Prove Me Wrong

Two-Column and Paragraph Proofs

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Published by *K20 Center*

Grade Level	9th – 10th Grade	**Time Frame**	115 minutes
Subject	Mathematics	**Duration**	1-2 class periods
Course	Geometry		

Essential Question

How can we use our knowledge of definitions, theorems, and postulates to justifying our reasoning?

Summary

In this lesson, students will use legal, game, and content based methods to understand how to create proofs.

Snapshot

Engage

Students use Chat Stations to discuss how they argue and how arguments can be made stronger and weaker.

Explore

Students watch a movie clip of a court scene and work as partners to construct the line of questioning and the corresponding reasons in a table. The whole class discusses the argument in the movie clip and determines how effective it is.

Explain

Students complete guided notes over the types of proofs, list reasons for proofs, and practice answering proofs.

Extend

Students work in small groups to complete a card matching activity to complete proofs.

Extend — ICAP

Students watch a video interview to understand how the legal field uses proofs.

Evaluate

Students use the GUS strategy to complete a proof on their own.

Standards

Oklahoma Academic Standards Mathematics (Geometry)

G.RL.1.1: Use undefined terms, definitions, postulates, and theorems in logical arguments/proofs.

Attachments

- Closing Argument Task Cards Teacher's Guide—Prove Me Wrong.docx
- Closing Argument Task Cards Teacher's Guide—Prove Me Wrong.pdf
- Closing Argument Task Cards—Prove Me Wrong - Spanish.docx
- Closing Argument Task Cards—Prove Me Wrong - Spanish.pdf
- Closing Argument Task Cards—Prove Me Wrong.docx
- Closing Argument Task Cards—Prove Me Wrong.pdf
- Cross-Examination Card Sets—Prove Me Wrong - Spanish.pdf
- Cross-Examination Card Sets—Prove Me Wrong.pdf
- Cross-Examination Key—Prove Me Wrong.docx
- Cross-Examination Key—Prove Me Wrong.pdf
- Cross-Examination Records—Prove Me Wrong - Spanish.docx
- Cross-Examination Records—Prove Me Wrong - Spanish.pdf
- Cross-Examination Records—Prove Me Wrong.docx
- Cross-Examination Records—Prove Me Wrong.pdf
- Evidence Guided Notes (Model Notes)—Prove Me Wrong.docx
- Evidence Guided Notes (Model Notes)—Prove Me Wrong.pdf
- Evidence Guided Notes—Prove Me Wrong - Spanish.docx
- Evidence Guided Notes—Prove Me Wrong - Spanish.pdf
- Evidence Guided Notes—Prove Me Wrong.docx
- Evidence Guided Notes—Prove Me Wrong.pdf
- Lesson Slides—Prove Me Wrong.pptx
- Opening Statements Posters—Prove Me Wrong.docx
- Opening Statements Posters—Prove Me Wrong.pdf
- Witness Testimony Sample Response—Prove Me Wrong.docx
- Witness Testimony Sample Response—Prove Me Wrong.pdf
- Witness Testimony—Prove Me Wrong - Spanish.docx
- Witness Testimony—Prove Me Wrong - Spanish.pdf
- Witness Testimony—Prove Me Wrong.docx
- Witness Testimony—Prove Me Wrong.pdf

Materials

- Lesson Slides (attached)
- Writing utensil
- Sticky notes
- Opening Statements Posters (attached)
- Witness Testimony handout (attached; one per student)
- Witness Testimony Sample Response document (attached)
- Evidence Guided Notes handout (attached; one per student)
- Evidence Guided Notes (Model Notes) document (attached)
- Cross-Examination Card Sets handout (attached; one per group)
- Cross-Examination Records handout (attached; one per group)
- Cross-Examination Key document (attached)
- Closing Arguments Task Cards (attached; one card per student)
- Closing Arguments Task Cards Teacher’s Guide (attached)

- UNO cards (optional)

20 minutes

Engage

Teacher's Note: Lesson Preparation

Prior to beginning the lesson, print the attached **Opening Statements Posters** and display them around the classroom. Print enough copies so that there are three to four students per poster.

Use the attached **Lesson Slides** to guide the lesson. Review the essential question and learning objective on **slides 3** and **4**.

Transition to **slide 5** and introduce the Chat Stations strategy. Place students into groups of three to four and have each group stand by one of the attached **Opening Statements Posters** and provide each student with three sticky notes.

