

**(A) Lesson Context**

BIG PICTURE of this UNIT:	<ul style="list-style-type: none"> <li>mastery with algebraic skills to be used in our work with co-ordinate geometry (midpoint, length, slope)</li> <li>understanding various geometric properties of quadrilaterals &amp; triangles</li> <li>how do you really prove that something is “true”?</li> </ul>		
CONTEXT of this LESSON:	Where we've been  You know about geometric figures and now you know how to find a midpoint and length.	Where we are  Becoming proficient with analytical tools to that we can analyze shapes in geometry	Where we are heading  How can I prove various geometric properties of quadrilaterals and triangles?

**(B) Lesson Objectives:**

- Exploring the midpoint and length of a line segment
- Exploring parallel lines and their properties
- Exploring perpendicular lines and their properties.
- Looking at various properties of shapes. Triangles and quadrilaterals.

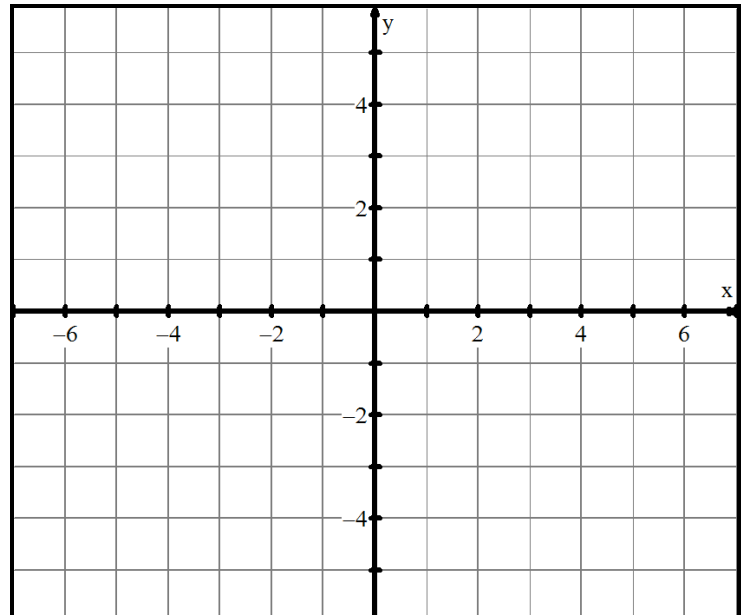
**WARM-UP:**

Given the points A(2,3) B(5,8) C(10,5) and D(7,0) create the line segments AB, BC, CD, DA and then discuss what kind of shape this makes. Can you be certain of the shape that it makes? Could you prove your ideas? Draw a picture of your shape from GeoGebra below.

# IM 1: Geometric Applications | Unit 2 – Coordinate Geometry

1. Given the 4 points  $A(-2,5)$ ,  $B(5,-1)$ ,  $C(-2,-4)$  and  $D(-5,2)$ , answer the following questions:

- a. Graph the 4 points on the grid provided.
- b. Calculate the midpoint of line segment AD.



- c. Calculate the length of line segment CB.

- d. Calculate the slope of line segment DC.

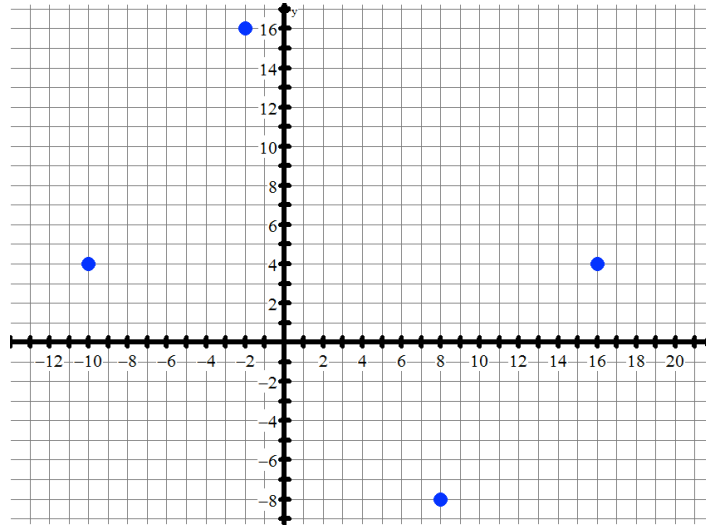
- e. Explain how you that AB is/isn't parallel to CD.

