How Can Maps Help Us?

Welcome to NSTA's Daily Do

Teachers and families across the country are facing a new reality of providing opportunities for students to ***do*** science through distance and home learning. The **Daily Do** is one of the ways NSTA is supporting teachers and families with this endeavor. Each weekday, NSTA will share a sensemaking task teachers and families can use to engage their students in authentic, relevant science learning. We encourage families to make time for family science learning (science is a social process!) and are dedicated to helping students and their families find balance between learning science and the day-to-day responsibilities they have to stay healthy and safe.

What is Sensemaking?

Sensemaking is actively trying to figure out how the world works (science) or how to design solutions to problems (engineering). Students ***do*** science and engineering through the science and engineering practices. Engaging in these practices necessitates students be part of a learning community to be able to share ideas, evaluate competing ideas, give and receive critique, and reach consensus. Whether this community of learners is made up of classmates or family members, students and adults build and refine science and engineering knowledge together.

Introduction

In today's Daily Do, How can maps help us?, students engage in science and engineering practices and use both patterns and scale, proportion and quantity as a lens to make sense of the phenomenon of changes in landscapes captured on a topographic map. Students have an opportunity to examine and use topographic maps in their respective locals. This task has been designed to be used by students, their families, and teachers in distance learning. While students could complete portions of this task independently, we encourage students to complete portions of this task under adult supervision.

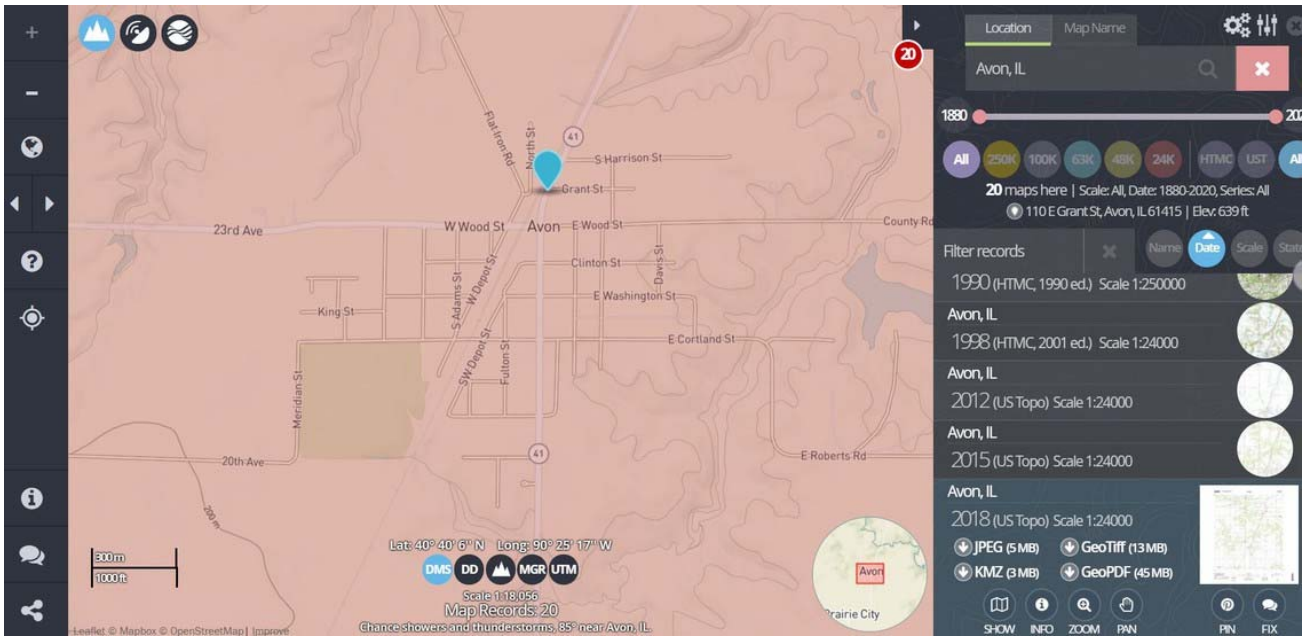
What is a topographic map? (Introduce the Phenomenon)

