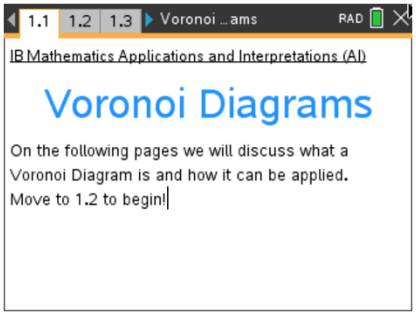
# Voronoi Diagrams

## Student Activity

Name _____

Class _____

**Open the TI-Nspire document *Voronoi_Diagrams.tns.***




The goal of this activity is to make a connection to Topic 3.6 of the curriculum in the course IB Mathematics Applications and Interpretations SL/HL. You will not only create your own Voronoi Diagram on paper and on the TI-Nspire CX II handheld, but you will also practice with what math is needed to make the diagram. Ultimately, you will apply it as you would in an IB Math AI class and on the IB Math AI exam.

**Move through pages 1.2 – 1.5 to learn about Voronoi Diagrams.**

**Move to page 1.6.**

1. What is a circumcenter?

2. Follow the directions to create a circumcenter on page 1.7. Discuss with a classmate what you have made and what possible uses there may be outside of the math classroom.

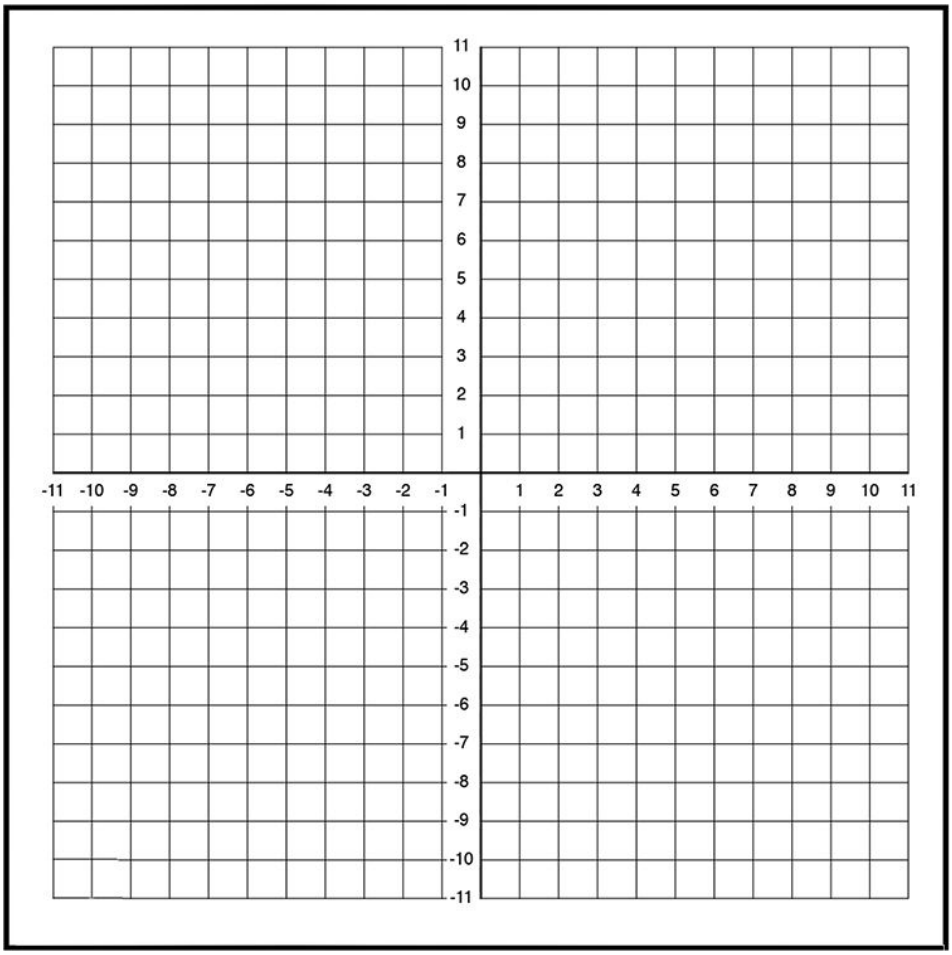
**Move to page 1.8.**

3. On this page, follow the directions to enhance the diagram created on page 1.7.

**Practicing with Voronoi Diagrams**

4. Before you continue with the activity on the handheld, let us practice by creating your own Voronoi Diagram on the following coordinate plane. Follow the directions below.

**Step 1:** Space out five (5) random points on the coordinate plane.
**Step 2:** Connect each of the five points creating triangles. Do not cross any of the lines.
**Step 3:** With a ruler, find the midpoint of each side of each triangle.
**Step 4:** With a ruler, draw a perpendicular bisector through each of the midpoints.
**Step 5:** Draw a point at each of the circumcenters.
**Step 6:** Connect the circumcenters with segments. There should be three line segments coming from each circumcenter. The third line may not connect to another circumcenter but may be drawn along one of the perpendicular bisectors.




