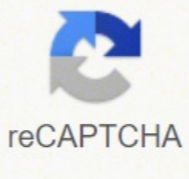




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How prove two lines are parallel

If you're seeing this message, it means we're having trouble loading external resources on our website. If you're behind a web filter, please make sure that the domains *.kastatic.org and *.kasandbox.org are unblocked. How can you prove two lines are actually parallel? As with all things in geometry, wiser, older geometers have trod this ground before you and have shown the way. By using a transversal, we create eight angles which will help us. What Makes Lines Parallel? Two lines are parallel if they never meet and are always the same distance apart. Both lines must be coplanar (in the same plane). To use geometric shorthand, we write the symbol for parallel lines as two tiny parallel lines, like this: $l \parallel m$. For example, to say line l is parallel to line m , we write: $l \parallel m$. What are Parallel Lines in Real Life? If you have ever stood on unused railroad tracks and wondered why they seem to meet at a point far away, you have experienced parallel lines (and perspective!). If the two rails met, the train could not move forward. Other parallel lines are all around you: Street markings Crosswalks Bookshelves Notebook paper Parallel Lines Cut By A Transversal A line cutting across another line is a transversal. When cutting across parallel lines, the transversal creates eight angles. Create a transversal using any existing pair of parallel lines, by using a straightedge to draw a transversal across the two lines, like this: Proving Lines are Parallel Those eight angles can be sorted out into pairs. Let's label the angles, using letters we have not used already: Angles In Parallel Lines These eight angles in parallel lines are: Corresponding angles Alternate interior angles Alternate exterior angles Supplementary angles Every one of these has a postulate or theorem that can be used to prove the two lines MA and ZE are parallel. Let's go over each of them. Corresponding Angles The Corresponding Angles Postulate states that parallel lines cut by a transversal yield congruent corresponding angles. We want the converse of that, or the same idea the other way around: If a transversal cuts across two lines to form two congruent, corresponding angles, then the two lines are parallel. To know if we have two corresponding angles that are congruent, we need to know what corresponding angles are. In our drawing, transversal OH sliced through lines MA and ZE , leaving behind eight angles. Each slicing created an intersection. If one angle at one intersection is the same as another angle in the same position in the other intersection, then the two lines must be parallel. Two angles are corresponding if they are in matching positions in both intersections. In our drawing, the corresponding angles are: $\angle B$ and $\angle G$, $\angle C$ and $\angle J$, $\angle F$ and $\angle L$, $\angle D$ and $\angle K$. If you check only a single pair of corresponding angles and they are equal, then the two lines are parallel. Alternate Angles Alternate angles as a group subdivide into alternate interior angles and alternate exterior angles. Exterior angles lie outside the open space between the two lines suspected to be parallel. Interior angles lie within that open space between the two questioned lines. In our drawing, $\angle B$, $\angle C$, $\angle K$ and $\angle L$ are exterior angles. Can you identify the four interior angles? Did you say $\angle D$, $\angle F$, $\angle G$ and $\angle J$? Alternate angles appear on either side of the transversal. They cannot by definition be on the same side of the transversal. In our drawing, $\angle B$ is an alternate exterior angle with $\angle L$. $\angle D$ is an alternate interior angle with $\angle J$. Can you find another pair of alternate exterior angles and another pair of alternate interior angles? Here are both pairs of alternate exterior angles: $\angle B$ and $\angle L$, $\angle C$ and $\angle K$. Here are both pairs of alternate interior angles: $\angle D$ and $\angle J$, $\angle F$ and $\angle G$. Alternate Exterior Angles If just one of our two pairs of alternate exterior angles are equal, then the two lines are parallel, because of the Alternate Exterior Angle Converse Theorem, which says: If two lines are cut by a transversal and the alternate exterior angles are equal, then the two lines are parallel. Angles can be equal or congruent; you can replace the word "equal" in both theorems with "congruent" without affecting the theorem. So if $\angle B$ and $\angle L$ are equal (or congruent), the lines are parallel. You could also only check $\angle C$ and $\angle K$; if they are congruent, the lines are parallel. You need only check one pair! Alternate Interior Angles Just like the exterior angles, the four interior angles have a theorem and converse of the theorem. We are interested in the Alternate Interior Angle Converse Theorem: If two lines are cut by a transversal and the alternate interior angles are equal (or congruent), then the two lines are parallel. So, in our drawing, if $\angle D$ is congruent to $\angle J$, lines MA and ZE are parallel. Or, if $\angle F$ is equal to $\angle G$, the lines are parallel. Again, you need only check one pair of alternate interior angles! Supplementary Angles Supplementary angles add to 180° . Supplementary angles create straight lines, so when the transversal cuts across a line, it leaves four supplementary angles. When a transversal cuts across lines suspected of being parallel, you might think it only creates eight supplementary angles, because you doubled the number of lines. Not true! It creates more than eight! In our main drawing, can you find all 12 supplementary angles? Around the top intersection: $\angle B$ and $\angle C$, $\angle C$ and $\angle F$, $\angle F$ and $\angle