SAMPLE CONTENT

PERFECT

MATHEMATICS

PART - II

BASED ON TEXTBOOK AND BOARD PAPER PATTERN

Application of co-ordinate Geometry

Air Traffic Control (ATC) controls the aircrafts on ground and in air space by using radar with the help of co-ordinate geometry.

STD. IX

(Eng. Med.)

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Target Publications® Pvt. Ltd.

Based on the **Latest Syllabus** prescribed by the Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04

PERFECT
Mathematics Part – II
STD. IX

Salient Features

- Written as per the **Latest Textbook and Board Paper Pattern**
- Complete coverage of the entire syllabus, which includes:
  - Solutions to all Practice Sets and Problem Sets
  - Intext and Activity/Project based questions from the textbook
- Exclusive Practice Includes:
  - Additional problems, Activities, Multiple Choice Questions (MCQs) and One mark questions
  - 'Chapter Assessment' at the end of each chapter
- Tentative marks allocation for all problems
- Constructions drawn with accurate measurements
- At the end of the book:
  - A separate section of 'Challenging Questions' is provided
- Includes Important Feature for holistic learning:
  - ***Smart Check***
- Q.R. codes provide solutions to the
  - Additional Problems for Practice.
  - Chapter Assessment.

Printed at: **India Printing Works,** Mumbai

Balbharati Registration No.: 2018MH0022

TEID: 3589

P.O. No. 12823

PREFACE

Creation of the **'Perfect Mathematics Part – II, Std. IX'** book was a rollercoaster ride. We had a plethora of ideas, suggestions and decisions to ponder over. However, our primary objective was to align book with the latest syllabus and provide students with ample practice material.

This book covers several topics including Basic Concepts in Geometry, Parallel Lines, Triangles, Constructions of Triangles, Quadrilaterals, Circle, Co-ordinate Geometry, Trigonometry, Surface Area and Volume. The study of these topics requires a deep and intrinsic understanding of concepts, terms and formulae. Hence, to ease this task, we present **'Perfect Mathematics Part – II, Std. IX'** a complete and thorough guide, extensively drafted to boost the confidence of students.

Before each Practice Set, short and easy explanation of different concepts with illustrations for better understanding is given. Solutions and Answers to Textual Questions and Examples are provided in a lucid manner.

Moreover, the inclusion of **Smart Check'** enables students to verify their answers. **'Textual Activities'** covers all the Textual Activities along with their answers. **'Additional Problems for Practice'** include multiple problems to help students revise and enhance their problem solving skills. **'Solved Examples'** from textbook are also a part of this book. **'Activities for Practice'** includes additional activities along with their answers for students to practice. **'One Mark Questions'** include **'Type A:** Multiple Choice Questions', **'Type B:** Solve the Following Questions' along with their answers. Every chapter ends with a **'Chapter Assessment'**. This test stands as a testimony to the fact that the child has understood the chapter thoroughly. **'Challenging Questions'** include questions that are not a part of the textbook, yet are core to the concerned subject. These questions would provide students enough practice to tackle Challenging Questions in their examination.

We have provided a tentative mark allocation for the problems in this book. However, marks mentioned are indicative and are subject to change as per the Maharashtra State Board's discretion.

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

Publisher

Edition: Third

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

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KEY FEATURES

Smart Check: Smart Check is a technique to verify the answers. This is our attempt to cross-check the accuracy of the answer. Smart check is indicated by ✓ symbol.

Activities for Practice: In this section we have provided multiple activities for practice in accordance with the latest paper pattern.

One Mark Questions: **Type A** consists of Multiple Choice Questions (which either require short solutions or direct application of mathematical concepts).
Type B consists of questions that require very short solutions with direct application of mathematical concepts.

Additional Problems for Practice: In this section we have provided ample practice problems for students and its **solutions are provided in QR code**. It also has Solved examples from the textbook, which are indicated by "+".

***Chapter Assessment*:** This section covers questions from the chapter for self-evaluation purpose. This is our attempt to offer students with revision and help them assess their knowledge of each chapter. **Solutions to the Chapter Assessment are provided in QR code.**

Challenging Questions: In light of the importance of specific questions in board examination, we have created a separate section of Challenging Questions for additional practice to boost the exam score

CONTENTS

Note:

- ***Smart check is indicated by ✓ symbol.***
- ***Solved examples from textbook are indicated by "+".***
- ***Intext and Activity/Project based questions from the textbook are indicated by "#".***
- ***Steps of construction are provided in Chapters for the students' understanding.***

1 Basic Concepts in Geometry

Note: Intext and Activity/Project based questions from the textbook are indicated by "#".

Let's Study

- Point, line and plane
- Co-ordinates of a points and distance
- Betweenness
- Conditional statements
- Proof

Let's Learn

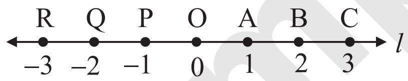
Basic concepts in geometry (Point, Line and Plane)

In Geometry, we have several undefined terms. Point, line and plane are a few of these terms which are however basic concepts in Geometry.
From these three undefined terms, all other terms in Geometry can be defined.

i. A **point** can be any dot made by a sharp tip. It determines a location and it has no size.
ii. A **line** is defined as something that extends infinitely in both directions but has no width and is one dimensional.
iii. A **plane** extends infinitely in two dimensions.
iv. Lines and planes are set of points.
v. Each line and each plane contains infinite number of points.

Co-ordinates of Points and Distance

1. Co-ordinates of a Point:
The number associated with a point on the number line is called the co-ordinate of that point.
In the figure below, co-ordinate of point P is –1 and that of point B is 2.



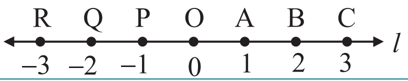
2. Distance between Two Points:
i. To find the distance between two points, consider their co-ordinates and subtract the smaller co-ordinate from the larger.
ii. The distance between points P and Q is denoted as d(P, Q). It is same as length of the segment PQ i.e., l(P, Q)

$(x > y)$

$(x < y)$

$\therefore$ $d(P, Q) = l(P, Q) = x - y$, if $x > y$
$d(P, Q) = l(P, Q) = y - x$, if $x < y$

Example :
For the number line shown below find
i. d(P, C) ii. d(R, P)



Solution:
i. Co-ordinate of the point P is –1.
Co-ordinate of the point C is 3.
Since $3 > -1$,
i.e., co-ordinate of point C > co-ordinate of point P,
d(P, C) = Co-ordinate of point C – Co-ordinate of point P
$\therefore$ $d(P, C) = 3 - (-1)$
$= 3 + 1$
$\therefore$ **d (P, C) = 4**

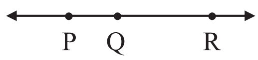
ii. Co-ordinate of the point R is –3.
Co-ordinate of the point P is –1.
Since $-1 > -3$,
i.e., co-ordinate of point P > co-ordinate of point R,
d(R, P) = Co-ordinate of point P – Co-ordinate of point R
$\therefore$ $d(R, P) = -1 - (-3)$
$= -1 + 3$
$\therefore$ **d(R, P) = 2**

Remember This

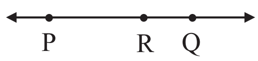
i. The distance between two points is obtained by subtracting the smaller co-ordinate from the larger co-ordinate.
ii. The distance between any two distinct points is a positive real number.
iii. If the two points are not distinct then the distance between them is zero.

Betweenness

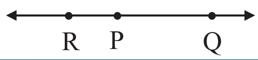
1. If the points P, Q and R are three distinct collinear points, then there are three possibilities.
Case I: Point Q is between P and R.



Case II: Point R is between P and Q.



Case III: Point P is between R and Q.



2. If d(P, Q) + d(Q, R) = d(P, R), then the point Q is said to be in between points P and R.

P Q R

3. The betweenness is written as P – Q – R or R – Q – P.

Example:

Three points A, B and C are such that d (A, B) = 6, d(A, C) = 8 and d(B, C) = 14. Find which of the point is between the other two.

