(A) Lesson Context

BIG PICTURE of this UNIT:	• mastery with algebraic skills to be used in our work with co-ordinate geometry (midpoint, length, slope) • understanding various geometric properties of quadrilaterals & triangles • how do you really "prove" that something is "true"?

(B) **Lesson Objectives:**

a. Exploring the midpoint and length of a line segment through dynamic geometry software (geogebra)
b. Develop proficiency in analytic/algebraic determination of midpoints of line segments
c. Apply the use of midpoints to problem solving questions

PART 1 – Skills REVIEW/EXPLORTION

(C) **Exploring Midpoint and Length – through graphing and intuition**

a. Use the mini-white boards to graph the following two points: A(0,0) and then B(14,4) and then draw the line segment AB

   i. Decide where the midpoint of the line segment AB should be. Explain/give a reason for your selected location.
   ii. Find the slope of line segment AB.
   iii. Find the angle the line segment makes with the positive x-axis using a protractor.
   iv. How would you determine the length of this line segment?

b. Use the mini-white boards to graph the following two points: C(-4,-6) and then D(8,2) and then draw the line segment CD

   i. Decide where the midpoint of the line segment CD should be. Explain/give a reason for your selected location.
   ii. Find the slope of line segment CD.
   iii. Find the angle the line segment makes with the positive x-axis using a protractor.
   iv. How would you determine the length of this line segment?

c. Use the mini-white boards to graph the following two points: E(-6,4) and then F(3,-5) and then draw the line segment EF

   i. Decide where the midpoint of the line segment EF should be. Explain/give a reason for your selected location.
   ii. Find the slope of line segment EF.
   iii. Find the angle the line segment makes with the positive x-axis using a protractor.
   iv. How would you determine the length of this line segment?

(D) **Exploring Midpoint & length – dynamic geometry software: geogebra**

Open an internet browser ➔ Using the following geometry applet (http://www.geogebratube.org/student/m12412), let's continue to explore how to find the midpoint and the length of line segments

a. Move the end points of the line segment to the given co-ordinates. Use the geogebra animation to determine both the midpoint and the length of the line segment AB in each case.

Point A	(2,5)	(3,6)	(-5,-4)	(-2,-8)	(3,-7)	(-2,9)	(0,-7)
Point B	(-4,7)	(0,-2)	(7,-1)	(-8,6)	(-4,-7)	(-2,2)	(5,0)
Midpoint							
Length							

Q? now, how can you predict where the midpoint should be?
Q? now, how can you calculate the length of a line segment?

b. Now Point A will be fixed at (16,-8) and you will have to move Point B to get to the **requested midpoint** ➔ Record the final position B ➔ Q? how can you predict where Point B should be?

Point A	(16,-8)	(16,-8)	(16,-8)	(16,-8)	(16,-8)	(16,-8)	(16,-8)
Midpoint	(0,0)	(6,-1)	(9,-6)	(12,0)	(0,-3)	(4.5,-4)	(8.5,1.5)
Point B							

Q? how can you predict where Point B should be?

c. CHALLENGE #1: Now Point A will be fixed and you will have to move Point B to get to the **requested length** ➔ Record the final position B ➔ Q? how can you predict where Point B should be?

Point A	(0,0)	(0,0)	(0,0)	(6,-8)	(6,-8)	(6,-8)
Length	3	4	10	5	20	9
Point B						

d. CHALLENGE #2: A line segment has an endpoint at $A(5,2)$ and has a length of 13 units. Determine the co-ordinate(s) of the other endpoint(s). Show the algebraic reasoning/work that leads to your conclusion.

PART 2 – Skills PRACTICE

1. Determine the midpoint of the line segment between $A(1,1)$ and $B(5,9)$
2. Determine the midpoint of the line segment between $A(-1,1)$ and $B(5,5)$
3. Determine the midpoint of the line segment between $A(-2,6)$ and $B(3,-4)$

4. Determine the length of the line segment between $A(1,1)$ and $B(5,9)$
5. Determine the length of the line segment between $A(-1,1)$ and $B(5,5)$
6. Determine the length of the line segment between $A(-2,6)$ and $B(3,-4)$

7. A line segment has an endpoint at A(5,2) and midpoint at M(9,-3). Determine the co-ordinates of the other endpoint. Show the algebraic reasoning/work that leads to your conclusion.

8. On the design plan for a landscaping project, a straight path runs from (11,29) to (53,9). A light is going to be placed halfway along the path.
   i. Draw a diagram that shows the path.
   ii. Determine the co-ordinates of the lamp on your diagram
   iii. The one lamp is not bright enough to illuminate the pathway. So two more lamps will be placed along the path, such that each lamp is placed a quarter of the distance of the path. Determine the coordinates of the other two lamps.

9. A perpendicular bisector of a line segment is a second line that will (i) cut the line segment in half and (ii) be perpendicular to the original line segment. Create a diagram to show this concept. A line segment ends at the points C(-2,0) and D(4,-4). Determine the equation for the perpendicular bisector of line segment CD.

10. A helicopter is travelling from Town A to Town B. A grid is overlaid on the map of this region and Town A is at (-70,770) and Town B is at (220,490) & Town C is the origin.
    i. Draw a diagram that shows the three towns.
    ii. Approximately how far did the helicopter travel?
    iii. What assumption did you make about the route of the helicopter?

11. Triangles can be classified according to the lengths of their sides (scalene, isosceles, equilateral). A given triangle has vertices at A(4,5), B(1,2) & C(6,1).
    i. Determine the lengths of all three sides and then classify the triangle type.
    ii. Construct the triangle on GEOGEBRA.
    iii. Where would you move point C such that you now had an isosceles triangle?