CHAPTER 8

Brainstorming 1

In groups

Aim: To identify two-dimensional loci in daily life situations.

Materials: Situation cards.

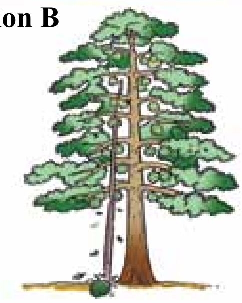
Steps:

1. Each group is given several situation cards that show activities involving movements in daily activities as shown below.

Situation A

Throwing a ball into the net.

Situation B



A durian falling from a tree.

Situation C

An airplane landing.

Situation D

The moving tip of the wiper on the windshield.

2. Discuss in the group and sketch the locus of a point on the object involved in the given situations.
3. Present the loci sketch and compare your answers with other groups.

Discussion:
Discuss five other movements in daily activities that can be categorised as loci.

From Brainstorming 1, it is found that:

The shapes of two-dimensional loci can be seen in the form of straight lines, arcs and curves.

Brainstorming 2

In pairs

Aim: To determine the locus of points that are of constant distance from a fixed point.

Materials: Blank paper, a pencil and a ruler.

Steps:

1. Mark a fixed point O on a sheet of paper (Diagram 1).
2. Measure 5 cm from the point O and mark ×.
3. Repeat step 2 as many times as possible (Diagram 2).

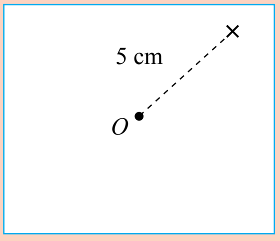


Diagram 1

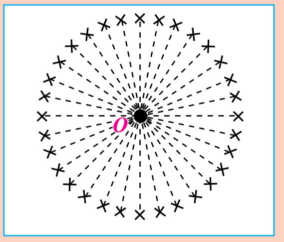


Diagram 2

4. Note the location of the points marked with × (Diagram 2).
5. Repeat steps 1 to 3 with different distances from the fixed point O.
6. Are the resulting geometric shapes the same as the shape obtained in step 4? Explain.

Discussion:

What is the geometric shape generated by the location of the dots ×? Explain.

From Brainstorming 2, it is found that:

Points marked at the same distance from a fixed point O forms a circle.

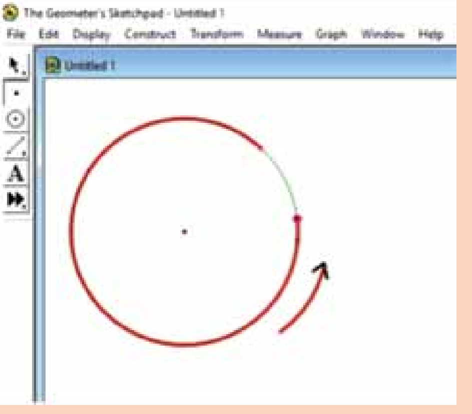
In general, the locus of a point that is equidistant from a **fixed point** is a **circle centred at that fixed point**.

Brainstorming 3 In pairs

Aim: To construct locus of points that are of constant distance from a fixed point.

Materials: Dynamic software

Steps:



1. Start with *New Sketch*.
2. Select *Compass Tool* and draw a circle.
3. Select *Point Tool* and mark.
4. Open *Display* menu and select *Trace Point* followed by *Animate Point*.
5. Observe the animation of the movement generated.

Discussion:

What is the geometric shape generated from the movement of the marked point?

From Brainstorming 3, it is found that:

A point that always moves at the same distance from a fixed point produces a circle.

Brainstorming 4

In pairs

Aim: To determine the locus of points that are equidistant from two fixed points.

Materials: Plain paper, a compasses, a ruler and a pencil.

Steps:

1. Mark two fixed points P and Q which are 8 cm apart (Diagram 1).

2. Using the compasses, mark the intersection, 4.5 cm from point P and point Q (Diagram 2).

4. Note the location of the intersecting marks in Diagram 3.

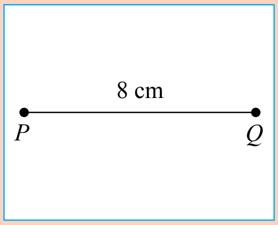


Diagram 1

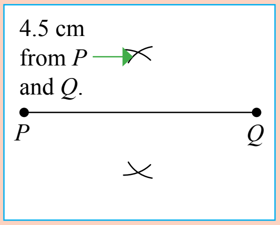


Diagram 2

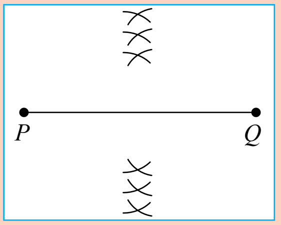


Diagram 3

5. Repeat steps 1 to 3 with different distances between point P and point Q.
Are your answers the same as the answer in step 4?

Discussion:
What is the shape produced by the location of the intersecting marks? Explain.

From Brainstorming 4, it is found that:

The location of the intersecting marks that are equidistant from fixed points P and Q form a straight line through the midpoint of PQ.