Solution:

Given, d (A, B) = 6, d(A, C) = 8 and d(B, C) = 14.

B ← 6 → A ← 8 → C

d(B, C) = 14 …(i)

d(A, B) + d(A, C) = 6 + 8

∴ d(A, B) + d(A, C) = 14 …(ii)

∴ d(B, C) = d(A, B) + d(A, C) …[From (i) and (ii)]

∴ **Point A is between the points B and C i.e., B – A – C or C – A – B.**

Activity:

1. Points A, B, C are given below. Check, with a stretched thread, whether the three points are collinear or not. If they are collinear, write which one of them is between the other two.

A B C

(Textbook pg. no. 4)

Ans: Point B is between the points A and C.

2. Given below are four points P, Q, R, and S. Check which three of them are collinear and which three are non collinear. In the case of three collinear points, state which of them is between the other two.

(Textbook pg. no. 4)

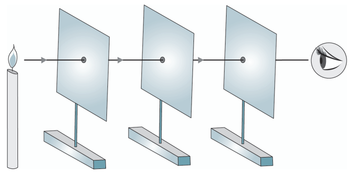
Ans: Points P, R and S are collinear.
Point R is between the points P and S.

3. Students are asked to stand in a line for mass drill. How will you check whether the students standing are in a line or not ? (Textbook pg. no. 4)

Ans: If one stands in front of the line and observes only the first student standing in the line, then all the students standing in that line are collinear i.e., standing in the same line. We can use this property of collinearity to check whether the students are standing in the same line or not.

4. How had you verified that light rays travel in a straight line? Recall an experiment in science which you have done in a previous standard. (Textbook pg. no. 4)

Ans:



The flame of the candle can be seen only when the pin holes in all cardboards are in the same straight line. We can use the set up shown in the figure above to verify that light rays travels in a straight line.

Practice Set 1.1

1. **Find the distances with the help of the number line given below. [1 Mark each]**

Q P K J H O A B C D E

–5 –4 –3 –2 –1 0 1 2 3 4 5 6

i.	d(B, E)	ii.	d(J, A)	iii.	d(P, C)
iv.	d(J, H)	v.	d(K, O)	vi.	d(O, E)
vii.	d(P, J)	viii.	d(Q, B)		

***Solution*:**

i. Co-ordinate of the point B is 2.
Co-ordinate of the point E is 5.
Since 5 > 2,
d(B, E) = 5 – 2
∴ **d(B, E) = 3**

ii. Co-ordinate of the point J is –2.
Co-ordinate of the point A is 1.
Since 1 > –2,
d(J, A) = 1 – (–2) = 1 + 2
∴ **d(J, A) = 3**

iii. Co-ordinate of the point P is –4.
Co-ordinate of the point C is 3.
Since 3 > –4,
d(P, C) = 3 – (–4) = 3 + 4
∴ **d(P, C) = 7**

iv. Co-ordinate of the point J is –2.
Co-ordinate of the point H is –1.
Since –1 > –2,
d(J, H) = –1 – (–2) = –1 + 2
∴ **d(J, H) = 1**

v. Co-ordinate of the point K is –3.
Co-ordinate of the point O is 0.
Since 0 > –3,
d(K, O) = 0 – (–3) = 0 + 3
∴ **d(K, O) = 3**

vi. Co-ordinate of the point O is 0.
Co-ordinate of the point E is 5.
Since 5 > 0,
d(O, E) = 5 – 0
∴ **d(O, E) = 5**

vii. Co-ordinate of the point P is –4.
Co-ordinate of the point J is –2.
Since –2 > –4,
d(P, J) = –2 – (–4) = –2 + 4
∴ **d(P, J) = 2**

viii. Co-ordinate of the point Q is –5.
Co-ordinate of the point B is 2.
Since 2 > –5,
d(Q, B) = 2 – (–5) = 2 + 5
∴ **d(Q, B) = 7**

2. If the co-ordinate of A is x and that of B is y, find d(A, B). **[1 Mark each]**

i. $x = 1, y = 7$ ii. $x = 6, y = -2$
iii. $x = -3, y = 7$ iv. $x = -4, y = -5$
v. $x = -3, y = -6$ vi. $x = 4, y = -8$

***Solution*:**

i. Co-ordinate of point A is $x = 1$.
Co-ordinate of point B is $y = 7$.
Since 7 > 1,
d(A, B) = 7 – 1
∴ **d(A, B) = 6**

ii. Co-ordinate of point A is $x = 6$.
Co-ordinate of point B is $y = -2$.
Since 6 > –2,
d(A, B) = 6 – (–2) = 6 + 2
∴ **d(A, B) = 8**

iii. Co-ordinate of point A is $x = -3$.
Co-ordinate of point B is $y = 7$.
Since 7 > –3,
d(A, B) = 7 – (–3) = 7 + 3
∴ **d(A, B) = 10**

iv. Co-ordinate of point A is $x = -4$.
Co-ordinate of point B is $y = -5$.
Since –4 > –5,
d(A, B) = –4 – (–5) = –4 + 5
∴ **d(A, B) = 1**

v. Co-ordinate of point A is $x = -3$.
Co-ordinate of point B is $y = -6$.
Since –3 > –6,
d(A, B) = –3 – (–6) = –3 + 6
∴ **d(A, B) = 3**

vi. Co-ordinate of point A is $x = 4$.
Co-ordinate of point B is $y = -8$.
Since 4 > –8,
d(A, B) = 4 – (–8) = 4 + 8
∴ **d(A, B) = 12**

3. From the information given below, find which of the point is between the other two. If the points are not collinear, state so. **[2 Marks each]**

i. d(P, R) = 7, d(P, Q) = 10, d(Q, R) = 3
ii. d(R, S) = 8, d(S, T) = 6, d(R, T) = 4
iii. d(A, B) = 16, d(C, A) = 9, d(B, C) = 7
iv. d(L, M) = 11, d(M, N) = 12, d(N, L) = 8
v. d(X, Y) = 15, d(Y, Z) = 7, d(X, Z) = 8
vi. d(D, E) = 5, d(E, F) = 8, d(D, F) = 6

***Solution*:**

i. Given, d(P, R) = 7, d(P, Q) = 10, d(Q, R) = 3
d(P, Q) = 10 …(i)
d(P, R) + d(Q, R) = 7 + 3 = 10 …(ii)
∴ d(P, Q) = d(P, R) + d(Q, R) …[From (i) and (ii)]
∴ Point R is between the points P and Q i.e., P – R – Q or Q – R – P.
∴ **Points P, R, Q are collinear**

ii. Given, d(R, S) = 8, d(S, T) = 6, d(R, T) = 4
d(R, S) = 8 …(i)
d(S, T) + d(R, T) = 6 + 4 = 10 …(ii)
∴ d(R, S) ≠ d(S, T) + d(R, T) …[From (i) and (ii)]
∴ **The given points are not collinear.**

iii. Given, d(A, B) = 16, d(C, A) = 9, d(B, C) = 7
d(A, B) = 16 …(i)
d(C, A) + d(B, C) = 9 + 7 = 16 …(ii)
∴ d(A, B) = d(C, A) + d(B, C) …[From (i) and (ii)]
∴ Point C is between the points A and B. i.e., A – C – B or B – C – A.
∴ **Points A, C, B are collinear**

iv. Given, d(L, M) = 11, d(M, N) = 12, d(N, L) = 8
d(M, N) = 12 …(i)
d(L, M) + d(N, L) = 11 + 8 = 19 …(ii)
∴ d(M, N) ≠ d(L, M) + d(N, L) …[From (i) and (ii)]
∴ **The given points are not collinear.**

v. Given, d(X, Y) = 15, d(Y, Z) = 7, d(X, Z) = 8
d(X, Y) = 15 …(i)
d(X, Z) + d(Y, Z) = 8 + 7 = 15 …(ii)
∴ d(X, Y) = d(X, Z) + d(Y, Z) …[From (i) and (ii)]
∴ Point Z is between the points X and Y i.e., X – Z – Y or Y – Z – X.
∴ **Points X, Z, Y are collinear**

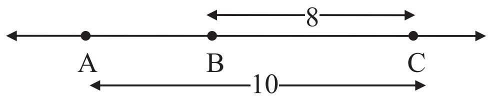
vi. Given, d(D, E) = 5, d(E, F) = 8, d(D, F) = 6
d(E, F) = 8 …(i)
d(D, E) + d(D, F) = 5 + 6 = 11 …(ii)
∴ d(E, F) ≠ d(D, E) + d(D, F) …[From (i) and (ii)]
∴ **The given points are not collinear.**

4. On a number line, points A, B and C are such that d(A, C) = 10, d(C, B) = 8. Find d(A, B) considering all possibilities. [3 Marks]

***Solution*:**

Given, d(A, C) = 10, d(C, B) = 8.