Have each group discuss the question on their poster, write their answer on a sticky note, and place it near the poster.

Next, have students rotate to the next poster and repeat the process. After each group has answered all the questions, have them return to the poster at which they started. Have students to read all of the sticky notes and organize them by similar ideas.

Ask each group to share what the sticky notes at their poster say and what they notice about the responses.

When all groups have shared, have students return to their seats.

20 minutes

Explore

Display **slide 7** prepare to show the *Legally Blonde* scene to students. Set the scene by explaining that the lead character, Elle, is a law student and is defending her client, who is accused of murder. Inform students that in this part of the scene, Elle is asking a witness questions to prove that her client is not guilty of murder. Ask students to evaluate Elle's argument by listening for strong points she makes and places she could have improved.

Embedded video

https://youtube.com/watch?v=GSu7BGbyJqc

After playing the video, move to **slide 8** and have students get into pairs.

Pass out a copy of the attached **Witness Testimony** handout to each pair and give time for students to work through the handout.

Sample Student Responses

Use the attached **Sample Witness Testimony** document to view possible reasons and lines of questioning.

Display **slide 9** to write in information for students or walk around the room and assist as needed.

When students are finished, transition through **slides 10-13** and facilitate a whole-class discussion over the four questions.

Teacher's Note: Guiding the Lesson

At this point in the lesson ensure that students understand that effective arguments happen in a logical order. Explain that people are less likely to agree with your argument if you do not explain yourself, or jump to the conclusion.

Optional Additional Activity

If time allows, unhide **slides 14-19** and complete the UNO Proofs activity.

Display **slide 14** and ask students if they are familiar with the game UNO. Review the rules for students who are not familiar with them.

Have students use the rules of UNO to predict how the game was played based on the given information. Encourage students to justify their order by using the game rules as reasons.

Move to **slide 15** and show students a sample response for the previous slide. Ask students how their descriptions are similar, and how they are different.

Repeat the process with **slides 16-19**, encouraging students to begin organizing their ideas in a table format as shown on the slide**.** Explain that this idea mimics mathematical proofs in the way there will be multiple correct answers. As long as the rules of UNO are followed correctly, a student's order of playing the cards is correct.

Consider investigating with the class how many possible answers there are for the proof.

30 minutes

Explain

Teacher's Note: Lesson Preparation

Prior to the lesson, review the reasons that are used in the proofs and ensure that students have been taught the meanings and uses of each one. If they have not, review them during this lesson.

Display **slide 20** and give each student a copy of the attached **Evidence Guided Notes** handout. Using the attached **Evidence Guided Notes (Model Notes)** document for guidance, review the definition of "proof" and "justify" with students and ask them to write these definitions on their handout. These two terms are related because a student writes a proof by "laying out their mathematical thoughts and processes step by step" in order to prove a statement is true.

Move to **slide 20** and explain that proof writers will categorize proofs based on the class that type of math is taught in. For example, algebraic proofs contain math and reasons commonly taught in algebra classes, while geometric proofs contain math and reasons commonly taught in geometry classes. These classifications serve no purpose other than to guide student towards possible reasons to use in their proof.

Move to **slide 21** and review the definitions that explain the difference between two-column and paragraph proofs. Have students write the types of proofs on their handout.

Move to **slide 22** and show the examples of both types of proofs. Point out that a two column proof and paragraph proof contain the same information, but differ in structure. Ask students the following questions to guide them in understanding these differences:

- Look at the first statement and reason in the two-column proof. Where does that information appear in the paragraph proof?
- Does the information appear in the same order in both the two-column proof and the paragraph proof?
- Look at the last two sentences of the paragraph proof. Would you make any changes?
- Which type of proof do you prefer? Why?

Optional Lesson Addition

There are three types of proofs: two-column, paragraph, and flowchart proofs. Two-column and paragraph proofs are most commonly used, and are consequently featured in this lesson. Consider adding flowchart proofs to this lesson if you would like students to use this format as well.

Display **slide 23** and direct students to look at the same information on their handout. Ask them to put a check mark next to all of the vocabulary words that they remember, and put a star next to any terms they do not know. Walk around the room and determine if any terms need to be reviewed.

Move to **slide 23** and informally review any terms needed by asking the students to define it and describe how it is used.

Move to **slide 24** and repeat this process with the terms "postulates" and "theorems".

Teacher's Note: Guiding the Lesson

This Reasons Word Bank was created using all proofs provided in the resources for this lesson. If you do not use all of the proofs, there will be some reasons in this table that do not get used.