Use the "Surviving Inside the EcoSphere" handout to guide student thinking throughout this task. This task is adapted from Dr. April Maskiewicz's Ecosphere Problem Tasks. Show students the photograph above to introduce them to EcoSpheres, and then have them answer question 1: *How long do you think the shrimp can survive inside the EcoSphere, and why do you think so?* Their answers and justifications will vary based on their background knowledge. After students answer this question and share their reasoning, show them the video. This video shows shrimp thriving in an EcoSphere 17 months after purchase, and a comment from the EcoSphere owner indicates the shrimp were still "alive and well" 6 years after purchase. After viewing and discussing this second video, have students provide an initial answer to the "Big Question:" *Based on your observations of the EcoSphere, how can the shrimp get the matter and energy they need to survive when they are closed within this system?*

Introduce the idea that we have specialized maps that can show us land features such as hills, valleys, and bodies of water.

Have students go to the United States Geologic Survey TopoView website.

Type in Avon IL in the Location and hit the search icon. Click "Avon, IL" and scroll down until you get to Avon, IL 2018 (US Topo) Scale 1:24000 as seen in the image below.



Choose the JPEG download to continue the activity (**image below**). Allow students to explore the image and record what they Notice and Wonder.

Lead a discussion using the following prompts:

- What do you notice as you look at the map?
- What do you wonder about as you look at the map?

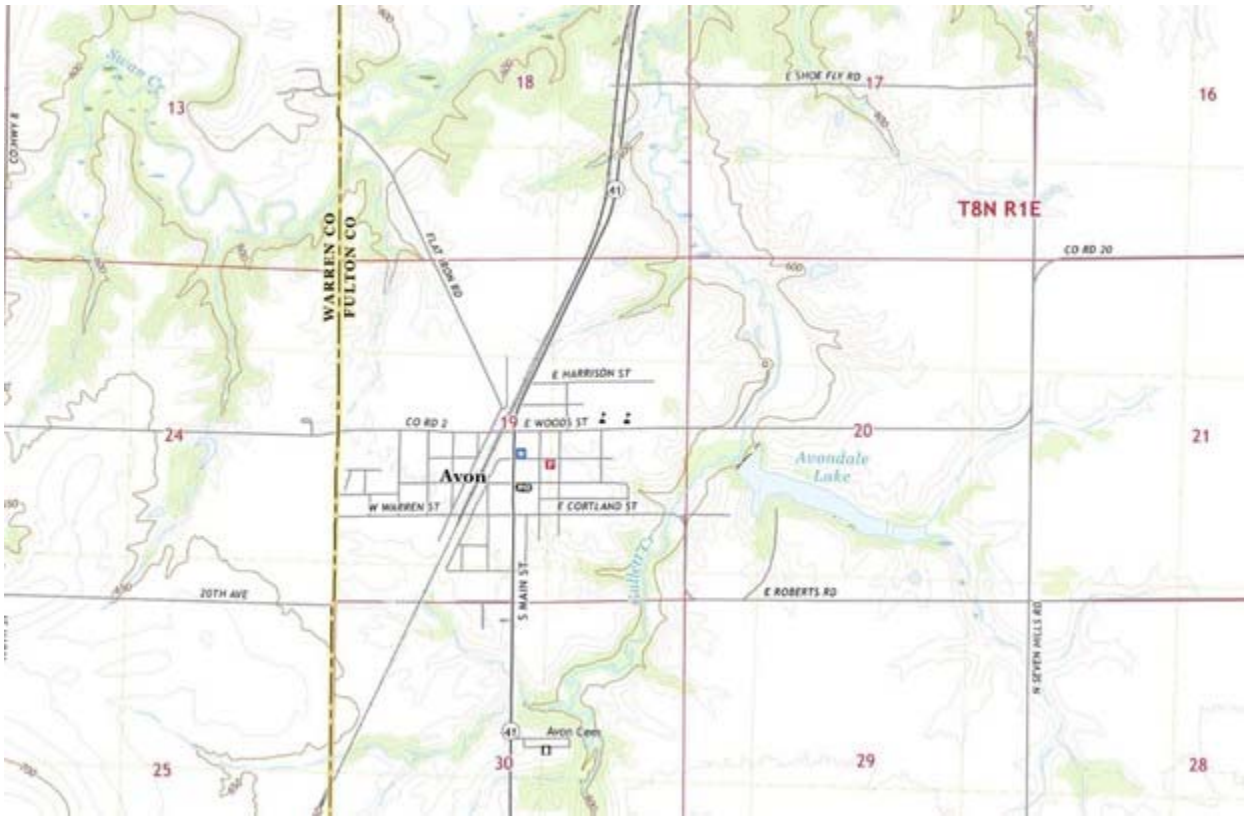
Students may share that they notice:

- There are a lot of squiggly lines.
- The creeks and water are blue.
- Some roads are black lines and others are red lines.
- Some of the squiggly lines have numbers on them.