**PART 2 – The Applications – Show your calculations to earn full credit.**

2. A city planner is designing a new park in Maadi. The plan for the rectangular park is shown on the diagram included. The four “corners” of the park are listed:

Label each “corner” with the corresponding coordinate:

- i.  $A(-10,4)$ , ii.  $B(-2,16)$ , iii.  $C(16,4)$  iv.  $D(8,-8)$



For this park, determine:

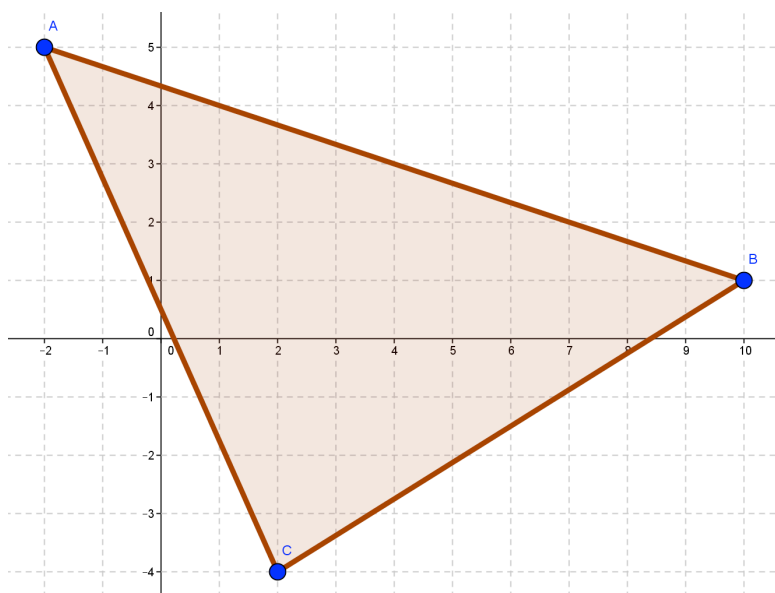
- a. The length and width of the park, in meters, given that 1 unit on the grid represents a distance of 10 meters.
- b. The perimeter of the park.
- c. The total area of the park.

3. The city planner decides to include one walking path within the park. This walking path will connect the midpoint of side AB to corner D (see diagram)

- d. Determine the coordinates of the midpoint of AB and label it as X on the diagram.
- e. Determine the length of the walking path (segment DX) within the park.
- f. Calculate the area of  $\triangle ADX$ .

3. Triangle ABC is shown in the diagram with vertices at  $A(-2,5)$ ,  $B(10,1)$ , and  $C(2,-4)$ . Answer the following questions:

- a. Find the midpoint of BC. Label it as M on the diagram of  $\triangle ABC$



- b. Draw the line segment from vertex A to point M

- c. Find the slope of side BC.

- e. Find the area of this triangle!

- d. Find the slope of segment AM.

- e. Is side BC perpendicular to segment AM? Show appropriate mathematical reasoning to justify why or why not.

**Formula Sheet**

Midpoint:  $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Distance/Length:  $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Slope:  $m = \frac{y_2 - y_1}{x_2 - x_1}$

Area of a rectangle:  $A = \text{length} \times \text{width}$

Area of a triangle:  $A = \frac{\text{base} \times \text{height}}{2}$

Perimeter of a rectangle:  $P = 2l + 2w$