

Look Up: Discovering Lines

Parallel, Perpendicular, Vertical, and Horizontal Lines

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Grade Level	8th – 9th Grade	**Time Frame**	2 class periods
Subject	Mathematics	**Duration**	90 minutes
Course	Algebra 1		

Essential Question

How can lines build great structures?

Summary

In this lesson, students will build on their knowledge of parallel lines by incorporating perpendicular, vertical, and horizontal lines. The goal is for students to understand the characteristics of different types of lines and then apply their knowledge to design a structure as an architect might. Students will be able to define, recognize, and create a structure using perpendicular, parallel, vertical, and horizontal lines.

Snapshot

Engage

Students watch a video about what an architect does.

Explore

Students investigate different types of lines through a Honeycomb Harvest.

Explain

Students eliminate any misconceptions and begin to understand how to identify parallel, perpendicular, vertical, and horizontal lines.

Extend

Students assume the role of an architect and design a structure using parallel, perpendicular, vertical, and horizontal lines.

Evaluate

Students create a two-minute elevator pitch to present their design to a potential stakeholder.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

A406: Exhibit knowledge of slope

Oklahoma Academic Standards Mathematics (Algebra 1)

A1.A.4.2: Analyze and interpret mathematical models involving lines that are parallel, perpendicular, horizontal, and vertical.

Attachments

- Honeycomb Harvest—Look Up - Spanish.docx
- Honeycomb Harvest—Look Up - Spanish.pdf
- Honeycomb Harvest—Look Up.docx
- Honeycomb Harvest—Look Up.pdf
- Lesson Slides—Look Up.pptx
- Life as an Architect—Look Up.docx
- Life as an Architect—Look Up.pdf
- Life as an Architect—Look-Up - Spanish.docx
- Life as an Architect—Look-Up - Spanish.pdf

Materials

- Lesson Slides (attached)
- Life as an Architect handout (attached; one per student; print two-sided)
- Honeycomb Harvest handout (attached; one cut-out set per group; print one-sided)
- Graph paper
- Pencils
- Colored pencils (optional)
- Student devices with internet access

Preparation

Before beginning this lesson, cut out the hexagons from the attached **Honeycomb Harvest** handout and put them in baggies. Include four blank hexagons in each bag. The number of groups you will have in each class will determine the number of baggies you will need for the activity. The activity should be done with either two or three students per group. This is the preparation needed for the activity during the Explore phase of the lesson.

10 minutes

Engage

Introduce the lesson using the attached **Lesson Slides**. Display **slide 3** to share the lesson's essential question: "How can lines build great structures?" Show **slide 4** to go over the lesson's primary learning objective. Review these slides with students to the extent you feel necessary.

Go to **slide 5** and pass out a copy of the attached **Life as an Architect** handout to each student. Prompt students to think about the following questions as they watch the video, and then play the *Celebrating Architecture: Look Up* video on the slide.

- What does an architect do?
- What skills does an architect need to be successful?

Embedded video

https://www.youtube.com/watch?v=JLhbTGzE6MA

Display **slide 6** and show students the picture of Westminster Abbey. As a whole class, see if anyone knows what the structure is and where it is located.

After you discuss Westminster Abbey's location, have students turn their attention to the architecture itself. With their Elbow Partners, have students talk about what they see. Encourage them to look at the lines and the configuration of the structure. Students should be talking in some manner about parallel, perpendicular, vertical, and horizontal lines.

After a couple minutes, pose the following question: *What would happen if the lines were not perpendicular?* Let students discuss that question with their partners, and then ask different pairs to share out.

20 minutes

Explore

Show **slide 7** and introduce the Honeycomb Harvest strategy. Have students get into groups of 2–3 and pass out baggies with pre-cut hexagons from the attached **Honeycomb Harvest** handout to each group.

Here, students are expected to analyze four vocabulary words (parallel, perpendicular, vertical, and horizontal) and show their relationship to the other concepts—pictures, linear equations, and definitions—by placing related hexagons together to create four honeycombs, one for each vocabulary word.