D$, $\angle D$ and $\angle B$. Around the bottom intersection: $\angle G$ and $\angle J$, $\angle J$ and $\angle L$, $\angle L$ and $\angle K$, $\angle K$ and $\angle G$. Those should have been obvious, but did you catch these four other supplementary angles? $\angle B$ and $\angle K$, $\angle L$ and $\angle C$, $\angle F$ and $\angle J$, $\angle D$ and $\angle G$. These four pairs are supplementary because the transversal creates identical intersections for both lines (only if the lines are parallel). The last two supplementary angles are interior angle pairs, called consecutive interior angles. Consecutive Interior Angle Converse Theorem If two lines are cut by a transversal and the consecutive interior angles are supplementary, then the two lines are parallel. Consecutive exterior angles have to be on the same side of the transversal, and on the outside of the parallel lines. So, in our drawing, only these consecutive exterior angles are supplementary: $\angle B$ and $\angle K$, $\angle L$ and $\angle C$. Keep in mind you do not need to check every one of these 12 supplementary angles. Just checking any one of them proves the two lines are parallel! Lesson Summary After careful study, you have now learned how to identify and know parallel lines, find examples of them in real life, construct a transversal, and state the several kinds of angles created when a transversal crosses parallel lines. Those angles are corresponding angles, alternate interior angles, alternate exterior angles, and supplementary angles. Using those angles, you have learned many ways to prove that two lines are parallel. Next Lesson: How to Construct Parallel Lines In order to continue enjoying our site, we ask that you confirm your identity as a human. Thank you very much for your cooperation. CC0/Pixabay "Are you a camera? Because every time I look at you I smile." Some people may find this flattering while others will find it more cringe-worthy. Pick-up lines are generally used to show interest in another person, but they can range from being extremely corny, funny and even sweet to overly sexual and degrading. Here is a look at a wide range of pick-up lines used in well-known films and by famous people as well as a few tips on how to actually use a pick-up line. Pick-Up Lines in Film Pick-up lines have been around for decades and have even made it into mainstream media. Michael Curtiz's film, Casablanca (1942), is a classic romantic film that has stood the test of time. While the orchestra is playing in the background over an unfolding romantic scene, Ilsa, played by Ingrid Bergman, looks into her old flame's eyes, Rick Blaine, played by Humphrey Bogart, and says, "Was that cannon fire, or is my heart pounding?" Classy. Another RomCom, Hitch (2005), is full of pick-up lines. One of the most memorable being, "I couldn't help but notice that you look a lot like my next girlfriend." Thelma and Louise (1991), has a scene where cowboy JD, played by Brad Pitt, says to Thelma (Geena Davis), "I may be an outlaw, darlin' but you're the one stealin' my heart." And what about this classy line in Couples Retreat (2009). "Do you have a cell phone I could use? Why? Someone has to call God and tell him that one of his angels is missing." Famous People Use Them Too Pick up lines aren't just used by the average Joe either. Ray Kroc is said to have used this line once or twice: "Watching you on the dance floor has made me think that maybe you could use some fries with that shake. I turned McDonald's into a nationwide restaurant chain, so I've got plenty of fries and shakes." Reggae musician, Bob Marley was known for his flirtatious personality with women and is reported to have used the line, "Are you Jamaican? Because Jamaican me crazy." Even Neil Armstrong had a few lines kept in his back pocket. "Do you come here often? I was the first one here. If by here you mean the moon." It All Depends on Personality The success or failure of a good pick-up line lies heavily on the personalities of the deliverer and receiver. For example, say someone goes up to a person and says, "Do you have sunburn, or are you always this hot?" A person that is extremely outgoing and energetic may respond completely different to this compared to someone who is shy and more introverted. Some say that extroverts and more energetic personalities are attracted to people who tend to use humor or direct pick-up lines. General Tips While everyone will respond to pick-up lines differently, there are a few general tips that will get you started in the right direction. First, be original. There are lines that people have heard over and over, and there is no use using it as it will only show that you can't even come up with your own pick-up line. Second, be funny and sometimes self-deprecating to make the person laugh and make you not come off as cocky. Third, be observational; include something that is relevant or current in pop-culture. Not only will it be a line, but also a little insight into your interest and personality. Lastly, make sure you deliver it well. First impressions are crucial and it is important to maintain eye contact, smile, be sincere and make a connection that will hopefully help you keep the conversation going. Remember Before blurting out a line to anyone, consider how you would feel if someone approached you and said it to you. If you think it's a good line and you choose to use it, pay attention to the receivers' body language. If there doesn't seem to be any interest, know when to walk away. Most importantly, if you do want to use a pick-up line, be true to yourself. Make sure that the line you've come up with is something that represents your personality. If you like corny pickup lines and you want to date someone who enjoys corny pickup lines, then that's the way to go. MORE FROM LIFE123.COM



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