Case I: Points A, B, C are such that, A – B – C.



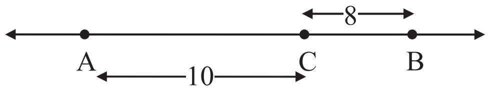
∴ d(A, C) = d(A, B) + d(B, C)

∴ 10 = d(A, B) + 8

∴ d(A, B) = 10 – 8

∴ d(A, B) = 2

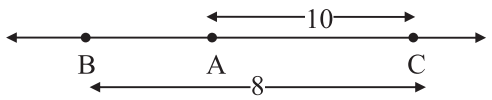
Case II: Points A, B, C are such that, A – C – B.



∴ d(A, B) = d(A, C) + d(C, B)
= 10 + 8

∴ d(A, B) = 18

Case III: Points A, B, C are such that, B – A – C.



From the diagram,
d (A, C) > d(B, C)
Which is not possible

∴ Point A is not between B and C.

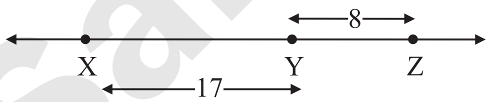
∴ **d(A, B) = 2 or d(A, B) = 18.**

5. Points X, Y, Z are collinear such that d(X, Y) = 17, d(Y, Z) = 8, find d(X, Z). [3 Marks]

***Solution*:**

Given,d(X, Y) = 17, d(Y, Z) = 8

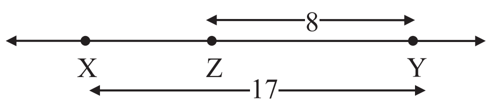
Case I: Points X, Y, Z are such that, X – Y – Z.



∴ d(X, Z) = d(X, Y) + d(Y, Z)
= 17 + 8

∴ d(X, Z) = 25

Case II: Points X, Y, Z are such that, X – Z – Y.



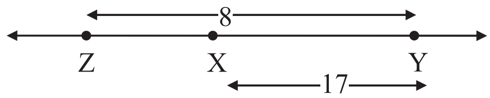
∴ d(X, Y) = d(X, Z) + d(Z, Y)

∴ 17 = d(X, Z) + 8

∴ d(X, Z) = 17 – 8

∴ d(X, Z) = 9

Case III: Points X, Y, Z are such that, Z – X – Y.



From the diagram,
d(X, Y) > d (Y, Z)
Which is not possible

∴ Point X is not between Z and Y.

∴ **d(X, Z) = 25 or d(X, Z) = 9.**

6. Sketch proper figure and write the answers of the following questions. [2 Marks each]

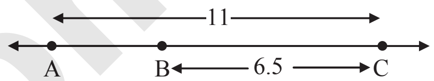
i. If A – B – C and l(AC) = 11, l(BC) = 6.5, then l(AB) = ?

ii. If R – S – T and l(ST) = 3.7, l(RS) = 2.5, then l(RT) = ?

iii. If X – Y – Z and $l(XZ) = 3\sqrt{7}$, $l(XY) = \sqrt{7}$, then l(YZ) = ?

***Solution*:**

i. Given, l(AC) = 11, l(BC) = 6.5



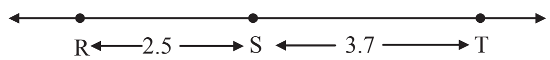
l(AC) = l(AB) + l(BC) …[A – B – C]

∴ 11 = l(AB) + 6.5

∴ l(AB) = 11 – 6.5

∴ ***l*(AB) = 4.5**

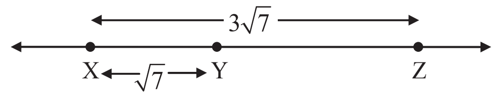
ii. Given, l(ST) = 3.7, l(RS) = 2.5



l(RT) = l(RS) + l(ST) …[R – S – T]
= 2.5 + 3.7

∴ ***l*(RT) = 6.2**

iii. $l(XZ) = 3\sqrt{7}$, $l(XY) = \sqrt{7}$



l(XZ) = l(XY) + l(YZ) …[X – Y – Z]

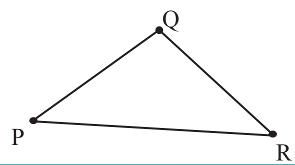
∴ $3\sqrt{7} = \sqrt{7} + l(YZ)$

∴ $l(YZ) = 3\sqrt{7} - \sqrt{7}$

∴ $\boldsymbol{l(YZ) = 2\sqrt{7}}$

7. Which figure is formed by three non-collinear points? [1 Mark]

Ans: Three non-collinear points form a triangle.



Let's Learn

1. Line Segment:

i. The union set of point A, point B and points between A and B is called segment AB, written as seg AB.

ii. seg AB and seg BA denote the same line segment.

iii. The points A and B are called the end points of seg AB.

iv. A line segment is a subset of a line.

2. Length of a Line Segment:

The distance between the end points of a line segment is called as the length of the segment.

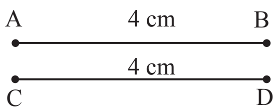
It is denoted by l(AB).

Note: i. $l(AB) = d(A, B)$

ii. $l(AB) = 4$ is also written as $AB = 4$

3. Congruent Segments:

Two line segments are said to be congruent, if they are of the same length.



If $l(AB) = l(CD) = 4$ cm, then

seg AB ≅ seg CD.

[Note: If we have to consider the length of segment AB, we write only AB or l(AB).**]**

4. Properties of Congruent Segments:

i. Reflexivity: seg AB ≅ seg AB

ii. Symmetry: If seg AB ≅ seg CD, then seg CD ≅ seg AB.

iii. Transitivity: If seg AB ≅ seg CD and seg CD ≅ seg PQ, then seg AB ≅ seg PQ.

5. Midpoint of a Segment:

The point M is said to be the midpoint of seg AB, if A – M – B and seg AM ≅ seg MB.

$\therefore \quad l(AM) = l(MB) = \frac{1}{2}\, l(AB)$

[Note: Every line segment has one and only one midpoint.**]**

Example : Point R is the midpoint of seg ST. If ST = 16, then find length of RS.

***Solution*:**

Point R is the midpoint of seg ST and

$l(ST) = 16$. …[Given]

$l(RS) = \frac{1}{2}\, l(ST)$ …[∵ R is midpoint of seg ST]

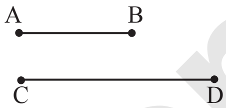
$\therefore \quad l(RS) = \frac{1}{2} \times 16 = 8$

$\therefore \quad \boldsymbol{l(RS) = 8}$

6. Comparison of Segments:

If $l(AB) < l(CD)$, then we say that seg AB is smaller than seg CD.

This is written as seg AB < seg CD or seg CD > seg AB.



7. Ray:

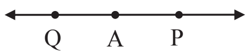
i. Suppose A and B are two distinct points, then the union set of all the points on seg AB and the point P on the line AB such that A – B – P, is called ray AB.

ii. Point A is called as the end point of ray AB.

iii. The ray is a subset of a line.

