

ASBAT

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Revised Lesson Notes

MATH - P.6

Term One

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TOPIC: SET CONCEPTS

SUB-TOPICS

- ❖ Meaning of a set and an element of a set.
- ❖ Naming sets.
- ❖ Symbols used in sets.
- ❖ Types of sets.
- ❖ Intersection set.
- ❖ Union set.
- ❖ Difference of sets.
- ❖ Forming all subsets from a given set.
- ❖ Finding number of subsets.
- ❖ Finding proper subsets.
- ❖ Finding number of members when subsets are given.
- ❖ Universal sets.
- ❖ Listing members and finding number of members of sets.
- ❖ Complement of sets.
- ❖ Shading Venn diagrams.
- ❖ Drawing Venn diagrams to show the number of elements.
- ❖ Finding number of elements in sets.
- ❖ Application of sets.
- ❖ Calculating simple probabilities using Venn diagrams.

TOPIC: WHOLE NUMBERS.

SUB-TOPICS

- Place values of whole numbers up to 7-digits(millions)
- Values of digits up to millions
- Expanding numbers
- Finding the expanded numbers
- Writing numbers in figures
- Writing numbers in words
- Rounding off whole numbers
- Rounding off decimals
- Writing Hindu-Arabic numerals in Roman numerals
- Writing Roman numerals in Hindu-Arabic numerals
- Application of Roman numerals

TOPIC: OPERATIONS ON WHOLE NUMBERS

SUB-TOPICS

- Changing from one base to another.
- Finding the unknown bases
- Finite system
- Application of finite system
- Addition of whole numbers with or without regrouping
- ✓ Word problems involving addition of whole numbers



- ✓ Subtraction of whole numbers with or without regrouping
- ✓ Word problems involving subtraction of whole numbers
- ✓ Multiplication of whole numbers
- ✓ Word problems involving multiplication of whole numbers
- ✓ Division of whole numbers
- ✓ Word problems involving division of numbers
- ✓ Mixed operations.
- ✓ Standard/scientific notation
- ✓ Properties on numbers
- ✓ Indices
- ✓ Solving equations on indices

TOPIC: PATTERNS AND SEQUENCES

SUB-TOPICS

- Tests and divisibility of 2,3,4,5 and 10.
- Types of numbers.
- Finding consecutive numbers.
 - ✓ Counting numbers
 - ✓ Even numbers
 - ✓ Odd numbers
- Finding factors and common factors of whole numbers.
- Prime factorization.
- Representing prime factors on Venn diagram.
- Finding the GCF and LCM.
- Finding the unknown values on the Venn diagram
- Application of LCM
- The relationship between the LCM and GCF.
- Calculating squares and square roots.
- Application of square roots.



SETS

Equivalent sets

A set is a collection of well-defined elements

Review

- ✓ Equal sets
- ✓ Intersection sets
- ✓ Union sets
- ✓ Difference of sets

SUBSETS

A subset is a set that can be obtained /formed from any given set.

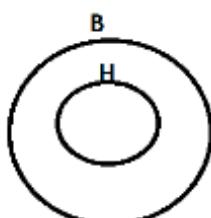
A symbol for subset is \subseteq (is a subset of)

Venn diagrams about subsets

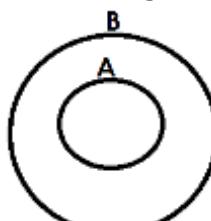
Examples

Draw a Venn diagram to show that all hens(H) are birds (B)

Solution

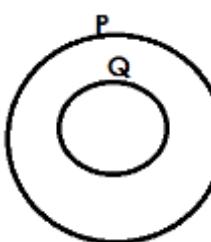


Draw a Venn diagram to show that set $A = A \cap B$



With the help of a venin diagram show that $n(P) = n(P \cup Q)$

Solution



Activity

1. Draw a Venn diagram to show that all cows(C) are animals(A)
2. With the help of a Venn diagram show that all girls (G) are female (F).
3. Draw a Venn diagram to show that set $K = P \cap K$
4. With the help of a Venn diagram, show that $n(P) = n(X \cup P)$
5. If $n(A) = n(A_n)$, show the illustration using a Venn diagram.



Listing subsets

Note:

An empty set is a subset of every set.

Any given set is a subset of itself.

Equal sets are not subsets of a given set. e.g. $\{a, b\}$ and $\{b, a\}$ since they are taken to be the same.

Example1

Set A= $\{2\}$. List all subsets in set A

Solution

$\{\}, \{2\}$

Example 2

If set T= $\{a, b\}$, list all subsets in set T.

Solution

$\{\}, \{a\}, \{b\}, \{a, b\}$

Example 3

Given that set M= $\{m, a, n\}$. List all subsets in set M.

$\{\}, \{m\}, \{a\}, \{n\}, \{m, a\}, \{m, n\}, \{a, n\}, \{m, a, n\}$

Activity

1. List all subsets in set A if A= $\{\Delta\}$
2. Given that set T= $\{4\}$ list all subsets in set T
3. If set y= $\{1, 2\}$. List all subsets in set y
4. Given that set P= $\{\square, \Delta\}$ List all subsets of set P
5. If set A= $\{c, o, w\}$. List all subsets in set A.
6. Set P= $\{\text{Annette, James, Ben}\}$. List all subsets in set P.
7. Set T= $\{a, b, c, d\}$. List all subsets in set T
8. Given that set M= $\{7, 8, 9, 3\}$. List all subsets that can be formed from set M.

FINDING NUMBER OF SUBSETS

Number of subsets = 2^n

Where: - **n** is number of elements in a given set

2 indicates that, number of subsets are in powers of 2.

Example1

Given that set P= $\{\}$, find number of subsets in set P.

Solution

$$\begin{aligned} \text{No. of subsets} &= 2^n \\ &= 2^0 \\ &= 1 \text{ subset.} \end{aligned}$$

Example2

If set T= $\{5\}$. Find number of subsets in set T



Solution

$$\begin{aligned}\text{No. of subsets} &= 2^n \\ &= 2^1 \\ &= 2 \text{ subsets}\end{aligned}$$

Example 3

Below is set A and B



Find number of subsets in set $(A \cap B)^I$

$$\begin{aligned}\text{No. of subsets} &= 2^n \\ &= 2^5 \\ &= 2 \times 2 \times 2 \times 2 \times 2 \\ &= 32 \text{ subsets}\end{aligned}$$

Example 4

If set $M = \{1, 2, 3, 4, 5, 6, 7, 8\}$ and set

$P = \{\text{all factors of } 12\}$. Find number of subsets in $M \cap P$

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

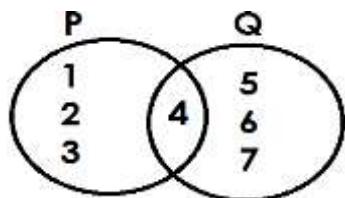
$$P = \{1, 2, 3, 4, 6, 12\}$$

$$M \cap P = \{1, 2, 3, 4, 6\}$$

$$\begin{aligned}\text{No. of subsets} &= 2^n \\ &= 2^5 \\ &= 2 \times 2 \times 2 \times 2 \times 2 \\ &= 32\end{aligned}$$

Activity

- Find number of subsets in set P with 4 elements.
- Given that set $y = \{\text{all vowel letters}\}$. Find number of subsets in set y.
- If set $K = \{a, b, c, d, e, f\}$, find number of subsets in set K.
- Below is set P and Q

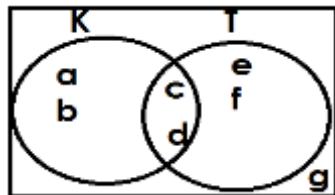


Find number of subsets in $P \cup Q$

- If set $A = \{\text{All even numbers less than } 10\}$ and set $B = \{\text{all factors of } 12\}$. Find number of subsets in $A \cap B$.



7. Use the Venn diagram below to answer question



Find number of subsets in K^I

FINDING NUMBER OF ELEMENTS GIVEN NUMBER OF SUBSETS

Formula:

$$2^n = \text{No. of subsets}$$

Examples

1. Set K has 1 subset. How many elements are in set K?

Solution

$$2^n = \text{no of subsets}$$

$$2^n = 1 \quad \text{but } 1 = 2^0$$

$$2^n = 2^0$$

$$n = 0$$

No element

2. Set M has 64 subsets. How many elements are in set M?

Solution

$$2^n = \text{No. of subsets}$$

$$2^n = 64$$

2	64
2	32
2	16
2	8
2	4
2	2
	1

$$2^n = 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

$$2^n = 2^6$$

$$n = 6$$

Example 3

3. Set K has 128 subsets. How many elements are in set K?

Solution

$$2^n = \text{No. of subsets}$$

$$2^n = 128$$



$2^n =$	2	128
	2	64
	2	32
	2	16
	2	8
	2	4
	2	2
	$2^n = 2^7$	1

$$n = 7$$

Example 4

Set M has 256 subsets. How many elements are in set M?

$$2^n = \text{No. of subsets}$$

$$2^n = 356$$

$2^n =$	2	256
	2	128
	2	64
	2	32
	2	16
	2	8
	2	4
	2	2
		1

$$2^n = 2^8$$

$$n = 8$$

Activity.

1. Set A has 8 subsets. Find the number of elements in set A.
2. There are 4 subsets in a set. How many elements are in that set.
3. Find the number of members in a set with the following number of subsets.
 - (a) 32 subsets
 - (b) 64 subsets
 - (c) 16 subsets

FINDING PROPER SUBSETS

(a) By listing.

1. If $P = \{a, b, c\}$, how many proper subsets has set P?

Solution

$$P = \{a, b, c\}$$

$$\{\}, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}$$

7 proper subsets.

2. Given that $M = \{p, q, r, s\}$. List the number of proper subsets in set M.



Solution

$$M = \{p, q, r, s\}$$

{ }, {p}, {q}, {r}, {s}, {p,q}, {p, r}, {p,s} {q,r}, {q,s}, {r,s}, {p,q,r}, {p,q,s}, {p,r,s}, {q,r,s}

15 proper subsets

ACTIVITY

List the proper subsets for each of the following sets

1. $B = \{a, b\}$
2. $C = \{x, y, z\}$
3. $D = \{t\}$
4. $p = \{a, b, c, d\}$
5. $q = \{\}$
6. $Z = \{1, 2, 3\}$

(b) By using the formula.

Formula:

$$\text{No. of proper subsets} = 2^n - 1$$

Where n is number of elements in a given set and 1 is the mother being subtracted from the formula.

Examples

1. If $x = \{1, 2, 3\}$. Find the number of proper subsets in set X.

Solution

Set X has 3 elements, how many proper subsets are in set X?

$$\text{Proper subsets} = 2^n - 1$$

$$\begin{aligned} &= 2^3 - 1 \\ &= \{2 \times 2 \times 2\} - 1 \\ &= 8 - 1 \\ &= 7 \text{ proper subsets.} \end{aligned}$$

2. Set $M = \{1\}$, how many proper subsets are in set M?

Set M has 1 element

$$\text{No. of proper subsets} = 2^n - 1$$

$$\begin{aligned} &= 2^1 - 1 \\ &= 2 - 1 \\ &= 1 \text{ proper subset.} \end{aligned}$$

3. How many proper subsets are in a set with 5 elements?

Solution

$$\begin{aligned} \text{No. of proper subsets} &= 2^n - 1 \\ &= 2^5 - 1 \\ &= \{2 \times 2 \times 2 \times 2 \times 2\} - 1 \\ &= 32 - 1 \\ &= 31 \text{ proper subsets.} \end{aligned}$$

Activity

1. If $B = \{1, 2\}$, how many proper subsets are in set B?
2. Given that $R = \{a, b, c, d, e, f\}$. Find the number of proper subsets in set R.