In general, the locus of a point that is equidistant from **two fixed points** is the **perpendicular bisector** of the line connecting the two fixed points.

Brainstorming 5

In pairs

Aim: To construct locus of points that are equidistant from two fixed points.

Materials: Dynamic software

Steps:

1. Start with *New Sketch*.
2. Select *Straightedge Tool* to draw a line segment. Select *Text Tool* to label point *A* and point *B*.
3. Select *Construct* menu to construct the midpoint of the line segment.
4. Mark both lines and midpoint segments with *Selection Arrow Tool.*
5. Select *Construct* menu to construct a perpendicular line (Diagram 1).

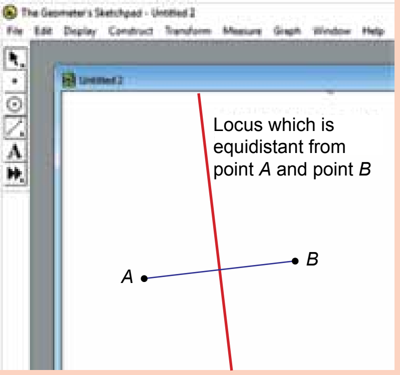


Diagram 1

Discussion:

What is the geometric shape produced? Explain.

From Brainstorming 5, it is found that:

The **locus that is equidistant** from two fixed points *A* and *B* is **a straight line perpendicular** to the straight line *AB* and it passes through the midpoint of *AB*.

Brainstorming 6 In pairs

Aim: To determine the locus of points that are of constant distance from a straight line.

Materials: Square grid paper, a ruler, a pencil.

Steps:

1. Draw a straight line *MN* (Diagram 1).
2. Mark a point ×, which is 3 units from the line *MN* (Diagram 2).

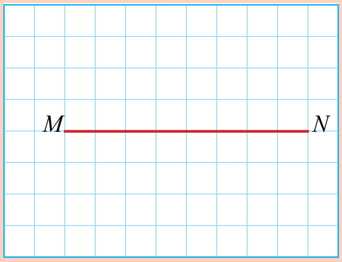


Diagram 1

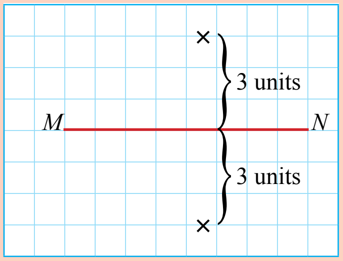


Diagram 2

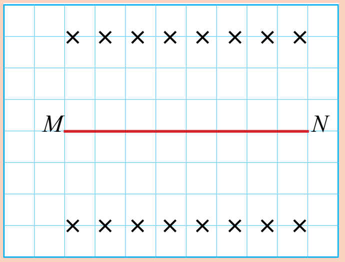


Diagram 3

3. Repeat step 2 with as many × points as possible (Diagram 3).
4. Note the location of the × points in Diagram 3. What do you think about the location of the × points?
5. Repeat steps 1 through 4 with a different unit distance.
6. Repeat steps 1 through 4 with the straight line *MN* drawn vertically.

Discussion:

What is your conclusion about the location of the points marked equidistantly from the straight line?

From Brainstorming 6, it is found that:

The locus of points that are equidistant from the line *MN* is a pair of straight lines parallel to *MN*.

In general, The locus of points that are of constant distance **from a straight line** are **straight lines parallel** to that straight line.

Brainstorming 7

In groups

Aim: To determine the locus of points that are equidistant from two parallel lines.

Materials: Plain paper, compasses, a ruler and a pencil.

Steps:

1. Draw two straight lines PQ and MN that are parallel (Diagram 1).
2. Using compasses, mark the point of intersection from point P and point M.
3. Repeat steps 2 for point Q and point N (Diagram 2).
4. Connect all the intersection points marked by drawing a straight line (Diagram 3).

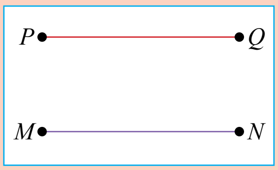


Diagram 1

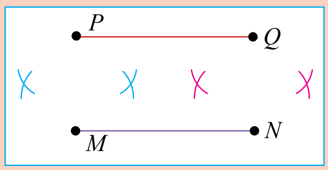


Diagram 2

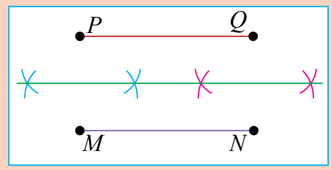


Diagram 3

5. Describe the nature of the straight line that connects all the points of intersection (Diagram 3).

Discussion:

1. Repeat steps 1 to 4 by drawing two vertical straight lines and two inclined straight lines. Ensure that each part of lines is parallel.
2. Do you get the same result as in step 4?

From Brainstorming 7, it is found that:

(a) The locus of points that are equidistant from two parallel lines PQ and MN is a straight line.

(b) The locus is parallel to the straight lines PQ and MN and it passes through the midpoints of the lines PQ and MN.

In general,

The locus of points that are **equidistant from two parallel lines** is **a straight line parallel to and passes through the midpoints** of the pair of parallel lines.

