Vision Empower & XRCVC

Teacher Instruction KIT

Practical Geometry

Syllabus: Karnataka State Board
Subject: Mathematics
Grade: 7
Textbook Name: Text cum Workbook (Revised) – Seventh standard
Chapter Number & Name: 10.Practical Geometry

1. OVERVIEW

1.1 OBJECTIVE & PREREQUISITES

Objective

- To learn to construct Parallel line and Triangles with SSS, SAS, ASA criterion

Prerequisite Concept

- The Triangle and its Properties

TIK_MATH_G7_CH7_The Congruence of triangle

- Practical geometry

TIK_MATH_G6_CH14_Practical Geometry

- Congruence of Triangles

TIK_MATH_G7_CH7_The Congruence of triangle

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*Kindly Note: Activities marked with * are mandatory*

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Angles

Triangles

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2. LEARN

2.1 KEY POINTS

1. Lines
2. Angles
3. Triangles

2.2 LEARN MORE

3. ENGAGE

3.2 INTEREST GENERATION ACTIVITY

Construction of lines, angles and triangles

Activity 1: Construction of lines, angles and triangles
Materials Required: Geometry kit, parchment paper, push pins
Prerequisites: Construction of lines, angles, triangles

Activity Flow

Make a tactile drawing of lines, arcs, triangles, with obvious mistakes in them, like a straight line with a bend in the middle, arcs where a small portion is a straight line, triangles where one corner is missing. Take ideas from the mistakes that sighted students usually make when first learning constructions, like when mid-way through drawing a line the ruler moves abruptly, or how loose compasses change radius in the middle of the construction of a circle, etc. Ask the student if they think the given examples are correct and if there are mistakes, what they are. Point out the mistakes to the student and show them the corrected tactile

diagram and talk to them about how in this lesson, they will learn how to draw correctly using instruments.

3.2 CONCEPT INTRODUCTION ACTIVITIES

Instructions to use geometry kit

Activity 2: Instructions to use geometry kit and some measures to be taken while construction of diagrams

Materials required: Geometry kit, parchment paper
Prerequisites: None

Activity Flow

Start by giving the student the accessible geometry kit, and allow them to explore the components. Describe the box and contents verbally and then move on to handing out the pieces one by one and orient the student to the components of the box. Start with the ruler, then the protractor, then the compass, then the divider and then the set-squares. Remember to take the student's hands over the tactile markings of the ruler, protractor and set-squares. Describe what they are used for and what the various markings indicate. This will make things easier in the classroom for you as well as the student. Inform the student of all the steps of construction before they start drawing, so that the student is aware of what is expected.

Some measures to be taken before beginning to construct diagrams with the Geometry Kit are given below.

1. *Place the clipboard from the wooden braille slate kit on the table.*
2. *Put the rubber mat on the board and align it along the clip of the board since the rubber mat will not fit under the clip due to its thickness.*
3. *Position the special plastic sheet (parchment paper) on top of the rubber mat. See that at least two sides of the sheet and the rubber mat are aligned.*
4. *Slide about 1cm of the sheet under the clip and fasten the sheet and the rubber mat.*
5. *After securing the top of the sheet under the clip, place one hand flat on the upper part of the sheet and begin gliding downwards to ensure that there are no lumps in the paper and it sticking out anywhere.*
6. *Using one binder clip on each of the other three sides will help to steady the entire sheet (not just the top of it).*

OR
In order to stabilize the kit, two metal strips (from two wooden braille kits) are used to hold the material secure. One metal strip should be attached to the second pair of holes from the top of the wooden braille slate while the other is to be set at the lowest or second lowest pair of holes in the slate. These metal strips need to have a rubber band wound on the side that opens to lock in the sheet and the rubber mat.

NOTE: This initial process may take some practice on the part of the child.

1. *Use a sharp object (such as a stylus or a ball pen) to begin drawing.*
2. *Labeling of diagrams (Optional - provided Brailler)*

- *Once the diagram is ready, insert the parchment paper into the Perkins Brailler as usual.*
- *Align the cursor to the correct position where the points of the diagram need to be labelled.*
- *Braille out the required points.*

Once the student is comfortable using the board, they would need to learn how to use the various instruments. The student should be oriented to each of the 5 instruments within the Geometry Kit. The student must also definitely have enough practice and understand how to safely handle pushpins, as these will be regularly required during various geometric constructions. The student will need immense practice of drawing lines with the ruler, measuring lengths with the compass, aligning the protractor to calculate angles etc.

Rules to be followed for some specific type of construction

Activity 3: Rules to be followed for some specific type of construction (points, lines, angles)

Materials required: Geometry kit, parchment paper, push pins
Prerequisites: None

Activity Flow

Given below are some specifics based on the type of construction:

1. Points
A point is denoted by a dot. It has no size. A point is always represented by a capital letter. The student could be asked to use a simple, small, round bindi or a pushpin to represent points in geometric constructions.