3. Find the number of proper subsets of a set which has;
- 4 elements
 - 3 elements
 - 7 elements
 - 9 elements

FINDING NUMBER OF ELEMENTS GIVEN NUMBER OF PROPER SUBSETS

Formula;

$$2^n - 1 = \text{No. of proper subsets}$$

Examples

1. Set M has 15 proper subsets. How many elements are in set M?

Solution

$$2^n - 1 = \text{No of proper subsets}$$

$$2^n - 1 = 15$$

$$\begin{array}{c} 2^n - 1 + 1 = 15 + 1 \\ \cancel{2} \quad \cancel{1} \\ \quad \quad \quad 0 \\ 2^n = 16 \\ \hline 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ 2 & \\ 1 & \end{array}$$

$$2^n = 2^4$$

$$n = 4$$

2. Set K has 255 proper subsets. How many elements are in set k?

Solution

$$2^n - 1 = \text{no of proper subsets}$$

$$2^n - 1 = 255$$

$$\begin{array}{c} n \\ 2 - 1 + 1 = 255 + 1 \\ \cancel{2} \quad \cancel{1} \\ \quad \quad \quad 0 \end{array}$$

$$2^n = 256$$

$$\begin{array}{c} 2^n = 256 \\ \hline 2 & 256 \\ 2 & 128 \\ 2 & 64 \\ 2 & 32 \\ 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ 2 & \\ 1 & \end{array}$$

$$2^n = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

$$2^n = 2^8$$

$$n = 8$$

3. Set R has 63 proper subsets. Find the number of elements in set R

$$2^n - 1 = \text{No of proper subsets}$$



$$2^n - 1 = 63$$

$$\begin{array}{r} \overset{n}{\cancel{2}} \cdot \underset{0}{\cancel{1}} + 1 = 63 + 1 \\ 0 \end{array}$$

$$2^n = 64$$

$2^n =$	<u>2</u>	<u>64</u>
	2	32
	2	16
	2	8
	2	4
	2	2
		1

$$2^n = 2^6$$

$$n = 6$$

Activity

1. Set H has 3 proper subsets. How many elements are in set H?
2. There are 15 proper subsets in set D. How many elements are in set D?
3. Find the number of members in a set with;
 - (a) 31 proper subsets
 - (b) 7 proper subsets
 - (c) 511 proper subsets
 - (d) 1023 proper subsets

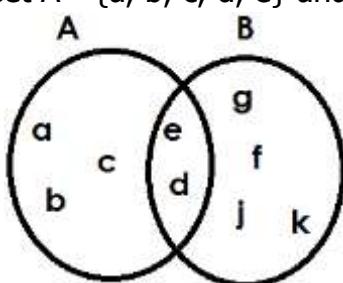
COMPLEMENT OF SETS

It is a set of elements outside the mentioned set.

Example: Complement of P means members in set P are not wanted.

Example2

Given set A= {a, b, c, d, e} and B= {e, d, g, f, j, k}



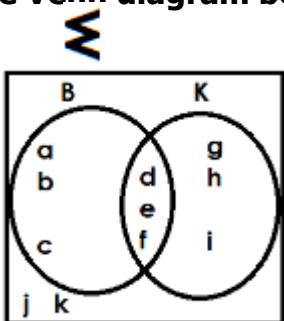
- a) Find $A^I = \{g, f, j, k\}$
- b) List members of $(A \cap B)^I = \{a, b, c, g, f, j, k\}$
- c) The complement of B = {a, b, c}
- d) List the members of $(A-B)^I$



Solution

$$(A-B)^I = \{e, d, g, f, j, k\}$$

Study the Venn diagram below and answer questions



a) Find the complement of set B

$$B^I = \{g, h, I, j, k\}$$

b) Find

(i) $(B \cap K)^I$

Solution

$$(B \cap K)^I = \{a, b, c, g, h, I, j, k\}$$

$$(ii) (B \cup K)^I$$

Solution

$$(B \cup K)^I = \{J, K\}$$

$$(iii) (K - B)^I$$

Solution

$$(K - B)^I = \{a, b, c, d, e, f, j, k\}$$

c) Find the number of elements in set K complement

Solution

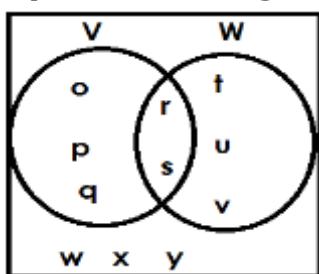
$$n(K^I)$$

$$K^I = \{a, b, c, j, k\}$$

$$n(K^I) = 5$$

Activity

Study the Venn diagram and answer questions



(a) Find

(i) V^I

(ii) $(V \cup W)^I$

(iii) $(V \cap W)^I$

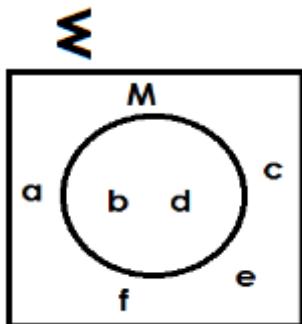
(iv) $(V - W)^I$

Find

(v) $n(W^I)$

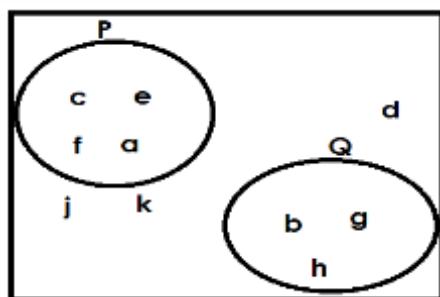
(vi) $n(V \cup W)^I$

- b. Find number of elements in the universal set.
 2. Study the given sets and answer the questions



- (a) Find $(M)^I$
 (b) List all the elements of M
 (c) List all the elements in the universal set.

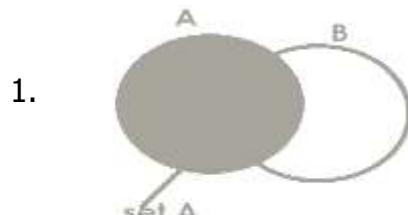
3.



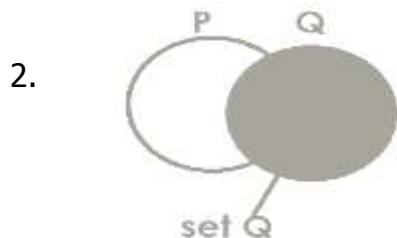
- (a) List all elements in P
 (b) List all elements in Q
 (c) Find P complement?
 (d) Find Q complement?
 (e) Find PUQ complement?
 (f) List all members in the universal set.

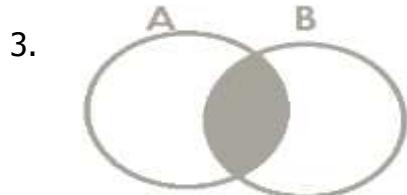
Describing shaded and un shaded regions of a Venn diagram

Examples



Or set $(B-A)'$



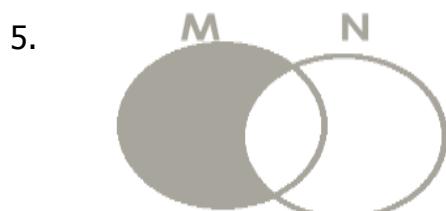


$A \cap B$

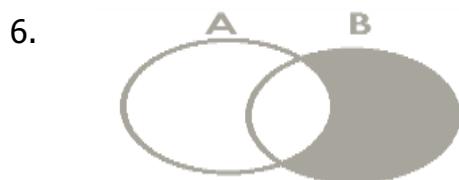
Set A intersection set B



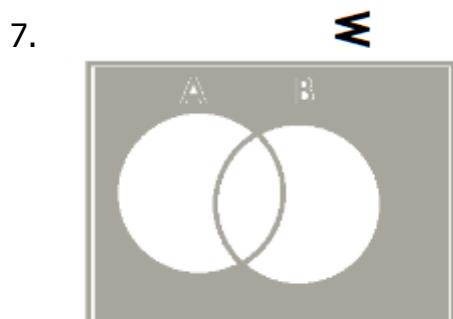
TUR or (Set T union set B)



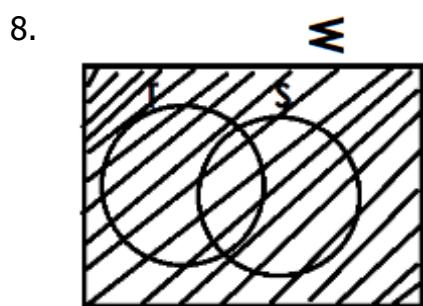
$M - N$ or M only or N^I



$B - A$ or B only or A'

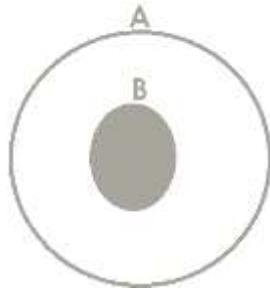


$(A \cup B)^I$ or $- A \cup B$

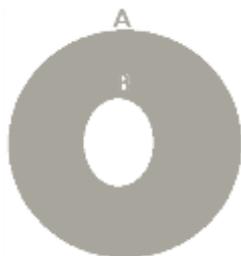


Universal set

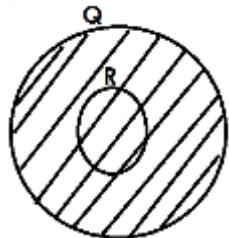
9.

 $A \cap B$ or $B \subseteq A$ or set B

10.

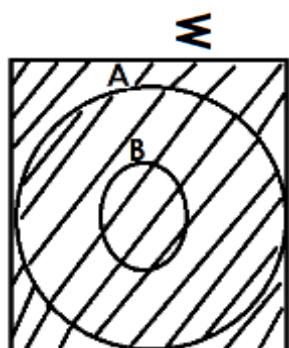
 $A \text{ only} / (A \cap B)^I / B^I / A - B$

11.



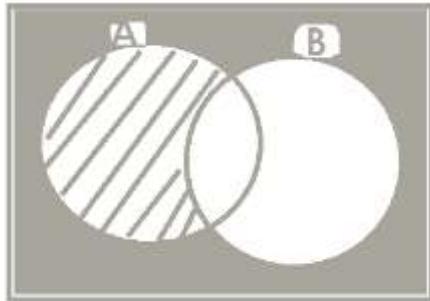
QUR

12.



M

13.

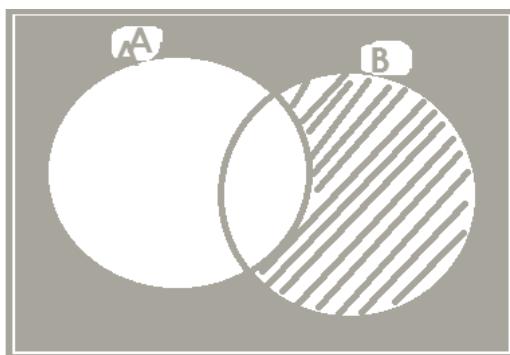


M

 B^I

14.

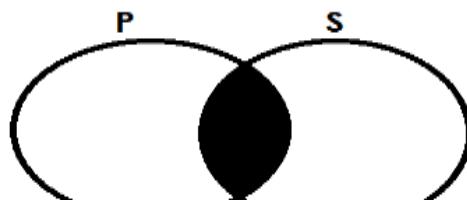
W

 A^I

Activity

Describe each of the shaded regions in the Venn diagrams below.

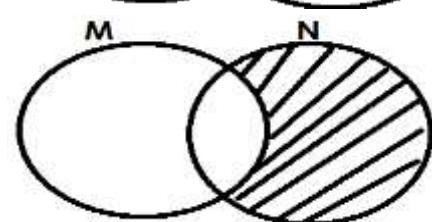
1.



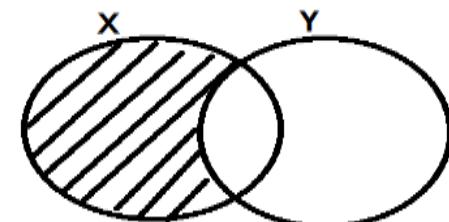
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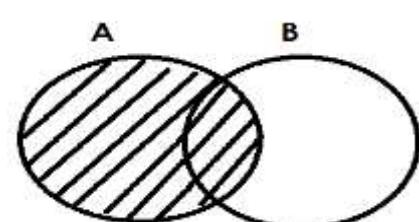
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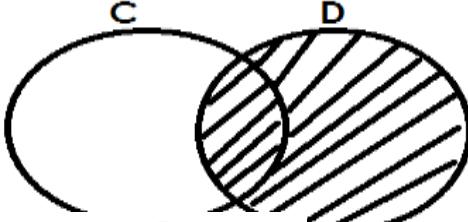
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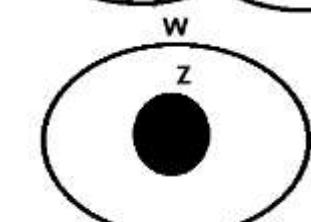
5.



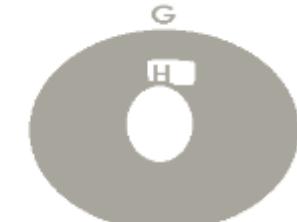
6.



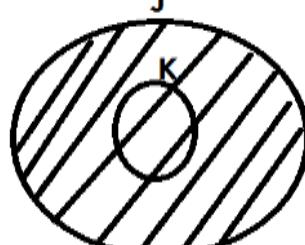
7.



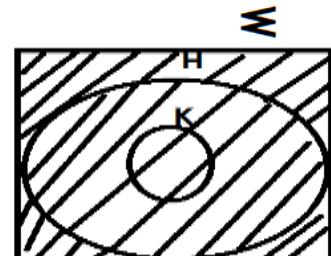
8.



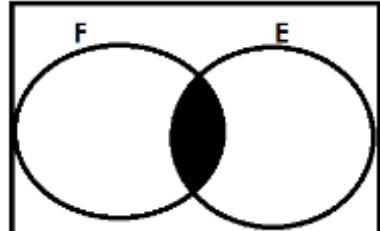
9.



