}{x^4} = 2209 - 2$$

$$x^4+\frac{1}{x^4} = 2207 \text{ Ans.}$$

(ii) $x - \frac{1}{x} = 3$

Sol. $x - \frac{1}{x} = 3$

$$x^2+\frac{1}{x^2} = \left(x+\frac{1}{x}\right)^2 + 2$$

By putting the values

$$x^2+\frac{1}{x^2} = (3)^2 + 2$$

$$x^2+\frac{1}{x^2} = 9 + 2$$

$$x^2+\frac{1}{x^2} = 11$$

$$x^4+\frac{1}{x^2} = \left(x+\frac{1}{x}\right)^2 - 2$$

$$x^4+\frac{1}{x^2} = (7)^2 - 2$$

$$x^4+\frac{1}{x^2} = 49 - 2$$

$$x^4+\frac{1}{x^2} = 47 \text{ Ans.}$$

(iii) $x + \frac{1}{x} = 2$

Sol. $x + \frac{1}{x} = 2$

$$x^2+\frac{1}{x^2} = \left(x-\frac{1}{x}\right)^2 - 2$$

By putting the values

$$x^2+\frac{1}{x^2} = (2)^2 - 2$$

$$x^2+\frac{1}{x^2} = 4 - 2$$

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

$$x^4+\frac{1}{x^4} = \left(x+\frac{1}{x}\right)^2 = -2$$

$$x^4+\frac{1}{x^4} = (2)^2 - 2$$

$$x^4+\frac{1}{x^4} = 4 - 2$$

$$x^4+\frac{1}{x^4} = 2 \text{ Ans.}$$

(iv) $x - \frac{1}{x} = 1$

Sol. $x - \frac{1}{x^2} = 1$

$$x^2+\frac{1}{x^2} = \left(x+\frac{1}{x}\right)^2 + 2$$

By putting the values

$$x^2+\frac{1}{x^2} = (1)^2 + 2$$

$$x^2+\frac{1}{x^2} = 3$$

$$x^4+\frac{1}{x^2} = \left(x+\frac{1}{x}\right)^2 - 2$$

$$x^4+\frac{1}{x^4} = (3)^2 - 2$$

$$x^4+\frac{1}{x^4} = 9 - 2$$

$$x^4+\frac{1}{x^4} = 7 \text{ Ans.}$$

By putting the values

8. If $x - \frac{1}{x} = 2$, then show that

(i) $x + \frac{1}{x} = 2$

Sol. $x^2+\frac{1}{x^2} = \left(x+\frac{1}{x}\right)^2 - 2$

$$x^2+\frac{1}{x^2} = 4 - 2$$

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

$$x^4+\frac{1}{x^4} = \left(x+\frac{1}{x}\right)^2$$

$$x^4+\frac{1}{x^4} = (2)^2-2$$

$$x^4+\frac{1}{x^4} = 4-2$$

$$x^4+\frac{1}{x^4} = 2$$

$$x^2+\frac{1}{x^2} = x^4+\frac{1}{x^4} = 2$$

Proved if $x+\frac{1}{x}=2$ then

$$x^2+\frac{1}{x^2} = x^4+\frac{1}{x^4}$$

EXERCISE 6.2

1. Factorize the following:

(i) **$25a+30b+5c$**

Sol. $25a+30b+5c$

$5(5a+6b+c)$ **Ans.**

(ii) **$8ab+4bc+12bd$**

Sol. $8ab+4bc+12bd$

$4(2ab+bc+3bd)$ **Ans.**

(iv) **$3t^2-6t^3+9t^5$**

Sol. $3t^2-6t^3+9t^5$

$3t^2(1-2t+3t^3)$ **Ans.**

(v) **$2x^2y^3+2x^4y-3x^3y^2-3xy^4$**

Sol. $2x^2y^3+2x^4y-3x^3y^2-3xy^4$

$xy(2xy^2+2x^3-3x^2y-3y^3)$ **Ans.**

(vi) **$2ax+bx+6ay+3by$**

Sol: $2ax+bx+6ay+3by$

$=2ax+6ay+bx+3by$

$=2a(x+3y)+b(x+3y)$

$=(2a+b)(x+3y)$

(vii) **$2yx+18y^2+3zx+27zy$**

Sol: $2yx+18y^2+3zx+27zy$

$2y(x+9y)+3z(x+9y)$

$=(2y+3z)(x+9y)$ **Ans.**

(viii) **$a^2+14ab+49b^2$**

Sol. $a^2+14ab+49b^2$

$=(a)^2+2\times a\times 7b+(7b)^2$

$=(a+7b)^2=(a+7b)(a+7b)$

(ix) **$y^2-34y+289$**

Sol.

$(y)^2-2xy\times 17+(17)^2$

$=(y+17)^2=(y+17)(y+17)$

2. Factorize the following:

(i) **k^2-81**

Sol: $k^2-18=(k^2)-(9)^2$

$=(k+9)(k-9)$

(ii) **$36d^2-1$**

Sol: $36d^2-1=(6d^2)-(1)^2$

$=(6d+1)(6d-1)$

(iii) **$25a^2-49b^2$**

Sol. $25a^2-49b^2$

$=(5a)^2-(7b)^2$

$=(5a+7b)(5a-7b)$

(iv) **$169x^2-144y^2$**

Sol. $169x^2-144y^2$

$=(13x)^2-(12y)^2$

$=(13x+12y)(13x-12y)$

(v) **$4m^2-4mm+n^2-4z^2$**

Sol: $4m^2-4mm+n^2-4z^2$

$=(2m-n)^2-(2z)^2$

$=(2m-n+2z)(2m-n-zy)$

(vi) **$64a^2-32ab+4b^2-9c^2$**

Sol. $64a^2-32ab+4b^2$

$\{(8a)^2-2\times 8a\times 2b+(2b)^2\}-9c^2$

$(8a-2b)^2-(3c)^2$

$(8a-2b+3c)\ 8a-2b-3c)$

EXERCISE 6.3

1. Find the cube of the following:

(i) **$3x+4$**

Sol. $(3x+4)^3$

$=(3x)^3+(4)^3+3\times 3x\times 4(3x+4)$

$=27x^3+64+36x(3x+4)$

$=27x^3+108x^2+144x+64$

(ii) **$5x+2t$**

Sol. $(5x+2t)^3$

$=(5x)^3+3(5x)(2t)(5x+2t)+(2t^3)$

$=125x^3+30xt(5x+2t)+8t^3$

$=125x^3+150x^2t+60x^2t+8t^3$

(iii) **$x-\frac{1}{x}$**

Sol. $\left(x+\frac{1}{x}\right)^3$

$=(x^3)-\left(\frac{1}{x}\right)^3-3\left(x+\frac{1}{x}\right)\left(x-\frac{1}{x}\right)$

$=x^3-\frac{1}{x^3}-\left(x-\frac{1}{x}\right)$

(iv) $3y - \frac{1}{3x}$

Sol. $\left(3y - \frac{1}{3x}\right)^3$

$= (3y^3) - \left(\frac{1}{3x}\right) - 3(3y)\frac{1}{3x}\left(3y - \frac{1}{3x}\right)$

$= 27y^3 - \frac{1}{27x^3} - \frac{3y}{x}\left(3y - \frac{1}{3x}\right)$

$= 27y^3 - \frac{1}{27x^3} - \frac{9y^2}{x} + \frac{3y}{x^2}$

(v) $\frac{x}{y} - \frac{y}{x}$

Sol. $\left(\frac{x}{y} - \frac{y}{x}\right)^3$

$= \frac{x^3}{y^3} - \frac{y^3}{x^3} - 3\left(\frac{x}{y} - \frac{y}{x}\right)$

$= \frac{x^3}{y^3} - \frac{y^3}{x^3} - \frac{3x}{y} + \frac{3y}{x}$

2. Find the value of:

(i) $x^3 \frac{1}{x^3}$ when $x + \frac{1}{x} = 4$

Sol: $x + \frac{1}{x} = 4$

$x^3 + \frac{1}{x^3} = ?$

$= \left(x + \frac{1}{x}\right)^3 = x^3 + \frac{1}{x^3} + 3\left(x + \frac{1}{x}\right)$

$x^3 + \frac{1}{x^3} + 3(4) = 64$

$x^3 + \frac{1}{x^3} + 12 = 64$

$x^3 + \frac{1}{x^3} = +12 - 12 = 64 - 12$

$x^3 + \frac{1}{x^3} = 52$

(ii) $x^3 - \frac{1}{x^3}$ when $x - \frac{1}{x} = 4$

Sol: $x - \frac{1}{x} = 4$

$\left(x - \frac{1}{x}\right) = (4)^3$

$x^3 - \frac{1}{x^3} - 3 = 64$

$x^3 - \frac{1}{x^3} - 3(4) = 64$

$x^3 - \frac{1}{x^3} - 3(4) = 64$

$x^3 - \frac{1}{x^3} - 12 = 64$

$x^3 - \frac{1}{x^3} - 12 + 12 = 64 + 12$

$x^3 - \frac{1}{x^3} = 76$

(iii) $x^3 - \frac{1}{x^3}$ when $x^2 + \frac{1}{x^2} = 8$

Sol: $x^2 + \frac{1}{x^2} = 8$

$x^2 + \frac{1}{x^2} - 2 = 8 - 2$

$\left(x - \frac{1}{x}\right)^2 = \left(\sqrt{6}\right)^2$

$\sqrt{\left(x - \frac{1}{x}\right)2}$

$x - \frac{1}{x} = \sqrt{6}$

$\left(x - \frac{1}{x}\right)3 = \left(\sqrt{6}\right)^3$

$x^3 - \frac{1}{x^3} - 3 = \left(x - \frac{1}{x}\right) = \sqrt{6 \times 6 \times 6}$

$x^3 - \frac{1}{x^3} - 3\sqrt{\left(\sqrt{6}\right)} = 6\sqrt{8}$

$x^3 - \frac{1}{x^3} = 6 - 3\sqrt{8}$

$x^3 - \frac{1}{x^3} = 3\sqrt{8}$

(iv) If $x-\frac{1}{x}=2$ then show that

Sol: $x^3-\frac{1}{x^3}=x^4$

$x-\frac{1}{x}=2$

$\left(x-\frac{1}{x}\right)^2=(2)^2$

$x^2+\frac{1}{x^2}-2=4$

$x^2+\frac{1}{x^2}=4-2$

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

$\left(x^2+\frac{1}{x^2}\right)^2=(2)^2$

$x^4+\frac{1}{x^4}+2=4$

$x^4+\frac{1}{x^4}=4-2$

$x^4+\frac{1}{x^4}=2$

$x^4+\frac{1}{x}=2$

$\left(X-\frac{1}{X}\right)3=(2)^3$

$x^3-\frac{1}{x^3}-3(2)=8$

$x^3-\frac{1}{x^3}-3(2)=8$

$x^3-\frac{1}{x^3}-6=8$

$x^3-\frac{1}{x^3}-6+6=8+6$

$x^3-\frac{1}{x^3}=14$

3. If $x+\frac{1}{x}$ then prove that

$x^2+\frac{1}{x^2}=x^4+\frac{1}{x^4}=x^3+\frac{1}{x^3}$

Sol. $x+\frac{1}{x}=2$

$\left(x+\frac{1}{x}\right)^2=(2)^2$

$x^2+\frac{1}{x^2}+2=4$

$x^2+\frac{1}{x^2}+2-2=4-2$

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

$\left(x^2+\frac{1}{x^2}\right)^2=(2)^2$

$x^4+\frac{1}{x^4}+2=4$

$x^4+\frac{1}{x^4}+2-2=4-2$

$x^4+\frac{1}{x^4}=2$

$x^4+\frac{1}{x^4}=2$

$\left(x+\frac{1}{x}\right)^3=(2)^3$

$x^3+\frac{1}{x^3}+3\left(x-\frac{1}{x}\right)=8$

$x^3+\frac{1}{x^3}+6=8$

$x^3+\frac{1}{x^3}+6-6=8-6$

$x^3+\frac{1}{x^3}=2$

Proved that

$x^2 + \frac{1}{x^2} = x^4 + \frac{1}{x^4} = x^3 + \frac{1}{x^3}$

4. If $x - \frac{1}{x} = 2$ then show that $x^3 - \frac{1}{x^3} = 14$

Sol: $x - \frac{1}{x} = 2$

$\left(x - \frac{1}{x}\right)^3 = (2)^3$

$x^3 - \frac{1}{x^3} - 3(2) = 8$

$x^3 - \frac{1}{x^3} - 3(2) = 8$

$x^3 - \frac{1}{x^3} - 6 = 8$

$x^3 - \frac{1}{x^3} - 6 + 6 = 8 + 6$

$x^3 - \frac{1}{x^3} = 14$

EXERCISE 6.4

1. Solve the equation by equating their coefficients.

(i) $3x - 4y = 1$
$2x - y = 3$

Sol: $3x - 4y = 1$
$2x - y = 3$
$2(3x-4y) = 1 \times 2$
$3(2x-y) = 3 \times 3$
$6x - 8y = 2$
$-6x \mp 3y = -9$
$-5y = -7$

$\frac{-5y}{-5} = \frac{-7}{-5}$

$y = \frac{7}{5}$

$3x - 4y = 1$

$3x - 4\left(\frac{7}{5}\right) = 1$

$3x - \frac{28}{5} = 1$

$5\left(3x - \frac{28}{5}\right) = 5(1)$

$15x - 25 = 5$
$15x = 5 + 28$
$15x = 33$

$x = \frac{33}{15}$

$\left\{\frac{33}{15}, \frac{7}{5}\right\}$

(ii) $8x - 4y = 1$
$9x - 3y = 25$

Sol: $8x - 4y = 1$
$9x - 3y = 25$
$9(8x - 4y) = 1 \times 9$
$8(9x - 3y) = 25 \times 8$
$72x - 36y = 9$
$-72x \mp 24y = -200$
$-12y = -191$

$\frac{-12y}{-12} = \frac{-191}{-12}$

$8x - 4y = 1$

$8x - 4\left(\frac{191}{12}\right) = 1$

$8x - \frac{191}{3} = 1$

$3(8x) - 3 \times \frac{191}{3} = 1 \times 3$

$24x - 191 = 3$
$24x = 3 + 191$
$24x = 194$

$\frac{24x}{24} = \frac{194}{24}$

$x = \frac{97}{12}$

$\left\{\frac{97}{12}, \frac{191}{12}\right\}$

(iii) $14x + 9y = 1$
$4x - 3y = 3$

Sol: $14x + 9y = 1$
$4x - 3y = 3$

$4(14x + 9y) = 1 \times 4$

$56x + 36y = 4$

$14(4x - 3y) = 3 \times 14$

$56x - 42y = 42$

$56x + 36y = 4$ ..... (i)

$-56x \mp 42y = -42$ ..... (ii)

$78y = -38$

By subtracting ii from i

$y = \frac{-38}{78} = \frac{-19}{39}$

$14x + 9y = 1$

$14x + 9\left(\frac{-19}{39}\right) = 1$

$14x - \frac{171}{39} = 1$

$39\left(14x - \frac{171}{39}\right) = 1 \times 39$

$546x - 171 = 39$

$546x = 39 + 171$

$546x = 210$

$x = \frac{210}{546} = \frac{70}{182} = \frac{35}{91} = \frac{5}{13}$

$\left\{\frac{5}{13}, \frac{-19}{39}\right\}$

(iv) **$6x + 7y = 1$**

$8x - 3y = 25$

Sol: $6x + 7y = 1$

$8x - 3y = 25$

$8(6x + 7y) = 1 \times 8$

$6(8x - 3y) = 25 \times 6$

$48x + 56y = 8$

$-48x - 18y = 150$

$74y = -142$

$y = \frac{-142}{74} = \frac{-71}{37}$

$6x + 7y = 1$

$6x + 7\left(\frac{-71}{37}\right) = 1$

$6x - \frac{497}{37} = 1$

$37\left(6x - \frac{497}{37}\right) = 1 \times 37$

$222x = 37 + 497$

$22x = 534$

$\frac{222x}{222} = \frac{534}{222}$

$x = \frac{534}{222} = \frac{267}{111} = \frac{89}{37}$

$x = \frac{89}{37}, y = \frac{-71}{37}$

Q.2. Solve the equations by method of.

(i) **$4x - 2y = 8$**

$2x - 2y = 6$

Sol: $4x - 2y = 8$

$\frac{4x}{4} - \frac{2y}{4} = \frac{8}{4}$

$x - \frac{y}{2} = \frac{1}{2}$

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

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

$x = \frac{y}{2}$

$2x - 2y = 6$

$-2y = 6$

$Y - 2y = 6$

$-y = 6$

$Y = -6$

$4x - 2y = 8$

$4x - 2(-6) = 8$

$4x + 12 = 8$

$4x = 8 - 12$

$4x = -4$

$x = -1$

$x = -1, y = -6$

(ii) **$8x - 3y = 8$**

$2x - 7y = 4$

Sol: $8x - 3y = 8$

$2x - 7y = 4$

$8x - 3y = 8$

$8x = 8 + 3y$

$\frac{8x}{8} = \frac{8+3y}{8}$

$$x = \frac{8+3y}{8}$$

$2x - 7y = 4$

$$\frac{2(8+3y)}{8} = 7y = 4$$

$$\frac{8+3y}{4} - 7y = 4$$

$4(8+3y) - 4(-7y) = 4 \times 4$

$32 + 12y + 28y = 16$

$32 + 40y = 16$

$40y = 16 - 32$

$40y = -16$

$$y = \frac{-16}{40}$$

$$y = \frac{-2}{5}$$

$8x - 3y = 8$

$8x - 3 = 8$

$8x + = 8$

$5 = 5 \times 8$

$40x + 6 = 40$

$40x = 40 - 6$

$$\frac{40x}{40} = \frac{34}{40}$$

$$x = \frac{34}{40} = \frac{17}{20}$$

$$x = \frac{17}{20}, y = \frac{-2}{5}$$

(iii) **Question in book is wrong**

Let the price of 1 apple = Rs x

Let the price of 1 pear = Rs y

Equation according to the question

$9x + 4y = 35$ ..... (i)

$5x + 2y = 19$ ..... (ii)

Multiplying (i) to 5 and (ii) to 9

$45x + 20y = 175$

$\underline{-\ 45x\ -\ 18y\ =\ -171}$

$2y = 4$

$y = 2$

$9x + 4y = 35$

$9x + 4(2) = 35$

$9x + 8 = 35$

$9x = 35 - 8$

$9x = 27$

$$\frac{9x}{9} = \frac{27}{9}$$

$x =$ Rs 3

Price of apple = Rs 3

Price of pear = Rs 2

3. **Solve the equations by cross multiplication method:**

(i) $2x + y + 3 = 0$

$x + y + 1 = 0$

Sol. $2x + y + 3 = 0$

$x + y + 1 = 0$

$$\frac{x}{(1(1)-1(3)} = \frac{y}{3(1)-2(1)} = \frac{1}{(2(1)-1(1)}$$

$$\frac{x}{1-3} = \frac{y}{3-2} = \frac{1}{2-2}$$

$$\frac{x}{-2} = \frac{y}{1} = \frac{1}{1}$$

$$\frac{x}{-2} = 1$$

$x = -2, y = 1$

(ii) $3x - 3y = 3$

$2x - 5y = 4$

Sol. $3x - 3y = 3$

$2x - 5y = 4$

OR

$3x - 3y - 3 = 0$

$2x - 5y - 4 = 0$

$$\frac{x}{-3(-4)(-5)(-3)} = \frac{y}{2(-3)-3(-4)}$$

$$= \frac{1}{3(-5)-2(3)}$$

$$\frac{x}{12-15} = \frac{y}{-6+12} = \frac{1}{-15+6}$$

$$\frac{x}{-3} = \frac{y}{6} = \frac{1}{-9}$$

$$\frac{x}{-3} = \frac{1}{-9}$$

$$-9x = -3$$

$$x = \frac{-3}{-9}$$

$$x = \frac{1}{3}$$

$$\frac{y}{6} = \frac{1}{-9}$$

$-9y = 6$

$y = \frac{6}{-9}$

$y = \frac{-2}{3}$ **Ans.**

(iii) $8x + 9y = 7$

$3x - 8y = 6$

Sol. $8x + 9y = 7$

$3x - 8y = 6$

OR

$8x + 9y - 7 = 0$

$3x - 8y - 6 = 0$

$$\frac{x}{9(-6)-8(-7)} = \frac{y}{-3(7)-8(-6)}$$

$$= \frac{1}{-8(8)-3(9)}$$

$$\frac{x}{1-54-56} = \frac{y}{-21+48}$$

$$= \frac{1}{-64-27}$$

$$\frac{x}{-110} = \frac{y}{27} = \frac{1}{-91}$$

$$\frac{x}{-110} = \frac{-1}{91}$$

$91x = 110$

$x = \frac{110}{91}$

$\frac{y}{27} = \frac{-1}{91}$

$91y = -27$

$y = \frac{027}{91}$ **Ans.**

(iv) $4x + 7y = 1$

$3x - 5y = 36$

Sol. $4x + 7y = 1$

$3x - 5y = 36$

OR

$4x + 7y - 1 = 0$

$3x - 5y - 36 = 0$

$$\frac{x}{7(-36)-5(1)} = \frac{y}{3(-1)-4(-36)}$$

$$= \frac{1}{4(-5)-3(7)}$$

$$\frac{x}{-252+5} = \frac{y}{-3+144}$$

$$= \frac{1}{-20-21}$$

$$\frac{x}{-247} = \frac{y}{141} = \frac{1}{-41}$$

$$\frac{x}{-247} = \frac{1}{-41}$$

$-41x = -247$

$x = \frac{-247}{41}$

$x = \frac{247}{41}$

$\frac{y}{141} = \frac{1}{41}$

$-41y = 141$

$y = \frac{141}{-41}$

$y = \frac{141}{-41}$

5. Solve the following:

(i) The sum of ages of father and his son is 60 years. If the difference between their ages is 40 years then find the age of father and his son.