8. Line:

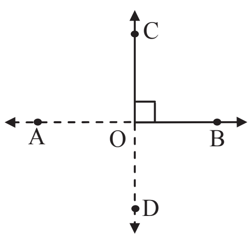
i. The union set of points on ray AP and opposite ray of ray AP is called line AP.



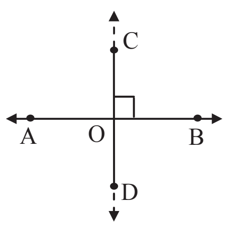
ii. The set of points of seg AP is a subset of points of line AP

9. Perpendicularity of Segments and Rays:

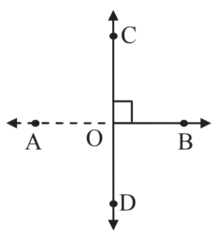
Two rays or two segments or a ray and a segment are said to be perpendicular to each other, if the lines containing them are perpendicular to each other.



ray OC ⊥ ray OB



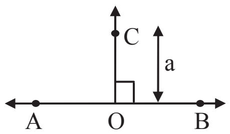
seg CD ⊥ line AB



line CD ⊥ ray OB

10. Distance of a point from a line :

i. If seg CO ⊥ line AB and point O lies on line AB, then the length of seg CO is called the distance of point C from line AB.



ii. Point O is called the foot of the perpendicular.

iii. If l(CO) = a, the point C is at a distance of a unit from line AB

Practice Set 1.2

1. The following table shows points on a number line and their co-ordinates. Decide whether the pair of segments given below the table are congruent or not. [3 Marks each]

Point	A	B	C	D	E
Co-ordinate	–3	5	2	–7	9

i. seg DE and seg AB
ii. seg BC and seg AD
iii. seg BE and seg AD

***Solution*:**

i. Co-ordinate of the point E is 9.
Co-ordinate of the point D is –7.
Since 9 > –7,
d(D, E) = 9 – (–7) = 9 + 7 = 16
∴ l(DE) = 16 …(i)
Co-ordinate of the point A is –3.
Co-ordinate of the point B is 5.
Since 5 > –3,
d(A, B) = 5 – (–3) = 5 + 3 = 8
∴ l(AB) = 8 …(ii)
∴ l(DE) ≠ l(AB) …[From (i) and (ii)]
∴ **seg DE and seg AB are not congruent.**

ii. Co-ordinate of the point B is 5.
Co-ordinate of the point C is 2.
Since 5 > 2,
d(B, C) = 5 – 2 = 3
∴ l(BC) = 3 …(i)
Co-ordinate of the point A is –3.
Co-ordinate of the point D is –7.
Since –3 > –7,
d(A, D) = –3 – (–7) = –3 + 7 = 4
∴ l(AD) = 4 …(ii)
∴ l(BC) ≠ l(AD) …[From (i) and (ii)]
∴ **seg BC and seg AD are not congruent.**

iii. Co-ordinate of the point E is 9.
Co-ordinate of the point B is 5.
Since 9 > 5,
d(B, E) = 9 – 5 = 4
∴ l(BE) = 4 …(i)
Co-ordinate of the point A is –3.
Co-ordinate of the point D is –7.
Since –3 > –7,
d(A, D) = –3 – (–7) = 4
∴ l(AD) = 4 …(ii)
∴ l(BE) = l(AD) …[From (i) and (ii)]
∴ **seg BE and seg AD are congruent. i.e, seg BE ≅ seg AD**

2. Point M is the midpoint of seg AB. If AB = 8, then find the length of AM. [2 Marks]

***Solution*:**

Point M is the midpoint of seg AB and l(AB) = 8. …[Given]

$l(\text{AM}) = \dfrac{1}{2}\, l(\text{AB})$

…[∵ M is midpoint of seg AB]

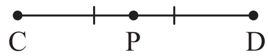
∴ $l(\text{AM}) = \dfrac{1}{2} \times 8 = 4$

∴ $\boldsymbol{l}$**(AM) = 4**

3. Point P is the midpoint of seg CD. If CP = 2.5, find l(CD). [2 Marks]

***Solution*:**

Point P is the midpoint of seg CD and l(CP) = 2.5 …[Given]



$l(\text{CP}) = \dfrac{1}{2}\, l(\text{CD})$ …[∵ P is midpoint of seg CD]

∴ $2.5 = \dfrac{1}{2} \times l(\text{CD})$

∴ l(CD) = 2.5 × 2

∴ $\boldsymbol{l}$**(CD) = 5**

4. If AB = 5 cm, BP = 2 cm and AP = 3.4 cm, compare the segments. [2 Marks]

***Solution*:**

Given, l(AB) = 5 cm, l(BP) = 2 cm,
l(AP) = 3.4 cm …[Given]
Since 2 < 3.4 < 5,
l(BP) < l(AP) < l(AB)
i.e., seg BP < seg AP < seg AB

5. Write the answers to the following questions with reference to the figure given below: [1 Mark each]

i. Write the name of the opposite ray of ray RP
ii. Write the intersection set of ray PQ and ray RP.
iii. Write the union set of ray PQ and ray QR.
iv. State the rays of which seg QR is a subset.
v. Write the pair of opposite rays with common end point R.
vi. Write any two rays with common end point S.
vii. Write the intersection set of ray SP and ray ST.

Ans:
i. Ray RS or ray RT
ii. Ray PQ
iii. Line QR
iv. Ray QR, ray QS, ray QT, ray RQ, ray SQ, ray TQ
v. Ray RP and ray RS,
ray RQ and ray RT
vi. Ray ST, ray SR
vii. Point S

[Note: *Questions iv, v, vi have more than one answers. Students may write answers other than the ones given.***]**

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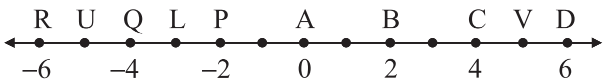
6. Answer the questions with the help of figure given below.



i. State the points which are equidistant from point B. **[2 Marks]**
ii. Write a pair of points equidistant from point Q. **[2 Marks]**
iii. Find d(U,V), d(P,C), d(V,B), d(U, L). **[2 Marks for each distance]**

Ans:
i. Points equidistant from point B are
a. A and C,
because d(B, A) = d(B, C) = 2

b. D and P,
because d(B, D) = d(B, P) = 4

---

ii. Points equidistant from point Q are
a. L and U,
because d(Q, L) = d(Q, U) = 1

b. P and R,
because d(P, Q) = d(Q, R) = 2

---

iii. a. Co-ordinate of the point U is –5.
Co-ordinate of the point V is 5.
Since 5 > –5,
d(U, V) = 5 – (–5)
= 5 + 5
∴ **d(U, V) = 10**

b. Co-ordinate of the point P is –2.
Co-ordinate of the point C is 4.
Since 4 > –2,
d(P, C) = 4 – (–2)
= 4 + 2
∴ **d(P, C) = 6**

c. Co-ordinate of the point V is 5.
Co-ordinate of the point B is 2.
Since 5 > 2,
d(V, B) = 5 – 2
∴ **d(V, B) = 3**

d. Co-ordinate of the point U is –5.
Co-ordinate of the point L is –3.
Since –3 > –5,
d(U, L) = –3 – (–5)
= –3 + 5
∴ **d(U, L) = 2**

Let's Learn

Conditional statements and converse

1. Conditional Statements:
i. Any statement stated in the 'if-then' form is said to be a conditional statement.
ii. The part of statement, which follows 'if' is called **antecedent** and that which follows 'then' is called **consequent**.

Example:
General Statement: Two intersecting lines are contained in one plane.

Conditional Statement: If two lines intersect each other, then they are contained in one plane.

2. Converse of a Statement:
i. A statement obtained by interchanging the antecedent and consequent is called the converse of the original statement.