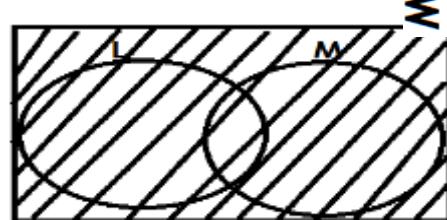
9.



11.



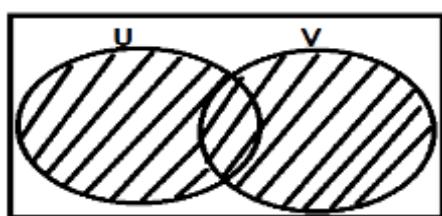
12.



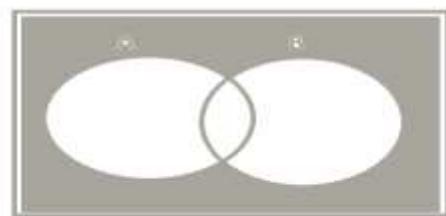


W

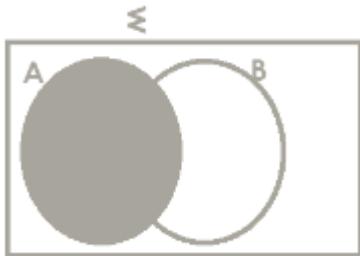
13.



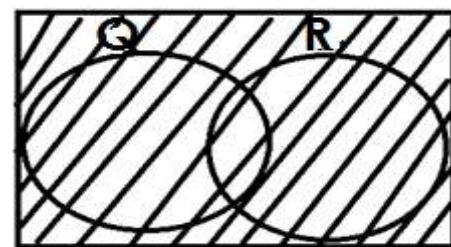
14.



15.



16.

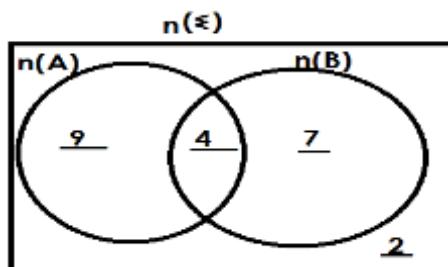


REPRESENTING AND FINDING NUMBER OF ELEMENTS ON A VENN DIAGRAM GIVEN GROUPED DATA

Examples

1. Given that $n(A-B) = 9$, $n(B-A) = 7$, $n(A \cap B) = 4$ and $n(A \cup B)^I = 2$

(a) Represent both sets on a Venn diagram below



(b) Find

(i) $n(A)$

$$n(A) = 9 + 4$$

$$= 13$$

(ii) $n(B)$

$$n(B) = 7 + 4$$

$$= 11$$

(iii) $n(A \cup B) = 9 + 4 + 7$

$$= 20$$

(iv) $n(A \cup B)^I$

$$n(A \cup B)^I = 2$$

(v) $n(A)^I$

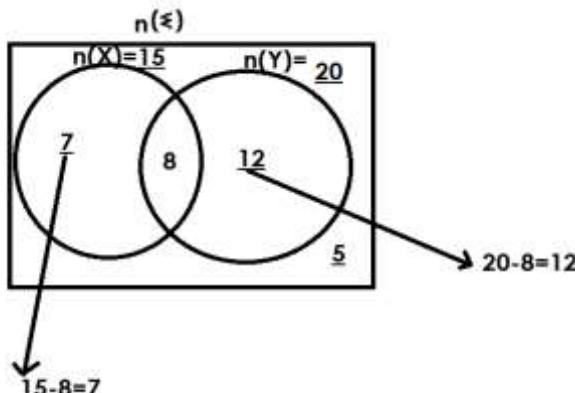
$$n(A)^I = 7 + 2$$

$$= 9$$



2. If $n(X) = 15$, $n(Y) = 20$, $n(X \cap Y) = 8$ and $n(X \cup Y)^I = 5$

(a) Use the above information to complete the Venn diagram below.



(b) Find

$$(iii) \quad n(X \cap Y)^I$$

(ii) $n(X-Y)$

soln.

$$7+8+12$$

$$7=24$$

(ii) $n(Y-X)$

$$(iv) \quad (v) \quad r n(\xi)$$

Soln.

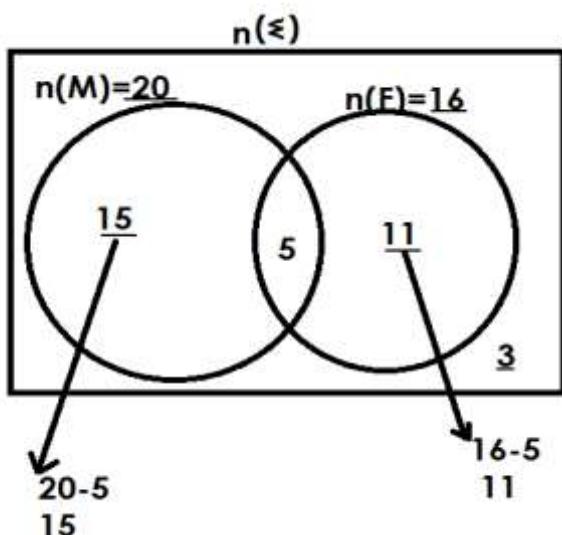
$$7+8+12+5$$

$$N(Y-X) = 12$$

$$=32$$

3. In a class, 20 pupils eat meat (M), 16 eat Fish (F) and 5 eat both while 3 pupils do not eat any of the mentioned.

(a) Represent the above information on a Venn diagram



(b) How many pupils eat only one dish?

Solution

Only one = $n(F)$ only + $N(M)$ only

$$=15+11$$

$$=26 \text{ pupils}$$



(c) How many pupils are in the whole class?

Solution

$$n(\xi) = 15 + 5 + 11 + 3 \\ = 34 \text{ pupils}$$

(d) Find the probability of picking a pupil who likes meat only from the class.

Soln.

$$\text{Probability} = \frac{n(D.C)}{n(T.C)}$$

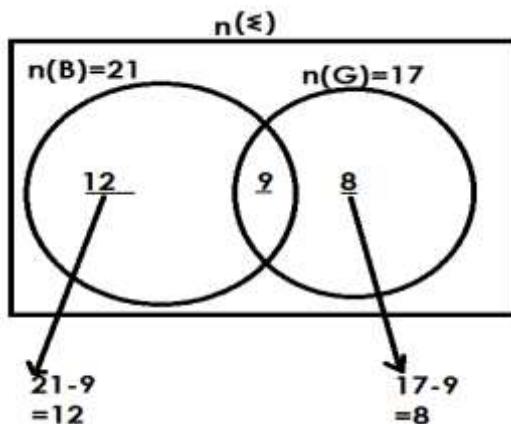
$$n(T.C)$$

$$n(D.C) = 20$$

$$n(T.C) = 34$$

$$\text{Probability} = \frac{20}{34}$$

4. It is given that; 21 farmers grow beans (B) and 17 farmers grow groundnuts (G). If 9 farmers grow both beans and ground nuts, draw a Venn diagram to show the above information.



(b) How many farmers grow only one type of crop?

$$\text{Only one} = n(B)\text{only} + n(G)\text{ only}$$

$$= 12 + 8$$

$$= 20$$

c. Find the probability of selecting a farmer at random who grows both crops

soln.

$$\text{Probability} = \frac{n(Q.C)}{n(T.C)}$$

$$n(Q.C) = 9$$

$$n(T.C) = 12 + 9 + 8$$

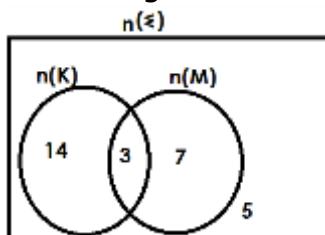
$$= 29$$

$$\text{Probability} = \frac{9}{29}$$



Activity

1. Use the Venn diagram below to answer questions that follow.

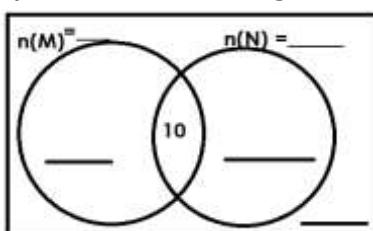


Find

- (i) $n(K)$
- (ii) $n(M)$
- (iii) $n(K \cap M)$
- (iv) $n(K \cup M)$
- (v) $n(\xi)$

2. Given that $n(M)=18$, $n(N)=25$, $n(M \cap N)=10$ and $n(M \cup N)^I=4$

- (a) Complete the Venn diagram below



- (b) Find $n(M-N)$

- (c) Find $n(\xi)$

3. In a class, pupils made choices of food stuff they prefer. Given rice(R) and Matooke (M). The findings were as follows.

$$n(R) = 20, n(M) = 28, n(R \cap M) = 8 \text{ and } n(R \cup M)^I = 2$$

- (a) Draw a Venn diagram representing the above information.

- (b) How many pupils chose rice only?

- (c) Find the number of pupils who chose matooke only.

- (d) How many pupils chose only one type of food?

- (e) How many pupils are in that class?

- (f) Find the probability of picking a pupil at random who likes rice.

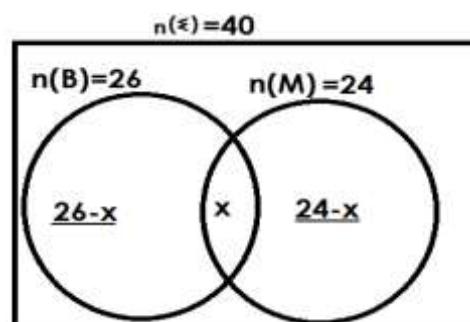
SOLVING PROBLEMS USING A VENN DIAGRAM

- (a) **GIVEN INTERSECTION AS THE UNKNOWN**

Example

In a village of 40 farmers, 26 grow beans (B) 24 grow maize (M) and x farmers grow both crops.

- (a) Complete the Venn diagram





(b) Find the value of x.

Solution

$$26 - \cancel{x} + \cancel{x} + 24 - 4 = 40$$

0

$$26 + 24 - x = 40$$

$$50 - x = 40$$

$$50 - 50 - x = 40 - 50$$

$$0 - x = -10$$

$$\frac{-x}{-1} = \frac{-10}{-1}$$

$$x = 10$$

(c) How many farmers grow only one crop?

Solution

Only one = n (B) only + n (M) only

$$= 26 - x + 24 - x$$

$$= 26 - 10 + 24 - 10$$

$$= 16 + 14$$

$$= 30 \text{ farmers}$$

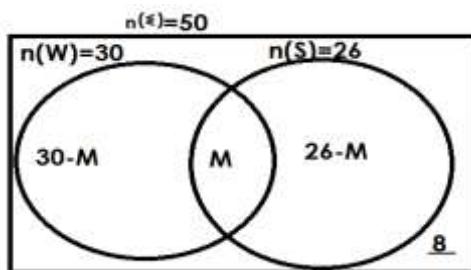
(d) Find the probability of picking a farmer who grows maize only from the village

$$\begin{aligned} \text{Prob} &= \frac{n(M)}{n(P)} \\ &= \frac{n(E)}{n(P)} \\ &= \frac{24 - x}{40} \\ &= \frac{24 - 10}{40} \\ &= \frac{14}{40} \end{aligned}$$

Example 2

In a bus of 50 passengers, 30 bought water (W), 26 bought soda(S) and M passengers bought both drinks while 8 passengers did not buy any of the mentioned.

(a) Complete the Venn diagram



(b) How many passengers bought both drinks?

$$\text{Soln. } 30 - \cancel{m} + \cancel{m} + 26 - \cancel{m} + 8 = 50$$

0

$$30 + 26 + 8 - m = 50$$

$$64 - m = 50$$

$$64 - 64 - m = 50 - 64$$

0

$$-m = -14$$

$$\frac{-m}{-1} = \frac{-14}{-1}$$

$$m = 14$$



14 Passengers

(c) How many passengers did not buy water?

Soln.

$$\begin{aligned} n(W)^I &= 26 - m + 8 \\ &= 26 - 14 + 8 \\ &= 12 + 8 \\ &= 20 \end{aligned}$$

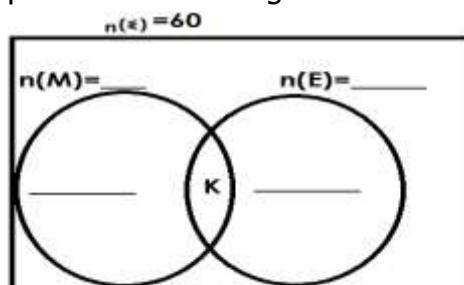
(d) Find the probability of picking a passenger who bought only one drink.

$$\begin{aligned} \text{Prob} &= \frac{n(E)}{n(P)} \\ &= \frac{30 - M + 26 - M}{50} \\ &= \frac{30 - 14 + 26 - 14}{50} \\ &= \frac{16 + 12}{50} \\ &= \frac{28}{50} \end{aligned}$$

Activity

1. In a class of 60 pupils, 40 like Math (M), 30 like English (E) and K pupils like both subjects

a) Complete the Venn diagram



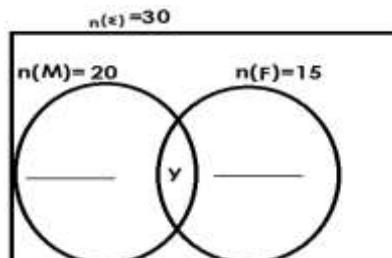
(b) Find the value of K.