Students may share that they wonder:

- Why are some of the squiggly lines numbered?
- Why are roads different colors?
- What are the green areas?
- Why are some squiggly lines close together and others are far apart?

Share with students that we will examine what the symbols on the map mean so we can begin to make sense of what we are looking at next.



Teacher Guidance for Reading Topographic Maps:

In the public land survey system, a grid divides the land into numbered townships, ranges, and sections. Each township represents 36 square miles (6 x 6 miles), and is divided into 36 sections (red numbers inside each box, 1 - 36). The ranges refer to how far east or west you are from a principal meridian. For the purposes of this Daily Do, it is helpful to know this so you can find a specific section (red number). For example, on the Avon topo map, the village of Avon is in Section 19 (red number 19) of Township 8 North, Range 1 East (red number abbreviated as T8N R1E).

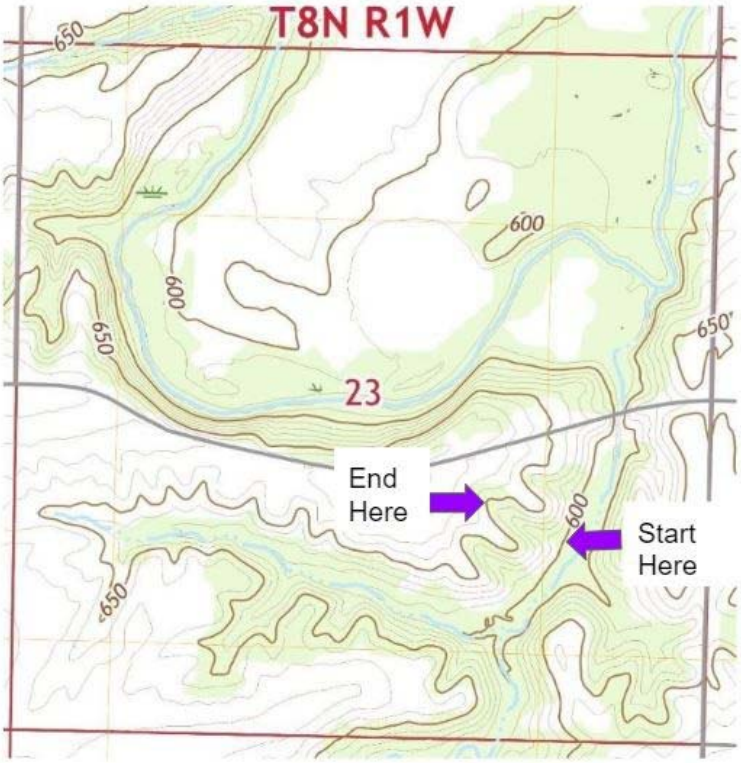
What do the lines mean on a topographic map?

Ask students what they think the lines on the map mean? There are different kinds of lines, so make sure students specify what lines they are talking about. Depending on the age of your students, you may want to show them the video, however, have older students figure out some things on their own or in small groups. Prompt students to look at both the dark lines, faint lines, and the numbers. If needed, prompt students by asking them, 'What do notice between the two dark links or what is the difference in the numbers between the dark lines?' Using what is already on the map, have students figure out what they can. Productive struggle is good; however, there is also a video option.

Video, How to read a topo map by Seth Horowitz

After figuring out how to read the lines on the map (discussion or video), check for understanding by asking students to figure out what the change in elevation between contour lines is on the map

of Avon IL. Students should be able to figure out that there is a difference of 10 m between each contour line. If students struggle, have them look in the box with the red 23 (red numbers are section numbers) found in Warren Co. T8N R1W (**image below**). Students should be able to see two labeled contour lines, 600 and 650. As they count the contour lines between the two labeled contour lines, they should determine there are 4 lines. This means that each line needs to increase by 10m to move from 600 to 650.