Brainstorming 8

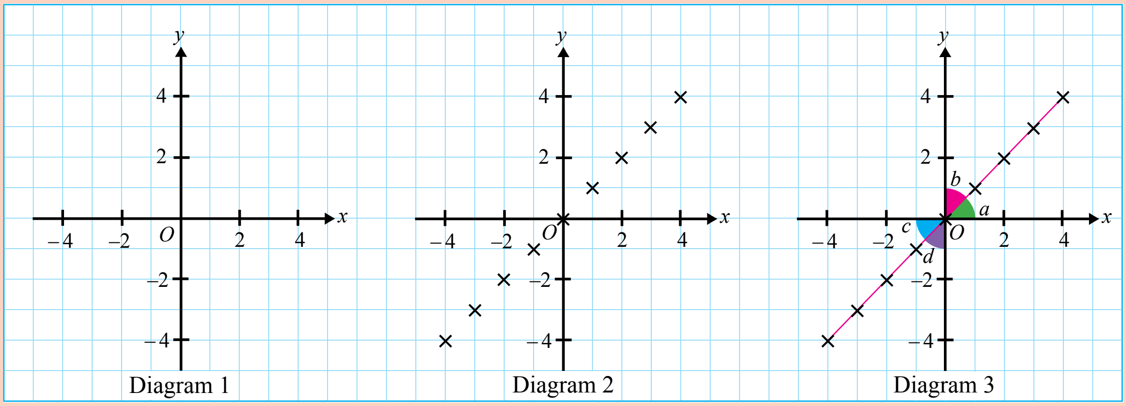
In groups

Aim: To determine the locus of a points that are equidistant from two intersecting lines.

Materials: A square grid paper, a ruler, a pencil and a protractor.

Steps:

1. Draw x-axis and y-axis on a Cartesian plane on the grid paper (Diagram 1).
2. Mark the coordinates of equal value pairs. For example, (0, 0), (–2, –2), (4, 4) and so on (Diagram 2).
3. Connect all the points with a straight line. Measure $\angle a$, $\angle b$, $\angle c$ and $\angle d$ using a protractor (Diagram 3).



Discussion:

1. What is your conclusion about the values of $\angle a$, $\angle b$, $\angle c$ and $\angle d$ which are the angles formed at the intersection of the x-axis and y-axis?
2. What is the relationship between the straight line that connects equal value pairs of coordinates to the values of $\angle a$, $\angle b$, $\angle c$ and $\angle d$?

From Brainstorming 8, it is found that:

(a) $\angle a = \angle b = \angle c = \angle d = 45°$.

(b) The straight line that connects equal value pairs of coordinates bisects the angle of intersection between the x-axis and y-axis.

In general,

The locus of point that are equidistant from **two intersecting lines** is the **angle bisector** of the angles formed by the intersecting lines.

Brainstorming 9 In pairs

Aim: To construct locus at a point that is equidistant from two intersecting straight lines.

Materials: Dynamic software

Steps:

1. Start with *New Sketch*.
2. Select *Straightedge Tool* to draw lines *AB* and *BC* intersecting at point *B*.
3. Use *Text Tool* to label point *A*, followed by point *B* and then point *C* (point of intersection must be marked on the second turn).
4. Mark all three points *A*, *B* and *C* with *Selection Arrow Tool*. (Diagram 1)
5. Select the *Construct* menu to construct the bisector of the angle (*Angle bisector*) between the two intersecting lines. (Diagram 2)

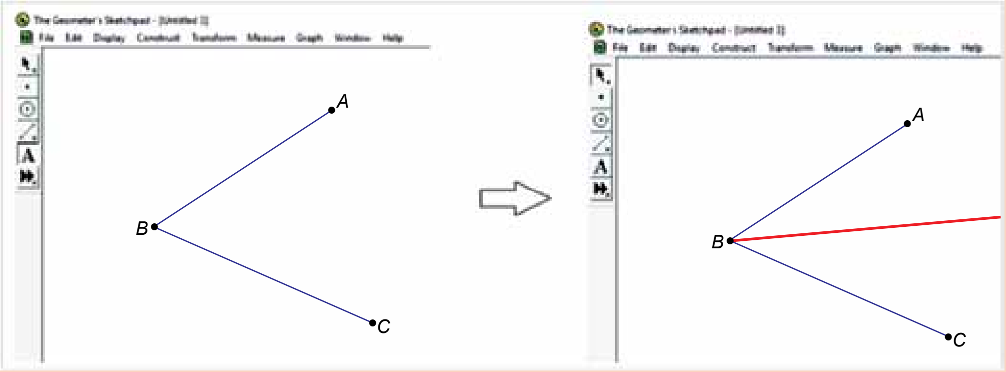


Diagram 1 Diagram 2

Discussion:

What is your conclusion about the locus of points that are equidistant from two intersecting lines?

From Brainstorming 9, it is found that:

The locus of a points that is equidistant from the two straight lines *AB* and *BC* intersecting at the point *B* is a straight line that bisects $\angle ABC$.