(c) How many pupils like only one subject?

(d) Find the probability of picking a pupil who likes Maths only to lead a prayer.

2. In a group of 30 people, 20 eat meat (M), 15 eat fish (F) and y people eat both dishes.

(a) Complete the Venn diagram below using the above information.



(b) How many people like both dishes?

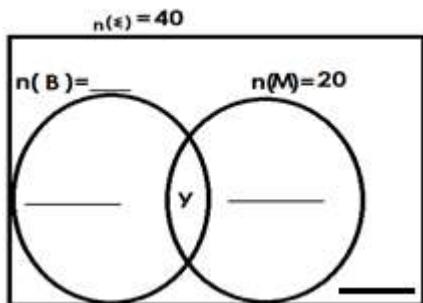
(c) How many people eat only one dish?

(d) Find the probability of picking a person who eats fish only from the group at random.



3. In a village of 40 farmers, 30 grow beans (B) 20 grow maize (M) and y farmers grow both crops while 6 farmers do not grow any of the mentioned crops.

(a) Complete the Venn diagram.



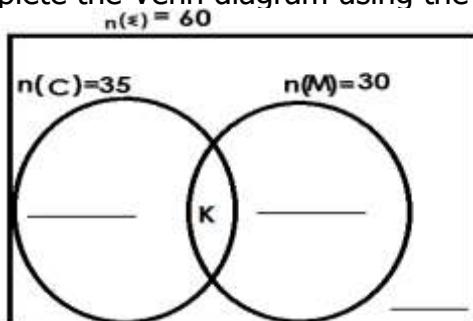
(b) Find the value of y .

(c) How many pupils do not grow maize?

(d) Find the probability of picking a farmer who grows only one crop.

4. At a party attended by 60 people, 35 ate chicken(C), 30 ate meat (M) and K people ate both dishes while 5 people ate neither of the two.

(a) Complete the Venn diagram using the above information.



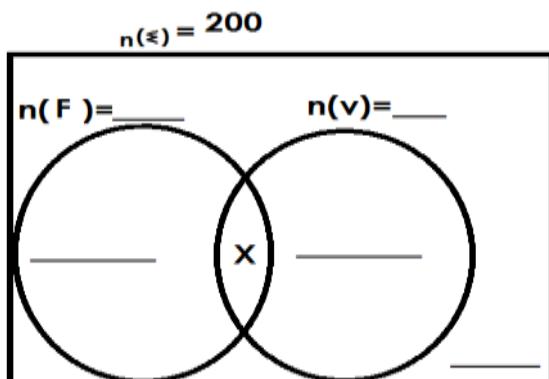
(b) How many people ate both dishes?

(c) Find number of people who ate only one dish.

(d) Find the probability of picking a person who did not eat chicken at the party.

5. In a school of 200 pupils, 150 play football (F) 100 play volleyball(V) X pupils play both and 40 pupils play neither of the two.

(a) Complete the Venn diagram.



(b) Find the value of X

(c) How many pupils play only one game?

(d) Find the probability of picking a pupil who does not play football from the school at random.



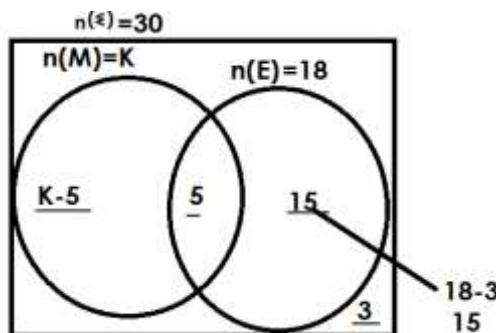
SOLVING PROBLEMS USING A VENN DIAGRAM

(B) GIVEN ONE OF THE SETS AS THE UNKNOWN

Example 1

In a class of 30 pupils K pupils like math (M), 18 like English (E) and 5 pupils like both subjects while 3 pupils like neither of the two.

(a) Complete the Venn diagram



(b) Find the value of K

Soln.

$$\begin{aligned} k-5+5+15+3 &= 30 \\ 0 & \\ k+18 &= 30 \\ k+18-18 &= 30-18 \\ 0 & \\ k &= 12 \end{aligned}$$

(c) How many pupils like only one subjects

Soln.

$$\begin{aligned} \text{Only one} &= n(M) \text{ only} + n(E) \text{ only} \\ &= k-5+15 \\ &= 12-5+15 \\ &= 7+15 \\ &= 22 \text{ pupils} \end{aligned}$$

(d) Find the probability of picking a pupil who does not like Maths (M) from the class.

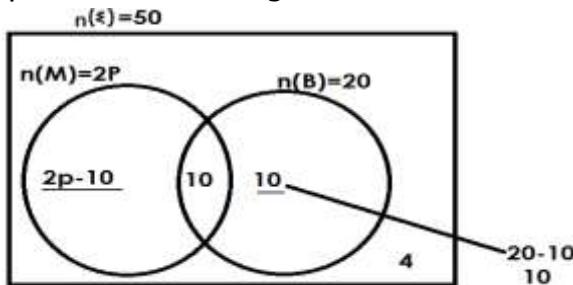
$$\begin{aligned} \text{Prob} &= \frac{n(E)}{n(P)} \\ &= \frac{15+3}{30} \\ &= \frac{18}{30} \end{aligned}$$

Example 2

In a village of 50 farmers, 20 grow maize (M), 2P farmers grow beans (B) and 10 farmers grow both crops while 4 farmers do not grow any of the mentioned.



(a) Complete the Venn diagram



(b) Find the value of P

Solution

$$2P - 10 + 10 + 10 + 4 = 50$$

$$\underline{0} \quad 2P + 24 = 50$$

$$\underline{2P + 24 - 24} = 50 - 24$$

$$\underline{\underline{0}} \quad 2P = 26$$

$$\frac{2P}{2} = \frac{26}{2}$$

$$P = 13$$

(c) How many farmers grow only one crop?

Solution

$$\text{Only one} = n(M) \text{ only} + n(B) \text{ only}$$

$$= 2P - 10 + 10$$

$$= (2 \times 13) - 10 + 10$$

$$= \underline{\underline{0}} \quad \underline{\underline{26 \text{ farmers}}}$$

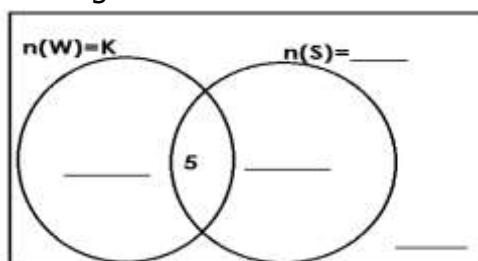
(d) Find the probability of picking a farmer who does not grow beans

$$\begin{aligned} \text{prob} &= \frac{\text{does not grow beans}}{n(P)} \\ &= \frac{n(E)}{n(P)} \\ &\quad \text{universal} \\ &= \frac{2P - 10 + 4}{50} \\ &= \frac{(2 \times 13) - 10 + 4}{50} \\ &= \frac{(26 - 10) + 4}{50} \\ &= \frac{13 + 4}{50} \\ &= \frac{17}{50} \end{aligned}$$

ACTIVITY

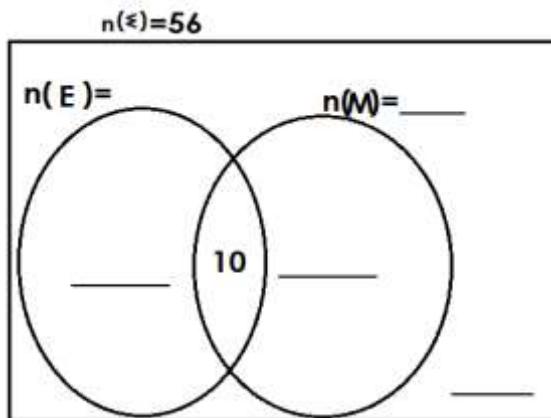
- In a group of 40 people, K people took water (W), 15 people took soda(S) and 5 people took both drinks while 8 people did not take any of the mentioned drinks.

(a) Complete the Venn diagram.

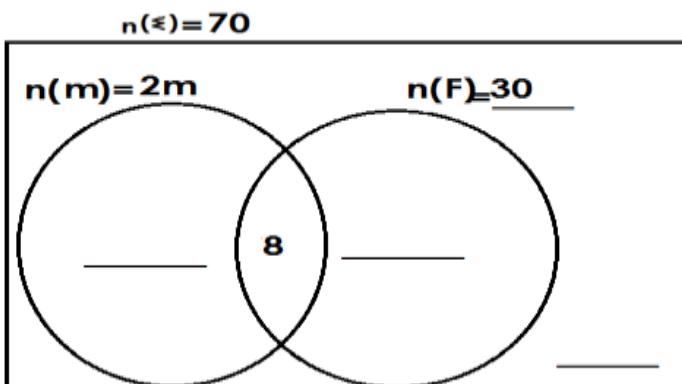




- (b) Find the value of k.
- (c) How many people took only one drink?
- (d) Find the probability of picking a person who did not take water from the group.
2. In a class of 56 pupils, 26 pupils like English (E), X pupils like Math(M) 10 pupils like both subjects and 6 pupils like none of the mentioned.
- (a) Complete the Venn diagram.



- (b) How many pupils like Math (M)?
- (c) How many pupils like only one subject?
- (d) Find the probability of picking a person who does not like English.
3. At a birthday party attended by 70 people, 2m people ate meat (M), 30 people ate fish(F) and 8 people ate both dishes, while 2 people did not eat any of the mentioned.
- (a) Complete the Venn diagram

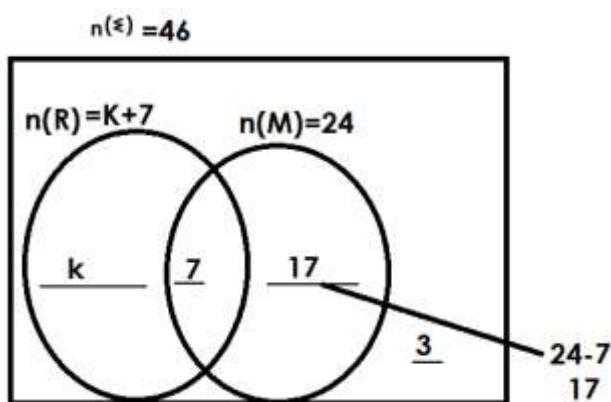


- (b) Find the value of m.
- (c) How many pupils eat only one dish?
- (d) How many pupils do not eat fish?
4. In a market of 40 traders, y traders sell shirts (S, 15 traders sell dresses(s) and 6 traders sell both types while 4 traders do not sell any of the mentioned.