Sol. Let age of father = x years

Age of son = y years

According to the condition equations:

$x + y = 60$ ...(i)

$x - y = 40$ ...(ii)

$2x = 100$

$x = \frac{100}{2}$

$= 50$ years

$x + y = 60$

$50 + y = 60$

$y = 60 - 50$

$y = 10$ years

Age of father = 50 years

Age of son = 10 years

(ii) **The cost of 3 books and 2 pens is Rs.395 and the cost of 2 books and 5 pens is Rs.355. Find the prices of book and pen.**

Sol. Let cost of 1 book =Rs. x

Price of pen = Rs. y

According to equation

$3x + 2y = 395$ ...(i)

$2x + 5y = 355$ ...(ii)

Multiplying equation (i) by 3 and equation (ii) by 3.

$6x + 4y = 790$

$6x + 15y = 1065$

$-11y = -275$

By subtracting

$$y = \frac{-275}{-11}$$

$y = 25$

$3x + 2y = 395$

$3x + 2(25) = 395$

$3x + 50 = 395$

Price of book = Rs. $3x = 395 - 50$

Price of pen = Rs. 25 $3x = 345$

$x = 115$

Price of 1 book = Rs. 115

Price of pen = Rs. 25

EXERCISE 6.5

1. Eliminate x by equating the co-efficient method.

(i) $ax - c = 0$, $bx - d = 0$ $(b \neq 0)$

Sol. $ax - c = 0$ ...(i)

$bx - d = 0$ ...(ii)

By dividing equation (i) with a

$$\frac{ax}{1} - \frac{c}{a} = 0$$

By dividing equation (ii) with b

$$\frac{bx}{b} - \frac{d}{b} = 0$$

$$x - \frac{c}{a} = 0 \quad \text{...(iii)}$$

$$x - \frac{c}{a} = 0$$

By subtracting equation (iii) from (iv)

$$\frac{d}{b} - \frac{c}{a} = 0$$

$$\frac{b}{d} = \frac{c}{a}$$

$ad = bc$

(ii) $3x + 3y = 4$, $x - y = 2$

Sol. $3x+3y = 4$

$3y+3y = 4$

$6y = 4 - 6$

$6y = -2$

$$y = \frac{-2}{6}$$

$$y = -\frac{1}{3}$$

$x - y = 2$

$$x - \frac{1}{3} = 2$$

$$x + \left(\frac{1}{3}\right) = 2$$

$$x = 2 - \frac{1}{3}$$

$$x = \frac{5}{3}$$

$$x = \frac{5}{3}$$

$$y = \frac{-1}{3}$$ **Ans.**

(iii) $xl = t, \frac{x}{n} = t$

$$xl = t, \frac{t}{1} = t$$

$xl = t$

$$x = \frac{t}{1}$$

$$\frac{x}{n} = t$$

$x = nt$

OR

$$\frac{t}{1} = \frac{nt}{1}$$

$t = nlt$

$l = nl$

OR

$nl = 1$ Ans.

1. Eliminate by substitution method.

Sol.

(i) $at = x,\ 2at = y$

$At = x,\ 2at = y$

$at = x$

$t = \frac{x}{a}$

(ii) $2at = y$

$T = \frac{y}{a^a}$

$2ax = ay$

$2x = y$ **Ans.**

(ii) $bt^2 = x, at^3 = y$

Sol.

(i) $bt^2 = x$

$at^3 = y$

$t^2 = \frac{x}{b}$

$t = \sqrt{\frac{x}{b}}$ **OR**

$\sqrt{\frac{x}{b}} = 3\sqrt{\frac{y}{a}}$ **Ans.**

(iii) $at^3 - d = 0,\ bt^2 + c = 0$

$at^3 - d$

Sol. $E^3 = \frac{d}{a}$

$bt^2 + c = 0$

$t^2 = -\frac{c}{b}$

$t = \sqrt{\frac{-c}{b}}$

$t^3 = \frac{d}{a}$

$t = 3\sqrt{\frac{d}{a}}$

$\sqrt{\frac{-c}{b}} = 3\sqrt{\frac{d}{a}}$

OR

$a\left(\frac{-c}{b}\right)^{3/2} - d = 0$

(iv) $x = \sqrt{3t}\ ;\ y = \sqrt{5t}$

Sol. $(x)^2 = \left(\sqrt{3t}\right)^2$

$\frac{x^2}{3} = t$

$y^3 = \sqrt{5t}$

$(y)^2 = \left(\sqrt{5t}\right)^2$

$y^2 = 5t$

$\frac{y^2}{5} = t$

$\frac{x^2}{3} = \frac{y^2}{5}$

$5x^2 = 3y^2$

OR

$x\sqrt{5} = y\sqrt{3}$

(v) $v_f = v_i + at$

$S = v_i t + \frac{1}{2}at^2$

Sol. $v_f = v_i + at$

$S = v_i t + \frac{1}{2}at^2$

$V_f = V_i + at$

$V_f - V_1 = at$

$\frac{V_f - V_1}{a} = t$

$S = V_1 t + \frac{1}{2}at^2$

$S = Vt\left(\frac{V_f - V_1}{a}\right) + \frac{1}{2}a\left(\frac{V_f - V_1}{a}\right)^2 +$

$S = \frac{V_1 V_f - V_1^2}{a} + \frac{1}{2}a\left(\frac{V_f^2 + V_1^2 - 2V_f V_1}{a^2}\right)$

$S = \frac{V_1 V_f - V_1^2}{a} + \frac{aV_f^2}{2} + \frac{aV_1^2}{2} - aV_f V_1$

$S = \frac{2V_1 V_f - 2V_1^2 aV_f^2 + a2V_1^2 - 2aV_f V_1}{2a}$

$S = \frac{V_f^2 - V_1^2}{2a}$

2. Eliminate x from;

(i) $x - \frac{1}{x} = m$

$x^2 - \frac{1}{x^2} = p^2$

Sol. $x - \frac{1}{x} = m$

$x^2 - \frac{1}{x^2} = p^2$

$\left(x - \frac{1}{x}\right)^2 = (m)^2$

$x^2 - \frac{1}{x^2} - 2 = m^2$

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

$\left(x + \frac{1}{x}\right)^2 = (m^2 + 2)^2$

$x^4 + \frac{1}{x^4} + 2 = m^4 + 4 + 4m^2$

$x^2 - \frac{1}{x^2} = p^2$

$\left(x^2 + \frac{1}{x^2}\right)^2 = (p^2)^2$

$x^4 + \frac{1}{x^4} - 2 = p^4$

$x^4 + \frac{1}{x^4} = p^4 + 2$

OR

$p^4 + 2 = m^4 + 4 + 4m^2$

OR

$m^4 + 4 + 4m^2 - p^4 - 2 = 0$

$m^4 + 4m^2 - p^4 + 2 = 0$ **Ans.**

(ii) $\frac{x}{x} + \frac{c}{x} = 2a$

$\frac{x}{x} - \frac{c}{x} = 3b$

Sol. $\left(\frac{x}{x} + \frac{c}{x}\right)^2 = (2a)^2$

$\frac{x^2}{c^2} + \frac{c^2}{x^2} + 2 = 4a^2$

$\frac{x^2}{c^2} + \frac{c^2}{x^2} + 2 - 2 = 4a^2 - 2$

$\frac{x^2}{c^2} + \frac{c^2}{x^2} = 4a^2 - 2$

$\frac{x}{c} - \frac{c}{x} = 3b$

$\left(\frac{x}{c} - \frac{c}{x}\right)^2 = (3b)^2$

$\frac{x^2}{c^2} + \frac{c^2}{x^2} - 2 = 9b^2$

$\frac{x^2}{c^2} + \frac{c^2}{x^2} = 9b^2 + 2$

$\frac{x^2}{c^2} + \frac{c^2}{x^2} = 4a^2 - 2$ **OR**

$9b^2 + 2 = 4a^2 - 2$ **OR**

$9b^2 + 2 - 4a^2 + 2 = 0$

$9b^2 - 4a^2 + 4 = 0$ **OR**

$-4a^2 + 9b^2 = -4$ **OR**

$4a^2 - 9b^2 = 4$ **Ans.**

(iii) $\frac{x^3}{a^3} + \frac{a^3}{x^3} = p$

$\frac{x^3}{a^3} + \frac{a^3}{x^3} = q$

Sol. $\left(\frac{x^3}{a^3} + \frac{a^3}{x^3}\right) = (P^2)$

$\frac{x^6}{a^6} + \frac{a^6}{x^6} = 2 = P^2$

$\frac{x^6}{a^6} + \frac{a^6}{x^6} = P^2 - 2$

$\left(\frac{x^3}{a^3} - \frac{a^3}{x^3}\right)^2 = (q)^2$

$$\frac{x^6}{a^6}+\frac{a^6}{x^6}-2=q^2$$

$$\frac{x^6}{a^6}+\frac{a^6}{x^6} = q^2+2 \text{ OR}$$

$$p^2-2 = q^2+2$$

$$p^2-q^2 = 4 \text{ Ans.}$$

(iv) $x^2-\frac{1}{x^2} = t$

$$x^4-\frac{1}{x^4} = m$$

Sol. $x^2-\frac{1}{x^2} = t$

$$\left(x^2-\frac{1}{x^2}\right)^2 = (t)^2$$

$$x^4+\frac{1}{x^4}-2 = t^2$$

$$x^4+\frac{1}{x^4} = t^2+2$$

$$x^4+\frac{1}{x^4} = m \text{ OR}$$

$$t^2+2 = m \text{ OR}$$

$$t^2-m+2 = 0$$

(v) $x+\frac{1}{x} = \ell$

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

$$\frac{1}{x^2} = (\ell)^2$$

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

$$x^2+\frac{1}{x^2} = \ell-2$$

$$x^2+\frac{1}{x^2} = t^2 \text{ OR}$$

$$\ell^2-2 = t^2 \text{ OR}$$

$$\ell^2-t^2 = 2 \text{ Ans.}$$

REVIEW EXERCISE 6

1. Fill in the blanks.

(i) To resolve an algebraic expression into its parts is called _____

(ii) An algebraic expression of degree 1 with one variable is called _____

(iv) If $a+b=9$; $a-b=7$, then the value of $a-b$ will be _____

(v) A linear equation in two variables is represented by _____.

(v) Factorization of $x+y+2xy$ is _____ x. Elimination is the

(vi) $a+b-2ab =$ _____

Ans. (i) factorization (ii) linear equation (iii) $a-b$ (iv) 63 (vi) $(x+y)^2$

2. Tick the correct

(i) $(50)^2(19)-^2 =$ _____

(a) 361 (b) 961

(c) 2139 (d) 2861

(ii) $\left(x+\frac{1}{x}\right)2$ _____ =

(a) $x^2+\frac{1}{x^2}+2$ (b) $x^2+\frac{1}{x^2}=2$

(c) $x^2+\frac{1}{x^2}$ (d) $x^2+\frac{1}{x^2}+4$

(iii) _____ $a^3+3(a+b)+b^3$

(a) $3(a+b)^2$ (b) $(3a+3b)^2$

(c) $(a+b)^3$ (d) $3(a+b)^3$

(iv) If $x+y=10$; $y=10$, then the value of x will be:

(a) 0 (b) 10

(c) 5 (d) 20

(v) If $x-y=10$ and $x+y=20$, x^2-y^2 = _____ Methods used for elimination are?

(a) 400 (b) 200

(c) 100 (d) 300

Ans. (i) (c) (ii) (a) (iii) (c) (iv) (b) (v) (b)

3. Answer the following questions:

(i) Give two examples of linear equation?

(ii) What are simultaneous linear equations? Give example.

(iii) How many methods can be used to solve simultaneous linear equations?

4. Solve the following questions using formula:

(i) $(529)^2 - (29)^2$

Sol. $(529)^2 - (29)^2$
$= (529 + 29)(529 - 29)$
$= (558)(500)$
$= 279000$

(ii) $(110)^2 - (10)^2$

Sol. $(110)^2 - (10)^2$
$= (110 + 10)(110 - 10)$
$= (120)(100)$
$= 12000$

(iii) $(298)^2$

Sol. $(298)^2 = (300 - 2)^2$
$= (300)^2 + (2)^2 - 2 \times 300 \times 2$
$= 90000 + 4 - 1200 = 88804$

4. Find the value of $a + b^2$, when:

(i) $a + b = 9,\ ab = 3$

Sol. $a + b = 9,\ ab = 3$
$a^2+b^2 = (a + b)^2 - 2ab$
By putting values
$= (9)^2 - 2(3)$
$= 81 - 6$
$a^2+b^2 = 75$ **Ans.**

(ii) $a + b = 7,\ ab = 2$

Sol. $a + b = 7,\ ab = 2$
$a^2+b^2 = (a - b)^2 + 2ab$
By putting values
$= (7)^2 + 2(2)$
$= 49 + 4$
$a^2+b^2 = 53$ **Ans.**

(iii) $a + b = 11, ab = 9$

Sol. $a + b = 11, ab = 9$
$a^2+b^2 = (a+b)^2 - 2ab$
By putting values
$= (11)^2 - 2(9)$
$= 121 - 18$
$a^2+b^2 = 103$ **Ans.**

5. Find the value of a^2-b^2, when:

(i) $a + b = 8$
$a - b = 7$

Sol. $a + b = 8$
$a - b = 7$
$a^2 - b^2 = (a + b)(a - b)$
By putting values
$A^2 - b^2 = (8)(7)$
$= 56$ **Ans.**

(ii) $a + b = 4$
$a - b = 5$

Sol. $a + b = 4$
$a - b = 5$
$a^2-b^2 = (a + b)(a - b)$
By putting values
$= (4)(5)$
$= 20$ **Ans.**

(iii) $a - b = 4$
$a + b = 12$

Sol. $a - b = 4$
$a + b = 12$
$a^2-b^2 = (a + b) + (a - b)$
By putting values
$= (12)(4)$
$= 48$ **Ans.**

6. Solve the following simultaneous linear equations:

(i) $x + y = 6$
$5x + y = 2$

Sol. $x + y = 6$
$5x + y = 2$
$x + y = 6 \quad \ldots(i)$
$5x + y = 12 \quad \ldots(ii)$
$- \quad + \quad -$
$-4x = 4$
By subtracting equation (ii) from (i)
$x = \frac{4}{-4}$
$x = -1$
$x + y = 6$
$-1 + y = 6$
$y = 6 + 1$
$y = 7$
$-1, 7$ **Ans.**

(i) $3x + 7y = 2$
$3x - 7y = 3$

Sol. $3x + 7y = 2$
$3x - 7y = 3$
$3x + 7y = 2$
$3x - 7y = 3$
$+$
$6x = 5$

Sol. By adding the equations
$6x = 5$
$x = \frac{5}{6}$
$3x + 7y = 2$

$$3\left(\frac{5}{6}\right)+7y = 2$$

$$\frac{5}{2}+7y = 2$$

$$7y = 2-\frac{5}{2}$$

$$14y = 4-5$$

$$14y = -1$$

$$y = \frac{-1}{14} \qquad \frac{5}{6}, \frac{-1}{14}$$ **Ans.**

7. Factorize the following:

(i) $8x^3 - 2xy^2$

Sol. $= 8x^3 - 2xy^2$

$= 2x(4x^2-y^2)$

$= 2x(2x+y)(2x-y)$ **Ans.**

(ii) $x^2y^2 - 81z^2$

Sol. $= x^2y^2 - 81z^2$

$= (xy)^2 - (9z)^2$

$= (xy+9z)(xy-9z)$ **Ans.**

(iii) $a^4 - 26a^2 + 169$

Sol. $= a^4 - 26a^2 + 169$

$= (a)^2 - 2(a)^2(13) + (13)^2$

$= (a^2-13)^2$ **Ans.**

(iv) $25x^2 + 80xy + 64y^2$

Sol. $= (5x)^2 + 2x5x + 8y + (8y)^2$

$= (5x+8y)^2$ **Ans.**

(v) $x^2 - 3x + 4x - 12$

Sol. $= x^2 + x - 12$

$= x + 4x - 3x - 12$

$= x(x+4) - 3(x+4)$

$= (x-3)(x+4)$

(vi) $16a^2 - 400b^2$

Sol. $= 16a^2 - 400b^2$

$= 4(4a^2 - 100b^2)$

$= 4\{(2a)^2 - 10b)^2\}$

$= 4(2a+10b)(2a-10b)$ **Ans.**

8. Solve by elimination method

(i) $2x - 46 = 3y$

$4x - 2y = -5$

Sol: $2x - 46 = 3y$

$2x - 3y = 46$

$4x - 2y = -5$

$2x - 3y = 46$

$2x = 46 + 3y$

$$x = \frac{46+3y}{2}$$

$4x - 2y = 5$

$$4\left(\frac{46+3y}{2}\right) - 2y = -5$$

$92 + 6y - 2y = -5$

$92 + 4y = -5$

$4y = -5 - 92$

$4y = 97$

$$y = \frac{-97}{4}$$

$2x - 3y = 46$

$2x - 3 = 46$

$2x + = 46$

$8x + 291 = 184$

$8x = -291 + 184$

$8x = -107$

$$x = -\frac{107}{8} \qquad y = -\frac{97}{4}$$ **Ans.**

(ii) $5x - 2y = -2$

$3x + 3y = 5$

Sol: $5x - 2y = -2$

$3x + 3y = 5$

$5x - 2y = -2$

$5x = -2 + 2y$

$$X = -\frac{2+2y}{5}$$

$$3x + 3y = 5 \quad 3\left(-\frac{2+2y}{5}\right)$$

$$-\frac{-6+6y}{5} + 3y = 5$$

$$5\left(\frac{-6+6y}{5}\right) + 3y = 5$$

$-6 + 6y + 15y = 25$

$21y = 25 + 6$

$21y = 31$

$$Y = \frac{31}{21}$$

$$5x - 2\left(\frac{31}{21}\right) = -2$$

$$5x - \frac{62}{21} = -2$$

$105x - 62 = -42$
$105x = -42 + 62$
$105x = 20$
$x = \frac{20}{105}$
$x = \frac{4}{21}$
$x = \frac{4}{21}, y = \frac{31}{21}$

Unit 7

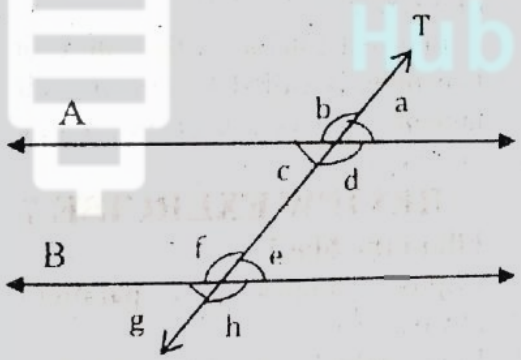
FUNDAMENTALS OF GEOMETRY

EXERCISE 7.1

Q.1. From the given figure identify the following:

(i) Corresponding angles.
(ii) Alternate interior angles
(iii) Vertical opposites angles
(iv) Interior angles on the same side of the transversal

Sol. (i) Corresponding angles.
bf, cg, ae,
$(\angle \ell, \angle f), (\angle c, \angle g), (\angle d, \angle h), (\angle a, \angle e)$



(ii) Alternate interior angles
Ans. $(\angle c, \angle e), (\angle d, \angle f)$
(iii) Vertical opposites angles
Ans. $(\angle a, \angle c); (\angle b, \angle d); (\angle e, \angle g); (\angle f, \angle h)$
(iv) Interior angles on the same side of the transversal
Ans. $(\angle d, \angle e)$

2. From the given figure calculate the following:

(i) $\angle 3$ and $\angle 4$
(ii) Value of alternate interior angles lies on line P.
$= (xy + 9z)(xy - 9z)$ **Ans.**
(iii) All vertical opposites angles.