2. Lines
A line, being an unending connection of points, there is no specific length that needs to be considered while constructing the same.

- *Fix a point closer to the left of the sheet with a pushpin.*
- *Use another pushpin to represent a second point towards the right. This could be placed approximately at the same level judging from the bottom of the board. Two fingers could be used to get an approximate measurement.*
- *Place the tactile ruler on the board such that it rests against the two pushpins.*
- *With prior practice, one can see to it that the ruler remains steady on the board.*
- *Use a stylus / ball pen and trace a straight line along the length of the ruler joining the two points.*

- *After the line is drawn, add arrowheads to both ends of the line with the stylus / ball pen.*
- *Consider the line MN.*

3. Line Segments

A line segment is a fixed portion of a line. This makes it possible to measure line segments. To draw a line segment of length 4.5 cm, one can use any of the two options as given below.

Option A:

- *With a pushpin, mark a point close to the bottom left of the board. Leave about 1 inch from the bottom of the board. (Keep in mind that this is point A. Labeling can be done after the diagram is ready.)*
- *Place the tactile ruler on the board such that it rests against the pushpin.*
- *See that the pushpin is at the 1 cm tactile marking of the ruler. This is done to make it easier to secure the ruler and so the ruler doesn't slip off.*
- *Hold the ruler steady, to be able to draw a straight line and so that the measurement is correct.*
- *Count 4.5 cm from the starting point. Since the starting point is at 1 cm, the length of 4.5 cm would land at 5.5 cm.*
- *Mark this second point on the line with another pushpin. (Remember this as point B. Labeling may be done later.)*
- *With the ruler already resting against both pushpins, use a stylus / ball pen and trace a straight line along the length of the ruler.*
- *Join A and B and get segment AB measuring 4.5 cm, make sure to begin at the first pushpin and end at the other to maintain the exact length of the line segment.*

Option B:

- *One can use the tactile ruler and draw an unmeasured line 'm' as mentioned above (in point 2. Lines). Keep in mind that the pushpin on the left is point A. Labeling can be done after the diagram is ready.*
- *Separately, place the blunt point of the compass on the 1 cm mark of the ruler.*
- *Open the compass to position the sharper point at 5.5 cm. This would measure a length of 4.5 cm, since we are beginning at 1 cm.*
- *Take off the first pushpin but take note of the point by placing one finger there.*
- *Seeing that the opening of the compass has not changed, place the blunt end on point A and swing an arc to cut line m at a point B.*
- *AB is a line segment of required length 4.5 cm.*

4. Intersecting Lines, Parallel Lines, Rays

Based on the construction of lines explained above, the different types of lines including intersecting Lines, parallel Lines and rays etc. may be constructed.

Angles
An angle is formed by two rays, called the sides/arms of the angle, sharing a common point, called the vertex of the angle.

- *One can use pushpins and the tactile ruler and draw an unmeasured line 'm' as mentioned above (in point 2. Lines). (Keep in mind that the point on the left is the vertex B, and the second point on the right is point C. Labeling can be done after the diagram is ready.)*

Example: To continue to construct a 60 degree angle ABC, one can use any of the two options as given below.

Option A:

- *Place the flat end of the protractor on the line drawn such that the centre point is at vertex B and the zero degree mark is at point C. Mark point C with a pushpin, if required.*
- *Confirm that the protractor is straight and steady and locate the 60 degree mark on it.*
- *There will be markings of tactile dots at each 10 degree.*
- *After confirming that you have located the 60 degree mark on the protractor, use a pushpin to mark this position as point A.*
- *Place the tactile ruler such that it rests on the vertex B and point A.*
- *Draw a straight line passing through both the points i.e. vertex B and point A.*
- *Angle ABC measures 60 degree.*

Option B:

- *Place the blunt point of the compass on the vertex B.*
- *Open the compass to position the sharper end at point C.*
- *Swing an arc to cut line m at point C and continue marking the arc in the area above the line m.*
- *Now, place the blunt point of the compass at point C where the arc had cut line m.*
- *Swing another arc to cut the first arc in the area above the line m.*
- *Use a pushpin to mark the point of intersection of the two arcs. (Keep in mind that this third point is point A. Labeling can be done after the diagram is ready.)*
- *Place the tactile ruler such that it rests on the vertex B and point A. If required, place a pushpin on vertex B again. Position the tactile ruler such that it rests on the vertex B and point A.*
- *Draw a straight line passing through both the points i.e. vertex B and point A.*
- *Angle ABC measures 60 degree.*

Construction of a line parallel to a given line

Activity 4: Construction of a line parallel to a given line, through a point not on the line

Materials required: Geometry kit, parchment paper
Prerequisites: Construction of lines, to draw arcs

Activity Flow

A line segment is a fixed portion of a line. This makes it possible to measure line segments. To draw a line segment of length 4.5 cm, one can use any of the two options as given below.

