# Lesson 1b Resource: Exploring Midpoints (Algebraic and Geometric Approaches)

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Objective:

To collaboratively explore the concept of midpoints using algebraic formulas and geometric representations.

## Instructions:

1. Work in your assigned groups to complete the tasks below.

2. Use both algebraic methods and geometric tools (e.g., Desmos or graph paper) to verify your solutions.

3. Share your findings with the class at the end of the session.

## Background Information:

The midpoint of a line segment connecting two points A(x1, y1) and B(x2, y2) can be calculated using the formula:

Geometrically, the midpoint is the point that divides the segment into two equal parts.

## Group Activity Tasks:

### Task 1: Algebraic Exploration – revision from Y10

1. Calculate the midpoint of the line segment joining the following points:

|  |  |
| --- | --- |
| a. A(2, 3) and B(6, 7) | Solution: M = = (4, 5) |
| b. A(-4, 5) and B(2, -3) | Solution: M = = (-1, 1) |

2. Write a general explanation of how to use the formula for finding midpoints.

### Task 2: Geometric Exploration – should also be revision

1. Plot the points from Task 1 on graph paper or using Desmos. (sample [here](https://www.desmos.com/geometry/1myg4flq7v))

2. Draw the line segment connecting each pair of points.

3. Mark the midpoint as calculated in Task 1 on the graph.

4. Verify geometrically that the midpoint divides the line segment into two equal parts.

5. Does the geometric midpoint agree with the algebraic calculation? Why/why not?

## Task 3: Applying the Midpoint Equation to Vectors

Determine the position vector of midpoint of the line segment AB if A=(2,3) and B=(6,7), using the following notes and instructions…. (ask for teacher help if you get stuck).

A Desmos page has been created to calculate the midpoint of a vector between 2 coordinate points [HERE](https://www.desmos.com/geometry/mtvdtjfdba)

From midpoint theory (explored above), we can calculate the midpoint of a vector line between 2 points as:

M = or M =

| **For our example, use the Desmo resource to verify that the midpoint is at:**  M =  =    (this gives the midpoint as a vector, what we’re all about here, rather than (4,2) which is point-form. |
| --- |

The midpoint formula can be written for vectors from the origin more formally as:

|  |
| --- |
|  |

The correct algebraic method for using the vector mid-point formula is by using these steps on the next page. Read and complete the second example. Keep that page for your reference, and then answer these question.

## Group Discussion and Reflection:

- How do algebraic and geometric approaches complement each other?

- Which method did your group find easier to use, and why?

- Present one key insight or challenge your group encountered during this activity.

***- How does finding the midpoint of 2 points compare with the previous learning activity of finding the length between 2 points? Compare.***

**Present your findings to the class.**

|  |  |
| --- | --- |
|  | **Using the points A(2,3) and B(6,7), find the midpoint of the vector between points A and B** |
| Roughly sketch the points and the joining vector by hand – for reference and in case you mess up the algebra |  |
| Put the points into vector form, cartesian is best (originating from the origin) | OA = 2i + 3j; and OB = 6i+ 7j |
| Plug OA and OB into the midpoint equation |  |
| Using vector addition, group the I and j components to average the components: |  |
| You don’t need the ‘i’ and ‘j’ because you are finding a coordinate (for the midpoint as (x,y), so drop them off and then tidy up |  |
| Tidying up … |  |

**Using these steps as your algebra template, complete the following**

|  |  |
| --- | --- |
|  | Using the points **A(-4, 5) and B(2, -3)**, find the midpoint of the vector between points A and B |
| Roughly sketch the points and the joining vector by hand – for reference and in case you mess up the algebra |  |
| Put the points into vector form, cartesian is best (originating from the origin) |  |
| Plug OA and OB into the midpoint equation |  |
| Using vector addition, group the I and j components to average the components: |  |
| You don’t need the ‘i’ and ‘j’ because you are finding a coordinate (for the midpoint as (x,y), so drop them off and then tidy up |  |
| Tidying up … |  |