Sol. (i) $\angle 3 = 140°, \angle 4 = 40°$
(ii) $40°, 140°$
(iii) $140°, 40°, 140°, 40°$

EXERCISE 7.2

1. From the given figure find the following.

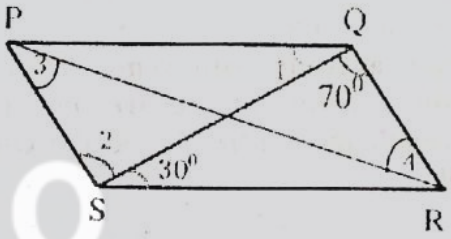
(i) $\angle 12\angle$ **Ans.** $m\angle 2 = 70°, m\angle 1 = 30°$

(ii) $\angle Q$ اور $\angle S$

Ans. $m\angle Q = 100°, m\angle S = 100°$

(iii) $\angle P$ اور $\angle R$

Ans. $m\angle R = m\angle S$



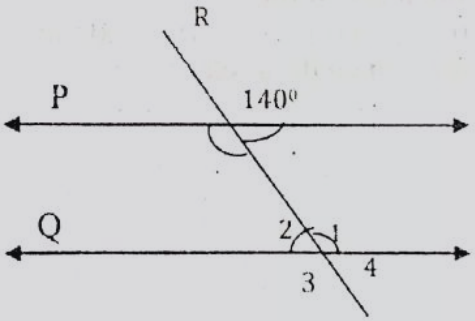
(i) $\angle 34\angle$

Ans. $40 = 4\angle°140 = 3\angle,°$

(ii) Alternative interior angles.

Ans. $40°, 140°$

(iii) Ans. $140°, 40°, 140°, 40°$



2. Complete the following table:

Polygon name	Number of sides	Sum of measure of interior angles
Triangle	3	180°
Quadrilateral	4	360°
Pentagon	5	560°
Hexagon	6	720°

Heptagon	7	1080°
Octagon	8	1260°

Q.3. **The sum of the measures of seven interior angles of an octagon is 1000. What is the measure of the eighth interior angle?**

Sol. $= 80°$

EXERCISE 7.3

1. **The diameter of a circle is 16 cm. What is its radius?**

Sol. Diameter = 16cm

Radius $= \frac{16}{2}$ = 8cm

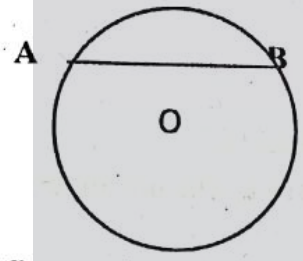
2. **The radius of a circle is 4 cm. What is its diameter?**

Sol. Radius = 4cm

Diameter $= 4 \times 2$ = 8cm

3. **Draw a circle with center 0 and any radius. Draw any chard not passing through the centre. Name the chord as AB.**

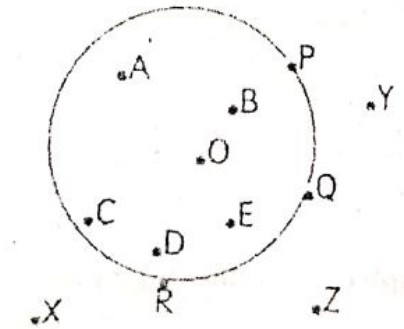
Sol.



4. **In the figure alongside name the points which are in the**

(i) interior **(ii)** exterior

(iii) in on the circle



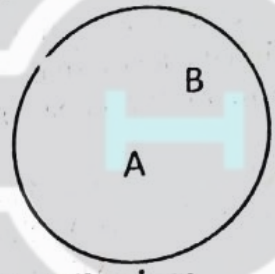
Sol. On the circle =P. Q. R.

Interior =A, B, C, D, E

Exterior =Y, Z.

5. **Take two points A and B on your note-book. Draw a circle with A as a centre which contains B in its interior.**

Ans.



6. **Define the following:**

(i) Circle

(ii) Sector of a circle

(iii) Chord of a circle

(iv) Concentric circles

Ans.

(i) **Circle:** A circle is the set of all points in a plane which are equidistant from a fixed point in the plane.

(ii) **Sector of a circle:** The circular region bounded by an arc of a circle and its two corresponding radial segments is called a sector of the circle.

(iii) **Chord of the circle:** A line segment joining any two points of a circle is called a chord of a circle.

(iv) **Concentric Circles:** concentric circles are circles of different sized which have a common center.

7. **Differentiate between secant and tangent of a circle.**

Sol. A line that intersects the curve or circle at two pints is called secant of a circle while tangent intersects a curve or circle at one point only.

REVIEW EXERCISE 7

1. **Fill in the blanks.**

(i) Opposite angles of a parallelogram are always

(ii) Lines which never intersect are called _____

(iii) Vertical angles are the angles _____ to each other.

(iv) A closed shape having at least _____ sides is called polygon.

(v) Hexagon is the type of polygon having _____ sides.

(vi) Octagon means _____ sided closed figure.

(vii) If all sides of a pentagon are equal, it is called _____ pentagon,

(viii) _____ circles are circles of different sizes which have a common centre.

(ix) Points that lie on the same circle are said to be _____.

Ans. (i) equal (ii) Parallel lines
(iii) opposite (iv) three
(v) six (vi) eight
(vii) regular (viii) concentric circle

Q.2. Select the correct answer.

(i) For the given figure which of the following is correct?

✓ (a) ∠1 and∠2 are vertically opposite angles

(b) ∠1 and ∠3are complementary angles.

(c) ∠2 and ∠4 are vertically opposite angles.

(d) ∠2 and ∠4 are supplementary angles.

(ii) The diameter of a circle is 7 cm. What is its radius?

(a) 4.5 cm (b) 3.2 cm
✓ (c) 3.5cm (d) 14cm

Q.3. What do you know about types of polygons?

Sol. A close figure consisting of at least three sides is called a polygon.

Q.4. Write all the terms associated with a circle.

(i) Circle (ii) Sector of a circle
(iii) Chord of a circle
(iv) Concentric circles

Ans.

(i) Circle: A circle is the set of all points in a plane which are equidistant from a fixed point in the plane.

(ii) Sector of a circle: The circular region bounded by an arc of a circle and its two corresponding radial segments is called a sector of the circle.

(iii) Chord of the circle: A line regment joining any two points of a circle is called a chord of a circle.

(iv) Concentric Circles: concentric circles are circles of different sized which have a common center.

Unit 8

PRACTICAL GEOMETRY

EXERCISE 8.1

Q.1. Bisect the following angles:

Q.2. Construct squares when the length of their diagonals are

(i) 4.7 cm (ii) 5cm

(i) 4.7 cm

Given: Diagonal = 4.7cm

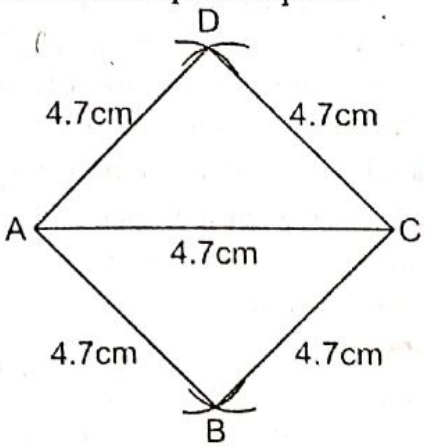
Construction:

(i) Drew $\overline{AC}$ 4.7cm

(ii) Taking A as center, drew on arc of radius 4.7cm upward and downward which meet the first arcs at points D and B.

(iii) Joined point D to points A and C, then joined point B to points a and C.

(iv) ABCD is the required square.



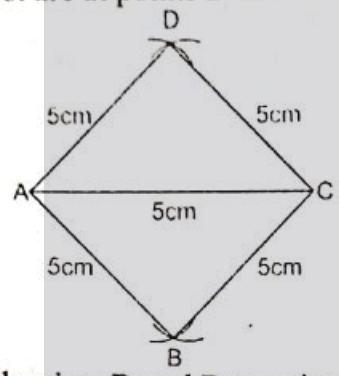
(ii) 5cm

Given: Diagonal 5cm

Construction: (i) Drew $\overline{AC}$ = 5cm

(ii) Taking A as center drew an arc of radius 5cm upwards and downwards.

(iii) Taking C as center drew an arc of the same radius upwards and downwards which meet the first arc at points B and D



(iv) Joined points D and B to points A and C.

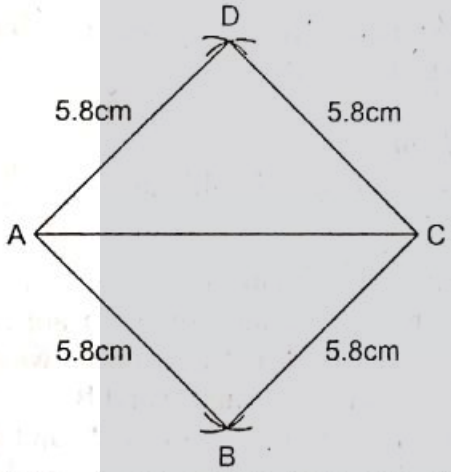
(v) ABCD is the required square.

(iii) 5.8cm

Given: Diagonal 5.8cm

Construction:

(i). Drew $\overline{AC}$ = 5.8cm



(ii) Taking A as center drew arc of radices 5.8cm upwards and downwards.

(iii) Taking C as center drew an arc of radius of 5.8cm upwards and downwards which meet the first arcs at points B and d .

(iv) Joined Points B and D to points A and C.

(v) ABCD is the required square

(iv) 6.4cm

Given: Diagonal 6.4cm

Construction:

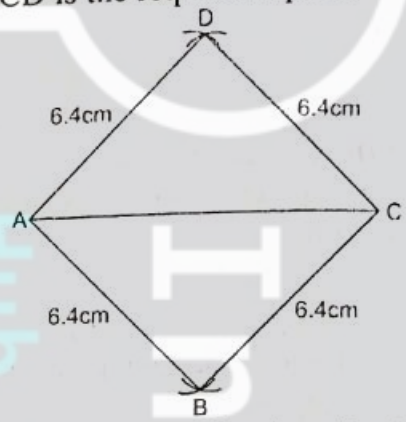
(i) Drew $\overline{AC}$ = 6.4cm

(ii) With point A drew and arcs of radius 6.4cm upside and downside.

(iii) With point c drew arcs of radius 6.4cm upside and downside which meet first arcs at point B and d.

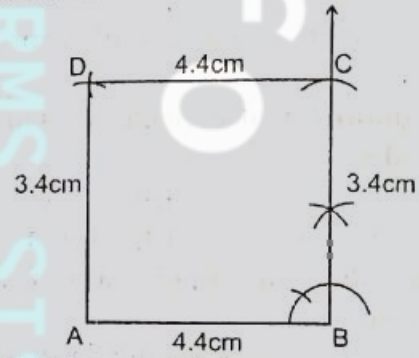
(iv) Joined point D and C to point A and C.

(v) ABCD is the required square



Q.4. Construct rectangle when its sides are:

(i) Sides 4.4cm and 3.4cm.



Given: Side 4.4cm and 3.4cm.

Construction:

(i) Drew $\overline{AB}$ =4.4cm

(ii) At point B drew an angle of 90°

(iii) With point C drew an arc of radius 3.4cm which meet the arm of angle 90° at point C.

(iv) With point C drew an arch of radius 4.4cm and with point A an other arc of radius 3.4cm which meet each other at point D.

(v) Joined point C to point D and point A to point D.

(vi) ABCD is the required rectangle.

(ii) 4cm, 5cm

Given:

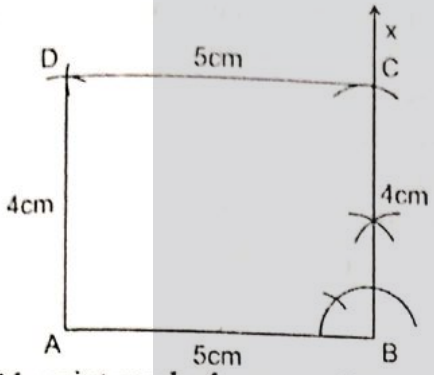
Sides 5cm

Construction:

(i) Drew $\overline{AB}$ =5cm

(ii) Constructed 90° angle at point B.

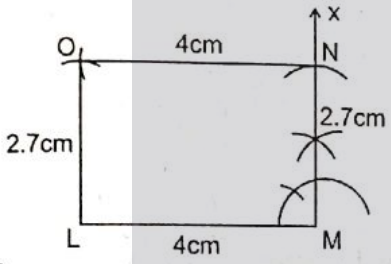
(iii) With point B drew an arc of radius 4cm which interact $\overrightarrow{Ax}$ at point C.



(iv) With point marked an arc of radius 5cm and with point A marked an arc of radius 4cm which intersect each other at point D.
(v) Joined point C and A to point D
(vi) ABCD is the required rectangle.

(iii) 2.7cm , 4cm

Given: Sides 4cm, 3.7cm



Construction:

Drew LM=4cm
(ii) With point M constructed ∠LMx = 90°
(iii) With point M drew an arc of radius 2.7cm which bisected Mx at N.
(iv) With point N drew an arc of radius 4cm and with point L marked arc of radius 2.7cm which bisected the first at point O.
(v) Joined point N and L to point O.
(vi) LMNO is the required rectangle.

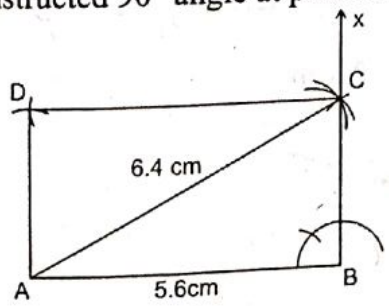
Q.5. Construct rectangles when

(i) Diagonal 64cm
And a side = 5.6 cm

Given: Diagonal 6.4cm and side=5.6cm

Construction:

(i) Drew $\overline{AB}$ = 5.6 cm
(ii) Constructed 90° angle at point b.

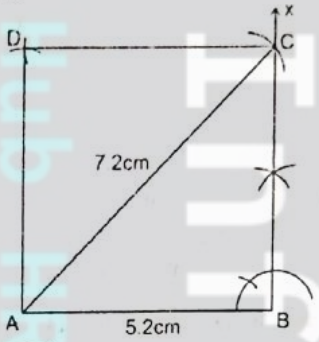


(iii) With point A marked an arc of radius 6.4cm which bisected Bx at point C.
(iv) With point A marked an arc of radius $\overline{BC}$ which intersected the first arc at point D.
(v) Joined point D to points A and C.
(vi) ABCD is the required rectangle.

(ii) (a) Side= 5.2 cm and diagonal = 7.2cm

Given: Side=5.2cm and diagonal 7.2cm

Construction:

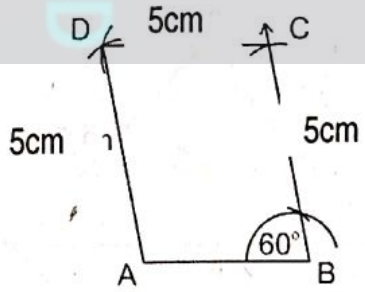


(i) Drew $\overline{AB}$ =5.2cm
(ii) Constructed an angle of 90° at point B.
(iii) Marked an arc of radius 7.2cm with point A which bisected Bx at point C.
(iv) Drew an arc of radius 5.2cm with point C and the other arc of radius BC with point A which bisected the first arc at point D.
(v) Joined point D to point C and A.
(vi) ABCD is the required rectangle.

Q.6. Construct rhombus when its slides and included angles are:

(i) 5cm 60°

Given:



Side 3cm and an angle = 60°

Construction:

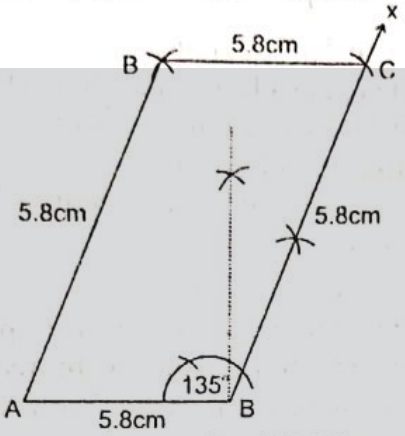
(i) Drew $\overline{AB}$ = 5cm
(ii) Constructed an angle of 60° at point B.
(iii) Bisected $\overline{BC}$ = 5cm
(iv) With point C marked an arc of radius 5cm with point A marked another arc of radius 5cm which bisected each other at point D.
(v) ABCD is the required rhombus.

(ii) 5.8cm, 135°

Given: Side 5.8cm

Angle = 135°

Construction: (i) Drew $\overline{AB}$ = 5.4cm



(ii) Constructed an angle of 135° at point B

(iii) With point B bisected $\overrightarrow{Bx}$ of arc 5.8c at point C.

(iv) With point C marked an arc of radius 5.8cm and with point A marked another arc bisected the first arc at point B.

(v) Joined point B to points A and C.

(vi) ABCD is the required rhombus

Q.7. Construct rhombus when its sides and diagonal are:

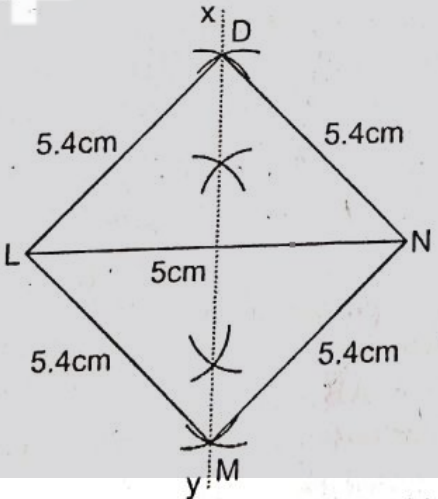
(i) Side 5.4cm, Diagonal 5cm

Given: Side 5.4cm and diagonal 5cm

Construction:

(i) Drew $\overleftrightarrow{LN}$ =5cm

(ii) Drew bisected $\overleftrightarrow{xy}$ of $\overline{LN}$



(iii) Drew two arcs of radius 5.4cm taking L as center which intersected $\overline{xy}$ at points O and M and N.

(iv) Joined point O and M with L and point N.

(v) LMNO is the required rhombus.

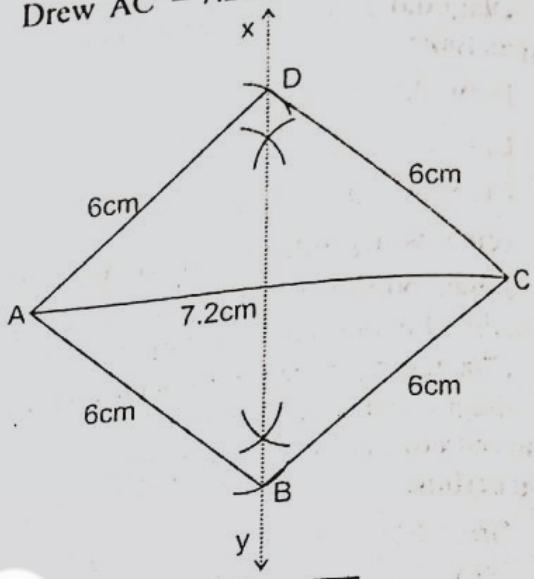
(ii) Given:

Side 7.2cm

Diagonal = 6cm

Construction:

(i) Drew $\overline{AC}$ = 7.2cm



(ii) Drew bisector $\overleftrightarrow{xy}$ of $\overline{AC}$.

(iii) Drew two arcs of radius 3 cm taking O as center which bisected $\overleftrightarrow{xy}$ at points B and D.

(iv) Joined point B and D to points A and C.

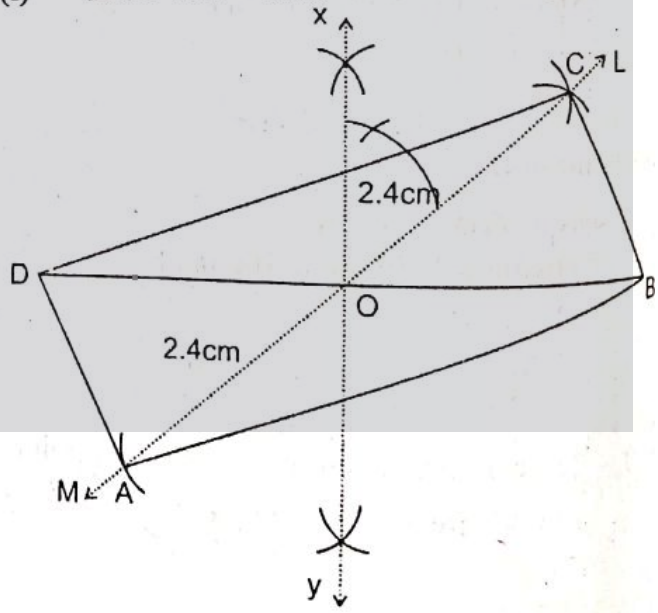
(vi) ABCD is the required rhombus.