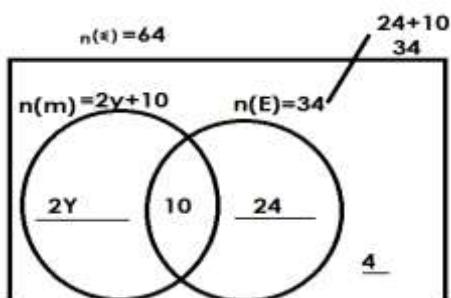


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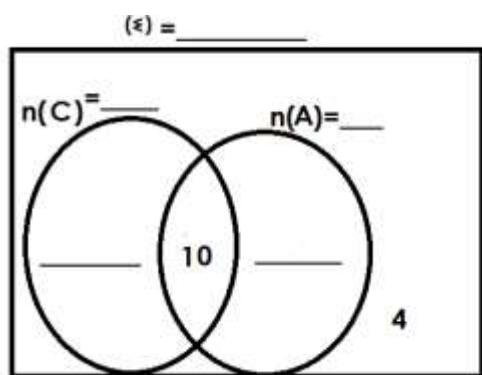
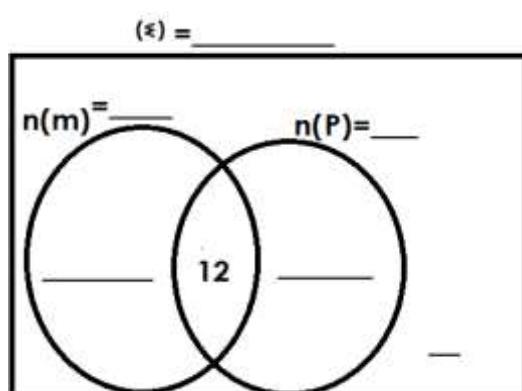
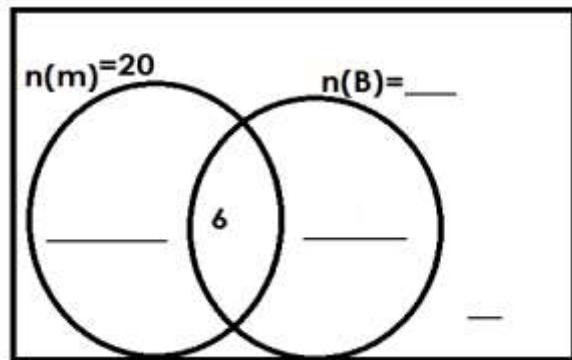


$$\begin{aligned}k+7+17+3 &= 46 \\k+27 &= 46 \\k+27-27 &= 46-27 \\0 &= k \\k &= 19\end{aligned}$$



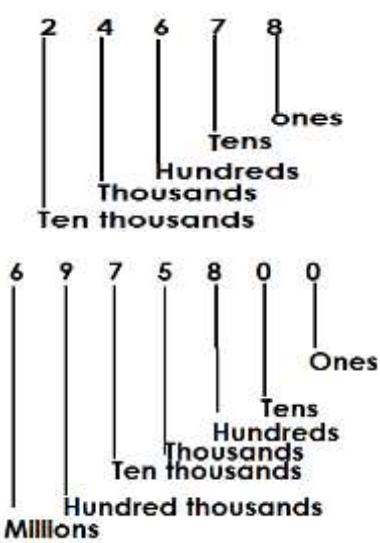
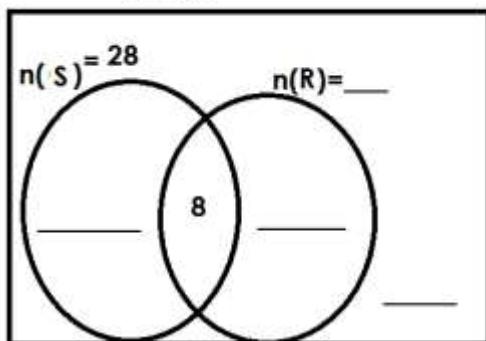
$$\begin{aligned}2y+10+24+4 &= 64 \\2y+38 &= 64 \\2y+38-38 &= 64-38 \\2y &= 26 \\2y &= 26 \\y &= 13\end{aligned}$$

$$\begin{aligned}&= \frac{n(E)}{n(P)} \\&= \frac{2y+24}{64} \\&= \frac{(2 \times 13) + 24}{64} \\&= \frac{26+24}{64} \\&= \frac{50}{64}\end{aligned}$$





$$(\varepsilon) = 56$$





5 0 4 6
Hundreds
7 6 0 3 7 9 7
Ten thousands

9 0 7 6 0 4
Hundred thousands

3 4 6 7
 $(7 \times 1) = 7$
 $6 \times 10 = 60$
 $4 \times 100 = 400$
 $3 \times 1000 = 3000$

7 9 4 6 7
 $(7 \times 1) = 7$
 $6 \times 10 = 60$
 $4 \times 10 = 400$
 $9 \times 1000 = 9000$
 $7 \times 10,000 = 70,000$

T TH H T O
2 3 5 6 8
 $(5 \times 100) = 500$



TH 8	H 5	T 3	O 6
--------------------	--------	--------	--------

Tens = 10
Hundreds = 100

$$\begin{array}{r} 100 \\ + 10 \\ \hline 110 \end{array}$$

^{T.TH} 6	TH 4	H 0	T 2	O 7
----------------------	--------------------	--------	--------	--------

2x10=20

Thousands = 1000

sum=1000
+ 200
1020

TH 8	H 0	T 6	O 7
--------------------	--------	--------	--------

6x10=60

Thousands = 1000

Difference
1000
- 60
940

TH 4	H 5	T 6	O 2
--------------------	--------	--------	--------

2x1=2

Hundreds = 100

Product
100 x 2
200



T	TH	TH	H	T	O
7	5	8	2	0	
				$2 \times 10 = 20$	
Thousands				= 1000	

$$\begin{array}{r} \text{Quotient} = \frac{50}{20} \\ \hline & 50 \\ & -20 \\ \hline & 0 \end{array}$$

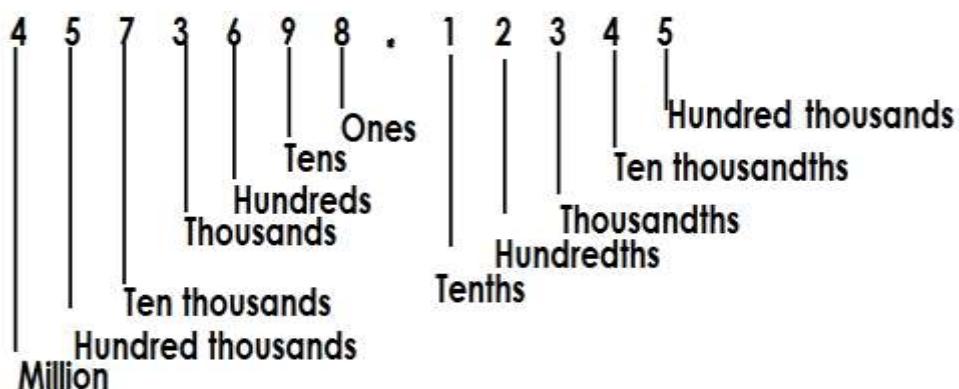
H	T	O
2	0	8

H	T	O
4	3	9



6	5	0
10 ²	10 ¹	10 ⁰

5 6 • 0 2 8
Whole digits Point Decimal digits



8 7 . 6 2 9
Hundreds

4 5 . 1 6 8
Tenths

Value=Digit x place value



$$\begin{array}{r} 0. \ 3 \ 4 \ 1 \\ | \\ 4 \times \frac{1}{100} = \frac{4}{100} \\ = 0.\overline{0}4 \\ = 0.04 \end{array}$$

$$\begin{array}{r} 0. \ 0 \ 4 \ 7 \\ | \\ 7 \times 1 \\ 1000 \\ 0.\overline{0}07 \\ 1000 \\ 0.007 \end{array}$$

$$\begin{array}{r} 0. \ 3 \ 4 \ 2 \\ | \\ 2 \times \frac{1}{1000} = \frac{2}{100} = 0.002 \\ 3 \times 1 = \frac{3}{10} \\ = 0.3 \\ \hline \text{sum} \\ 0.002 \\ + 0.300 \\ \hline 0.302 \end{array}$$



$$2 \begin{array}{r} 4.06 \\ \times 7 \\ \hline 4 \end{array} \quad \begin{array}{r} =7 \\ 1000 \\ \hline 7 \times 1 \\ 1000 \end{array} = 0.007$$

$$\begin{array}{r} 4.000 \\ - 0.007 \\ \hline 3.995 \end{array}$$

$$12.4 \quad \begin{array}{r} 4 \\ \times 1 \\ \hline 10 \\ 2 \times 1 = 2 \end{array} \quad \begin{array}{r} =4 \\ 10 \\ = 0.4 \end{array} \quad \left| \begin{array}{l} \text{Quotient} = 2 \div 0.4 \\ = 2 \div \frac{4}{10} \\ = 2 \times \frac{10}{4} \\ = \frac{20}{4} \\ = 5 \end{array} \right.$$





4	9	*	3	5
10^2	10^0	*	10^1	10^3

1	8	4	*	0	0	9
10^2	10^1	10^0	*	10^1	10^2	10^3

$$(1 \times 10^2) + (8 \times 10^1) + (4 \times 10^0) + (0 \times 10^1) + (0 \times 10^2) + (9 \times 10^3)$$



$$\begin{array}{r} 6 \ 0 \ 0 \ 0 \ 0 \\ 4 \ 0 \ 0 \ 0 \\ 3 \ 0 \ 0 \\ + \ 0 \ 7 \ 0 \\ \hline 0 \ 0 \ 9 \\ \hline 6 \ 4 \ 3 \ . \ 7 \ 9 \end{array}$$

$$\begin{array}{r} 7 \ 0 \ 0 \ . \ 0 \ 0 \\ 5 \ . \ 0 \ 0 \\ 0 \ . \ 0 \ 8 \\ \hline 7 \ 0 \ 5 \ . \ 0 \ 8 \end{array}$$

$$\begin{array}{r} 4 \ 0 \ . \ 0 \ 0 \\ 3 \ . \ 0 \ 0 \\ + \ 0 \ . \ 8 \ 0 \\ 0 \ . \ 0 \ 5 \\ \hline 4 \ 3 \ . \ 8 \ 5 \end{array}$$

$$\begin{array}{r} 3 \ 0 \ 0 \ . \ 0 \ 0 \\ 7 \ . \ 0 \ 0 \\ + \ 0 \ . \ 2 \ 0 \\ 0 \ . \ 0 \ 9 \\ \hline 3 \ 0 \ 7 \ . \ 2 \ 9 \end{array}$$

$$\begin{array}{r} 4 \ 0 \ . \ 0 \ 0 \ 0 \\ + \ 0 \ . \ 8 \ 0 \ 0 \\ 0 \ . \ 0 \ 0 \ 9 \\ \hline 4 \ 0 \ . \ 0 \ 0 \ 9 \end{array}$$



$$(3 \times 10^2) + (5 \times 10^1) + (4 \times 10^0) + (8 \times 10^{-1})$$

$$\begin{array}{r} 3 \quad 0 \quad 0 \quad . \quad 0 \\ \quad 5 \quad 0 \quad . \quad 0 \\ + \quad \quad 4 \quad . \quad 0 \\ \hline 2 \quad 5 \quad 4 \quad . \quad 8 \end{array}$$

$$(6 \times 10^1) + (9 \times 10^0) + (7 \times 10^{-1}) + (3 \times 10^{-2})$$

$$(6 \times 10) + (9 \times 1) + (7 \times \frac{1}{10}) + (3 \times \frac{1}{10^2})$$

$$\begin{array}{r} 60 \quad + 9 \quad + \frac{7}{10} \quad + \frac{3}{10 \times 10} \\ 60 \quad + 9 \quad + 0.7 \quad + \frac{3}{100} \\ 60 \quad 6 \quad + 0 \quad + 0.7 \quad 0 \quad + 0.03 \\ \quad 9 \quad . \quad 0 \quad 0 \\ + \quad 0 \quad . \quad 7 \quad 0 \\ \hline 6 \quad 9 \quad . \quad 7 \quad 3 \end{array}$$

$$(8 \times 10^1) + (6 \times 10^2) + (5 \times 10^3)$$

$$(2 \times 10^3) + (8 \times 10^1) + (1 \times 10^2)$$

$$(5 \times 10^2) + (4 \times 10^1)$$



$$(7 \times 10^3) + (8 \times 10^2) + (6 \times 10^1) + (1 \times 10^0) + (9 \times 10^{-2}) + (6 \times 10^{-3})$$

$$(0 \times 10^0) + (7 \times 10^{-3})$$



4 3

$$\begin{array}{r} \text{Th} \quad \text{H} \quad \text{T} \quad \text{O} \\ \boxed{4} \quad \boxed{8} \quad \boxed{6} \quad \boxed{7} \\ \hline 5 \quad 0 \quad 0 \quad 0 \end{array}$$

$$\begin{array}{r} \text{H} \quad \text{T} \quad \text{O} \\ 0 \quad \boxed{7} \quad \boxed{5} \\ \hline 1 \quad 0 \quad 0 \\ \hline 1 \quad 0 \quad 0 \end{array}$$



$$\begin{array}{r} 3 \quad 9 \quad . \quad 4 \quad 5 \\ + \quad 0 \quad . \quad 1 \\ \hline 3 \quad 9 \quad . \quad 5 \end{array}$$

$$\begin{array}{r} 9 \quad 7 \quad . \quad 6 \quad 5 \quad 6 \\ + \quad 0 \quad . \quad 1 \quad 4 \\ \hline 9 \quad 7 \quad . \quad 7 \end{array}$$