Example:
Conditional statement:
If two lines intersect, then they are in a plane.
Converse: If two lines are in a plane, then they intersect each other.

ii. If a property is true, then its converse may or may not be true.

Example:
Conditional statement:
If a number is a prime number, then it is even or odd.
Converse: If a number is even or odd then it is a prime number.
Here, the given statement is true but its converse is not true.

Proofs

Till 300 B.C., Pythagoras and his group discovered many geometric properties and developed the theory of geometry to a great extent. At that time, Euclid, a teacher of mathematics at Alexandria in Egypt, brought about a revolutionary change in the outlook of the study of geometry. He organized the entire knowledge of geometry in such a way that if we assume some simple and obvious facts as true, then the other facts can be derived by logical reasoning.

1. **Postulates:** The self evident geometrical statements which are accepted by all are called postulates.

2. **Theorems:** Properties which can be proved logically are called theorems.

3. **The five postulates of Euclid:**

i. There are infinite lines passing through a point.

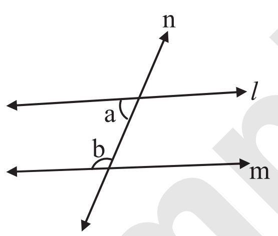
ii. There is one and only one line passing through two points.

iii. A circle of given radius can be drawn by taking any point as its centre.

iv. All right angles are congruent to each other.

v. If two interior angles formed on one side of a transversal of two lines add up to less than two right angles, then the lines produced in that direction intersect each other.

Example:



In the given figure $\angle a$ and $\angle b$ are interior angles formed on one side of transversal n.

If $\angle a + \angle b < 90° + 90°$

i.e., $\angle a + \angle b < 180°$

then lines l and m will be produced in the direction of $\angle a$ and $\angle b$, intersecting each other.

4. **Proof:**

i. The logical argument made to prove a theorem is called its proof.

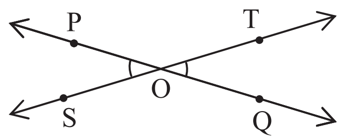
ii. When we are going to prove that a conditional statement is true, its antecedent is called **given part** and the consequent is called **the part to be proved**.

5. **Types of proofs:**

i. **Direct proof:** If from an antecedent, we reach upto the consequent using axioms or previously proved theorems, then it is called a direct proof.

Example:

Theorem: The opposite angles formed by two intersecting lines are of equal measures.



Given: Line PQ and line ST intersect at point O such that P – O – Q, S – Q – T.

To prove: i. $\angle POT = \angle SOQ$

ii. $\angle POS = \angle QOT$

Proof: $\angle POS + \angle POT = 180°$ …(i)[Angles in linear pair]

$\angle POS + \angle SOQ = 180°$ …(ii)[Angles in linear pair]

$\angle POS + \angle POT = \angle POS + \angle SOQ$ …[From (i) and (ii)]

$\therefore$ $\angle POT = \angle SOQ$ …[Eliminating $\angle POS$]

Similarly, we can prove that

$\angle POS = \angle QOT$

ii. **Indirect proof:** In this method, we suppose that the consequent is false and proceed logically and arrive at a step which contradicts what is given (antecedent) or some well known fact and then we accept that the consequent is true.

Example:

Statement: A prime number greater than 2 is odd.

Conditional statement: If p is a prime number greater than 2, then it is odd.

Given: p is a prime number greater than 2.

$\therefore$ 1 and p are the only divisors of p.

To prove: p is an odd number.

Proof: Let us assume that p is not an odd number.

$\therefore$ p is an even number

$\therefore$ divisor of p is 2 …(i)

But it is given that p is a prime number greater than 2

$\therefore$ 1 and p are the only divisors of p …(ii)

Statements (i) and (ii) are contradictory.

$\therefore$ our assumption , that p is not an odd number is false.

This proves that a prime number greater than 2 is odd.

Practice Set 1.3

1. **Write the following statements in 'if-then' form.** **[1 Mark each]**

i. The opposite angles of a parallelogram are congruent.

ii. The diagonals of a rectangle are congruent.

iii. In an isosceles triangle, the segment joining the vertex and the midpoint of the base is perpendicular to the base.

Ans:

i. If a quadrilateral is a parallelogram, then its opposite angles are congruent.

ii. If a quadrilateral is a rectangle, then its diagonals are congruent.

iii. If a triangle is isosceles triangle, then segment joining the vertex of a triangle and midpoint of the base is perpendicular to the base.

---

2. Write converses of the following statements. **[1 Mark each]**

i. The alternate angles formed by two parallel lines and their transversal are congruent.

ii. If a pair of the interior angles made by a transversal of two lines are supplementary, then the lines are parallel.

iii. The diagonals of a rectangle are congruent.

Ans:

i. If the alternate angles made by two lines and their transversal are congruent, then the two lines are parallel.

ii. If two parallel lines are intersected by a transversal, then the interior angles formed by the transversal are supplementary.

iii. If the diagonals of a quadrilateral are congruent, then that quadrilateral is a rectangle.

Problem Set – 1

1. Select the correct alternative answer for the questions given below. **[1 Mark each]**

i. How many midpoints does a segment have ?

(A) only one (B) two
(C) three (D) many

ii. How many points are there in the intersection of two distinct lines ?

(A) infinite (B) two
(C) one (D) not a single

iii. How many lines are determined by three distinct points?

(A) two (B) three
(C) one or three (D) six

iv. Find d(A, B), if co-ordinates of A and B are – 2 and 5 respectively.

(A) –2 (B) 5
(C) 7 (D) 3

v. If P – Q – R and d(P, Q) = 2, d(P, R) = 10, then find d(Q, R).

(A) 12 (B) 8
(C) $\sqrt{96}$ (D) 20

Answers:

i. (A) ii. (C) iii. (C)
iv. (C) v. (B)

Hints:

iv. Since 5 > –2,
d(A, B) = 5 – (–2) = 5 + 2 = 7

---

v. d(P, R) = d(P, Q) + d(Q, R)
∴ 10 = 2 + d(Q, R)
∴ d(Q, R) = 8

---

2. On a number line, co-ordinates of P, Q, R are 3, – 5 and 6 respectively. State with reason whether the following statements are true or false. **[2 Marks each]**

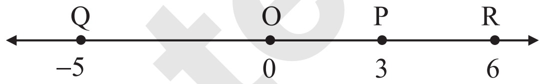
i. d(P, Q) + d(Q, R) = d(P, R)

ii. d(P, R) + d(R, Q) = d(P, Q)

iii. d(R, P) + d(P, Q) = d(R, Q)

iv. d(P, Q) – d(P, R) = d(Q, R)

***Solution*:**



Co-ordinate of the point P is 3.
Co-ordinate of the point Q is –5.
Since 3 > –5,
d(P, Q) = 3 – (–5) = 3 + 5
d(P, Q) = 8

Co-ordinate of the point Q is –5.
Co-ordinate of the point R is 6.
Since 6 > –5,
d(Q, R) = 6 – (–5) = 6 + 5
∴ d(Q, R) = 11

Co-ordinate of the point P is 3.
Co-ordinate of the point R is 6.
Since 6 > 3,
d(P, R) = 6 – 3
∴ d(P, R) = 3

i. d(P, Q) + d(Q, R) = 8 + 11
= 19 …(i)
d(P, R) = 3 …(ii)
∴ d(P, Q) + d(Q, R) ≠ d(P, R) …[From (i) and (ii)]
∴ **The given statement is false.**

---

ii. d(P, R) + d(R, Q) = 3 + 11
= 14 …(i)
d(P, Q) = 8 …(ii)
∴ d(P, R) + d(R, Q) ≠ d(P, Q) …[From (i) and (ii)]
∴ **The given statement is false.**