(iii) Side 7.2cm, Diagonal 6cm

Given: Side 7.2cm and diagonal 6cm

Construction:

(i) Drew $\overleftrightarrow{BD}$ = 6cm



(ii) Drew bisected $\overleftrightarrow{xy}$ of $\overleftrightarrow{BD}$

(iii) Drew two arcs of radius 3cm taking L as center which intersected $\overline{xy}$ at points B and D.

(iv) Joined point D with B and point A and C.

(v) ABCD is the required rhombus.

(ii) Diagonal 7.2cm and Side 6cm

Construction:

(i) Drew $\overline{AC}$ =7.2cm

(ii) Drew bisected $\overleftrightarrow{xy}$ of $\overline{AC}$

(iii) Drew two arcs of radius 2.4cm taking O as center which intersected $\overline{xy}$ at points B,D.

(iv) Joined point B and D to points A and C.

(vi) ABCD is the required rhombus.

Q.8. Construct a square when sum of its diagonal and a side is 6.2 cm.

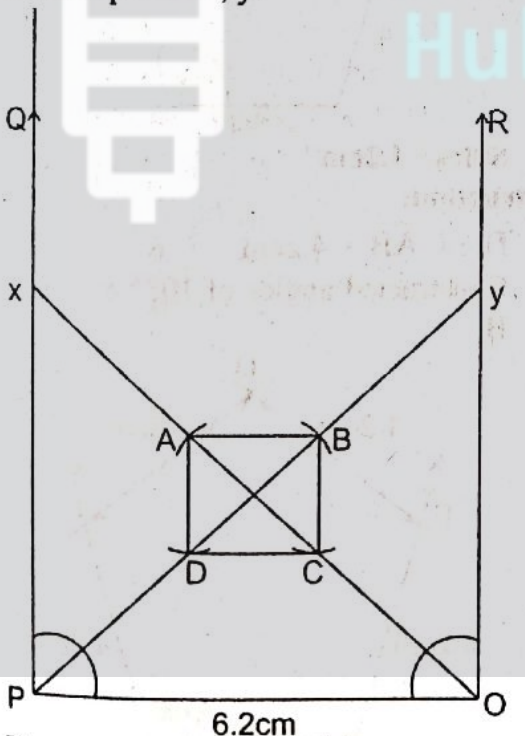
Given: Sum of diagonals and sides =6.2cm.

Construction:

(i) Drew $\overline{PO}$ = 6.2 cm

(ii) Drew two parallel lines on both sides of $\overline{PO}$

(iii) Drew bisectors of angles P and Q which meet at points x, y.



(iv) Drew an arc of radius 6.2cm from point A which directed $\overrightarrow{px}$ at point B. Similarly, drew other arc from point O which bisected $\overline{xo}$

(v) Drew arc $\overline{AB}$ radius from point A which bisected $\overline{BY}$ radius from point B which dissected $\overline{ox}$ at point C and A.

(vi) Joined points B to C and point A to D

(vii) ABCD is the required square.

Q.9. Construct a kite when

(i) Diagonal 6.5cm, sides 4.5cm, 3.8cm.

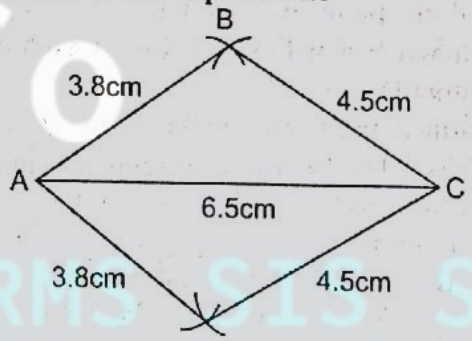
Construction:

(i) Drew $\overline{AC}$ = 6.5cm

(ii) Drew two arcs of 4.5cm from point C and two arcs from point A of radius 3.8cm which intersected each other at point B and D.

(iii) Joined point B to point A, C and point D to points A, C.

(vii) ABCD is the required rite



(ii) Diagonal =7cm, sides =3cm, 4cm.

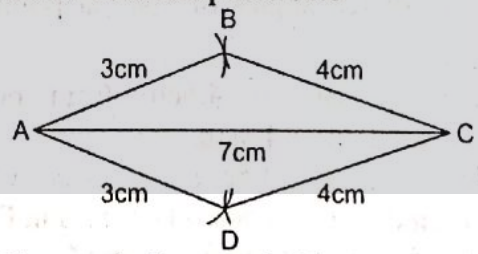
Construction:

(i) Drew $\overline{AC}$ =7cm

(ii) With B marked two arcs of radius 4cm from point A and two arcs from point A of 3cm radius which intersected each other at points B and D.

(iii) Joined point B and D to points A and C.

(vii) ABCD is the required kite

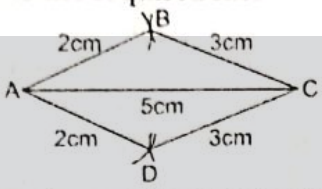


(iii) Diagonal =5cm and sides =3cm, 2cm.

Construction:

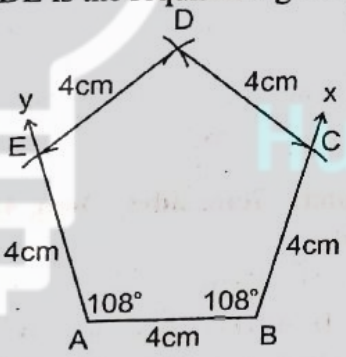
(i) Drew $\overline{AC}$ =5cm

(ii) Drew two arcs of radius 2cm from point A and two arcs of radius 3cm from point C which direct each other at points B and D.
(iii) Joined point B and D to points A and C.
(vii) ABCD is the required kite

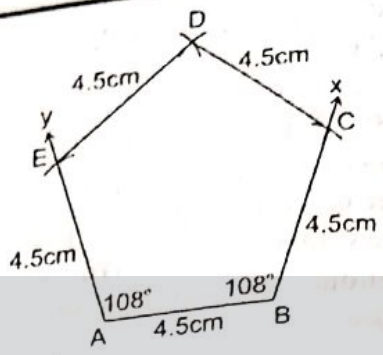


Q.10. Construct a regular pentagon when its each side is:
(i) 4cm (ii) 4.5 cm

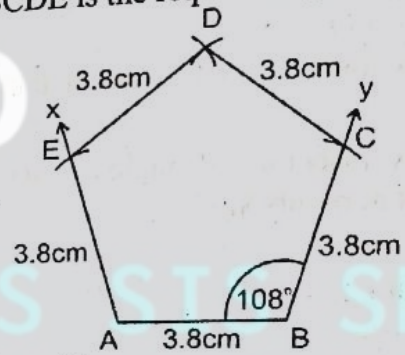
Construction:
(i) Drew $\overline{AB}$ = 4cm
(ii) Constructed angles of 108° at points A and B.
(iii) Marked two arcs of radius 4cm from point A and B.
(iv) Marked two other arcs of radius 4cm from points E and C which bisect each other at point D.
(iii) Joined point D to points C and E.
(vii) ABCDE is the required regular pentagon.



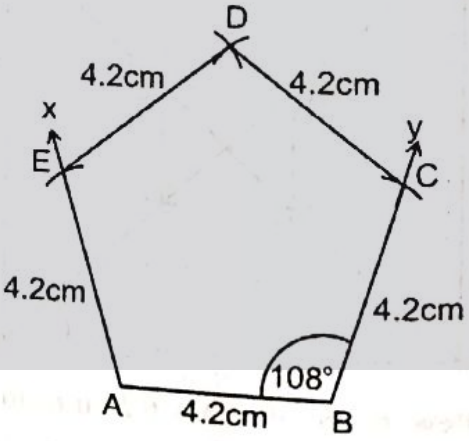
(ii) 4.5cm
Given: Sides 4.5cm
Construction:
(i) Drew $\overline{AB}$ =4.5cm
(ii) Constructed angles of 108° at points A & B.
(iii) Bisected $\overline{BC}$ = 4.5cm from point A dissected AE = 4.5cm.
(iv) Marked arcs of 4.5cm from points C and E which dissected each other at point D.
(iii) Joined point D to points E and C.
(vii) ABCDE is the required regular pentagon.



(iii) Sides 3.8cm
Construction:
(i) Drew $\overline{AB}$=3.8cm
(ii) Constructed angles of 108° at points A and B.
(iii) Bisected $\overline{BC}$ = 3.8cm from point A dissected $\overline{AE}$ = 3.8cm.
(iv) Drew arcs radius 3.8cm from points E and C which bisected each other at point D.
(iii) Joined point D to points E and C.
(vii) ABCDE is the required regular pentagon.



(iv) Sides= 4.2cm
Construction:
(i) Drew $\overline{AB}$ = 4.2cm
(ii) Constructed angles of 108° at points A and B.



(iii) Bisected $\overline{BC}$ = 4.2cm and $\overline{AE}$ =4.2cm.

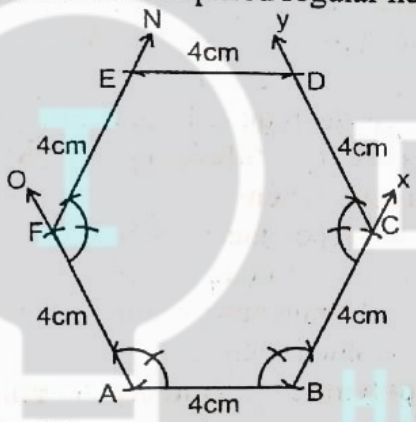
(iv) Drew arcs of radius 4.2cm from points E and C which bisected each other at point D.
(iii) Joined point D to points E and C.
(vii) ABCDE is the required regular pentagon.

Q.11. Construct a regular hexagon when its side is

(i) Sides 4cm (ii) 4.5cm

Construction:

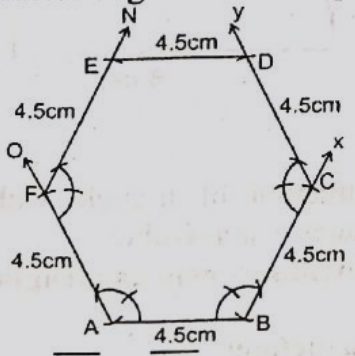
(i) Drew $\overline{AB}$ =4cm
(ii) Constructed angles of 120° at points A and B.
(iii) Bisected $\overline{BC} = \overline{AE}$ =4cm.
(iv) Constructed angles of 120° at points C & F.
(v) Bisected $\overline{EF} = \overline{CD}$ =4cm
(vi) Joined point E to point D.
(vii) ABCDE is the required regular hexagon.



(ii) Sides 4.5cm

Construction:

(i) Drew $\overline{AB}$ =4.5cm
(ii) Constructed angles of 120° at points A&B.
(iii) Bisected $\overline{BC} = \overline{AF}$ =4.5cm.
(iv) Constructed angles of 120° at points C&F.

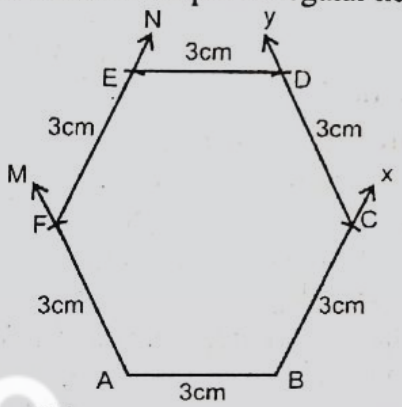


(v) Bisected $\overline{EF} = \overline{CD}$ =4cm
(vi) Joined point E to point D.
(vii) ABCDE is the required regular hexagon.

(iii) Sides 3cm

Construction:

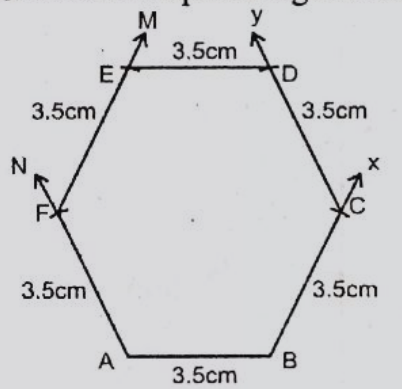
(i) Drew $\overline{AB}$ =3cm
(ii) Constructed angles of 120° at points A and B.
(iii) Bisected $\overline{BC} = \overline{AF}$ = 3cm.
(iv) Constructed angles of 120° at points C and F.
(v) Bisected $\overline{EF} = \overline{CD}$ = 4cm
(vi) Joined points E and D.
(vii) ABCDE is the required regular hexagon.



(iv) Sides 3.5cm

Construction:

(i) Drew $\overline{AB}$ =3.5cm
(ii) Constructed angles of 120° at points A&B.
(iii) Bisected $\overline{BC} = \overline{AF}$ = 3.5cm.
(iv) Constructed angles of 120° at points C & F.
(v) Bisected $\overline{EF} = \overline{CD}$ = 4cm
(vi) Joined point E to point D.
(vii) ABCDE is the required regular hexagon.



EXERCISE 8.2

Q.1. Construct right angled triangle ABC with m∠B = 90° when

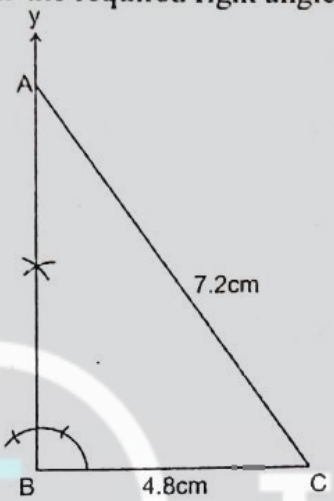
(1) AC = 7.2 cm; BC = 4.8cm

Construction:

Given: $\overline{AC}$ =7.2cm , $\overline{BC}$ =4.8cm

Construction:

(i) Drew $\angle \overline{BC}$ =4.8cm
(ii) Constructed CBy = 90° at point B.
(iii) Marked an arc of radius 7.2cm from point C which meets By at point A.
(vi) Joined point A to point C.
(vii) ABC is the required right angled triangle.

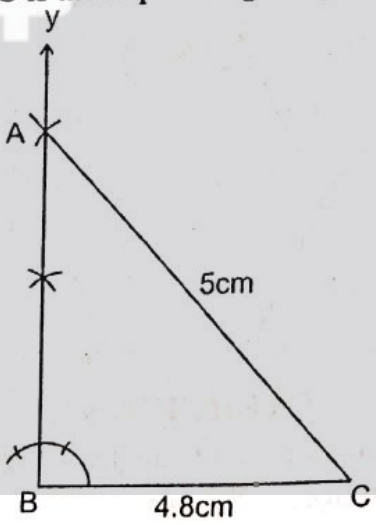


(ii)

Given: Sides of right angled triangle $\overline{AC}$ = 5cm, $\overline{BC}$ =4.0cm

Construction:

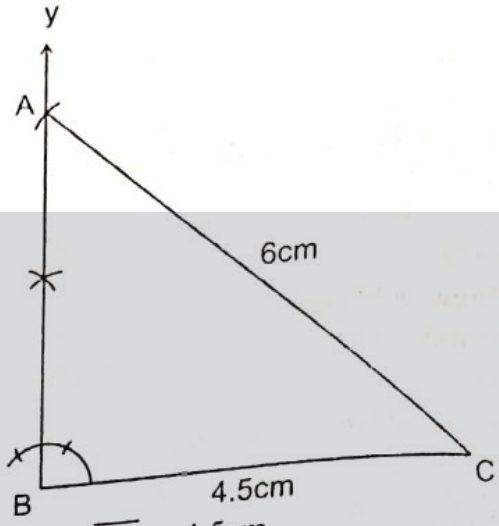
(i) Drew $\overline{BC}$ = 4.8cm
(ii) Constructed ∠CBy=90° at point B.
(iii) Marked an arc of radius 5cm from point C which bisects by at point A.
(vi) Joined point A to point C.
(vii) ABC is the required right angled triangle.



(iii)

Given: Sides of right angled triangle are 4.5c, 6cm

Construction:



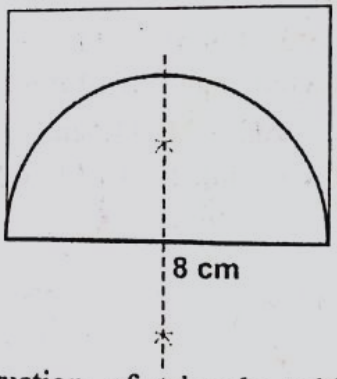
(i) Drew $\overline{BC}$ = 4.5cm
(ii) Constructed an angle of 90° at point B.
(iii) Marked an arc of radius –6cm from point C which bisects by at point A.
(vi) Joined point A to point C.
(vii) ABC is the required right angled triangle.

Q.2. Construct following right angled triangles when:

(i) Hypotenuse = 8.5cm and length of a side is 6cm.
(ii) Hypotenuse = 6cm and length of a side is 3cm.

(i) Hypotenuse = 8.5cm and length of a side is 6cm.

Sol.

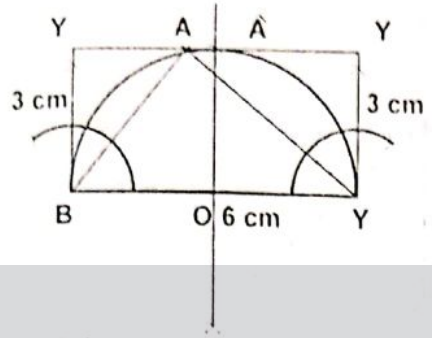


Construction of triangle with the given measures is impossible.

(ii) Hypotenuse = 6cm and length of a side is 3cm.

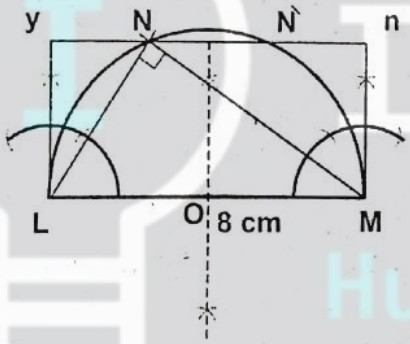
Sol. Construction:

(i) Drew $\overline{AB}$ = 6cm
(ii) Bisected $\overline{AB}$ at point O with the help of compass.
(iii) Drew semi-circle with center 0.



(iv) Drew right angles with point B and C.
(v) Marked an arc with radius 3 cm from point B and C.
(vi) Joined point Y and X which meets at point A, A′.
(vii) Joined point A to point B and C.
(viii) ABC is the required right angled triangle.

Q.3. Construct a right angled triangle LMN, when hypotenuse $m\overline{MN}$ = 8cm and perpendicular from vertex L to $\overline{MN}$ is 3.5cm.



Construction:

(i) Drew $\overline{LM}$ = 8cm
(ii) Drew right angles with point L and M.
(iii) Drew a semi-circle with point 0 of $\overline{OM}$ radius.
(iv) Drew arcs of 3 cm with points M and L.
(v) Joined points x, y.
(vi) Line $\overline{xy}$ touches the semi-circle at points N, N′.
(vii) Joined point N to points L, M.
(viii) LMN is the required triangle.

REVIEW EXERCISE 8

Q.1. Fill in the blanks with suitable words.

(i) Two unparalleled lines joining at a point, make an _____.
(ii) In case of square all the sides are _____.
(iii) Angles rectangle has _____.
(iv) In right triangle of one side is 3 and other is 4, the hypotenuse will be _____
(v) We can construct a _____ pentagon when a side is given

Ans. (i) angle (ii) equal (iii) 4 (iv) 5. ??

Q.2. Choose the correct option.