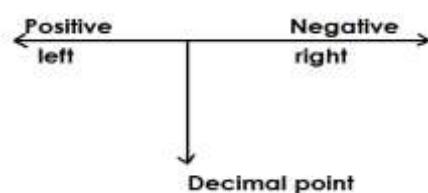
$$\begin{array}{r} 8 \quad 9 \quad . \quad 9 \quad 9 \quad 4 \\ + \quad 0 \quad . \quad 0 \quad 1 \\ \hline 9 \quad 0 \quad . \quad 0 \quad 0 \end{array}$$

$$\begin{array}{r} 9 \quad 9 \quad . \quad 8 \quad 9 \quad 0 \quad 7 \\ + \quad 0 \quad . \quad 0 \quad 0 \\ \hline 9 \quad 9 \quad . \quad 8 \quad 9 \end{array}$$

$$\begin{array}{r} 9 \quad 9 \quad . \quad 6 \\ + \quad 0 \quad . \quad 6 \\ \hline 9 \quad 9 \end{array}$$



$$\begin{array}{r} & \overset{1 \text{ R.D.}}{5} & 9 & 9 \\ & + & 1 & \swarrow \\ 6 & 0 & 0 & - 6 & 5 & 7 \end{array}$$



$$8 . \overbrace{4}^? \overbrace{3}^? \times 10^2$$
$$= 8.43 \times 10^2$$

$$9 \cancel{6} \cdot 3 \times 10^1$$
$$9.63 \times 10^1$$



$$4.67616 \times 10^?$$
$$4.67616 \times 10^2$$

$$0.246 \times 10^?$$
$$2.46 \times 10^{-2}$$

$$0.00478 \times 10^?$$
$$4.78 \times 10^{-3}$$

$$420000 \times 10^?$$
$$4.2 \times 10^5$$

$$= 4.9 \times 10^?$$
$$= 4.9 \times 10^0$$

$$\frac{873 \times 10 \times 10}{100}$$
$$873$$



$$= \frac{524 \times 10 \times 10}{100}$$
$$= 524$$

$$9.6 \times 10 = \frac{96 \times 1}{10 \times 100}$$
$$= \frac{96}{1000}$$
$$= 0.096$$

$$6.234 \times 10^5 = \frac{6.234 \times 1}{1000 \quad 100000}$$
$$= \frac{0.0006234}{100000000}$$
$$= 0.00006234$$

$$7 \times 10^{-1}$$

$$7.2 \times 10^{-2}$$

$$6.24 \times 10^{-4}$$

$$2.14 \times 10^{-1}$$

$$3.678 \times 10^{-3}$$

$$7.03 \times 10^{-5}$$





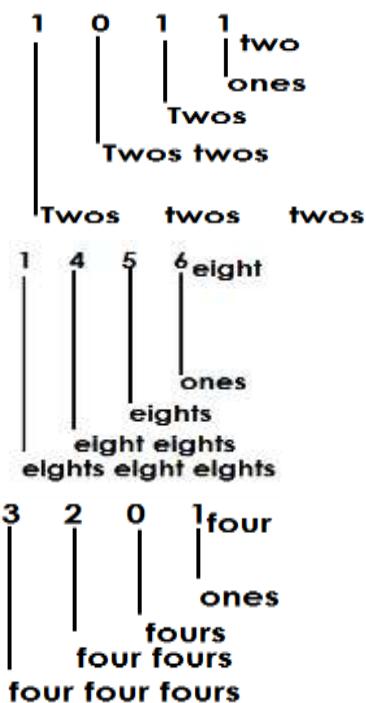




LXXXIX
80 | 9

M CM XC IX
1000 900 90 9







TH	H	T	O
1	0	0	0

two

 $1 \times 2 \times 2 \times 2 = 8$

H	T	O
1	0	0

two
two twos = $1 \times 2 \times 2 = 4$

ff	f	o
2	3	4

five

 $2 \times 5 \times 5 = 50$

ss	s	o
3	4	5

six

 $4 \times 6 = 24$

ff	f	o
3	1	2

five
2x1=2

 $3 \times 5 \times 5 = 75$

ss	s	o
4	1	3

six
3x1=3

 $1 \times 6 = 6$
 $4 \times 6 \times 6$
 $4 \times 36 = 144$



1 1 1 1
two

TH H T O
1 1 1 1
two

H T O
1 0 1
two

fff ff f o
1 2 0 3

four

ee e o
5 6 7
eight



1 0 0 1
TH H T O
1 0 0 1
two

H T O
1 1 1
two

ff f o
1 2 4
five

2 1 2
H T O
2 1 2
three

1	1	0	0
2^3	2	2	2 ⁰



B	N	R
2	29	1
2	14	0
2	7	1
2	3	1
2	1	1
	0	

$29 = 11101_{\text{two}}$

B	N	R
5	75	0
5	15	0
5	3	3
	0	



B	N	R
8	42	2
8	5	5
	0	



B	N	R
3	17	2
3	5	2
3	1	1
	0	





B	N	R
3	6	0
3	2	2
0	0	



B	N	R
5	15	0
5	3	3
0		

1	0	2
4^2	4^1	4^0

B	N	R
2	17	1
2	8	0
2	4	0
2	2	0
2	1	1
0		

$$\begin{array}{c|c|c} 2 & 0 & =12 \\ \hline k & k^0 & \\ \hline \end{array} \quad \begin{array}{l} 2k+0 =12 \\ 2k =12 \\ \cancel{2k} =\cancel{12}^6 \\ \cancel{k} =1 \\ k =6 \end{array}$$

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$$\begin{array}{|c|c|} \hline 3 & 2 \\ \hline y^1 & y^0 \\ \hline \end{array} = \begin{array}{|c|c|c|c|} \hline 1 & 0 & 1 & 1 \\ \hline 2^3 & 2^2 & 2^1 & 2^0 \\ \hline \end{array}$$

$$(3xy^1) + (2x^0y^0) = (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (1 \times 2^0)$$

$$(3xy) + (2x^1) = (1 \times 2 \times 2^2) + (0 \times 2^2) + (1 \times 2) + (1 \times 1)$$

$$3y+2 = 8+0+2+1$$

$$3y+2 = 11$$

$$\cancel{3y+2-2} = 11-2$$

0

$$3y = 9$$

$$\begin{array}{r} \cancel{3y} \\ -9 \\ \hline 3 \end{array}$$

$$y=3$$

$$\begin{array}{|c|c|c|} \hline 1 & 0 & 3 \\ \hline m^2 & m^1 & m^0 \\ \hline \end{array} = 28$$

$$(1 \times m^2) + (0 \times m^1) + (3 \times m^0) = 28$$

$$(1 \times m^2) + (0 \times m^1) + (3 \times 1) = 28$$

$$m^2 + 0 + 3 = 28$$

$$m^2 + 3 = 28$$

$$\cancel{m^2+3-3} = 28-3$$

$$m^2 = 25$$

$$\sqrt{m^2} = \sqrt{25}$$

$$m = 5$$



$$(2 \times k^2) + (0 \times k^1) + (3 \times k^0) = (1 \times 3^3) + (2 \times 3^2) + (2 \times 3^1) (2 \times 3^0)$$

$$(2k^2) + (0 \times k) + (3 \times 1) = (1 \times 3 \times 3 \times 3) + (2 \times 3 \times 3) + (2 \times 3) + (2 \times 1)$$

$$2k^2 + 0 + 3 = 27 + 18 + 6 + 2$$

$$2k^2 + 3 = 53$$

$$2k^2 + 3 - 3 = 53 - 3$$

$$2k^2 = 50$$

$$\begin{array}{r} 1 \\ \times k^2 \\ \hline 1 \\ 1 \\ \hline k^2 \end{array} \quad \begin{array}{r} = 50 \\ \hline 25 \\ 2 \\ 1 \end{array}$$

$$\sqrt{k^2} = \sqrt{25}$$

$$k^2 = 5$$

$$\begin{array}{r} 1 & 1 & 0 \text{ two} \\ + & 1 & 1 \text{ two} \\ \hline 1 & 0 & 1 \text{ two} \end{array} \quad \left| \begin{array}{l} \frac{2}{2} = 1r0 \\ \frac{2}{2} = 1r0 \end{array} \right.$$

$$\begin{array}{r} 1 & 1 & 1 & 1 \text{ two} \\ + & 1 & 1 & 1 \text{ two} \\ \hline 1 & 1 & 1 & 1 \text{ two} \end{array} \quad \left| \begin{array}{l} \frac{2}{2} = 1r0 \\ \frac{3}{2} = 1r1 \end{array} \right.$$

$$\begin{array}{r} 3 & 1 & 0 \text{ five} \\ + & 2 & 1 & 2 \text{ five} \\ \hline 1 & 0 & 2 & 2 \text{ five} \end{array} \quad \left| \begin{array}{l} \frac{5}{5} = 1r0 \end{array} \right.$$



$$\begin{array}{r} 1 & 1 & 1 & 1 \text{two} \\ - 1 & 0 & 0 & 0 \text{two} \\ \hline 0 & 1 & 1 & 1 \text{two} \end{array}$$

$$\begin{array}{r} 0 & & 1 & 1 \\ \cancel{1} & \cancel{0} & \cancel{0} & 0 \text{two} \\ - 1 & 1 & 1 \text{two} \\ \hline 0 & 0 & 0 & 1 \text{two} \end{array}$$

$$\begin{array}{r} 3 & 0 & 0 \text{ four} \\ - 2 & 1 & 1 \text{ four} \\ \hline 0 & 2 & 3 \text{ four} \end{array}$$

$$\begin{array}{r} \times 1 & 0 \text{ two} \\ 1 & 1 \\ \hline 1 & 0 \\ + 1 & 0 \\ \hline 1 & 1 & 0 \text{ two} \end{array}$$

$$\begin{array}{r} 1 & 1 & 1 & \text{two} \\ \times 1 & 1 & 1 & \text{two} \\ \hline 1 & 1 & 1 \\ + 1 & 1 & 1 \\ \hline 1 & 0 & 1 & 0 & 1 \text{ two} \end{array} \quad \left| \begin{array}{l} \underline{2=1r0} \\ 2 \\ \underline{3=1r1} \\ 2 \end{array} \right.$$



$$\begin{array}{r} 2 \ 0 \ 2\text{three} \\ \times \ 1 \ 2\text{three} \\ \hline 1 \ 1 \ 1 \ 1 \\ + \ 2 \ 0 \ 2 \\ \hline 1 \ 0 \ 2 \ 0 \ 1\text{three} \end{array}$$

$$\begin{aligned} 2 \times 2 &= 4 \\ 4:3 &= 1r1 \\ 4:3 &= 1r1 \\ 3:3 &= 1r0 \end{aligned}$$

$$\begin{array}{r} 2 \ 1 \\ 1 \ 4 \ 2 \text{ five} \\ \times \ 4 \ 3 \text{ five} \\ \hline 1 \ 0 \ 3 \ 1 \\ 1 \ 2 \ 2 \ 3 \\ \hline 1 \ 3 \ 3 \ 1 \ 1 \text{ five} \end{array}$$

$$\begin{aligned} 3 \times 2 &= 6 \\ 6:5 &= 1r1 \\ 3 \times 4 &= 12 \\ 12:5 &= 2r3 \\ 6:5 &= 1r3 \\ 17:5 &= 3r2 \end{aligned}$$

$$\begin{array}{r} 1 \ 1 \\ 3 \ 1 \ 2 \text{ four} \\ \times \ 3 \ 2 \text{ four} \\ \hline 1 \ 2 \ 3 \ 0 \\ + \ 2 \ 2 \ 0 \ 2 \\ \hline 2 \ 3 \ 3 \ 1 \ 0\text{four} \end{array}$$

$$\begin{aligned} 4:4 &= 1r0 \\ 6:4 &= 1r2 \\ 6:4 &= 1r2 \\ 4:4 &= 1r0 \\ 10:4 &= 2r2 \\ 5:4 &= 1r1 \end{aligned}$$

B	NO	rem
8	12	4
8	1	1
	0	

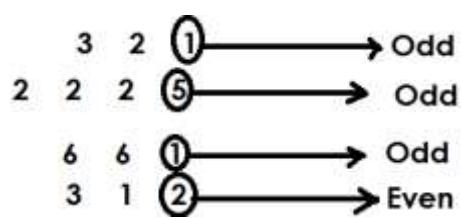


B	NO	rem
5	7	2
5	1	1
	0	



B	NO	rem
6	4	4
	0	







3 **36**
36

1 1 1 1 1 **2**
12

2 **34**
34



5 5 6
1 0 4
2 4 5



$$\begin{array}{r} 8 \ 6 \\ - \ 2 \\ \hline 8 \ 4 \end{array}$$

$$\begin{array}{r} 1 \ 7 \ 9 \\ - \ 4 \\ \hline 1 \ 7 \ 5 \end{array}$$

$$\begin{array}{r} 1 \ 7 \\ - 1 \ 0 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 2 \ 4 \\ - 1 \ 2 \\ \hline 1 \ 2 \end{array}$$

$$\begin{array}{r} 7 \ 9 \ 6 \\ - \ 4 \\ \hline 7 \ 9 \ 2 \end{array}$$

$$\begin{array}{r} 7 \ 9 \\ - 4 \\ \hline 7 \ 5 \end{array}$$



$$\begin{array}{r} 2 \boxed{1} 60 \\ - 160 \\ \hline \end{array}$$

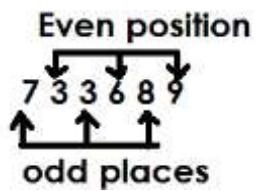
$$\begin{array}{r} 2 \boxed{0} 80 \\ - 80 \\ \hline \end{array}$$

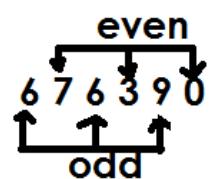
$$\begin{array}{r} 45 \boxed{0} 94 \\ - 94 \\ \hline \end{array}$$