As they work, students will notice there are four blank hexagons. On these hexagons, explain that groups must create their own representation of each vocabulary word and place it within their designated honeycombs.

Do not rush this portion of the lesson. It may take students some time to analyze and place each hexagon in what they believe is the appropriate honeycomb. Once students create their honeycombs, have them justify their honeycomb placements on the Life as an Architect handout from earlier in the lesson. Have students also describe what they created on each blank hexagon to represent each vocabulary word.

20 minutes

Explain

Display **slide 8**. Make sure all students have completed their honeycombs and are ready to justify their findings. When everyone is ready, bring the class back together. Ask each group to share out their answers to the following questions:

- Where did you place your hexagons and why? (Share *only one* honeycomb scenario.)
- What did you create on the blank hexagon for the honeycomb scenario you just shared? Why?

At this point, do not try to correct anyone if they placed a hexagon in the “wrong” honeycomb. Some of the hexagons may fit in more than one honeycomb depending on how you view them, but the definitions should be with their respective vocabulary words. Just let students talk about their analysis while you jot down different misconceptions they have.

Show **slide 9**. Using the information students learned from the Honeycomb Harvest, have students help you place the definitions and examples in the different columns on the slide. Depending on the examples or the misconceptions you noticed earlier, you may have to elaborate on these lists to meet students' needs. Use this time to focus on slope and resolve misconceptions. Make sure students understand that parallel lines have the same slope; perpendicular lines have slopes that are the negative reciprocal of each other (or have a product of negative one); vertical lines have an undefined slope; and horizontal lines have a slope of zero.

30 minutes

Extend

Display **slide 10**. After students understand what it means to have lines that are parallel, perpendicular, vertical, and horizontal, they will return their focus to the career of the architect. Direct students' attention back to the Life as an Architect handout.

Have students think about where they would want to leave their mark in the world by creating a structure in that location. The structure may be in any location and may be used for any function. Let students be creative with what they want to design.

Once students decide on the location and the function of the structure, have them start to sketch their drawing of the building. Students may draw any structure they want, but it must include two sets of perpendicular lines, two sets of parallel lines, two vertical lines, and two horizontal lines.

After students have created a rough sketch of their structure, have them copy it on graph paper. Have students show which lines are perpendicular, parallel, vertical, and horizontal by labeling the slope of each line. Remind them that architects have to be very precise in their dimensions and drawing to keep a building structurally sound. Let students be creative with what they want to design; consider having students use colored pencils.

10 minutes

Evaluate

Teacher's Note: Using Padlet

Padlet is an online community classroom that allows students to post videos in response to prompts. Padlet is free, but it requires you to set up your virtual classroom beforehand. Once your virtual classroom is created, students may join by following a link that you share with them. Next, add a topic, share a link to the topic, and invite students to post a video with their responses. Students will be able to view one another's posted videos.

Show **slide 11**. To introduce the closing activity, address the importance of architecture beyond the lines and structural considerations.

Display **slide 12**. Let students know they will use Padlet to role-play with a potential client who wants to invest in a new property.

Have students create a two-minute Elevator Speech to highlight the benefits of their design and explain why they think the client should invest in their design. Remind students that they must include some of their mathematical reasoning for why the building will be safe and secure.

Resources

- AIANational. (2014, December 12). *Celebrating Architecture: Look Up* [Video]. YouTube. https://www.youtube.com/watch?v=JLhbTGzE6MA
- K20 Center. (n.d.). Elbow Partners. Strategies. https://learn.k20center.ou.edu/strategy/116
- K20 Center. (n.d.). Elevator Speech. Strategies. https://learn.k20center.ou.edu/strategy/57
- K20 Center. (n.d.). Honeycomb Harvest. Strategies. https://learn.k20center.ou.edu/strategy/61
- K20 center. (n.d.). Padlet. Tech Tools. https://learn.k20center.ou.edu/tech-tool/1077