Option A:

- *Take a sheet of paper. Make a horizontal fold and crease it. This creased fold represents a line l. Then make a vertical fold and the intersecting point will be the middle point of the horizontal line.*
- *Unfold the paper. To mark a point A put a small bindi on the paper exactly above and middle of the line l.*
- *As we have already folded the paper perpendicular (vertically) to the line l. And this perpendicular passes through the point A. Name the perpendicular AN.*
- *Make a fold perpendicular to this perpendicular through the point A. Name the new perpendicular line as m. Now, l and m are parallel to each other.*

Option B:
Construction using ruler and compasses only

1. *Fix a parchment sheet of paper on a rubber board with push pins in all four corners such that the sheet will not move.*
2. *Place the tactile ruler on the board, hold the ruler steady, to be able to draw a straight line l and use a stylus / ball pen and trace a straight line along the length of the ruler.*
3. *Place a pushpin on any point on the line as B and one more push pin representing point A above the line l. With the help of tactile ruler join B to A.*
4. *With B as centre and a convenient radius, draw an arc cutting l at point say C and on the line BA at point say D with the help of compasses.*
5. *Now with A as centre and the same radius as in the previous step, draw an arc EF cutting AB at point G.*
6. *Place the pointed tip of the compasses at point C and adjust the opening so that the pencil tip is at D.*
7. *With the same opening as in the previous step and with G as centre, draw an arc cutting the arc EF at H.*
8. *Now, join AH to draw a line m. Note that angle ABC and Angle BAH are alternate interior angles. Therefore m is parallel to l.*

Recap of congruent triangles and its properties

Activity 5: Recap of congruent triangles and its properties

Materials required: Geometry kit, parchment paper, push pins

Prerequisites: Construction of triangles

Activity Flow

Triangles are classified based on sides or angles and the following important properties concerning triangles:

(i)The exterior angle of a triangle is equal in measure to the sum of interior opposite angles.
(ii) The total measure of the three angles of a triangle is 180 degree.
(iii) Sum of the lengths of any two sides of a triangle is greater than the length of the third side.
(iv) In any right-angled triangle, the square of the length of hypotenuse is equal to the sum of the squares of the lengths of the other two sides.

In the chapter on Congruence of triangles, we saw that a triangle can be drawn if any one of the following sets of measurements is given:

(i) Three sides.
(ii) Two sides and the angle between them.
(iii) Two angles and the side between them.
(iv) The hypotenuse and a leg in the case of a right angled triangle.

SSS criterion

Activity 6: Constructing a triangle when the lengths of its three sides are known.

Materials Required: Geometry kit, Parchment paper, push pins

Prerequisites: Construction of triangles

Activity Flow

Example: Construct a triangle ABC, given that AB = 5cm, BC = 6cm and AC = 7cm.

1. *We can start with any of these lengths. Let's draw the line segment BC of length 6cm.*
2. *From B, point A is at a distance of 5cm. So, with B as centre, draw an arc of radius 5 cm. Now A will be somewhere on this arc. Our job is to find where exactly A is.*
3. *From C, point A is at a distance of 7cm. Make sure to cut the first arc while drawing the second arc. So, with C as centre, draw an arc of radius 7cm.*
4. *A has to be on both the arcs drawn. So, it is the point of intersection of arcs. Mark the point of intersection of arcs as A. Join AB and AC. Triangle ABC is now ready.*

SAS criterion

Activity 7: Constructing a triangle when the lengths of two sides and the measure of the angle between them are known

Materials required: Geometry kit, parchment paper, push pins
Prerequisites: Construction of triangles

Activity Flow

Example: Construct a triangle PQR, given that PQ=3cm, QR=5.5 cm and angle PQR=60 degree.

1. *Draw a line segment QR of length 5.5 cm.*
2. *At Q, keep the protractor and put a dot at an angle 60 degrees with a stylus . Then draw a line QX passes through the mark making 60 degrees with QR. (The point P must be somewhere on this ray of the angle.*
3. *To fix P, the distance QP has been given. With Q as centre, draw an arc of radius 3cm. It cuts QX at the point P.*
4. *Join PR. Triangle PQR is now obtained.*

ASA criterion

Activity 8: Constructing a triangle when the measures of two of its angles and the length of the side included between them is given

Materials required: Geometry kit, parchment paper, push pins
Prerequisites: Construction of triangles

Activity Flow

Example: Construct ΔXYZ *if it is given that XY = 6 cm,* $m\angle ZXY = 30^\circ$ *and* $m\angle XYZ = 100^\circ$

1. Draw XY of length 6 cm.
2. At X, keep the protractor and put a dot at an angle 30 degrees with a stylus draw a ray XP making an angle of 30 degree with XY. By the given condition, Z must be somewhere on the XP.
3. At Y, keep the protractor and put a dot at an angle 100 degrees with a stylus draw a ray YQ making an angle of 100 degree with YX. By the given condition, Z must be on the ray YQ also.
4. Z has to lie on both the rays XP and YQ. So, the point of intersection of the two rays is Z. Triangle XYZ is now completed.