(i) A hexagon has six sides and _____ angles:
(a) 3 (b) 4
(c) 5 (d) 6 ✓

(ii) A square can be construct of _____ it diagonals and side is given
(a) division of (b) multiplication
✓ (c) square of (d) difference of

(iii) A square can be constricted of the sum of its diagonal and _____ is given.
(a) angles (b) side
✓ (c) hypotenuse (d) vertices

(iv) A rhombus can be constricted of one _____ and the base angle are given.
(a) hypotenuse (b) side
(c) hypotenuse (d) vertices ✓

(v) In right angled triangle, the angle opposite to hypotenuse is measure of:
(a) 30° (b) 45°
(c) 60° (d) 90°

(vi) In regular pentagon, each angle is of measure
(a) 90° (b) 108°
(c) 45° (d) 360°

(vii) In rectangle each angle is of measure of
(a) 30° (b) 45°
(c) 60° (d) 90°

(viii) In square each angle is measure of
(a) 30° (b) 45°
(c) 60° (d) 90°

(ix) In rectangle opposite sides are
(a) not equal (b) not parallel
(c) equal (d) perpendicular

(x) In parallelogram opposite sides are
(a) not parallel (b) not equal
(c) equal (d) Perpendicular

Q.3. Define the following terms:
(i) Pentagon (ii) Square
(iii) Parallelogram (iv) Rectangle
(v) Rhombus (vi) Kite

Ans. (i) Pentagon:

A regular pentagon has all the sides equal and each interior angle is of 108°.

(ii) **Square:** A square is a closed plane figure which has four sides and all are equal. It has four angles and each angle is equal to 90°.

(iii) **Parallelogram:** The opposite sides are equal and parallel

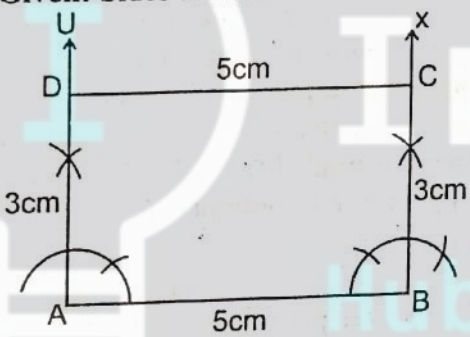
(iv) **Rectangle:** A rectangle is a quadrilateral with four right angles and opposite sides are equal.

(v) **Rhombus:** A rhombus has four equal sides but none of its internal angles is 90°.

(vi) **Kite:** A kite is quadrilateral which has equal sides. The diagonals do not bisect each other.

Q.4. Construct rectangle when its sides are 5cm and 3cm.

Ans. Given: Sides are 5cm and 3cm.



Construction:

(i) Drew $\overline{AB}$ =5cm

(ii) Constructed an angle of 90° at point B and point A.

(iii) Marked an arc of 3cm radius from points A and B which cut Bx at C and Ay at point D.

(vi) Joined point C and D.

(vii) ABCD is the required rectangular.

Q.5. Construct a parallelogram with diagonals 6cm and 6cm. The angle between diagonals is 60°.

Ans. Given:

Diagonals = 6cm an 6cm angle between diagonal 60°

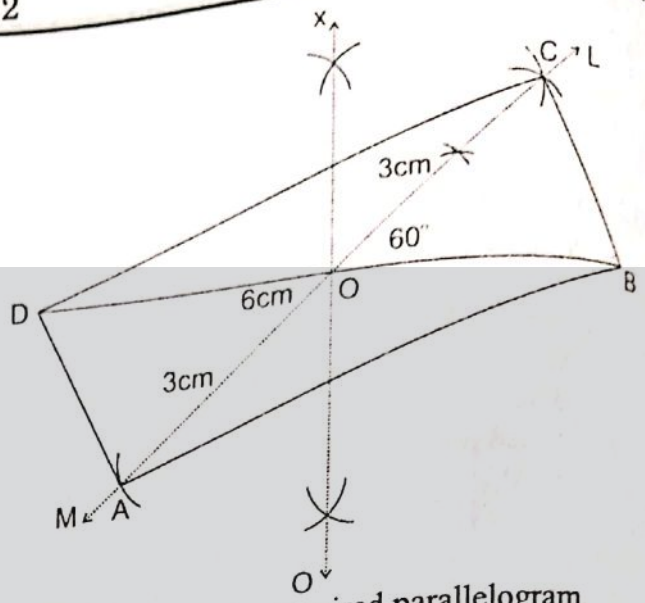
Construction:

(i) Drew $\overline{BD}$ = 6cm

(ii) Constructed bisector of BD at point O.

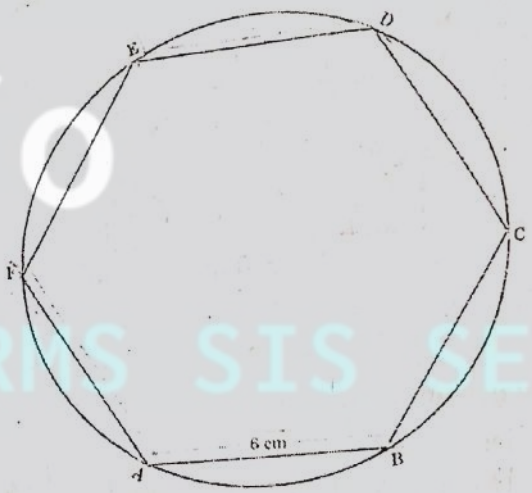
(iii) Marked an arc of radius 3cm which cut the bisector a points C and A.

(vi) Joined point A to point B and D to point C.



(vii) ABCDE is the required parallelogram.

Q.6. Construct a regular hexagon when its each side is 6 cm.



Sol. Construction:

(i) Drew a circle of radius of 6cm.

(ii) Took a point A on the circle.

(iii) Drew an arc of 6cm which meets the circle at point B.

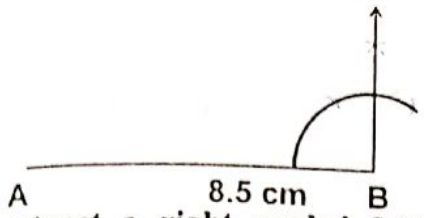
(iv) With point B marked another are of radius 6 cm. Similarly marked points C, D, E, F.

(v) Joined the marked points.

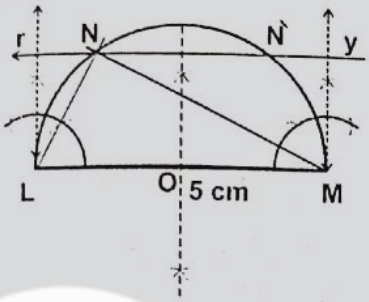
(vi) ABCDEF is the required hexagon.

Q.7. Construct a right triangle ABC with m∠B = 90° having $\overline{AC}$ = 4 cm; and $\overline{AB}$ = 3.5 cm

Sol. Impossible to construct a right angled triangle with the given measurements because $(AC)^2 \neq (AB)^2 + (BC)^2$.



Q.8. Construct a right angled LMN, when hypotenuse m$\overline{MN}$ = 8cm - and perpendicular from vertex L to $\overline{MN}$ is 3.5cm.



Sol. **Construction:**

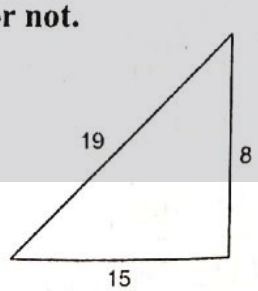
(i) Drew $\overline{LM}$ = 8cm.
(ii) Drew a semi-circular with point 'O' mid-point of $\overline{LM}$.
(iii) Constructed right angles with points L&M.
(iv) Marked arcs with point L and M of 3.5 cm radius on point.
(v) Joined x, y. Line $\overline{xy}$ touches semi-circle at point N, N'.
(vi) Joined point N to point M and L.
(vii) LMN is the required right angled triangle.

Unit 9

AREA & VOLUMES

EXERCISE 9.1

1. **Use Pythagoras Theorem to decide whether each of these triangles is right angled or not.**



(i) **Sol.**

According to Pythagoras Theorem:

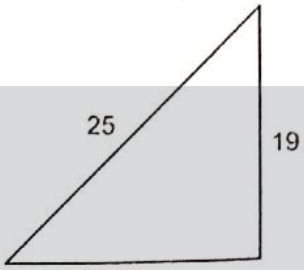
$(15)^2 + (8)^2 = (19)^2$

$225 + 324 \neq 361$

$545 \neq 361$

Not right angle triangle.

(ii)



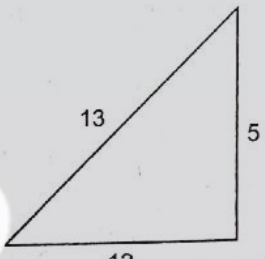
Sol. $(14)^2 + (19)^2 = (25)^2$

$196 + 361 \neq 625$

$557 \neq 625$

Not right angled triangle.

(iii)

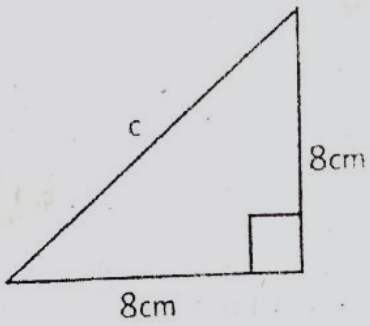


Sol. $(5)^2 + (12)^2 = (169)^2$

$25 + 144 = 169$

Q.2. **Use Right Angled Triangle Pythagoras Theorem to find the length of the missing sides.**

(i) **Sol.**

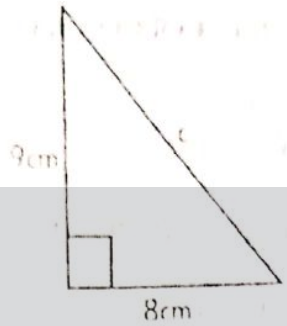


(ii)

$c = \sqrt{(8)^2 + (8)^2}$

$= \sqrt{64 + 64} = \sqrt{128}$

$= 128 = \sqrt{64 \times 2} = 8\sqrt{2}$

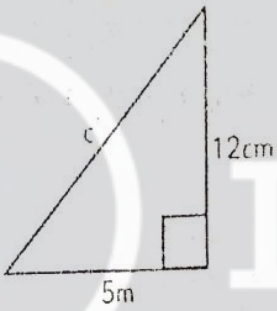


Sol. $\sqrt{(9)^2 + (8)^2}$

$= \sqrt{81+64} = \sqrt{145}$

$= 12 - 04\text{cm}$

(iii)

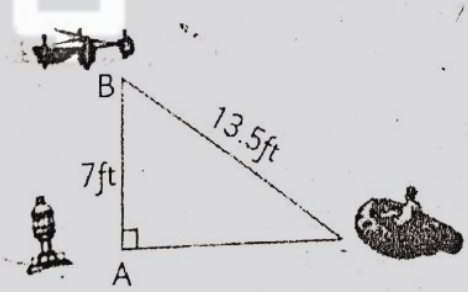


Sol. $c = \sqrt{(12)^2 + (5)^2} = \sqrt{144+25}$

$= \sqrt{169} = 13\text{cm}$

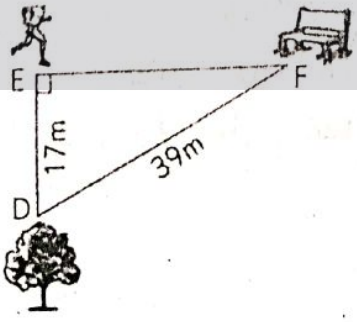
Q.3. Find the length of each side in each of the following figures:

(i)



Sol. $AC = \sqrt{(13.5)^2 - (7)^2}$

$= \sqrt{182.5 - 49} = 11.5 = 11.5 \text{ ft.}$



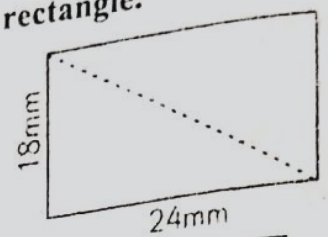
Sol. $\sqrt{(39)^2 - (17)^2}$

$DF = \sqrt{1521 - 289}$

$= \sqrt{1232}$

$= 35.2 \text{ m}$

Q.4. Find the length of the diagonal of the given rectangle.



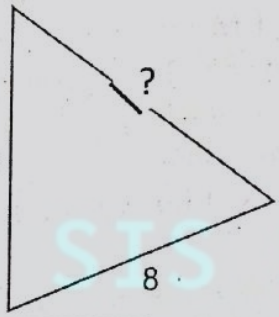
Sol. $\sqrt{(18)^2 + (24)^2}$

$= \sqrt{324 + 576}$

$= \sqrt{900} = 30\text{mm}$

Find the length of side not given.

(i)



Sol. $\sqrt{(8)^2 + (8)^2} = ?$

$\sqrt{64+64} = \sqrt{128}$

11.31

1	128
	1
21	28
	21
223	700
	669
2261	3100
	2261

Ans. 11.31cm

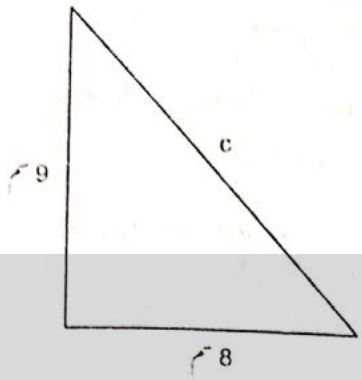
(ii) Sol.

$C = \sqrt{(8)^2 + (9)^2}$

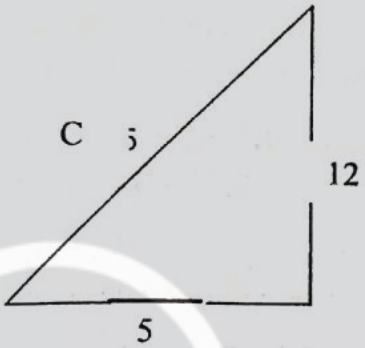
$= \sqrt{64 + 81}$

$= \sqrt{145}$

$= 12.04 \text{ cm}$



(iii)



Sol.

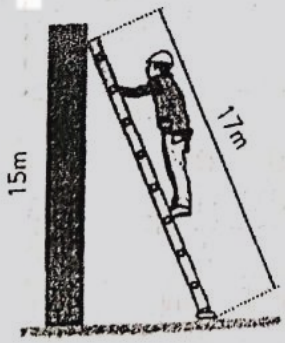
$$C = \sqrt{(12)^2 + (5)^2}$$

$$C = \sqrt{144 + 25}$$

$$C = \sqrt{169}$$

$$C = 13\text{cm}.$$

Q.5. Firefighters have a 17 m extension ladder. In order to reach 15m up a building, how far away from the building should the Joot of the ladder be placed?



Sol.

$$\sqrt{(17)^2 - (15)^2}$$

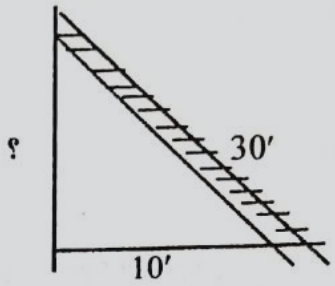
$$= \sqrt{289 - 225} = \sqrt{64} = 8\text{m}$$

Q.6. A 30-ft ladder is leaning against a building. If the foot of the ladder is 10 ft away from the base of the building, how Jar up the building does the ladder reach?

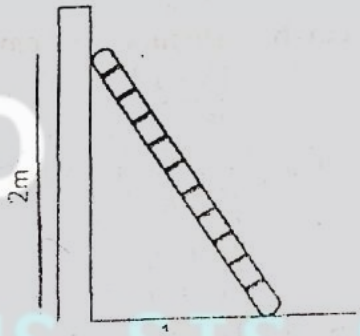
Sol. $? = \sqrt{(3)^2 - (10)^2}$

$$= 10\sqrt{8} = \sqrt{900 - 100} = \sqrt{800}$$

$$= \sqrt{100 \times 8}$$



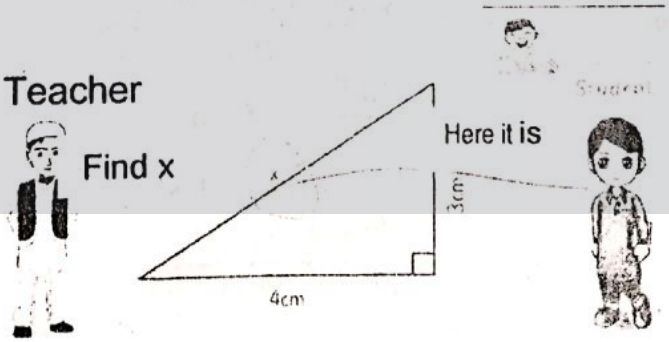
Q.7. Find the length of the ladder given in the figure.



Sol. $\sqrt{(2)^2 + \left(1\frac{1}{2}\right)^2} = \sqrt{4 + \frac{9}{4}}$

$$= \sqrt{\frac{16+9}{4}} = \sqrt{\frac{25}{4}} = \frac{5}{2} = 2\frac{1}{2}\text{m}$$

Q.8. A 20m ladder is leaned against a wall. If the base of the ladder is 8 m from the wall, how high up the wall will the ladder reach?



Sol. $= \sqrt{(20)^2 - (8)^2}$

$= \sqrt{400 - 64} = \sqrt{336}$

$= \sqrt{336} = 18.3\text{m}$

EXERCISE 9.2

1. Find the area of the following triangles if

(i) a = 5cm, b = 4cm, c = 8cm

a = 5cm, b = 4cm, c = 8cm.

Sol. $s = \frac{5+4+8}{2}$

$= \frac{17}{2}$

$= 8.5\text{cm}$

Area $= \sqrt{8.5(8.5-5)(8.5-4)(8.5-8)}$

$= \sqrt{8.5\times3.5\times4.5\times0.5}$

$= \sqrt{66.9375}$

$= 8.18\ \text{cm}^2$

(ii) a = 17cm, b = 19cm, c = 12 cm

Sol. $s = \frac{17+19+12}{2} = \frac{48}{2} = 24\text{ cm}$

Area $= \sqrt{24(24-17)(24-19)(24-12)}$

$= \sqrt{24\times7\times5\times12}$

$= \sqrt{10080}$

$= 100.4\ \text{cm}^2$

(iii) a =13cm, b = 16cm, c = 15cm

Sol. $s = \frac{13+16=15}{2}$

$= \frac{44}{2} = 22\text{ cm}$

Area $= \sqrt{22(22-13)(22-16)(22-15)}$

$= \sqrt{22\times9\times6\times7} = \sqrt{8316} = 91.19\ \text{cm}^2$

Q.2. A triangle has sides measuring 4.27 cm, 6,08 cm and 9.25 cm, find area.

(i) a =4.27cm, b = 6.08cm, c = 9.25 cm

Sol. $s = \frac{4.27+6.08+9.25}{2}$ f4

$= \frac{19.6}{2} = 9.8\text{ cm}$

Area $= \sqrt{9.8(9.8-4.27)(9.8-6.08)}$

$= \sqrt{9.8-9.25}$

$= \sqrt{9.8\times5.53\times3.72\times0.55}$

$= \sqrt{110.88}$

$= 10.53\ \text{cm}^2$

Q.3. Find the area of an equilateral triangle with a side of 8 cm

(i) a = 8cm, b = 8cm, c = 8cm

Sol. $s = \frac{8+8+8}{2}$

$= \frac{24}{2}$ f = 12 cm

Area $= \sqrt{12(12-8)(12-8)(12-8)}$

$= \sqrt{12\times4\times4\times4}$

$= \sqrt{768} = 27.7\ \text{cm}^2$

Q.4. An isosceles triangle has edge-lengths of 5.67cm, 5.67 on arid 9.2 cm. What is its area?

(i) a = 5.67cm, b = 5.67cm, c = 9.2 cm

Sol. $s = \frac{5.67+5.67+9.2}{2}$

$= \frac{20.54}{2} = 10.27\text{ cm}$

Area $= \sqrt{10.27(10.27-5.67)(10.27-5.67)(10.27-9.2)}$

$= \sqrt{10.27\times4.60\times4.60\times1.07}$

$= \sqrt{232.525} = 15.25\ \text{cm}^2$

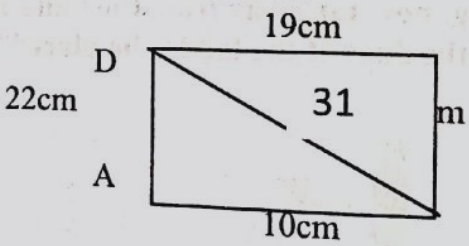
Q.5. A field is in the shape of a quadrilateral ABCD.

AB-= 10 meter BC = 15 meter

CD =19 meter AD =22 meter

BD = 31 meter

Calculate its area.