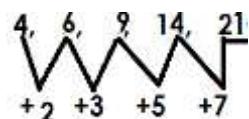
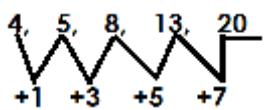


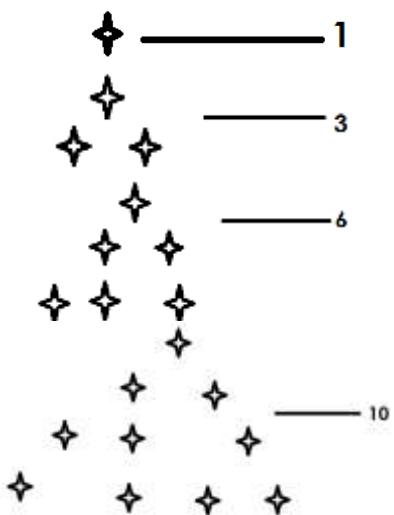
1 2 0

2 5 5









$$\frac{n(n+1)}{2}$$

$$\begin{array}{rcl} \frac{n(n+1)}{2} & \parallel & = \frac{5}{\cancel{2}-1} \\ = \frac{9(9+1)}{2} & & = 9 \times 5 \\ & & = 45 \end{array}$$

$$\begin{array}{rcl} \frac{n(n+1)}{2} & & \\ = \frac{5(5+1)}{2} & & \\ = \frac{5(6)}{\cancel{2}-1} & & \\ = 5 \times 3 & & \\ = 15 & & \end{array}$$



$$\begin{aligned}&= \frac{n(n+1)}{2} \\&= \frac{7(7+1)}{2} \\&= \frac{7(8)}{2} \\&= 7 \times 4 \\&= 28\end{aligned}$$

$$\begin{aligned}&= \frac{n(n+1)}{2} \\&= \frac{3(3+1)}{2} \\&= \frac{3(4)}{2} \\&= 3 \times 2 \\&= 6\end{aligned}$$



$$\begin{aligned}k+k+1+k+2 &= 27 \\k+k+k+1+2 &= 27 \\3k+3 &= 27 \\3k+3-3 &= 27-3 \\3k &= 24 \\3k &= \underline{\underline{24}} - 8 \\3k &= \underline{\underline{24}} - \underline{\underline{8}} \\3k &= \underline{\underline{3}} - 1 \\k &= 8\end{aligned}$$

$$\begin{aligned}P-1+P+P+1 &= 39 \\P+P+P+1-1 &= 39 \\P+P+P &= 39 \\3P &= 39 \\3P &= \underline{\underline{39}} - 13 \\3P &= \underline{\underline{39}} - \underline{\underline{13}} \\3P &= \underline{\underline{3}} - 1 \\P &= 13\end{aligned}$$



$$\begin{array}{r} 13 \\ \cancel{39} \\ \hline -3 \\ 1 \end{array}$$

$$\begin{aligned} k+k-1+k-2 &= 45 \\ k+k+k-1-2 &= 45 \\ 3k-3 &= 45 \\ 3k-3+3 &= 45+3 \\ 0 &= 48 \\ 3k &= 48 \\ \underline{18k} &= \underline{48} \\ 1 &= 1 \\ k &= 16 \end{aligned}$$



$$\frac{k+k+1+k+2}{3} = 8$$

$$\frac{k+k+k+1+2}{3} = 8$$

$$\frac{3k+3}{3} = 8$$

$$\frac{3k+3 \times 3}{3} = 8 \times 3$$

$$\cancel{3k+3} = 24$$

$$\cancel{3k+3-3} = 24-3$$

0

$$\cancel{3k} = 21$$

$$\cancel{\cancel{3k}} = \cancel{21}$$

$$k = 7$$



$$\begin{array}{lcl} k+k+2+k+4 & =42 \\ k+k+k+2+4 & =42 \\ 3k+6 & =42 \\ 3k+6-6 & =42-6 \\ 0 & & \\ 3k & =36 \\ \cancel{1}\cancel{2}k & =\cancel{3}6\cancel{1}2 \\ 1\cancel{2} & =\cancel{3}1 \\ k & =12 \end{array}$$

$$\begin{array}{lcl} P+P-2+P-4+P-6 & =44 \\ P+P+P+P-2-4+6 & =44 \\ 4P-12 & =44 \\ 4P-12+12 & =44+12 \\ 4P & =56 \\ \cancel{4}P & =\cancel{5}6\cancel{1}4 \\ \cancel{4} & =\cancel{4}1 \\ P & =14 \end{array}$$



$$\frac{k+k+2+k+4}{3} = 8$$

$$\frac{k+k+k+2+4}{3} = 8$$

$$\frac{3k+6}{3} = 8$$

$$\frac{3k+6}{3} = 8$$

$$\frac{3k+6 \times 3}{3} = 8$$

$$\begin{array}{rcl} 3k+6 & = 8 \times 3 \\ 3k+6 & = 24 \\ 3k+6-6 & = 24-6 \\ 0 & & \end{array}$$

$$\begin{array}{rcl} 3k & = 18 \\ 1\cancel{3}k & \cancel{-}\cancel{1} & \\ 1\cancel{3} & & \\ k & = 6 & \end{array}$$



2	36
2	18
3	9
3	3
	1

$$F_{36} = \{2_1, 2_2, 3_1, 3_2\}$$

2	50
5	25
5	5
	1

$$\begin{aligned} F_{50} &= 2 \times 5 \times 5 \\ &= 2 \times 5^2 \end{aligned}$$

2	100
2	50
2	25
5	5
	1

$$F_{100} = 2 \times 2 \times 5 \times 5$$

2	360
2	180
2	90
3	45
3	15
5	5
	1

$$\begin{aligned} F_{360} &= 2 \times 2 \times 2 \times 3 \times 3 \times 5 \\ &= 2^3 \times 3^2 \times 5^1 \end{aligned}$$



$$=2 \times 2 \times 3 \times 5$$

$$=4 \times 15$$

$$=60$$

$$\{2_1, 3_1, 5_1, 5_2\}$$



$$F_{30} = \{ 2_1 \ y_1 \ 15_1 \}$$

$$y \times 2 \times 5 = 30$$
$$10y = 30$$

$$\cancel{10}y = 3\cancel{0}$$

$$y = 3$$
$$y = 3_1$$

$$k \times 2 \times 3 \times 5 = 90$$
$$30k = 90$$

$$\cancel{30}k = \frac{90^3}{\cancel{30}}_1$$

$$k = 3$$
$$k = 3_2$$

$$m \times 2 \times 3 = 12$$
$$6m = 12$$
$$\cancel{6}m = \frac{12^2}{\cancel{6}}_1$$
$$m = 2$$

$$m = 2_2$$

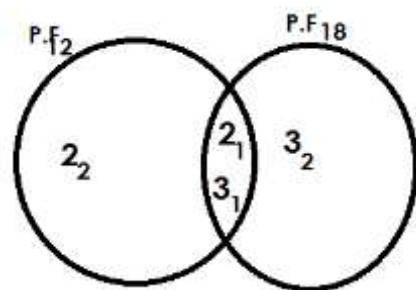


$$P.F_{12} = \begin{array}{|c|c|} \hline P.F & NO \\ \hline 2 & 12 \\ \hline 2 & 6 \\ \hline 3 & 3 \\ \hline & 1 \\ \hline \end{array}$$

$$P.F_{18} = \begin{array}{|c|c|} \hline P.F & NO \\ \hline 2 & 18 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \\ \hline \end{array}$$

$$P.F_{12} = \{2_1, 2_2, 3_1\}$$

$$P.F_{18} = \{2_1, 3_1, 3_2\}$$

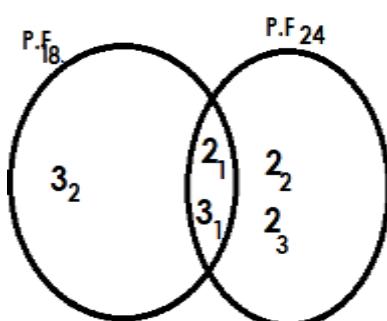


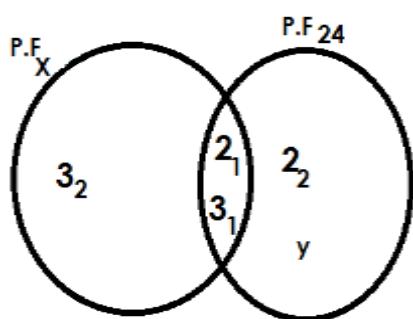
$$P.F_{18} = \begin{array}{|c|c|} \hline P.F & NO \\ \hline 2 & 18 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \\ \hline \end{array}$$

$$P.F_{24} = \begin{array}{|c|c|} \hline P.F & NO \\ \hline 2 & 24 \\ \hline 2 & 12 \\ \hline 2 & 6 \\ \hline 3 & 3 \\ \hline & 1 \\ \hline \end{array}$$

$$P.F_{18} = \{2_1, 3_1, 3_2\}$$

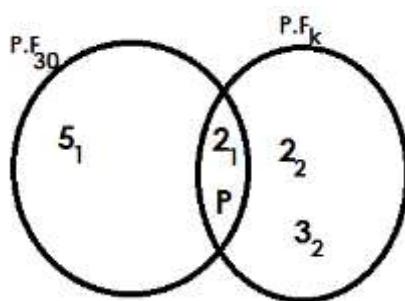
$$P.F = 24 \{2_1, 2_2, 2_3, 3_1\}$$





$$\begin{aligned}y \times 2 \times 2 \times 3 &= 24 \\12y &= 24 \\12 \cancel{y} &= \frac{24}{12} \\12 &\end{aligned}$$

y $\frac{2}{3}$

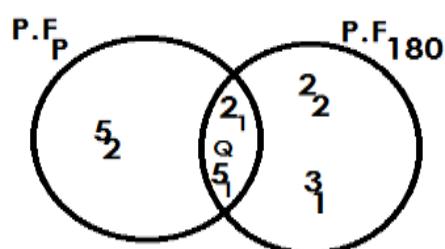
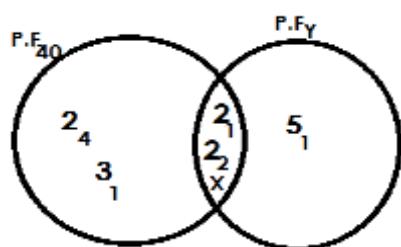
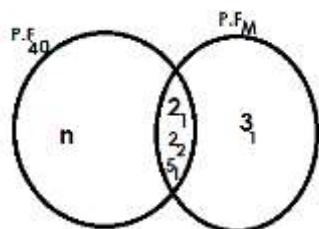


$$P \times 2 \times 5 = 30$$

$$10P = 30$$

$$\frac{10P}{10} = \frac{30}{10}$$

$$P = \begin{matrix} 3 \\ 1 \end{matrix}$$



2	12	18
2	6	9
3	3	9
3	1	3
	1	1



2	20	30
2	10	15
3	5	15
5	5	5
	1	1

2	40	50
2	20	25
2	10	25
5	5	25
5	1	5
	1	1

2	24	30
2	12	15
2	6	15
3	3	15
5	1	5
	1	1



2	20	36
2	10	18
3	5	9
3	5	3
5	5	1
	1	1

2	20	50
2	10	25
5	5	25
5	1	5
	1	1

$$\begin{aligned} &= \frac{100}{3} \\ &= \frac{60}{3} \\ &= 5 \text{ r}2 \\ &= 1 \frac{2}{3} \text{ hrs} \\ &\quad \left(\begin{array}{r} 8:00 \\ +1:40 \\ \hline 9:40 \end{array} \right) \\ &\quad \frac{2}{3} \times 60 \\ &= 40 \text{ min} \\ &= 1 \text{ hour } 40 \text{ minutes} \end{aligned}$$



$$1\frac{1}{2} \text{ hrs} = \frac{3}{2} \times 60 \text{ mins}$$

=90 minutes

2	60	90
2	30	45
3	15	45
3	5	15
5	5	5
	1	1

$$\begin{array}{r} & 10:00 \\ \{ \frac{180}{60} \} \text{ hrs} & + 3:00 \\ & \hline 13:00 \\ \\ & 13:00 \\ & - 12:00 \\ & \hline 1:00 \end{array}$$



CF	NO	NO
2	8	12
2	4	6
	2	3

CF	NO	NO
3	12	15
	4	5

CF	NO	NO
2	6	8
3	4	

CF	NO	NO
2	18	24
3	9	12
	3	4



LCM x GCF

Given number

$$= \underline{36^2} \times 6$$
$$\underline{\quad 18}$$
$$\underline{\quad \quad 1}$$

$$= 12$$

LCM x GCF

Given number

$$= \underline{72^{18}} \times 6^1$$
$$\underline{\quad 24}$$
$$\underline{\quad \quad 4}$$
$$\underline{\quad \quad \quad 1}$$

