



Visualizing Pathways Day 1

Introduction

This activity is an opportunity for students to think visually to make sense of the different pathways connecting two points on a geometric solid. Students work to justify a pathway as the shortest and develop their reasoning using multiple pieces of evidence.

Agenda

Activity	Time	Description/Prompt	Materials
Mindset Message	10 min	Play the mindset video, <i>The Importance of Struggle</i> , https://youcubed.org/weeks/week-4-grade-9-12/	Mindset Video day 1, <i>The Importance of Struggle</i>
Launch	10 min	<ul style="list-style-type: none"> Introduce the activity to students. Have groups select a geometric solid to start with. 	<ul style="list-style-type: none"> Visualizing Pathways handout Geometric solids or paper nets
Investigate	30 min	<ul style="list-style-type: none"> Investigate the different geometric solids and pathways. Record conjectures and justifications. 	<ul style="list-style-type: none"> Maths journals Pencils
Discuss	15 min	Share possible pathways and conjectures and justifications for the shortest pathway.	
Debrief Mindset Message	5 min	Ask students to reflect on the struggles they had while they explored the activity. Invite them to share the moments when they were challenged the most and what they learned from going through that challenge. Remind them of the idea that they are learning the most when they are struggling at the edge of their understanding.	

For the teacher

Students do not have enough opportunity to build and explore three-dimensional shapes. Often students are asked to focus on the shortest distance between two points without being asked to think about the path on the surface of an object. This activity asks students to focus on the surface of the object and the distance between two points on the surface. Focusing on the surface is a nice way to introduce a branch of mathematics called topology. This is an exciting area of mathematics many know nothing about. If you would like to share more about topology with your students, we recommend you ask them to search the term and share their findings with their classmates.

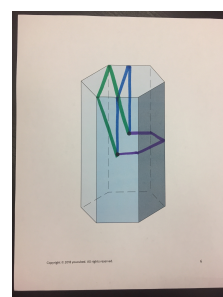
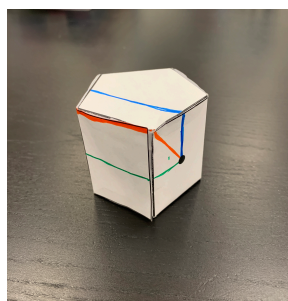
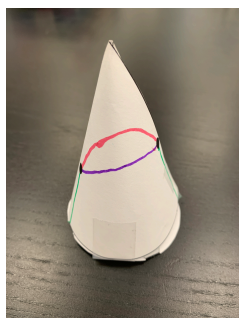
Setting up the activity

There are two sets of geometric solid paper nets included with this activity. One set of solids has two points placed on different faces for each solid. Students will explore the different pathways they can create between the two points on the faces of the solid. Their goal is to determine the shortest path on the solid between the two points and develop a convincing argument to justify how they know the path is the shortest possible. The other set of solids does not have points placed on the faces. Students will place their own points and explore the different pathways between the two points. Consider deciding what you want students to focus on during this activity. You might make both sets of solids available and give groups the choice to decide what they want to explore. You might also have groups first explore the solids with points and then move to the solids without points.

Activity

Set students up to work in groups. Let them know that working in groups on this activity is beneficial because it allows them to see and discuss lots of possibilities which allows them to explore many different ways to visualize this problem and justify their conjectures.

Introduce the problem by showing any of the geometric solids and telling students they will be exploring the question, "What is the shortest pathway between two points on a given solid traveling on the surface?" Show them the points on the solid. Tell them they will need to develop justifications for their conjectures about which pathway they believe is the shortest. Emphasize that the goal of this activity is to develop convincing arguments about which pathway is shortest. Encourage them to use multiple methods to represent the length of the different pathways they explore.



Invite groups to decide which geometric solid they would like to start with. Encourage them to select a solid they think would be challenging. You may want to have a set of wood or plastic solids for students



to reference during the activity. We have included paper nets so students can make their own. You may want to include more than one copy so students can build more than one example.

As groups are exploring, suggest they record the different pathways, conjectures, and justifications in their maths journal. Encourage groups to be specific in their conversations about how they know the pathway is the shortest, which will help them write thorough justifications. Invite students to think visually and algebraically about ways to represent the length of the pathways in order to compare them.

Once groups have explored 2-3 shapes bring the class together. Invite groups to share their conjectures and justifications for the shortest pathways.

Visualizing Pathways

What is the shortest pathway between two points on a given solid traveling on the surface?