---

iii. d(R, P) + d(P, Q) = 3 + 8
= 11 …(i)
d(R, Q) = 11 …(ii)
∴ d(R, P) + d(P, Q) = d(R, Q) …[From (i) and (ii)]
∴ **The given statement is true.**

iv. d(P, Q) – d(P, R) = 8 – 3
= 5 …(i)
d(Q, R) = 11 …(ii)
∴ d(P, Q) – d(P, R) ≠ d(Q, R) …[From (i) and (ii)]
∴ **The given statement is false.**

---

3. Co-ordinates of some pairs of points are given below. Hence find the distance between each pair. [1 Mark each]

i. 3, 6 ii. –9, –1
iii. – 4, 5 iv. 0, – 2
v. $x + 3$, $x - 3$ vi. –25, –47
vii. 80, –85

***Solution*:**

i. Co-ordinate of first point is 3.
Co-ordinate of second point is 6.
Since 6 > 3,
Distance between the points = 6 – 3 = **3**

---

ii. Co-ordinate of first point is –9.
Co-ordinate of second point is –1.
Since –1 > –9,
Distance between the points = –1 – (–9)
= –1 + 9 = **8**

---

iii. Co-ordinate of first point is –4.
Co-ordinate of second point is 5.
Since 5 > – 4,
Distance between the points = 5 – (– 4)
= 5 + 4 = **9**

---

iv. Co-ordinate of first point is 0.
Co-ordinate of second point is –2.
Since 0 > – 2,
Distance between the points = 0 – (–2)
= 0 + 2
= **2**

[Note: *The question has been modified.***]**

---

v. Co-ordinate of first point is $x + 3$.
Co-ordinate of second point is $x - 3$.
Since $x + 3 > x - 3$,
Distance between the points = $x + 3 - (x - 3)$
= $x + 3 - x + 3$
= 3 + 3
= **6**

---

vi. Co-ordinate of first point is –25.
Co-ordinate of second point is –47.
Since –25 > –47,
Distance between the points = –25 – (–47)
= –25 + 47
= **22**

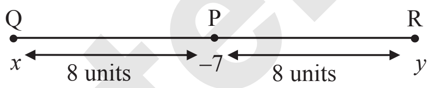
vii. Co-ordinate of first point is 80.
Co-ordinate of second point is –85.
Since 80 > –85,
Distance between the points = 80 – (–85)
= 80 + 85
= **165**

---

4. Co-ordinate of point P on a number line is – 7. Find the co-ordinates of points on the number line which are at a distance of 8 units from point P. [3 Marks]

***Solution*:**

Let point Q be at a distance of 8 units from P and on left side of P
Let point R be at a distance of 8 units from P and on right side of P.



i. Let the co-ordinate of point Q be x.
Co-ordinate of point P is –7.
Since point Q is to the left of point P,
$-7 > x$
∴ d(P, Q) = $-7 - x$
∴ $8 = -7 - x$
∴ $x = -7 - 8$
∴ $x = -15$

---

ii. Let the co-ordinate of point R be y.
Co-ordinate of point P is –7.
Since point R is to the right of point P,
$y > -7$
∴ d(P, R) = $y - (-7)$
∴ $8 = y + 7$
∴ $8 - 7 = y$
∴ $y = 1$
∴ **The co-ordinates of the points at a distance of 8 units from P are –15 and 1.**

---

5. Answer the following questions. [1 Mark each]

i. If A – B – C and d(A, C) = 17, d(B, C) = 6.5, then d (A, B) = ?
ii. If P – Q – R and d(P, Q) = 3.4, d(Q, R) = 5.7, then d(P, R) = ?

***Solution*:**

i. Given, (A, C) = 17, d(B, C) = 6.5
d(A, C) = d(A, B) + d(B, C) ...[A–B–C]
∴ 17 = d(A, B) + 6.5
∴ d(A, B) = 17 – 6.5
∴ **d(A, B) = 10.5**

---

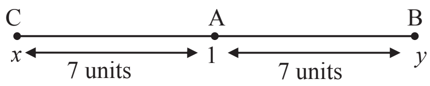
ii. Given, d(P, Q) = 3.4, d(Q, R) = 5.7
d(P, R) = d(P, Q) + d(Q, R) ...[P–Q–R]
= 3.4 + 5.7
∴ **d(P, R) = 9.1**

6. Co-ordinate of point A on a number line is 1. What are the co-ordinates of points on the number line which are at a distance of 7 units from A ? [3 Marks]

***Solution*:**

Let point C be at a distance of 7 units from A and on left side of A

Let point B be at a distance of 7 units from A and on right side of A.



i. Let the co-ordinate of point C be x.
Co-ordinate of point A is 1.
Since point C is to the left of point A,
$1 > x$

$\therefore$ d(A, C) $= 1 - x$

$\therefore$ $7 = 1 - x$

$\therefore$ $x = 1 - 7$

$\therefore$ $x = -6$

ii. Let the co-ordinate of point B be y.
Co-ordinate of point A is 1.
Since point B is to the right of point A,
$y > 1$

$\therefore$ d(A, B) $= y - 1$

$\therefore$ $7 = y - 1$

$\therefore$ $7 + 1 = y$

$\therefore$ $y = 8$

$\therefore$ **The co-ordinates of the points at a distance of 7 units from A are –6 and 8.**

---

7. Write the following statements in conditional form. [1 Mark each]

i. Every rhombus is a square.
ii. Angles in a linear pair are supplementary.
iii. A triangle is a figure formed by three segments.
iv. A number having only two divisors is called a prime number.

Ans:

i. If a quadrilateral is a rhombus, then it is a square.
ii. If two angles are in a linear pair, then they are supplementary.
iii. If a figure is a triangle, then it is formed by three segments.
iv. If a number has only two divisors, then it is a prime number.

---

8. Write the converse of each of the following statements. [1 Mark each]

i. If the sum of measures of angles in a figure is 180°, then the figure is a triangle.
ii. If the sum of measures of two angles is 90°, then they are complement of each other.
iii. If the corresponding angles formed by a transversal of two lines are congruent, then the two lines are parallel.
iv. If the sum of the digits of a number is divisible by 3, then the number is divisible by 3.

Ans:

i. If a figure is a triangle, then the sum of the measures of its angles is 180°.
ii. If two angles are complement of each other, then sum of their measures is 90°.
iii. If two lines are parallel, then the corresponding angles formed by a transversal of two lines are congruent.
iv. If a number is divisible by 3, then the sum of its digits is also divisible by 3.

---

9. Write the antecedent (given part) and the consequent (part to be proved) in the following statements. [2 Marks each]

i. If all sides of a triangle are congruent, then its all angles are congruent.
ii. The diagonals of a parallelogram bisect each other.

Ans:

i. If all sides of a triangle are congruent, then its all angles are congruent.
Antecedent (Given): All the sides of the triangle are congruent.
Consequent (To prove): All the angles are congruent.

---

ii. The diagonals of a parallelogram bisect each other.
Conditional statement: "If a quadrilateral is a parallelogram, then its diagonals bisect each other.
Antecedent (Given): Quadrilateral is a parallelogram.
Consequent (To prove): Its diagonals bisect each other.

---

10. Draw a labelled figure showing information in each of the following statements and write the antecedent and the consequent. [3 Marks each]

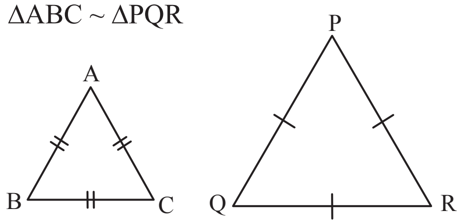
i. Two equilateral triangles are similar.
ii. If angles in a linear pair are congruent, then each of them is a right angle.
iii. If the altitudes drawn on two sides of a triangle are congruent, then these two sides are congruent.

Ans:

i. Two equilateral triangles are similar.
Conditional statement: "If two triangles are equilateral, then they are similar.
Antecedent (Given): Two triangles are equailateral.
i.e., ΔABC and ΔPQR are equilatral triangle.

Consequent (To prove): Triangles are similar

i.e., $\Delta ABC \sim \Delta PQR$



ii. If angles in a linear pair are congruent, then each of them is a right angle.