What can the contour lines tell us? (Making Sense)

Say, "Now that we know what contour lines are on the map, I want you to find the following places on the map:

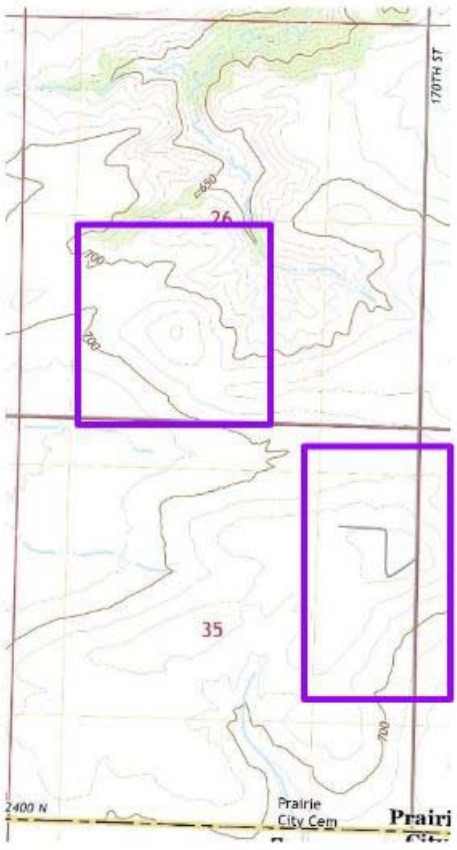
1. Where is the highest point?
2. Where is the lowest point?
3. Use the scale on the map. Imagine you are going to walk a distance of 1000 ft, where on the map would be the steepest climb or descent you would want to avoid? You may want to mark a line on a piece of paper representing 1000 ft using the scale on the bottom of the map for quicker reference.

***Note**: We chose to use feet for this because meters were too long of a distance given the scale of the map and lack of elevation change.**

Allow students some time to work on finding the locations on the map. If students struggle, provide the following supports and use the images below:

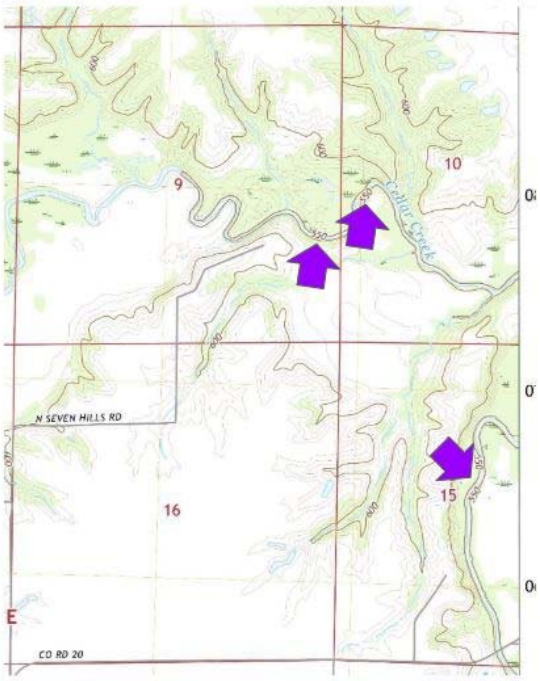
1. The highest points, which are higher than 730 and less than 740, can be found in Warren Co. T8N R1W sections 26 and 35. We say it's between 730 and 740 because there is land inside the 730 line but there is not a 740 line.
2. The lowest points, which are below 550 and above 540, can be found in Fulton Co. sections 9, 10, and 15. We say it's between 550 and 540 because there is land inside the 550 line but there is not a 540 line.
3. The steepest climb or descent is found in Warren Co. T8N R1W section 23 right below the section number. The 1000ft measurement covers 10 contour lines, which is the most number of lines.