Transition through **slides 25-26** and use the statements to ensure that students understand where reasons come from and why proofs can look different before moving on to examples.

Display **slide 27** and ask students to solve the algebra problem. Ask them to list each step in the equation in the left column of the provided table.

After students have had an opportunity to solve the problem, transition through **slides 27-31** and help students make the connection between solving the problem and constructing the proof.

Transition through **slides 32-39** and explain the steps of creating a proof.

After students construct a two-column proof, give them time to transfer the same information into a paragraph format. Each student's paragraph can differ slightly as long as it contains the same information as the two-column proof.

If time allows or students need more practice, unhide **slides 40-45** and allow students to complete more proofs.

When students are finished, have them add their work to their math notebook if that is a classroom norm.

Teacher's Note: Guiding the Lesson

If students have difficulty deciding on a reason, have them look back at their Reasons Word Bank and use one of those reasons.

30 minutes

Extend

Teacher's Note: Lesson Preparation and Customization

This activity is designed to meet your pacing needs. Students will be completing a card matching activity in which they match statement and reason cards to a two-column proof card. Before printing the handouts, identify which type of proofs you would like to be the focus of the lesson. Print the following pages of each handout to align to the following topics:

- **Algebraic Proofs:** Cross Examination Cards (pages 1-5) and Cross Examination Cards Record (page 1)
- **Angle Proofs:** Cross Examination Cards (pages 6-10) and Cross Examination Cards Record (page 2)
- **Segment Proofs:** Cross Examination Cards (pages 11-15) and Cross Examination Cards Record (page 3)
- **Similar Triangle Proofs:** Cross Examination Cards (pages 16-19) and Cross Examination Cards Record (page 4)
- **Congruent Triangle Proofs:** Cross Examination Cards (pages 20-25) and Cross Examination Cards Record (pages 5-6)
- **Parallel Lines Proofs:** Cross Examination Cards (pages 26-30) and Cross Examination Cards Record (page 7)

Once you have decided on a proof type, cut out the individual statement and reason cards. The two-column proof cards do not need to be cut out, since there is only one per page.

Use paperclips or storage bags to keep the proof set and the answers grouped together. Additionally, consider printing on card stock paper so that the cards can be reused.

Have students move into groups of three or four. Display **slide 46** and pass out a copy of the **Cross-Examination Card Sets** and **Cross-Examination Records** handouts to each group. Introduce the Card Matching strategy and have students match the missing statements and reasons with the provided cards. Direct groups to record their results on the handout.

As groups match the cards, use the attached **Cross-Examination Key** document to check students' work and ask them to look back at any proofs that are not correct.

If time allows, move to **slide 47** to show students the video interview with a criminal defense attorney to understand how proofs are used by the justice system.

Embedded video

https://youtube.com/watch?v=RW4SVMW5pgg

15 minutes

Evaluate

Teacher's Note: Lesson Preparation

Prior to the lesson, print and cut out the attached **Closing Arguments Task Cards** handout. Use the attached **Closing Arguments Task Cards Teacher's Guide** for example response and to determine which proofs are developmentally appropriate for your students.

Display **slide 48** and give each student one task card from the attached **Closing Arguments Task Cards** handout. Instruct students to complete the proof on their task card. They can use the back of the card or on a separate sheet of paper if additional space is needed.

After students have completed their proofs, move to **slide 49** and have them use the GUS Method to share their feelings about the answer that they have provided. Have students add their GUS response under their proof.

Sample Student Responses

See the attached **Closing Arguments Task Cards Teacher's Guide** for possible proof responses.

Resources

- K20 Center. (n.d.). Card Matching. Strategies. https://learn.k20center.ou.edu/strategy/1837
- K20 Center. (n.d.). Chat Stations. Strategies. https://learn.k20center.ou.edu/strategy/944
- K20 Center. (n.d.). Elbow Partners. Strategies. https://learn.k20center.ou.edu/strategy/116
- K20 Center. (n.d.). GUS Method. Strategies. https://learn.k20center.ou.edu/strategy/76
- K20 Center. (2022, September 22). *K20 ICAP - Prove Me wrong* [Video]. YouTube. https://www.youtube.com/watch?v=RW4SVMW5pgg
- Movieclips. (2015, November 30). *Legally blonde (2001) - Elle wins! scene (11/11) | Movieclips* [Video]. YouTube. https://www.youtube.com/watch?v=GSu7BGbyJqc