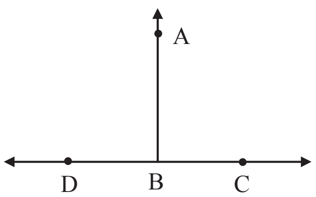
Antecedent (Given): Angles in a linear pair are congrunent.

$\angle ABC$ and $\angle ABD$ are angles in a linear pair

i.e., $\angle ABC \cong \angle ABD$

Consequent (To prove): Each angle is a right angle.

i.e., $\angle ABC = \angle ABD = 90°$



iii. If the altitudes drawn on two sides of a triangle are congruent, then these two sides are congruent.

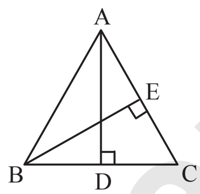
Antecedent (Given): Altitude drawn on two sides of triangle are congruent.

In ΔABC, $AD \perp BC$ and $BE \perp AC$.

seg AD $\cong$ seg BE

Consequent (To prove): Two sides are congruent.

side BC $\cong$ side AC



Activities for Practice

1. Co-ordinates of points are given below. Find the distance between the pair.

$x + 5, x - 5$ **[2 Marks]**

Co-ordinate of first point is $x + 5$.

Co-ordinate of second point is $x - 5$.

Since $\boxed{} > \boxed{}$,

Distance between the points

$= \boxed{}$

$= x + 5 - x + 5$

$= 5 + 5$

$= \boxed{}$

2. Point C is the midpoint of seg AB. If AB = 10, then find the length of AC. **[2 Marks]**

Point C is the midpoint of seg AB and

$l(AB) = 10$. …[Given]

$l(AC) = \boxed{\frac{}{}} \times \boxed{}$

…[$\because$ C is midpoint of seg AB]

$\therefore$ $l(AC) = \frac{1}{2} \times \boxed{}$

$\therefore$ $l(AC) = \boxed{}$

3. From the information given below, find which of the point is between the other two. If the points are not collinear, state so.

$d(P, R) = 9\sqrt{3}$, $d(P, Q) = 6\sqrt{12}$,

$d(Q, R) = \sqrt{27}$. **[3 Marks]**

Given,

$d(P, R) = 9\sqrt{3}$,

$d(Q, R) = \sqrt{27} = \boxed{}$

$d(P, Q) = 6\sqrt{12} = \boxed{}$ …(i)

$d(P, R) + d(Q, R) = \boxed{}$ …(ii)

$\therefore$ $d(P, Q) = \boxed{} + d(Q, R)$

…[From (i) and (ii)]

$\therefore$ Points P, R, Q are $\boxed{}$

$\therefore$ Point R is between the points P and Q

i.e., $\boxed{}$.

4. Co-ordinate of point Y on a number line is 2. Find the co-ordinates of points on the number line which are at a distance of 5 units from Y. **[3 Marks]**

Let point X be at a distance of 5 units from Y and on left side of Y.

Let the co-ordinate of point X be x.

Co-ordinate of point Y is $\boxed{}$.

Since point X is to the left of point Y,

$x < 2$

$\therefore$ d(X, Y) = $\boxed{\quad\quad}$

$\therefore$ x = $\boxed{\quad}$

Let point Z be at a distance of 5 units from Y and on right side of Y.

Let the co-ordinate of point Z be z.

Co-ordinate of point Y is 2.

Since point Z is to the right of point Y,

z > 2

$\therefore$ d(Y, Z) = $\boxed{\quad}$

$\therefore$ z = $\boxed{\quad}$

$\therefore$ The co-ordinates of the points at a distance of 5 units form Y are $\boxed{\quad\quad\quad\quad}$.

One Mark Questions

Type A: Multiple Choice Questions

1. The distance between two points having co-ordinates –8 and 7 is the same as distance between the points having co-ordinates
   (A) –9 and 10 (B) –1 and 13
   (C) –4 and 4 (D) –3 and –18

2. The possible co-ordinates of point R which is at a distance of 19 units from point S having co-ordinate 12 are
   (A) 31, –7 (B) –31, 7
   (C) 31, 7 (D) –31, –7

3. Points A and B are at a distance of 4 units from the origin but on opposite sides of it. The co-ordinate of point C which is at the same distance as B from A and to right of A is
   (A) 8 (B) 12
   (C) 16 (D) 0

4. If two points lie on the right side of zero such that the co-ordinate of second point is three times that of the first, then the distance between the two points is equal to
   (A) the co-ordinate of the first point
   (B) two times the co-ordinate of the first point
   (C) three times the co-ordinate of the first point
   (D) two times the co-ordinate of the second point

5. If the co-ordinates of two points are doubled, then the distance between the two points will
   (A) remain unchanged
   (B) become half the original distance
   (C) become two times the original distance
   (D) cannot be predicted

6. Five points are collinear such that A – B – C and D – B – E. If d(A, B) > d(B, D) and d(B, E) > d(B, C), then which of the following options is wrong?
   (A) D – A – B (B) D – B – E
   (C) A – C – E (D) B – C – E

7. Which of the following is not a subset of a ray?
   (A) point (B) line segment
   (C) line (D) all are subsets

8. The union of a line segment and a ray is a ________ .
   (A) point (B) line segment
   (C) ray (D) line

9. The union of ray AB and ray BA is ________ .
   (A) seg AB (B) line AB
   (C) ray AB (D) ray BA

Type B: Solve the Following Questions

1. If 3 points P, Q, R are collinear such that R is between P and Q, l (PR) = 3, l(PQ) = 8, then find l(QR).

2. If the co-ordinate of point X is –19 and that of point Y is –26, then find d(X, Y).

3. If L – M – N such that M is the mid-point of seg LN and l(ML) = 5, then find l(NL).

4. What is the intersection set of line AB and ray AB?

5. What is the union set of seg AB and line AB.

6. Write the given statement in 'if – then' form. 'Sum of the angles of a square is 360°.'

7. Write converse of the given statement. 'If a number is divisible by 6, then it is divisible by both 2 and 3.'

8. The co-ordinate of point C is –3 and that of point D is 3. If point O is the mid-point of seg CD, then find co-ordinate of point O.

9. If Z – P – Q and l(PQ) = 5, l(PZ) = 6, then find l(ZQ).

10. The co-ordinate of point X is –1 and the co-ordinate of point Y is 0. If Y is the mid-point of seg XZ, then find l(XZ).

Additional Problems for Practice

Based on Practice Set 1.1

1. The co-ordinates of some points are given in the table below: **[1 Mark each]**

Point	P	Q	R	S	T
Co-ordinate	– 8	6	2	– 5	1

Find d(P, Q), d(Q, R), d(Q, S), d(Q, T).