LCM x GCF

Given number

$$= \underline{24^3} \times 2$$
$$\underline{\quad 8}$$
$$\underline{\quad \quad 1}$$
$$= 6$$



$$\begin{array}{ccccccc} 1, & 4, & 9, & 16, & 25, & \underline{36} \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 1^2 & 2^2 & 3^2 & 4^2 & 5^2 & 6^2 \\ 6^2 = 6 \times 6 \\ = 36 \end{array}$$

$$\begin{array}{ccccccc} 81, & 64, & 49, & 36, & 25, & 16 \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 9^2 & 8^2 & 7^2 & 6^2 & 5^2 & 4^2 \\ 5^2 = 5 \times 5 & 4^2 = 4 \times 4 \\ = 25 & = 16 \end{array}$$



$$\left(\frac{11}{12}\right)^2 = \frac{11}{12} \times \frac{11}{12}$$

$$= \frac{121}{144}$$

$$\left(3\frac{1}{2}\right)^2 = 3\frac{1}{2} \times 3\frac{1}{2}$$

$$= \frac{7}{2} \times \frac{7}{2}$$

$$= \frac{49}{4} \text{ r } 1$$

$$= 12\frac{1}{4}$$

$$\left(4\frac{1}{3}\right)^2 = 4\frac{1}{3} \times 4\frac{1}{3}$$

$$= \frac{13}{3} \times \frac{13}{3}$$

$$= \frac{169}{9} \text{ rem } 7$$

$$= 18\frac{7}{9}$$

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$$(0.4)^2 = 0.4 \times 0.4$$

$$= \frac{4}{10} \times \frac{4}{10}$$

$$= \frac{16}{100}$$

$$= 0.16$$

$$(1.2)^2 = 1.2 \times 1.2$$

$$= \frac{12}{10} \times \frac{12}{10}$$

$$= \frac{144}{100}$$

$$= 1.44$$

$$\sqrt{\quad}$$

$$\sqrt{36} = \begin{array}{c|c} 2 & 36 \\ 2 & 18 \\ 2 & 9 \\ 3 & 3 \\ \hline & 1 \end{array}$$

$$= \sqrt{(2 \times 2) \times (3 \times 3)}$$

$$= 2 \times 3$$

6

$$\sqrt{36} = 6$$

$$\sqrt{81} = \begin{array}{c|c} 3 & 81 \\ 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ \hline & 1 \end{array}$$

$$= \sqrt{81} = (3 \times 3) \times (3 \times 3)$$

$$= 3 \times 3$$

$$= 9$$

$$\sqrt{81} = 9$$



$$\begin{array}{r} \sqrt{49} = \\ \quad\quad\quad 7 \left| \begin{array}{c} 49 \\ 7 \\ \hline 1 \end{array} \right. \\ = \sqrt{49=(7\times7)} \\ = 7 \\ \hline \sqrt{49}=7 \end{array}$$

$$\begin{array}{r} \sqrt{289} = \\ \quad\quad\quad 17 \left| \begin{array}{c} 289 \\ 17 \\ \hline 1 \end{array} \right. \\ = \sqrt{289=(17\times17)} \\ = 17 \\ \hline \end{array}$$

$$\begin{array}{r} \sqrt{\frac{9}{36}} = \sqrt{\frac{9}{36}} \\ \sqrt{9} = \sqrt{9} = \\ \quad\quad\quad 3 \left| \begin{array}{c} 9 \\ 3 \\ \hline 1 \end{array} \right. \\ = \sqrt{3\times3} \\ = 3 \\ \hline \end{array}$$

$$\begin{array}{r} \sqrt{36} = \sqrt{36} = \\ \quad\quad\quad 2 \left| \begin{array}{c} 36 \\ 2 \\ \hline 18 \end{array} \right. \\ \quad\quad\quad 3 \left| \begin{array}{c} 18 \\ 3 \\ \hline 9 \end{array} \right. \\ \quad\quad\quad 3 \left| \begin{array}{c} 9 \\ 3 \\ \hline 3 \end{array} \right. \\ = \sqrt{(2\times2) \times (3\times3)} \\ = 2\times3 \\ = 6 \\ \hline \end{array}$$

$$\begin{array}{r} \sqrt{\frac{16}{25}} = \sqrt{\frac{16}{25}} \\ \sqrt{16} = \sqrt{16} = \\ \quad\quad\quad 2 \left| \begin{array}{c} 16 \\ 8 \\ 4 \\ 2 \\ \hline 1 \end{array} \right. \\ = \sqrt{(2\times2) \times (2\times2)} \\ = 2\times2 \\ = 4 \\ \hline \sqrt{\frac{16}{25}} \end{array}$$

$$\begin{array}{r} \sqrt{25} = \sqrt{25} = \\ \quad\quad\quad 5 \left| \begin{array}{c} 25 \\ 5 \\ \hline 1 \end{array} \right. \\ = \sqrt{5\times5} \\ = 5 \\ \hline \end{array}$$



$$\sqrt{7\frac{1}{9}}$$

$$\sqrt{\frac{64}{9}}$$

$$\begin{array}{r|l} 2 & 64 \\ 2 & 32 \\ 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ \hline & 1 \end{array}$$

$$\begin{aligned}\sqrt{64} &= \sqrt{(2 \times 2) \times (2 \times 2) \times (2 \times 2)} \\ &= 2 \times 2 \times 2 \\ &= 8\end{aligned}$$

$$\sqrt{9} =$$

$$\begin{array}{r|l} 3 & 9 \\ 3 & 3 \\ \hline & 1 \end{array}$$

$$\begin{aligned}\sqrt{9} &= \sqrt{(3 \times 3)} \\ &= 3\end{aligned}$$

$$\begin{aligned}\sqrt{7\frac{1}{9}} &= \sqrt{\frac{64}{9}} \\ &= 2 \frac{2}{3}\end{aligned}$$

$$\sqrt{\frac{25}{9}}$$

$$\begin{array}{r|l} 5 & 25 \\ 5 & 5 \\ \hline & 1 \end{array}$$

$$\begin{aligned}&= \sqrt{5 \times 5} \\ &= 25\end{aligned}$$

$$\sqrt{9} =$$

$$\begin{array}{r|l} 3 & 9 \\ 3 & 3 \\ \hline & 1 \end{array}$$

$$\begin{aligned}&= \sqrt{(3 \times 3)} \\ &= 3\end{aligned}$$

$$\sqrt{1\frac{7}{9}} =$$

$$1\frac{2}{3}$$

$$\begin{aligned}\sqrt{0.64} &= \sqrt{\frac{64}{100}} \\ &= 0.8\end{aligned}$$



$$\sqrt{64} = \begin{array}{c|c} 2 & 64 \\ 2 & 32 \\ 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ 1 & \end{array}$$

$$\begin{aligned}\sqrt{64} &= \sqrt{(2 \times 2) \times (2 \times 2) \times (2 \times 2)} \\ &= 2 \times 2 \times 2 \\ &= 8\end{aligned}$$

$$\sqrt{0.64} = \frac{8}{10} = 0.8$$

$$\sqrt{100} = \begin{array}{c|c} 2 & 100 \\ 2 & 50 \\ 2 & 25 \\ 2 & 5 \\ 1 & \end{array}$$

$$\begin{aligned}\sqrt{100} &= \sqrt{(2 \times 2) \times (5 \times 5)} \\ &= 2 \times 5 \\ &= 10\end{aligned}$$

$$\sqrt{1.44} = \sqrt{\frac{144}{100}}$$

$$\sqrt{144} = \begin{array}{c|c} 2 & 144 \\ 2 & 72 \\ 2 & 36 \\ 2 & 18 \\ 2 & 9 \\ 3 & 3 \\ 3 & 1 \end{array}$$

$$\begin{aligned}\sqrt{144} &= \sqrt{(2 \times 2) \times (2 \times 2) \times (2 \times 3)} \\ &= 2 \times 2 \times 3 \\ &= 12\end{aligned}$$

$$\sqrt{1.44} = \frac{12}{10} = 1.2$$

$$\sqrt{100} = \begin{array}{c|c} 2 & 100 \\ 2 & 50 \\ 2 & 25 \\ 2 & 5 \\ 1 & \end{array}$$

$$\begin{aligned}\sqrt{100} &= \sqrt{(2 \times 2) \times (5 \times 5)} \\ &= 2 \times 5 \\ &= 10\end{aligned}$$

$$\sqrt{0.0009} = \sqrt{\frac{9}{10000}}$$

$$\sqrt{9} = \begin{array}{c|c} 3 & 9 \\ 3 & 3 \\ 1 & \end{array}$$

$$\sqrt{(3 \times 3)} = 3$$

$$\sqrt{0.0009} = \frac{3}{100} = 0.03$$

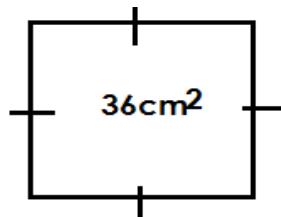
$$\sqrt{10000} = \begin{array}{c|c} 2 & 10000 \\ 2 & 5000 \\ 2 & 2500 \\ 2 & 1250 \\ 2 & 625 \\ 5 & 125 \\ 5 & 25 \\ 5 & 5 \\ 1 & \end{array}$$

$$\begin{aligned}\sqrt{10000} &= \sqrt{(2 \times 2) \times (2 \times 2) \times (5 \times 5) \times (5 \times 5)} \\ &= 2 \times 2 \times 5 \times 5 \\ &= 100\end{aligned}$$



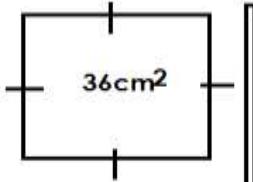
$$\sqrt{y^2} = \sqrt{16}$$
$$y = 4$$

$$\sqrt{a^2} = \sqrt{9}$$
$$a^2 = 9$$
$$\sqrt{a^2} = \sqrt{9}$$
$$a = 3$$



$$s \times s = \text{Area}$$

$$s^2 = 36$$
$$\sqrt{s^2} = \sqrt{36}$$
$$s = 6\text{cm}$$



$$s \times s = \text{Area}$$

$$s^2 = 7\frac{1}{9}$$

$$s^2 = \frac{64}{9}$$

$$\sqrt{s^2} = \sqrt{\frac{64}{9}}$$

$$s = \frac{8}{3}\text{r2}$$

$$\text{side} = 2\frac{2}{3}$$

$$P = 4s$$
$$= 4 \times 2\frac{2}{3}\text{m}$$
$$= 4 \times \frac{8}{3}\text{m}$$
$$= \frac{32}{3}\text{m}$$
$$= 10\frac{2}{3}\text{m}$$



2
3
↓
Base

Exponent/ Index



$$2^2 \times 2^3$$

$$2^{2+3}$$

$$2^5$$

$$(2 \times 2 \times 2) \times (2 \times 2)$$

$$8 \times 4$$

$$32$$

$$\begin{aligned}10^1 \times 10^2 &= 10^{1+2} \\&= 10^3 \\&= 10 \times 10 \times 10 \\&= 1000\end{aligned}$$

$$\begin{aligned}2^2 \times 3^3 &= 3^5 \\&= (3 \times 3 \times 3) \times (3 \times 3) \\&= 27 \times 9 \\&= 243\end{aligned}$$



$$\begin{aligned}4^3 \times 4^0 &= 4^{3+0} \\&= 4^3 \\&= 4 \times 4 \times 4 \\&= 64\end{aligned}$$

$$\begin{aligned}4^3 \div 4^2 &= 4^{3-2} \\&= 4^1 \\&= 4\end{aligned}$$

$$\begin{aligned}&= 6^{\frac{5-4}{2}} \\&= 6^{\frac{1}{2}} \\&= \sqrt{6} \\&= 6 \times 6 \\&= 36\end{aligned}$$

$$\begin{aligned}&= 3^{4-1} \\&= 3^3 \\&= 3 \times 3 \times 3 \\&= 27\end{aligned}$$

$$\begin{aligned}&= 5^{3-0} \\&= 5^3 \\&= 5 \times 5 \times 5 \\&= 125\end{aligned}$$



$$\frac{2^3 \times 2^4}{2^5}$$

$$= 3^{2-5}$$

$$= 3^{-3}$$

$$= \frac{1}{3^3}$$

$$= \frac{1}{3 \times 3 \times 3}$$

$$= \frac{1}{27}$$

$$\begin{aligned} & \frac{2^3 \times 2^4}{2^5} \\ & = \frac{2 \times 2 \times \cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2}}{\cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2}} \\ & = 4 \end{aligned}$$

$$\begin{aligned} & = \frac{5^2 \times 5^3}{5^7} \\ & = \frac{5 \times 5 \times 5 \times 5 \times 5}{5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5} \\ & = \frac{1}{25} \end{aligned}$$

$$= n^{7-4}$$

$$= n^3$$

$$3^2 : 3^5$$