For triangle ABD

$s = \frac{10+31+22}{2} = \frac{63}{2} = 31.5\text{ cm}$

Area $= \sqrt{(31.5)(31.5-10)(31.5-31)(31.5-22)}$

$= \sqrt{31.5\times21.5\times0.5\times9.5}$

$= \sqrt{3047.625}$

$= 55.21\text{ cm}$

For triangle ABD

$S = \frac{31+15+19}{2} = \frac{65}{2}$

$= 32.5$

Area $= \sqrt{(32.5)(32.5-31)(32.5-15)(32.5-19)}$

$= \sqrt{32.5\times1.5\times17.5\times13.5}$

$= \sqrt{11517.187}$

$= 107.31\ cm^2$

Area of quadrilateral

$= 107.31 + 55.21$

$= 162.52\ cm^2$

EXERCISE 9.3

1. Find the surface area and volume of the spheres whose radii are given with $\pi = \frac{22}{7}$

(i) r = 2.8m (ii) r = 5.6 ml

(iii) r = 6.3 cm (iv) r = 70 cm

(v) r = 1m (vi) r= 15 m

Sol. (i) r = 2.8m

Area $= 4\pi r^2$

$= 4 \times \frac{22}{7} \times (2.8)^2$

$= 4 \times \frac{22}{7} \times 2.8 \times 2.8$

$= 98.5 m^2$

Volume $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 2.8 \times 2.8 \times 2.8$

$= 91.99\ m^3$

(ii) r = 5.6m

Area $= 4\pi r^2$

$= 4 \times 5.6 \times 5.6 \times 22$

$= 394.24\ m^2$

Volume $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 5.0 \times 5.6 \times 5.6$

$= 735.91\ m^3$

(iii) r = 6.3cm

Area $= 4\pi r^2$

$= 4 \times \frac{22}{7} \times 6.3 \times 6.3$

$= 499\ cm^2$

Volume $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 5.0 \times 5.6 \times 5.6$

$= 735.91\ m^3$

Volume $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 6.3 \times 6.3 \times 6.3$

$= 1047.8\ m^3$

(iv) r = 70 cm

Area $= 4\pi r^2$

$= 4 \times \frac{22}{7} \times 70 \times 70$

$= 61600\ cm^2$

Volume $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 70 \times 70 \times 70$

$= 1437333\ cm^3$

(v) r = 1m

Sol. r = 1m

Area $= 4\pi r2$

$= 4 \times 1 \times 1 \times \frac{22}{7}$

$= \frac{88}{7} m^2 = 12.56 m^2$

Volume $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 1 \times 1 \times 1 = \frac{88}{21}$

$= 4.2\ m^3$

(vi) r= 15 m

Sol. r = 15m

Surface area $= 4\pi r^2$

$= 4 \times \frac{22}{7} \times 15 \times 15$

$= \frac{19800}{7} m^3 = 28.26 m^2$

Volume $= \frac{4}{3} \times \frac{22}{7} \times 15 \times 15 \times 15 = 14142.86\ m^3$

Q.2. Find the volume of sphere whose surface area is 2464 cm^2.

Surface Area $= 2464\ cm^2$

Radius $= \sqrt{\frac{Area}{4\pi}}$

$$= \sqrt{\frac{2464}{4} \times \frac{7}{22}}$$

$$= \frac{112 \times 7}{4}$$

$$= \sqrt{\frac{764}{4}}$$

$$= \frac{28}{2} = 14 \text{ cm}$$

$$\text{Volume} = \frac{4}{3}\pi r^2$$

$$= \frac{4}{3} \times \frac{22}{7_1} \times 14 \times 14^2$$

$$= \frac{2664}{3} = 821.3 \text{ cm}^3$$

Q.3. A spherical drum has radius 8.4m how many litres of water can be stored in it?

Radius =8.4 m

$$\text{Volume} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3} \times \frac{22}{7} \times 8.4 \times 8.4 \times 8.4$$

$$= \frac{52157}{21} = 2483.71 \text{ litre}$$

Q.4. The radius of sphere A is twice that of a sphere B. Find:

(i) The ratio among their surface areas.

(ii) The ratio among their volumes.

Sol. Let r of $1^{st} = 1$

$$\text{Area} = 1 \times 1 \times \frac{22}{7} = \frac{22}{7}$$

$$\text{Volume} = \frac{4}{3}$$

$$r = \frac{4}{3} \times \frac{22}{7} \times 1 \times 1 \times 1$$

$$= \frac{88}{21} = \frac{88}{7}$$

$$\text{Volume} = \frac{4}{3} \text{ XII}$$

$$= \frac{4}{3} \times \frac{22}{7} \times 2 \times 2 \times 2 = \frac{704}{21}$$

$$\text{Ratio in areas} = \frac{22}{7} : \frac{88}{7} = 1 : 8$$

Let the r of

$$\text{Area } \pi r^2 = \pi^4$$

$$\text{Volume} = \frac{4}{3}\pi r3 = \frac{4}{3} \times \frac{22}{7} \times r^2 r^2 r^2$$

$$= \frac{88r}{21} = \frac{4}{3}\pi r^3$$

Q.5. The surface area of a sphere is $5767\pi m^2$. What will be its volume? If it is melted, how many small spheres of, diameter 1 cm can be made out of it?

Sol. Surface area = 576 π cm2

$$\text{Radius} = \frac{\text{Area}}{4\pi} = \sqrt{\frac{576}{4\pi}}$$

$$= \frac{576}{7} \times \frac{7}{22} = \sqrt{\frac{4032}{154}}$$

$$= \frac{4032}{154} = \sqrt{26.3} \text{ m} = 5.1 \text{ cm}$$

$$\text{Volume} = \frac{4}{3}\pi r^3$$

$$\frac{4}{3} \times \frac{22}{7} \times 5.1 \times 5.1 \times 5.1$$

$$= \frac{11673.29}{21} = 555.7 \text{ cm}^3$$

Q.6. A solid copper sphere of radius 3cm is melted and electric wire of diameter 0.4cm is made out of the copper obtained. Find the length of the wire.

Sol. Radius = 3cm

$$\text{Volume} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3} \times \frac{22}{7} \times 3 \times 3 \times 3$$

$$= \frac{2376}{21} = 113.14 \text{cm}^3$$

Radius of wire = 0.4 cm

$$\text{Length of wire} = \frac{113.14}{0.4}$$

$$= \frac{113.14 \times 10}{4} = \frac{1131.4}{4} = 232.85 \text{ cm}$$

EXERCISE 9.4

Q.1. Write down the missing elements of cone for which all lengths are in meters.

	r	h	Curved surface	Base area	Total surface

(i)	12	5			
(ii)	9				
(iii)		8			
				28.28 curved surface area m^2	120.78 total surface area m^2

Sol.

	r	h	ℓ	Curved surface	Base area	Total surface
(i)	12	5	13	489.84	452.16	942
(ii)	9	23.32	25	706.5	254.34	960.84
(iii)	6	8	10	188.4	113.04	301.44
(iv)	3	9.34	9.81	92.49	28.28 curved surface area m^2	120.78 total surface area m^2

Q.2. How much sugar can contain a conical roof whose height is 7m and radius 3m while 1 m^3 space contains 50 kg of sugar?

Sol. Volume of cone $= \frac{1}{3}\pi r^2 h$

$$= \frac{1}{3} \times \frac{22}{7} \times 3 \times 3 \times 7$$

$$= \frac{1386}{21} = 66\ m^3$$

Sugar quantity $= 66 \times 50 = 3300$ kg.

Q.3. Find the volume of cone if r = 5cm and l = 8cm

Sol. Radius = 5cm

ℓ = 8 cm

Height $= \sqrt{(8)^2 - (5)^2}$

$= \sqrt{64 - 25} = 6.24$ cm

Conical volume $= \frac{1}{3}\pi r^2 h$

$$= \frac{22}{7} \times \frac{22}{7} \times 5 \times 5 \times 6.24$$

$$= \frac{3432}{71} = 163.45\ cm^3$$

REVIEW EXERCISE 9

Fill in the blanks with suitable words.

(i) According to Pythagoras Theorem, hypotenuse =._____

(ii) In Hero's formula, s =_____,

(iii) According to Hero's formula, area of triangle = _____

(iv) Formula for determining the surface area of a sphere is _____

Ans. (i) $(Base)^2 + (perpendicular)^2$

(ii) $\frac{c+b+a}{2}$

(iii) $\sqrt{S(S-a)(S-b)(S-c)}$

(iv) $4\pi r^2$ (v) 7cm

Q.2. Calculate and write missing values in the following table:

S.No.	Base	Prependicular	Hypotenuse	Area
(i)		12 cm	13 cm	
(ii)	48 dm	14 dm	i	
(iii)	9m		16m	
(iv)		3cm	5cm	6cm^2
(v)	8cm		10cm	24 cm^2

Sol.

S.No.	Base	Prependicular	Hypotenuse	Area
(i)	5cm	12 cm	13 cm	3cm^2
(ii)	48 dm	14 dm	336 dm	
(iii)	9m	13.28m	16m	9m
(iv)	4cm	3cm	5cm	6cm^2
(v)	8cm	6cm	10cm	24 cm^2

Q.3. Find surface area and volume of the following spheres. Their radii are given. ($\pi = 3.14$)

(i) 21cm (ii) 7m

(i) 21cm

Sol.

(i) Radius = 21 cm

Surface area $= 4\pi r^2$

$= 4 \times 3.14 \times 21 \times 21$

$= 5538.96\ cm^2$

Volume $= \frac{4}{3}\pi r^3$

$$= \frac{4}{3} \times 3.14 \times 21 \times 21 \times 21$$

$= 38773 cm^3$

(ii) 7m

Sol. Radius = 7 m

Surface area $= 4\pi r^2$

$= 4 \times 3.14 \times 7 \times 7$

$= 614.44\ m^2$

Volume $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times 3.14 \times 7 \times 7 \times 7$

$= 1436\ m^3$

Q.4. Find radius of the given spheres: (Area/Volume is given)

Sol. (i) Volume $= 721 cm^3$

$r^3 = \frac{\text{Volume}}{\frac{4}{3}\pi}$

$= 721 \times \frac{4}{3} \times \frac{22}{7}$

$r^3 = 172$

$r = 3\sqrt{172}$

$= 5.56cm$

(ii) Volume $= 616 cm^3$

$r^3 = \frac{4}{3}$

$= 616 \times \frac{3}{4} \times \frac{22}{7}$

$r^3 = 147$

$r = 3\sqrt{147} = 5.28cm$

Q.5. How will the surface area and volume of a sphere will change if its radius is increased three times.

Sol. Surface area $= (3)^2 = 9$ times

Volume $= (3)^3 = 27$ times

Q.6. Find the surface area of cone with r = 7cm ℓ = 12cm.

Sol. r = 7cm, ℓ = 12cm

Surface area = Area of base + lateral area

$\pi r^2 + \pi r \ell$

$= \frac{22}{7} \times 7 \times 7 + \frac{22}{7} \times 7 \times 12$

$154 + 264 = 418 cm^2$

Q.7. A cone shaped minarets is 12dm high and has a diameter of 14dm. Find its volume.

Sol. h = 12dm, Diameter = 14dm

radius $= \frac{14}{2} = 7$ dm

$\ell = \sqrt{(12)^2 - (7)^2} = \sqrt{144 - 49}$

$= \sqrt{95} = 9.8$ dm

Volume $= \frac{1}{3}\pi r2\ h$

$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 12$

$= \frac{1849}{3} = 616.33 dm^2$

Q.8. Find the volume of a football of radius 10.5cm.

Sol. r = 10.5 cm

Volume $= \frac{4}{3}\pi r^3 = 10.5 \times 10.5 \times 10.5 \times \frac{4}{3} \times \frac{22}{7} = \frac{101871}{21} = 4851 dm$

(iii) r = 7cm, ℓ = 12cm

Sol. $\ell = \sqrt{(12)^2 + (7)^2}$

$= \sqrt{144 - 49}$

$= \sqrt{95}$

Curved surface area $= \pi r(\ell + r)$

$= \pi 7(12 + 7)$

$= \pi 7(19)$

$= 133\pi cm^2$

Volume $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi \times 7 \times 7 \times \sqrt{95} = 159\pi\ cm^3$

Unit 10

DEMONSTRATIVE GEOMETRY

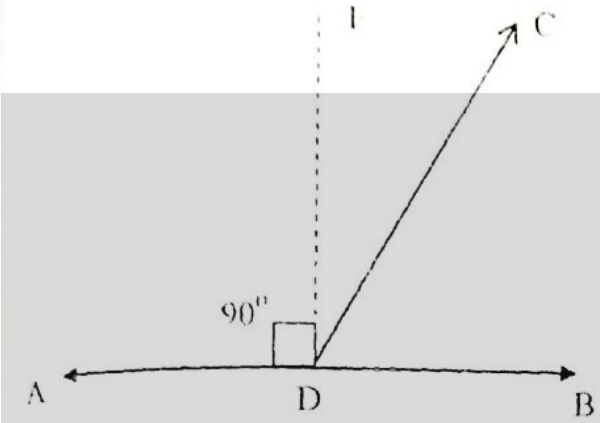
Theorem 1:

If a straight line stands on another straight line, the sum measures of two angles so formed is equal to two right angles. Given: Straight line CD stands on straight line AB

To prove: $m\angle BDC + m\angle CDA = 180$

Construction:

Draw $\perp$ DE on AB

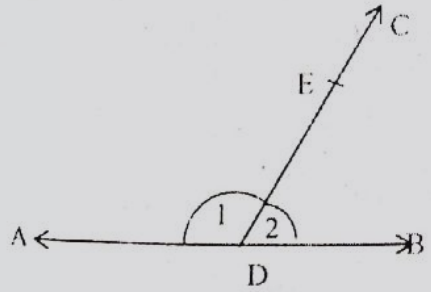


Proof:

Statements	Reasons
$m\angle BDC = 90° \rightarrow$(i) $m\angle EDA = 90° \rightarrow$(ii)	Construction
$\Rightarrow m\angle BDC + \angle EDA = 180°$	Sum of (i) and (ii)
$\Rightarrow m\angle BDC + m\angle CDE + m\angle EDA = 180°$	$m\angle BDC + m\angle CDE = m\angle BDE$
$\Rightarrow m\angle BDC + m\angle CDA = 180°$	$m\angle CDE + m\angle EDA = m\angle CDA$

Adjacent Angle:

Two angles are called adjacent angles if both have a common arm. In figure angle $\angle ABC$ and $\angle DBC$ are adjacent angles, because both have a common arm $\overline{BC}$



Theorem 2:

If the sum of measure of two adjacent angles is e angles, the external arms of the angle are in a straight line. Given: $m\angle BDC$ and $m\angle CDA$ are adjacent angles such that $m\angle BDC + m\angle CDA = 180°$.

Proof: To prove: $\overleftrightarrow{AB}$ is straight line.

Statements	Reasons
$m\angle BDC + \angle CDA = 180°$	Given
$m\angle 1 + m\angle 2 = 180°$	supplementary angles.
$\Rightarrow$ $m\angle BDC$ and $m\angle CDA$ are adjacent supplementary angles.	Linear pairs of angles.
Hence external arms make a straight line	i.e. Non-common arms of two adjacent angles
$\Rightarrow$AB is straight line	

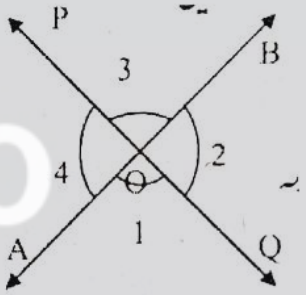
Theorem 3

If two lines intersect each other, then the opposite vertical angles are congruent

Given: Lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{PQ}$ intersect each other at point O.

To prove:

$m\angle 1 = m\angle 3$ and $m\angle 2 = m\angle 4$.

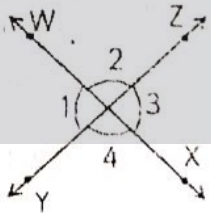


Proof

Statements	Reasons
$m\angle 1 + m\angle 2 = 180° \rightarrow$ (i)	Supplementary angels
$m\angle 2 + m\angle 3 = 180° \rightarrow$(ii)	Supplementary angels
$\Rightarrow m\angle 1 + m\angle 2 = m\angle 2 + m\angle 3$	Transitive property of equality
$\Rightarrow m\angle 1 = m\angle 3 \Rightarrow \angle 1 \cong \angle 3$	Canceling $m\angle 2$ from both sides
Similarly $\angle 2 \cong \angle 4$	

EXERCISE 10.1

1. If $m\angle 1 = 65°$ then find the measures of remaining angels.



Sol. = $65°$

$m\angle 2$ = $180° - 65° = 115°$

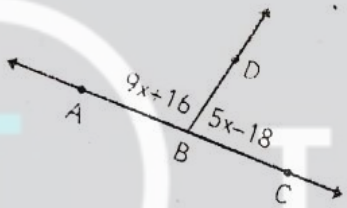
$m\angle 3$ = $180° - 115° = 65°$

$m\angle 4 = mc = 2 = 115°$

2. In the figure $m\angle P = m\angle R$ Prove that $m\angle Q = m\angle S$

Sol. $m\angle P = m\angle R$ .....
$m\angle R = m\angle S$ .....
$m\angle P = m\angle Q$ .....
$m\angle Q = m\angle S$ .....

Q.3. (i) Find $m\angle ABD$ and $m\angle DBC$.
(ii) Is $\overline{AC}$ a straight line.



Sol.

(i) $9x + 16 + 5x - 18 = 180°$
$14x - 2 = 180$
$14x = 180 + 2$
$14x = 182$
$x = \frac{182}{14} = 13°$

(ii) $9x + 16$
$m\angle ABD\ 9(13)+16=117+16 = 133°$
$m\angle BDC = 5x - 18$
$=5 \times 13 - 18$
$=65 - 18 = 47°$

Theorem 4:

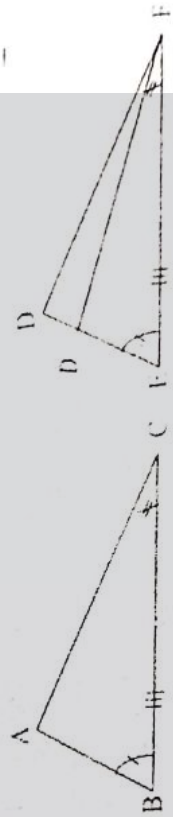
In any correspondence of two triangles, if two sides and included angle of one triangle are congruent to the corresponding sides and inched angle the other, the two triangles are congruent

Given: $\Delta ABC \leftrightarrow \Delta DEF$
$\angle B \cong \angle E$
$\angle C \cong \angle F$
$\overline{BC} \cong \overline{EF}$

To prove : $\Delta ABC \cong \Delta DEF$

Proof:

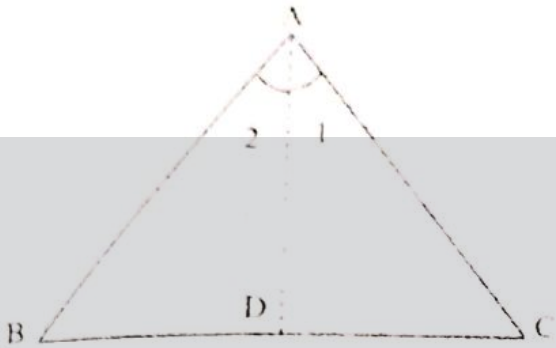
Suppose $\overline{AB} \ncong \overline{DE}$ then there is point D' on DE such that $m\overline{AB} = m\overline{D'E}$ and joint D to F.



Proof

Statements	Reasons
In $\Delta ABC \leftrightarrow \Delta D'EF$	Construction
$\overline{AB} \cong \overline{D'E} \rightarrow$ (i)	Given
$\overline{BC} \cong \overline{EF} \rightarrow$ (ii)	Given
$\angle B \cong \angle E \rightarrow$ (iii)	Given
$\therefore \Delta ABC \cong \Delta D'EF$	Side Angle Side postulate.
So $\angle C \cong \angle D'EF$	Given
If $\angle C \cong \angle DFE$	Both are congruent to $\angle C$
This can only occur when D' are the same points	Proved that D and D' are the same points.
So, $\overline{DE} \cong \overline{DE} \rightarrow$ (iv)	
Thus from ii, iii and iv we have	
$\Delta ABC \cong \Delta DEF$	

Theorem 5: If two sides of a triangle sides are also congruent then angles opposite to these sides are also congruent.



Construction: Draw bisector of $\angle A$ which meet $\overline{BC}$ at point D.

Proof:

Statements	Reasons
In $\Delta ABD \leftrightarrow \Delta ADC$	Construction
M $\overline{AB} \cong \overline{AD}$	Given
$\angle 1 \cong \angle 2$	Common
$\Delta ABD \cong \Delta ADC$	S.A.S. $\cong$ S.A.S.
Hence $\angle B \cong \angle C$	By congruence of Δs

Corollary 1: An equilateral triangle is an equiangular triangle.

Corollary 2: In an isosceles triangle, the angles at the base are congruent

Exterior Angle:

If one side of a triangle is produced then the angle which the produce side makes with the adjacent side (not produce) is called exterior angle. In the figure $\angle ACD$ is an exterior angle.

Theorem 6: "An exterior angle of a triangle is greater in measure, than either of its opposite interior angles."