2. From the information given below, find which of the point is between the other two. If the points are not collinear, state so. **[2 Marks each]**
i. d(P, Q) = 12, d(Q, R) = 5, d(P, R) = 7
ii. d(D, E) = 3, d(E, F) = 8, d(D, F) = 9
iii. d(A, B) = 20, d(C, A) = 11, d(B, C) = 9
iv. d(X, Y) = 19, d(Y, Z) = 12, d(X, Z) = 7

3. If A – B – C and l(AB) = 16, l(BC) = 5, then find l(AC). **[2 Marks]**

4. If P – Q – R, l(PQ) = $3\sqrt{2}$, l(PR) = $5\sqrt{2}$, then find l(QR). **[2 Marks]**

5. The co-ordinate of point B on the number line is –3. Find the co-ordinates of the points which are at a distance of 6 units from point B. **[3 Marks]**

6. What is the betweenness of the points A, B and D, if d(A, B) = 6, d(B, D) = 5, d(A, D) = 11? **[2 Marks]**

+7. On a number line, points A, B and C are such that d (A, B) = 5, d (B,C) = 11 and d (A, C) = 6.
Which of the points is between the other two? **[2 Marks]**

+8. U, V and A are three cities on a straight road. The distance between U and A is 215 km, between V and A is 140 km and between U and V is 75 km. Which of them is between the other two? **[2 Marks]**

+9. The co-ordinate of point A on a number line is 5. Find the co-ordinates of points on the same number line which are 13 units away from A. **[3 Marks]**

Based on Practice Set 1.2

1. The following table shows points on a number line and their co-ordinates. Decide whether the pair of segments given below the table are congruent or not. **[3 Marks each]**

Point	L	M	N	P	Q	R
Co-ordinate	– 5	0	8	– 1	7	4

i. seg MN and seg PQ
ii. seg QR and seg LM
iii. seg LP and seg NR
iv. seg NP and seg LR

2. If B is the midpoint of seg PQ and l(PQ) = 7 cm, then find l(PB). **[2 Marks]**

3. If B is the midpoint of seg AC and d(A, C) = 13.5 cm, then find the length of seg AB. **[2 Marks]**

Based on Practice Set 1.3

1. Write the following statements in ‘if-then’ form. **[1 Mark each]**
i. In a right angled triangle, the length of the side opposite to the angle of 30° is half the hypotenuse.
ii. The diagonals of an isosceles trapezium are congruent.
iii. The diagonals of a rhombus bisect each other
iv. The diagonals of a square are congruent and perpendicular bisectors of each other.

2. Write converses of the following statements. **[1 Mark each]**
i. If a line is drawn parallel to one side of a triangle and it intersects the other two sides at two distinct points, then it divides the two sides in the same ratio.
ii. If the opposite sides of a quadrilateral are congruent, then it is a parallelogram.

3. Draw a labelled figure showing information in each of the following statements and write the antecedent and the consequent. **[3 Marks each]**
i. If two angles of a triangle are congruent, then the sides opposite to those angles are congruent.
ii. The diagonals of a rectangle are congruent.
iii. If two angles of a triangle are not congruent, then the side opposite to the greater angle is the longer side.
iv. If two lines are parallel to the same line, then they are parallel to each other.
v. There is one and only one circle passing through three given non-collinear points.

Chapter Assessment

Total Marks: 25

Q.1. A. Choose the correct alternative. [4]

i. If d (A, B) = d (A, C) + d(B, C), then the betweenness of the points A, B and C is _______.

(A) A – B – C (B) A – C – B
(C) C – A – B (D) C – B – A

ii. If the co-ordinates of two points are –15 and –17, then the distance between them is _______.

(A) 15 units (B) 17 units
(C) 2 units (D) 32 units

iii. The co-ordinate of a point, 9 units from the point A and having co-ordinate 7, is _______.

(A) 15 (B) 7
(C) –1 (D) –2

iv. The intersection of seg AB and line AB is _______.

(A) seg AB (B) line AB
(C) ray AB (D) ray BA

Q.1. B. Solve the following questions. [2]

i. 'Sum of the opposite angles of a cyclic quadrilateral is 180°'. Write the given statement in 'if – then' form.

ii. If A – B – C, and l(AC) = 6, l(AB) = 4, then find l(BC).

Q.2. A. Complete the following activities. (Any one) [2]

i. Co-ordinates of points are given below. Find the distance between the points.
z + 3.8, z – 3.8
Co-ordinate of first point is z + 3.8.
Co-ordinate of second point is z – 3.8.
Since $\boxed{}$ > $\boxed{}$,
Distance between the points
= $\boxed{}$
= z + 3.8 – z + 3.8
= 3.8 + 3.8
= $\boxed{}$

ii. Point R is the midpoint of seg PQ. If PQ = 15, then find the length of RQ.
Point R is the midpoint of seg PQ and l(PQ) = 15. …[Given]
$l(RQ) = \dfrac{\boxed{\ }}{\boxed{\ }} \times \boxed{}$
…[∵ R is the midpoint of seg PQ]
∴ $l(RQ) = \dfrac{1}{2} \times \boxed{}$
∴ l(RQ) = $\boxed{}$

Q.2. B. Solve the following questions. (Any two) [4]

i. What is the betweenness of the points P, Q, R, if d(P,Q) = 13.7, d(Q, R) = 17.9, d(P, R) = 31.6.

ii. Point C is the midpoint of seg AB. If AC = 3.5, then find l(AB).

iii. If PQ = 7.2 cm, XY = 6.9 cm and MN = 8.4 cm, then compare the segments.

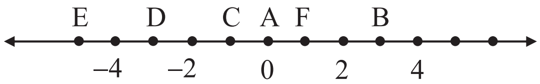
Q.3. A. Complete the following activities. (Any one) [3]

i. Co-ordinate of point Y on a number line is 2. Find the co-ordinates of points on the number line which are at a distance of 5 units from Y.
Let point X be at a distance of 5 units from Y and on left side of Y.
Let the co-ordinate of point X be x.
Co-ordinate of point Y is $\boxed{\ }$.
Since point X is to the left of point Y,
$x < 2$
∴ d(X, Y) = $\boxed{}$
∴ x = $\boxed{\ }$
Let point Z be at a distance of 5 units from Y and on right side of Y.
Let the co-ordinate of point Z be z.
Co-ordinate of point Y is 2.
Since point Z is to the right of point Y,
$z > 2$
∴ d(Y, Z) = $\boxed{\ }$
∴ z = $\boxed{\ }$
∴ The co-ordinates of the points at a distance of 5 units form Y are $\boxed{}$.

ii. Co-ordinates of points A, B, C, D are 12, 7, –1 and –5 respectively. Determine whether the pair of seg AB and seg CD are congruent or not.
Co-ordinate of the point A is 12.
Co-ordinate of the point B is 7.
Since 12 > 7,
d(A, B) = $\boxed{}$
∴ l(AB) = $\boxed{\ }$ ...(i)
Co-ordinate of the point C is –1.
Co-ordinate of the point D is –5.
Since –1 > –5,
d(C, D) = $\boxed{}$
∴ l(CD) = $\boxed{}$ ...(ii)
∴ l(AB) $\boxed{}$ l(CD)
∴ seg AB and seg CD are $\boxed{}$

Q.3. B. Solve the following questions. (Any one) **[3]**

i. Answer the following questions with the help of figure given below.

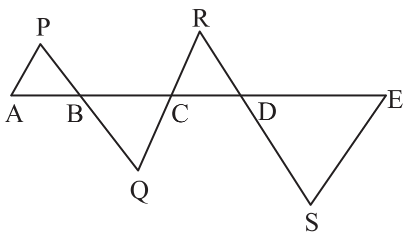


a. Find d(E, C).
b. State the points which are equidistant from A.
c. Write the segment which is congruent to seg AF.

ii. Points P, Q and R are on a number line such that d(P, R) = 15, d (Q, R) = 5. Find d(P, Q) considering all possibilities.

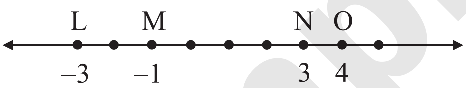
Q.4. Solve the following questions. (Any one) **[4]**

i. In the given figure, l(AC) = 8, l(BC) = 5.
Seg BD ≅ seg CE ≅ seg AC, then determine whether the segments in each of the following pairs are congruent or not.



a. seg BC and seg DE
b. seg AB and seg CD.

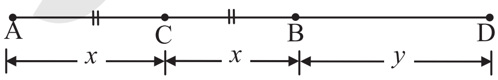
ii. Find the distances with the help of the number line given below.



a. d(L, N) b. d(L, O)
c. d(M, N) d. d(M, O)

Q.5. Solve the following questions. (Any one) **[3]**

i. Point C is the midpoint of seg AB. D is any point on seg AB produced. Prove that the difference of squares of seg AD and seg BD is four times the area of the rectangle formed by seg AC and seg CD.



ii. The co-ordinate of point L on a number line is 9. Find the co-ordinates of points on the same number line which is 17 units away from L.

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