Highest Point Guidance



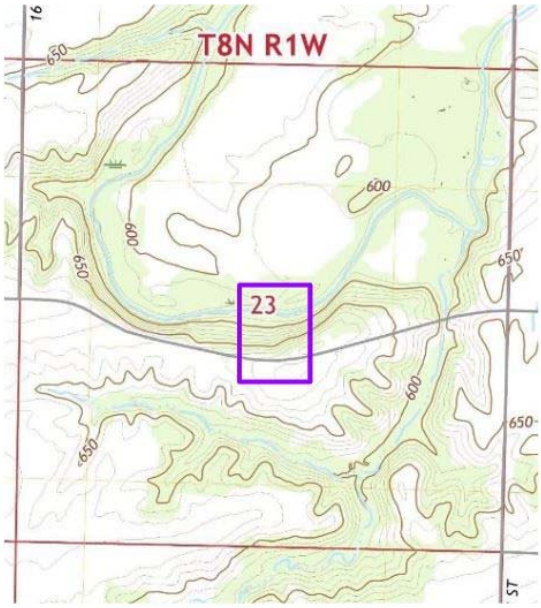
The two highest points on the map can be found inside the purple boxes.

Lowest Point Guidance



The three purple arrows are pointing to the 550m contour line labels found on the map which indicate the lowest point.

Steepest Climb Guidance



The steepest climb over 1000ft can be found starting near the red 23 at the top of the purple box and following to the bottom right portion of the purple box.

What do the other symbols on the map mean?

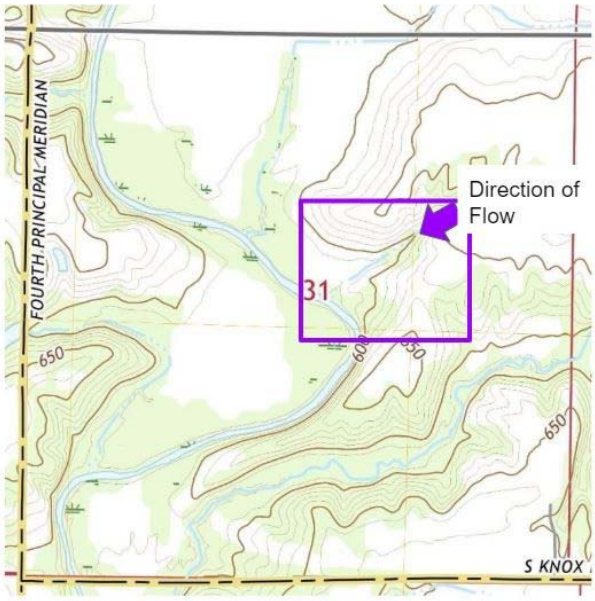
Go to USGS Topographic Map Symbols

Have students use the resource to answer the following questions:

1. Where are there schools on the map?
2. What creek does the railroad cross?
3. Find the symbol "PO," what do you think it stands for? Where can you find them?
4. Which direction does the intermittent stream in Knox Co. section 31 flow?

Allow students some time to work on finding the locations on the map. If students struggle, provide the following supports:

1. The school symbol is very small on the resource, but looks like a building with a flag on the top. Direct students to look in the village of Avon. Students should locate two schools next to each other.
2. The railroad runs through the middle of the map and is parallel to State Route 41. It is easiest to see it at the top of the map. It crosses Cedar Creek in Fulton Co. section 8.
3. The symbol "PO" stands for Post Office. Students should find two of them, one in the village of Avon and one in the village of St. Augustine.
4. Direct students to look in Knox Co. T9N R1E section 31. There are three intermittent streams flowing south or southwest, it will be easiest to look at the one near the red 31. Students need to remember from the video that they should look for a "V" set of contour lines to determine the direction of flow of a stream, creek, or river. The direction of flow of the intermittent stream near the red 31 is southwest. See the **image below** for guidance.



How can we use topographic maps where we live? (Solve a Problem)

Say, "Let's see if we can use topographic maps in our area to plan a trip!" Have students return to the United States Geologic Survey TopoView website using the first link. Type in the name of the

city, town, or village where your students attend school or live. Decide as a group the starting point of your trip and what kind of trip you will take, by foot or by bicycle.
Have students map a trip on foot that would be the most direct route towards a creek or body of water. If students decide to go by bicycle, have them map a trip that would avoid hills.
Allow students to share out the trips they have planned.
If students are able, with adult supervision, have them follow the trip they made and take pictures or video along the way to share.