Given: ABC is a triangle with $m\angle 4$ an exterior angle.

$\angle 1$, $\angle 2$ are its opposites interior angles

To Prove:

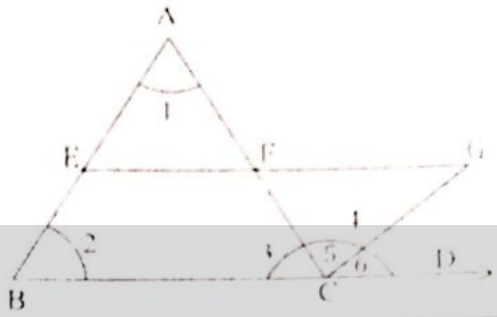
$m\angle 4 > m\angle 1$ and $m\angle 4 > m\angle 2$

Construction:

Mark mid points of $\overline{AB}$ and $\overline{AC}$ as E and F respectively. Join E an4F end extended it upto G such that $m\overline{EF} = m\overline{FG}$ Join G to C

Proof:

$\angle EFA \cong \angle CFG$

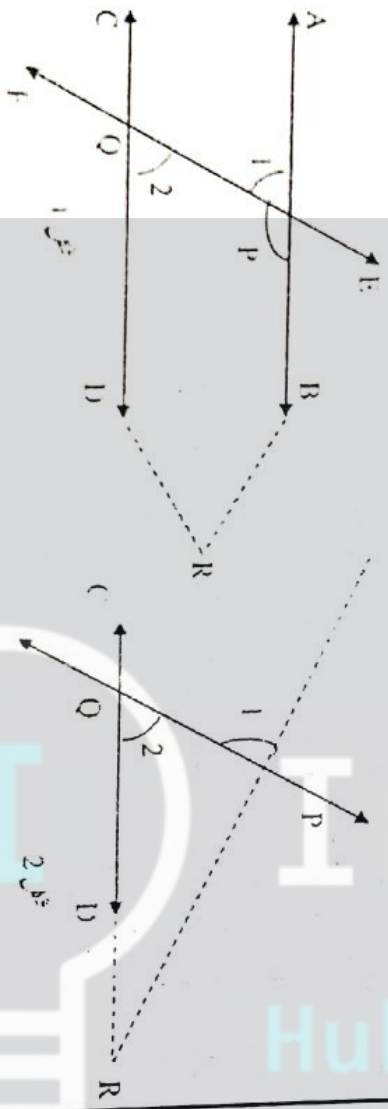


Statement	Reasons
In $\Delta AEF \leftrightarrow \Delta CGF$	
$\overline{AF} \cong \overline{CF}$	Construction
$\angle EFA \cong \angle CFG$	Opposite vertical angle
$\overline{EF} \cong \overline{GF}$	Construction
So $\Delta AEF \cong \Delta CGF$	S.A.S. $\cong$ S.A.S.
$\angle A \cong \angle 5$	By definition of congruent triangles
$m\angle acd = m\angle 5 + m\angle 6$ so $m\angle acd > m\angle 5$ $m\angle acd > m\angle a$ Similarly we can prove that $m\angle ACD > m\angle B$	$m\angle A = m\angle 5$

Theorem 7:

If a transversal intersects two lines such that the **pair of** alternate angles are congruent then lines are parallel.

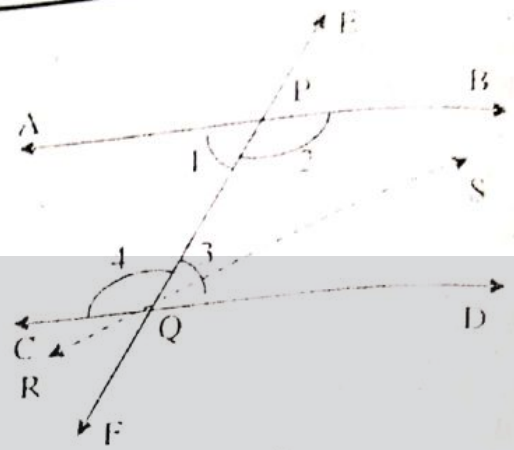
Proof: If AB and CD are not parallel, then they will meet at any point R and PQR will be a triangle. (Fig.2)



Statements	Reasons
In ΔPQR	
$m\angle 1 > m\angle 2$	Exterior angle of triangle is greater than opposite interior angles.
But $m\angle 1 = m\angle 2$	Given
Therefore, our supposition is wrong that AB and CD are not parallel. Hence AB and CD are parallel.	

Theorems 8:

If a transversal intersects two parallel lines the alternate angles so formed are congruent.



Given: $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ and CD are parallel and $\overleftrightarrow{EF}$ intersects them at point P and Q respectively.

To prove: $\angle 1 \cong \angle 3$

$\angle 2 \cong \angle 4$

Proof: Suppose that $\angle 1 \ncong \angle 3$, draw a line $\overleftrightarrow{RS}$ through point Q such that

$\angle 1 \cong \angle DQS$

Statements	Reasons
Since $\angle 1 \cong$ DQS	By supposition
$\Rightarrow \overleftrightarrow{AB}$ and $\overleftrightarrow{RS}$ are parallel	alternate angle $\angle 1$ and $\angle DQS$ are congruent
But $\overleftrightarrow{AB}$ is parallel to $\overleftrightarrow{CD}$	Given
$\Rightarrow \overleftrightarrow{AB}$ is parallel to two intersecting lines $\overleftrightarrow{CD}$ and $\overleftrightarrow{RS}$ which is not possible. So our supposition i.e. $\angle 1 \ncong \angle 3$ is wrong	Playfair's axiom
Hence $\angle 1 \cong \angle 3$	Supposition is wrong
Similarly $\angle 2$ s$\angle 4$	

Theorem 9

The sum of measures of the three angles of a triangle is 180°

Given: ABC is a triangle

To prove: $m\angle 1 + m\angle 2 + m\angle 3 = 180°$

Construction:

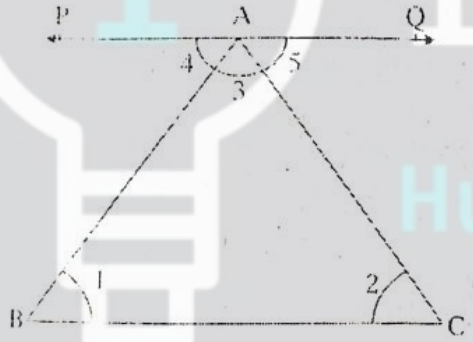
Draw $\overleftrightarrow{PQ}$ parallel to $\overleftrightarrow{BC}$ passing through point a.

Proof:

Statements	Reasons
$m\angle 1 = m\angle 4 \rightarrow$ (i)	Alternate angles
$m\angle 2 = m\angle 5 \rightarrow$ (ii)	Alternate angles
$m\angle 1 + m\angle 2 = m\angle 4 = m\angle 5$	Adding (i) and (ii)
$m\angle 1 + m\angle 2 = m\angle 3 + m\angle 5 + m\angle 3$	Adding $m\angle 3$ on both sides
But $m\angle 1 + m\angle 2 + m\angle 3 = m\angle 4 + m\angle BAQ$ $\because m\angle 5 + m\angle 3 = m\angle BAQ$	Supplementary angle
$\Rightarrow m\angle 1 + m\angle 2 + m\angle 3 = 180°$	

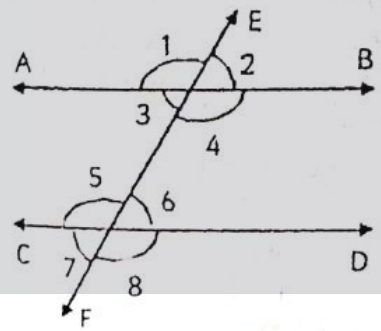
Corollary 1: Every triangle has at least two acute angles.

Corollary 2: in right triangle, the acute angles are complementary.



EXERCISE 10.2

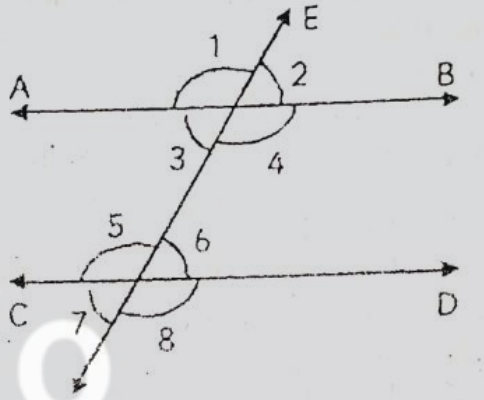
Q.1. In figure $\overleftrightarrow{AB} || \overleftrightarrow{CD}$ and $m\angle 1 = 120°$. Find the measure of other angles.



Sol.
$m\angle 1 = 120°$
$m\angle 3 = 120°$ $m<1 = m<3$
$m\angle 4 = 180° - 120° = 60°$
$m\angle 2 = 60°$
$m\angle 4 = m\angle 6$
$m\angle 6 = 60°$
$m\angle 8 = 60°$
$m\angle 7 = 120°$
$m\angle 5 = 120°$

Q.2. From the figure 2 prove that $\overleftrightarrow{AB} || \overleftrightarrow{CD}$ if any of the following holds:

(i) $m\angle 2 = 70°$ and $m\angle 6 = 70°$
(ii) $m\angle 4 = 100°$ and $m\angle 5 = 100°$
(iii) $m\angle 1 = 100°$ and $m\angle 5 = 100°$
(iv) $m\angle 1 = 120°$ and $m\angle 6 = 60°$



Sol.
$m\angle 6 = 70° = m\angle 2 = 70° \leftrightarrow$
$m\angle 2 = m\angle 3$ and $m\angle 3 = m\angle 6$
$m\angle 5 = 100°$ $m<4 = 100°$
$m\angle 5 = 100° = m\angle 1 = 100°$
$m\angle 6 = 60° = m\angle 1 = 120°$
$m\angle 6 = 60°$ $\because m\angle 5 = 180° - 60° = 120°$
$m\angle 5 = 120° = m\angle 1 = 120°$

EXERCISE 10.3

Q.1. If the measure of angels of a triangle are in the ratio 1:2:3 then show that it is right angle triangle.

Sum of angle = 180°
Ratio in angles = 1 : 2 :3
Sum of ratios = 1+2+3=6

1st angle measurement $= \frac{180}{6} \times 1 = 30°$

2nd angle measurement $= \frac{180}{6} \times 2 = 60°$

3rd angle measurement $= \frac{180}{6} \times 3 = 90°$

Measurement of all the three angles is 180° and the 3rd angle is of 90°

Q.3. Find the measure of the third angle of a triangle if the measures of its two angles are 37° and 56°.

Sol. $180° - (37° + 56°)$

$= 180° - 93° = 87°$

Q.4. A triangle is a right-angled isosceles triangle. Find the measure of each of its base angle.

Sol. $\frac{180°}{3} = 60°$ each angle.

Q.5. In a triangle are angle A is twice angle B. Angle C is 20° more than angle B. Find the angles.

Sol. Let angle B = x°

Angle C = x + 20

Angle A = 180 – (x + 20 + x)

= 180 – 2x + 20

= 180 – 2x

= 180 + 20 – 180

x = 10°

∠B = 10°

∠C = 10 + 20 = 30°

∠A = 180° – 40 = 140°

Q.6. The ratio of two angles in a triangle is 3:5. The third angle is 52°. Find the other two angles.

Sol. Sum of three angles = 180°

Sum of two angles = 180° –52° = 128°

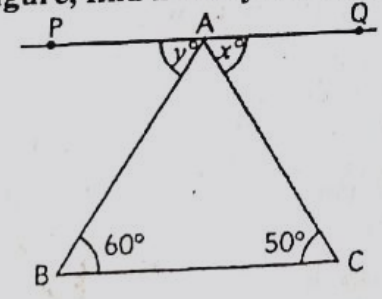
Ratio between two angles = 3 : 5

Sum = 3 + 5 = 8

Measure of 1st angle = $\frac{128}{8} \times 3 = 48$

Measure of 2nd angle 128 × 5 = 80°

Q.7. In figure, find x and y if PQ || BC.



Sol PQ || BC

∴ ∠x° = 50° } Alternate angles

∠y° = 60° }

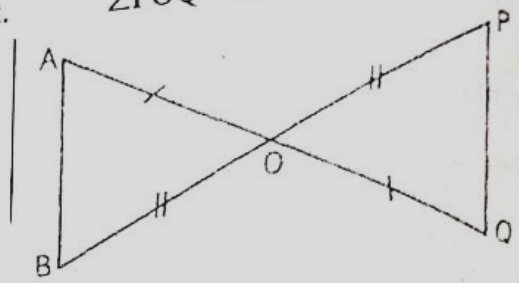
Q.8. In figure, O is the mid-point of AQ and BP.

(a) Is ΔOQP?

(b) Which pairs of matching parts have you used to answer (a)?

(c) Is AB = PQ?

{Hint. ∠POQ = ∠BOA (vert. opp. ∠s)}



Sol. ΔABC = ΔPQO

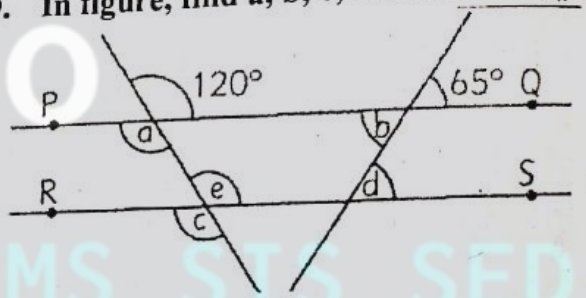
$\overline{BO} = \overline{PO}$

$QO = \overline{AO}$

∠POQ = ∠AOB

∴ ΔABO = ΔPQO

Q.9. In figure, find a, b, c, d and e if PQ || RS.



Sol.

∠a = 1210° Vertical angles

∠e = 120° Alternate angle

∠b = 65° Vertical angle

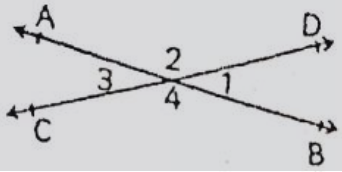
∠d = 65′ Alternate angle

∠e = 12° Alternate angle

REVIEW EXERCISE 10

Q.1. Select the correct answer.

(i) For the given figure which of the following is correct?



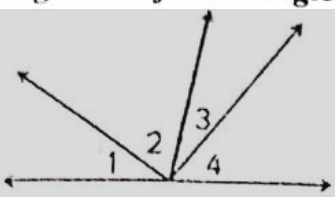
(a) ∠q and ∠2 are vertically opposite angles,

(b) ∠1 and ∠3 are complementary angles.

✓ (c) ∠2 and ∠4 are vertically opposite angles,

(d) ∠2 and ∠4 are supplementary angles.

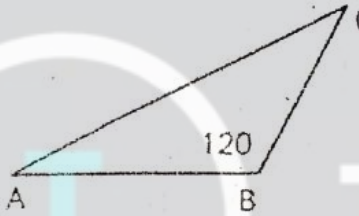
(ii) **For the given figure which of the following are adjacent angles?**



(a) ∠1, ∠3 (b) ∠2, ∠3 ✓

(c) ∠4, ∠2 (d) ∠1, ∠4

(iii) **In ΔABC, m∠B = 1 20° Ratio between m∠A and m∠C is 5 : 7 then, m∠C is**



✓ (a) 35° b 25°

(c) 60° (d) 30°

Q.2. If the measure of angles of a triangle are in the ratio 1:2:3 then show that it is right angle triangle.

Sol. Ratio between angels = 1 : 2 : 3

Sum of ratios = 1 + 2 + 3 = 6

Measures of 1st angle $= \frac{180 \times 1}{6} = 30°$

Measure of 2nd angle $= \frac{180 \times 2}{6} = 60°$

Measure of 3rd angle $= \frac{180}{6} \times 30 = 90°$

One angle of the triangle is of 90°

So the triangle is right angled triangle.

Q.3. In the triangle ABC, the angle A is three times angle B. Angle C is 60°. Find angle A.

Sol. Let angle B = x°

M angle A = 3x

M ∠C = 60°

Sum of three angles of a triangle = 180°

x + 3x + 60 = 180°

4x + 60 = 180°

4x = 180° – 60°

4x = 120°

$X = \frac{120^\circ}{4} = 30°$

m∠B = 30°

m∠A = 3 × 30 = 90°

m∠B = 60°

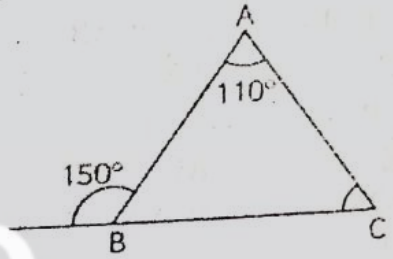
Q.4. Measure of one of the angles of parallelogram is 70. Find the measure of the remaining angles. A.

Sol. Measure of the angles of a Parallelogram = 360°

Measure of one angle = 70°

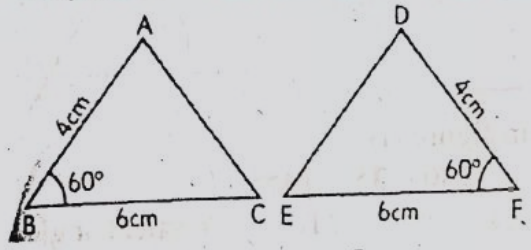
Measure of remaining angles = 360° – 70° = 290°

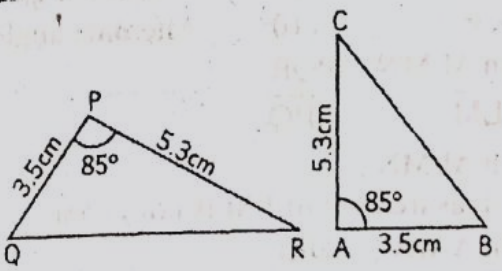
Q.5. In figure, find ACB.

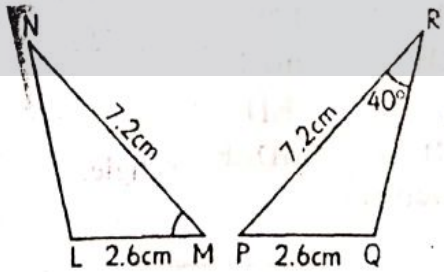


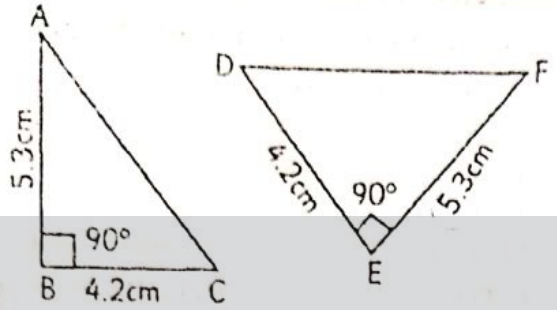
Sol. m∠CBA = 180° – 150° = 30°

Q.6. In the following pairs of triangles figure, measurements of some elements given. By using SAS congruency property state which are congruent and write the result in symbolic form.









Sol. In $\angle ABC \cong \Delta BCE$

(II) $\overline{AB} \cong \overline{DF}$

$m\angle B \cong m\angle F$

$\overline{BC} \cong \overline{EF}$

$\therefore \Delta ABC \cong \Delta DEF$

Congruent

(II) In $\Delta PQR \cong \Delta CAB$

$\overline{QP} \cong \overline{AB}$

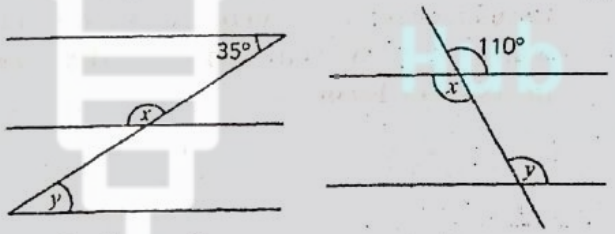
$m\angle P \cong m\angle A$

$\overline{PR} \cong \overline{AC}$

$\therefore \Delta PQR \cong \Delta CAB$

Congruent

Q.7. Each figure given below, shows a pair of parallel lines out by a transversal. Find *x* and y. Give reasons.