RHS criterion

Activity 9: Constructing a right angled triangle when the length of one leg and its hypotenuse are given

Materials required: Geometry kit, parchment paper, push pins
Prerequisites: Construction of triangles

Activity Flow

Example: Construct triangle LMN, right angled triangle at M, given that LN = 5 cm and MN = 3cm.

1. *Draw MN of length 3 cm.*
2. *At M, draw MX perpendicular to MN. (L should be somewhere on this perpendicular)*
3. *With N as centre, draw an arc of radius 5cm. (L must be on this arc, since it is at a distance of 5cm from N).*
4. *L has to be on the perpendicular line MX as well as on the arc drawn with centre N. Therefore, L is the meeting point of these two. Triangle LMN is now obtained.*

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

Cloth-hangers, scissors, arrowheads, partly opened doors, pyramids, set squares, an edge of a ruler, an edge of tables, cycle spokes, wheels etc are examples of angles in real life.

4. EXERCISES & REINFORCEMENT

4.1 EXERCISES & REINFORCEMENT

Practice and Recall

Activity 10: Exercise Problems

Materials required: Geometry kit, parchment paper, push pins

Prerequisites: Construction of triangles, angles

Activity Flow

Help the students to solve all the problems in the class.

1. *Draw a line, say AB, take a point C outside it. Through C, draw a line parallel to AB using ruler and compasses only.*
2. *Draw a line l. Draw a perpendicular to l at any point on l. On this perpendicular choose a point X, 4 cm away from l. Through X, draw a line m parallel to l.*
3. *Let l be a line and P be a point not on l. Through P, draw a line m parallel to l. Now join P to any point Q on l. Choose any other point R on m. Through R, draw a line parallel to PQ. Let this meet l at S. What shape do the two sets of parallel lines enclose?*
4. *Construct ΔXYZ in which XY= 4.5 cm, YZ = 5 cm and ZX = 6 cm. 2.*
5. *Construct an equilateral triangle of side 5.5 cm.*
6. *Draw ΔPQR with PQ = 4 cm, QR = 3.5 cm and PR = 4 cm. What type of triangle is this?*
7. *Construct ΔABC such that AB = 2.5 cm, BC = 6 cm and AC = 6.5 cm. Measure $\angle B$.*
8. *Construct ΔDEF such that DE = 5 cm, DF = 3 cm and $m\angle EDF = 90^\circ$.*
9. *Construct an isosceles triangle in which the lengths of each of its equal sides are 6.5 cm and the angle between them is 110 degree.*

10. Construct ΔABC with BC = 7.5 cm, AC = 5 cm and $m\angle C = 60^\circ$

11. Construct ΔABC, given $m\angle A = 60^\circ$, $m\angle B = 30^\circ$ and $AB = 5.8$ cm .

12. Construct ΔPQR if PQ = 5 cm, $m\angle PQR = 105^\circ$ and $m\angle QRP = 40^\circ$

(Hint: Recall angle-sum property of a triangle).

13. Examine whether you can construct ΔDEF such that

$EF = 7.2$ cm, $m\angle E = 110^\circ$ and $m\angle F = 80^\circ$. Justify your answer.

14. Construct the right angled ΔPQR, where $m\angle Q = 90^\circ$, $QR = 8$ cm and $PR = 10$ cm .

15. Construct a right-angled triangle whose hypotenuse is 6 cm long and one of the legs is 4 cm long.

16. Construct an isosceles right-angled triangle ABC, where $m\angle ACB = 90^\circ$ and AC = 6 cm.

4.2 IMPORTANT GUIDELINES*

Exercise Reading

It is very important that the children practice their learnings as well as their reading. Hence have the children read out the newly learned concepts from their textbooks or other available resources.

Perform Textbook Activity

It is good practice to have the children perform the textbook activities. Your textbook activities might not be accessible hence go through this resource to learn how to make textbook content accessible

Provide Homework

To evaluate their understanding and to help the student revise and implement the new learnt concept ensure to provide them with homework. Students should perform one or two of the questions mentioned above or from the textbook exercises with the teacher in Class and the remaining may be given for homework. Also, ensure that the student knows their special skills linked to independently using their accessible books as it will be critical to doing homework independently

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