5. Discuss with a classmate what you have created. Give several examples of what you think the singular point located in each region you created represents.

**Move to page 1.9.**

6. Now that you have created your own Voronoi Diagram, you will practice one last skill on the handheld before application. Follow the directions on page 1.9 to create a triangle using coordinates and the segment tool on page 1.10.

**Move to page 1.11**

7. You have now created a triangle using 3 coordinates on page 1.10. Find the equation of each line that would pass through each side using the coordinates you selected. Write your equations in the form $ax + by + d = 0$ where $a, b, d \in \mathbb{Z}$.

**Move to page 1.12.**

8. This is another opportunity to enhance your handheld skills. Follow the directions on page 1.12 to learn how to create a more appealing diagram.

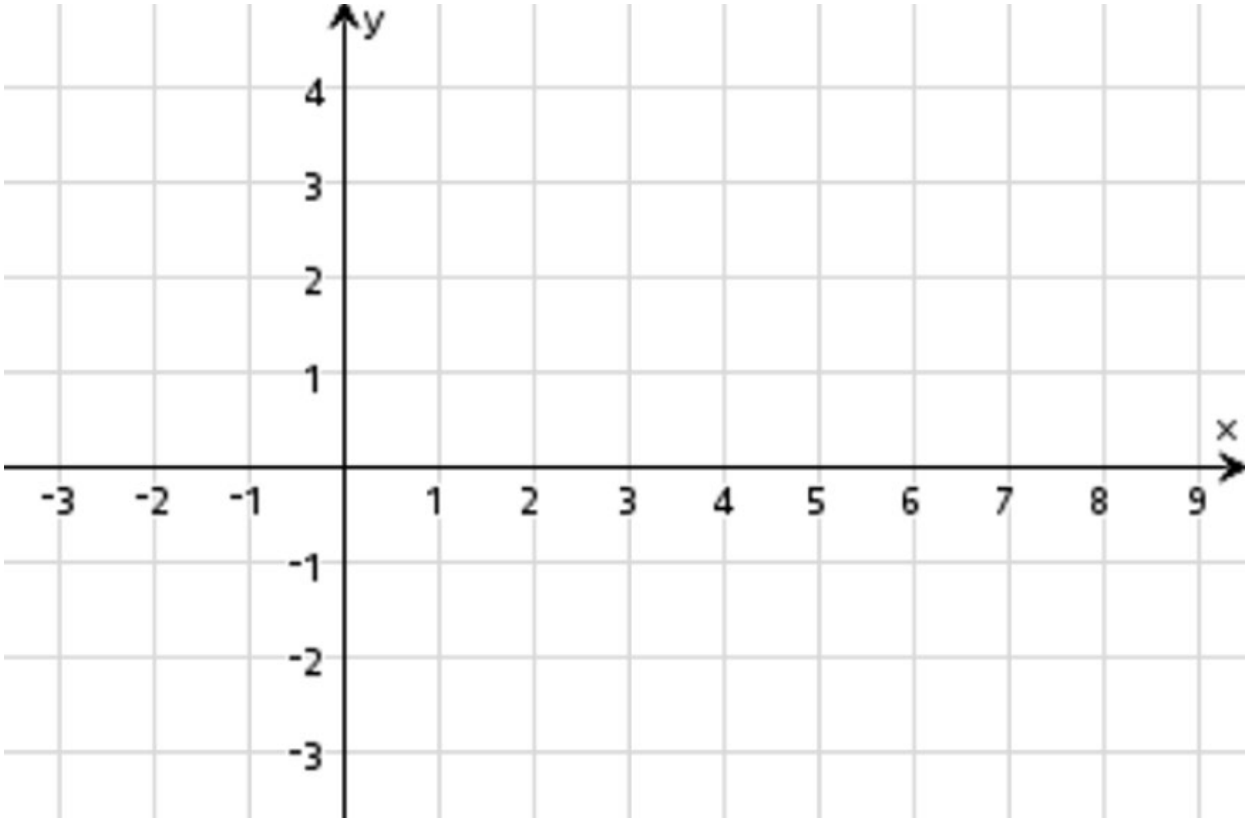
**Extension**

**Move to Page 1.13.**

9. Here is a chance to put all the steps together and create your own Voronoi Diagram on the handheld. Follow the instructions on page 1.13 to create your own diagram on page 1.14. Once finished, discuss with your class what the important features of the diagrams are and where you think they can be applied outside of the mathematics classroom.

**Application**

10. There are five hospitals, A, B, C, D, and E in the city. The coordinates of the hospitals are A(2, 3), B(1, -1), C(5, 4), D(3, 1), and E(4, -2). In order for each hospital to accommodate an equal amount of the population, how should the city be divided into regions so that there is one hospital in each region and this hospital is centrally located for each region? Use the TI-Npsire CX II handheld or the graph paper on the next page to answer this problem.




11. Explain why or why not the location (1, 6) would be a good choice for the city to add another hospital.