Sol. in figure (i)

$x = 180 - 35 = 145°$

$\angle x = 110°$ Vertical angles

$\angle y = 110°$ Alternate angles

In ΔLMN, ΔPQR

$\overline{LM} \cong \overline{PQ}$

In ΔLMN

Measurement of LM is not given

(ii) In ΔABC, ΔDEF

$\overline{AB} \cong E°F$

$m\angle B \cong m\angle E$

$\overline{BC} \cong \overline{ED}$

$\therefore \Delta ABC \cong \Delta DEF$

Congruent

Unit 11

TRIGNOMETRY

EXERCISE 11.1

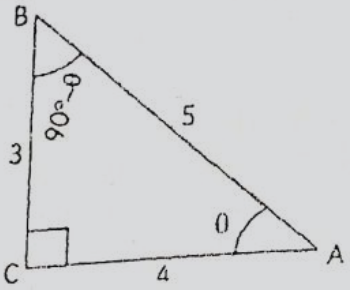
1. For each of the following right angled triangles, find

(i) Tan θ (ii) Cot θ

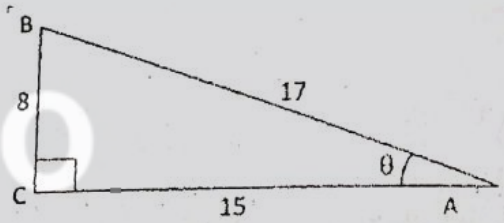
(iii) Cosec θ (iv) Sec θ

(v) Cos θ (vi) Sin θ

(a)



(b)



Sol.

(i) $\tan\theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{3}{4}$

(ii) $\cot\theta = \frac{\text{Base}}{\text{Perpendicular}} = \frac{4}{3}$

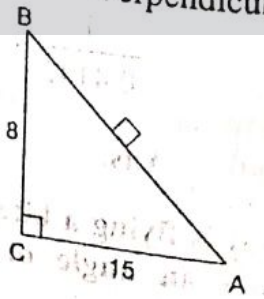
(iii) $\cot\theta = \frac{\text{Base}}{\text{Perpendicular}} = \frac{4}{3}$

(iv) $\sec\theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{5}{4}$

(v) $\cos\theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{4}{5}$

(vi) $\sin\theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{3}{5}$

(vii) $\sec\theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{5}{4}$



(viii) $\cos\theta = \frac{\text{Base}}{\text{Perpendicular}} = \frac{4}{5}$

(i) $\tan\theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{8}{15}$

(ii) $\cot\theta = \frac{\text{Base}}{\text{Perpendicular}} = \frac{8}{15}$

(iii) $\cot\theta = \frac{\text{Base}}{\text{Perpendicular}} = \frac{15}{8}$

(iv) $\sec\theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{17}{8}$

(v) $\cos\theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{15}{17}$

(vi) $\sin\theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{8}{17}$

(vii) $\sec\theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{17}{8}$

(viii) $\cos\theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{15}{8}$

Q.2. Evaluate (i) 5 sin 45° + 2 cos 45° (ii) 3cos 45° – 2sin 45°.

(i) **5sin45° + 2cos45°**

Sol. 5sin45° + 2cos45°

By putting the values

$$5\sqrt{\frac{1}{\sqrt{2}}} + 2\frac{1}{\sqrt{2}}$$

$$= \frac{7}{\sqrt{2}} = 4.95$$

(ii) **3cos45° – 2sin45°**

Sol. 3cos45° – 2sin45°

By putting the values

$$3\frac{1}{\sqrt{2}} - 2\frac{1}{\sqrt{2}}$$

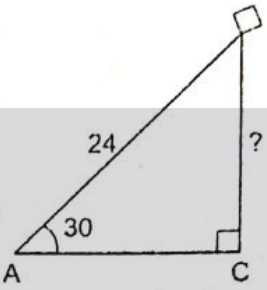
$$= \frac{3}{\sqrt{2}} - 2\frac{1}{\sqrt{2}}$$

$$= \frac{1}{\sqrt{2}} = \frac{1}{0.4142}$$

$$= \frac{1}{0.4142}$$ **Ans.**

Q.3. A little boy is flying a kite. The string of kite makes an angle of 30° with the ground. Find the height of the kite when string is 24m long.

Sol.



$$\text{Sin}30° = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{1}{2}$$

$$\frac{\text{Perpendicular}}{24} = \frac{1}{2}$$

$$2 \text{ perpendicular} = 24$$

$$\text{Perpendicular} = \frac{24}{2} = 12\text{m}$$ **Ans.**

Q.4. Find the "a" distance across the river.

Sol. $\text{Cost } 30° = \frac{\sqrt{3}}{1}$

$$= \sqrt{3} \times 36 = 62.4\text{m}$$

Q.5. Find the values of following:

(i) **2sin45° . cos45°**

Sol. 2sin45° . cos45°

$$2 \times \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}}$$

$$= 2 \times \frac{1}{(\sqrt{2})^2} = 2 \times \frac{1}{2} = 1$$

(ii) **sin60° cos30° + cos60° sin30°**

Sol. sin60° cos30° + cos60° sin30°

By putting the values

$$\frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} + \frac{1}{2} \times \frac{1}{2}$$

$$= \frac{\sqrt{(3)^2}}{(2)^2} + \left(\frac{1}{2}\right)^2$$

$$= \frac{3}{4} + \frac{1}{4} = \frac{3+1}{4} = \frac{4}{4} = 1$$ **Ans.**

(iii) **sin60° cos3o°**

Sol.

sin60° cos30°

By putting the values

$$\frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} = \frac{\sqrt{(3)^2}}{(2)^2} = \frac{3}{4} = 0.75$$

(iv) $\sin60^\circ \sin30^\circ + \cos60^\circ \sin30^\circ$

Sol. $\sin60^\circ \sin30^\circ + \cos60^\circ \sin30^\circ$

By putting the values

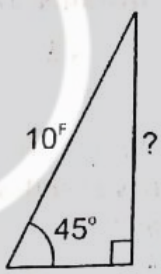
$$\frac{\sqrt{3}}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{(2)^2} + \frac{\sqrt{3}}{4}$$

$$= \frac{\sqrt{3} + \sqrt{3}}{4} = \frac{2\sqrt{3}}{4}$$

$$= 2\frac{\sqrt{3}}{42} = \frac{\sqrt{3}}{2} \text{ Ans.}$$

Q.6. The length of the slope of a slide is 10 feet while it makes an angle of 45° with the ground. Find the height of the top of slide from ground.

Sol.



$$\text{Sin}45^\circ = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$$

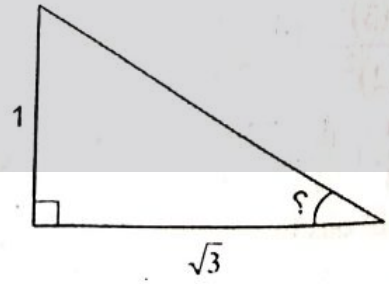
$\sqrt{2}$ Perpendicular = Hypotenuse

$\sqrt{2}$ Perpendicular = Hypotenuse

$$\text{Perpendicular} = \frac{10}{\sqrt{2}} \text{ Ans.}$$

Q.7. The height of a stick is one foot, whereas the length of its shadow is v3 feet. What is the angle between the ground and sun at that time?

Sol.



$$\text{Tan}30^\circ = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$$

$$\sqrt{2}\ \text{Perpendicular} = \frac{1}{\sqrt{3}}$$

$$= 30^\circ \text{ Ans.}$$

REVIEW EXERCISE 11

Q.1. Fill in the blanks with suitable words.

(i) The word "trigonometry" is made from _____ words.

(ii) There are _____ trigonometric ratios of secθ.

(iii) cosθ is the _____ of secθ.

(iv) The value of sin 0 and cosθ for 45° is _____

(v) In a right-angled triangle, hypotenuse = 10cm and base = 5cm, angle between them will be _____.

(vi) Cost (60°) = _____.

(vii) Tan 30° = _____.

(viii) Cosec 45° = _____.

(ix) Sec 60° = _____.

(x) Cot θ = _____.

Ans. (i) three (ii) six (iii) inverse

(iv) $\frac{1}{\sqrt{2}}$ (v) 68, (vi) $\frac{1}{2}$

(vii) $\frac{1}{\sqrt{3}}$ (viii) $\sqrt{2}$

(ix) 2 (x) $\frac{\text{Base}}{\text{Perpendicular}}$

Q.2. Tick the correct answers.

(i) What will be the height of perpendicular of a right angle triangle, if length of base is 3 metres and that of hypotenuse is 5 meters.

(a) 3 metres (b) 4 metres ✓

(c) 5 metres (d) 6 metres

(ii) At what base angle, the base and perpendicular of a right angle triangle will be the same?

(a) 15° (b) 25° ✓

(c) 35° (d) 45°

(iii) The reciprocal of sinθ is.

(a) Cos θ (b) Cot θ ✓

(c) Cosec θ (d) Sec θ

(iv) Cosec (30°) = _____

(a) $\frac{1}{2}$ (b) 2

(c) $\frac{\sqrt{3}}{2}$ (d) 1 ✓

Q.3. Match each term and its definition.

(i) Measure of the opposite side divided by the measure of the hypotenuse.

Sol. $\frac{b}{c}$

(ii) Measure *of* the adjacent side divided by the measure of the hypotenuse.

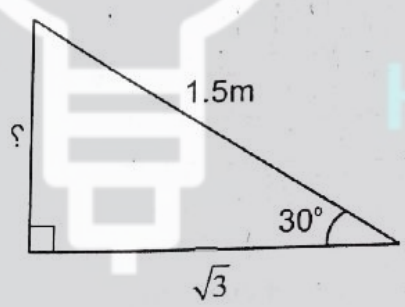
Sol. $\frac{a}{c}$

(iii) Measure of the opposite side divided by the measure of the adjacent side.

Sol. $\frac{a}{b}$

Q.4. An inclined plane is attached with a truck to load some luggage on it. The length of inclined plane is 1.5 m whereas it is making an angle of 30° with ground. Find the height of the truck.

Sol.



$$\text{Sin}30^\circ = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{1}{2}$$

$$\frac{\text{Perpendicular}}{1.5} = \frac{1}{2}$$

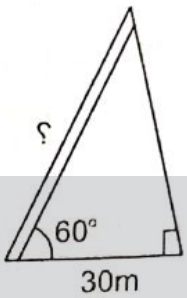
$$2\,\text{perpendicular} = 1.5$$

$$\text{Perpendicular} = \frac{1.5}{2}$$

$= 0.75\text{m}$ **Ans.**

Q.5. A ladder makes an angle of 60° with the ground and reaches at a certain height along the wall. If the distance between foot of ladder and wall is 30m then find the height of the ladder.

Sol.



$$\cos 60^\circ = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{1}{2}$$

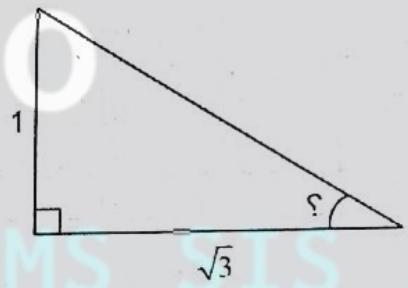
$$2\,\text{Base} = \text{Hypotenuse}$$

$$2 \times 30 = \text{Hypotenuse}$$

60 m Hypotenuse $= 60$ m **Ans.**

Q.6. The height of a stick is one foot, whereas the length of its shadow is $\sqrt{3}$ feet. What is the angle between the ground and Sun at that time?

Sol.



$$\text{Tan}30^\circ = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$$

$$\sqrt{2}\ \text{Perpendicular} = \frac{1}{\sqrt{3}} = 30^\circ \text{ Ans.}$$

Q.7. How much wide is the river?

Sol. $\frac{\text{mAD}}{\text{mBD}} = \frac{1}{\sqrt{3}}$

$$(\text{m}\overline{\text{AD}})\sqrt{3} = 400$$

$$\text{m}\overline{\text{AD}} = \frac{400}{\sqrt{3}} = \frac{400}{\sqrt{3}}$$

Unit 12

INFORMATION HANDLING

EXERCISE 12.1

Q.1. The daily water consumption (inra^3) of 25 different textile mills of Faisalabad recorded by the Water Authority is shown.

2400	2700	1100	1830	2200
2320	1990	1500	2050	2300
2250	1400	1720	2620	1580
1210	1700	2520	1900	1440
1640	2100	1360	1750	2600

Identify the frequency of each class by constructing a frequency distribution with six classes.

Sol.

Classes	Tally marks	Frequency
1101–1370	||	2
1371–1640	𝍸	5
1641–1910	𝍸 |	6
1911–2180	|||	3
2181–2450	𝍸	5
2451–2720	||||	4

Lowest value = 1100

Largest value = 2700

Rangel 2700 – 1100= 1600

Q.2. The daily sales of books in a book shop for 20 consecutive days are:

9	45	42	18	60
31	54	32	39	15
12	20	19	22	28
16	40	38	44	25

Find the class limit in which the sales are maximum by constructing a frequency distribution table with 5 classes.

Sol.

Classes	Telly marks	Frequency
9–19	𝍸 |	6
20–30	|||	3
30–40	𝍸	5
40–50	||||	4
50–60	||	2

Largest value = 60 Lowest value = 9

Range = 60 – 9 = 51 h = 51 ÷ 5 = 10

1, 1, 1, 2, 3, 3, 3, 4, 5, 5, 6, 8, 10, 10, 10, 11, 11, 12, 12, 12, 13, 14, 15, 16, 17, 18, 20, 21, 21, 21, 27, 31, 32, 36, 44, 48, 64

Classes	Telly marks	Frequency
1–8	𝍸 𝍸 ||	12
9–16	𝍸 𝍸 ||	12
17–24	𝍸 |	6
25–32	|||	3
33–40	|	1
41–48	||	2
49–56	–	–
57–64	|	1
Total		37

Q.3. Make the class boundaries for the classes given in the following data. **Sol.**

Classes	Frequency
14–18	2
19–23	3
23–27	1
27–31	6
31–35	4

Sol.

Class	Frequency	Class boundaries
15–19	2	14.5–19.5
19–23	3	19.5–23.5
23–27	1	23.5–27.5
27–31	6	27.5–31.5
31–35	4	31.5–35.5

Q.4. Following are the number of kilometers covered by different 37 athletes in long walk.

10,44,12,16, 21, 31,32,2,1,10,3, 6, 4, 5, 20, 27, 11, 17, 48, 64, 8, 10, 12, 36, 13, 1, 12, 3, 18, 11, 15, 14, 3,1, 5, 21, 21

Construct a frequency distribution starting with the class 1-8.

Sol. By writing in descending order:

1, 1, 1, 2, 3, 3, 3, 4, 5, 5, 6, 8, 10, 10, 10, 11, 12, 12, 12, 13, 14, 15, 16, 17, 18, 20, 21, 21, 21, 27, 31, 32, 36, 44, 48, 64

Classes	Tally marks	Frequency
1–8	𝍸 𝍸 ||	12
9–16	𝍸 𝍸 ||	12
17–24	𝍸 |	6
25–32	||	3
33–40	|	1
41–48	||	2
49–56	–	–
57–64	|	1
ٹوٹل		37

EXERCISE 12.2

Q.1. Find the mean of following:

(i) 6, 4, 15, 12, 20, 28, 30, 25, 10, 25

Sol. Average = 6+4+15+12+20+28+30+25 +10+25 = $\frac{175}{10}$ = 17.5 **Ans.**

(ii) **1, 1, 0, 1, 4**

Sol. Average = 1+1+0+1+1+4 = 8/6 =1.33 **Ans.**

(iii) **6, 5, 3.5, 2.4, 9.1**

Sol. Average = 6.0 + 5.0 + 3.5 + 2.4 + 9.1

$= \frac{26.0}{5} = 5.2$ **Ans.**

(iv) **0.5, 0.6, 0.8, 0.2, 0.7, 01**

Sol. Average= 0.5+0.6+0.8+0.2+0.7+0.1

$= \frac{2.9}{6} = 0.48$ **Ans.**

(v) **4, 4, 4, 4, 4**

Sol. Average = 4 + 4 + 4 + 4 + 4 =20/5 = 4 **Ans.**

Q.2. The arithmetic mean of 25 numbers is 68. Find their sum.

Arithmetic (mean of 25 numbers) = 68

Sum of 25 numbers = 68 × 25 = 1700

Q.3. Following are the weights (in pounds) often students.
88,72,115,70,90,95,90,81,95,125
Find mean, median and mode

88, 72, 115, 70, 90, 95, 90, 81, 95, 125

Sol. Average = 88+72+115+70+90+95+90+ 81 + 95 + 125

$= 921 = \frac{921}{10} = 92.1$ pounds

Mode = 90, 95 Median = 88

Q.4. Calculate mean, median and mode of 7.9,11,10,8,9,12

Sol. By writing in descending order:

7, 8, 9, 9, 10, 11, 12

Average = 7 + 8 + 9 + 9 + 10 + 11 + 12

$= 66 = \frac{66}{7} = 9.43$ pound

Mode = 9 Median = 9

Q.5. Calculate mode of 1,2,2,2,3,4,5,5,5,6,6,6,7,7

Sol. Mode = 2, 5, 6

7. The heart beat of a child was recorded as 120, 121, 120, 125, 119, 118, 124
Find the average heart beat and also median and mode.
120, 121, 120, 125, 119, 118, 124

Sol. By writing in descending order:

118, 119, 120, 120, 121, 124, 125

Average = 118+119+120+120 + 121+124 + 125

$= \frac{847}{7} = 121$

Mode = 120 Median = 120

REVIEW EXERCISE 12

1. Fill in the blanks with suitable words.

(i) Range is the _____ between the largest & smallest values of a data.

(ii) The frequency of 2 in 3,2,5,1,2,1,3,2,4 is _____.

(iii) Frequency distribution is represented by _____

(iv) Class interval size = _____.

(v) The number of times a value occurs in a data is called _____

(vi) Average of a data is also known as _____

(vii) The highest frequency value represents the _____ of the data.

(viii) Central value of arrange data is known as _____

(ix) The mean of 3,2,5,1,2,1,3,2,4 is _____

(x) To measure central tendency of a data, _____ are used.

Ans. (i) difference (ii) 3

(iii) frequency table

(iv) $\frac{\text{Range}}{\text{No. of classes}}$

(v) mode (vi) Arithmetic mean

(vii) Mode (viii) Median

(ix) 2.56

(x) Mean, Medium, Mode

Q.2. Choose the correct option:

(i) Mean of 50, 0, 30, 12

(a) 20 (b) 21

(c) 22 (d) 23 ✓

(ii) Mean is also known as:

(a) frequency (b) mode

(c) median (f) average ✓

(iii) Median of the data 4,5,7 is

(a) 4 (b) 5 ✓

(c) 7 (d) None of them

(iv) Mode of the data is 4, 5, 7, 4, 8, 5, 7, 1, 7.

(a) 54 (b) 5

✓ (c) 7 (d) 8

(v) Frequent quantity in a data is known as

(a) frequency (b) mode ✓

(c) median (d) average

(vi) In an odd number of items arranged in ascending order, mid-values (items) is called

(a) frequency (b) mode

✓ (c) median (d) average

(vii) Range of the data 4,8,9,3,10 is

(a) 4 (b) 7 ✓

(c) 8 (d) 10

(viii) The number of items an item occurs in a data is called its

✓ (a) frequency (b) mean

(c) median (d) none of them

(ix) The size of class interval is denoted by

(a) c (b) *h* ✓

(c) i (d) d

(x) Frequency is denoted by

✓ (a) f (b) *h*

(c) i (d) d

Q.3. The height of trees given in feet in a certain locality is:

5,10,10,15,15,20,25,15,20,5

Find mean, mode and median.

Sol.

$$\text{Mean} = \frac{5 + 10 + 10 + 15 + 15 + 20 + 25 + 15 + 20 + 5}{20 + 5}$$

$$= \frac{140}{10} = 14$$

Mode = 15 Median = 15

Q.4. The weights in kg of 9 students of class 8 are as under. Find the median.

29,32,45,27,30,47,35,37,33

Sol. By writing in descending order:

27, 29, 30, 32, 33, 35, 37, 45, 47

Median = 33

Q.5. 36 students scored the flowing marks in a class test.

1	2	3	3	4	0	3	1	2
0	3	5	0	1	4	4	4	4
2	1	3	4	3	1	3	4	3
0	4							

Draw a tally bar chart for the marks obtained and the number of students.

Sol.

Class interval	Tally Marks	Frequency
0 — 1	𝍸 𝍸	10
2 — 3	𝍸 𝍸 𝍸	15
4 — 5	𝍸 𝍸 |	

Q.6. Height of 24 boys of Grade-VIII was measured in inches, which is given: 58, 56, 60, 55,59, 65, 62, 57, 58, 58, 69, 65,68, 64, 58, 60, 59, 57, 559, 61, 68, 58, 63, 59 Represent the data by a histogram.

Sol.

Class	Frequency	Class boundaries
50 – 54	—	49.5 – 54.5
55 – 59	𝍸 𝍸 ||| 13	54.5 – 59.5
60 – 64	||| | 6	59.5 – 64.5
65 – 60	𝍸 5	64.5 – 69.5