Geometric Proofs... The 'Two-Column Proof'

Key Terms (in your notes)...

deductive reasoning
Drawing a specific conclusion through logical reasoning by starting with general assumptions that are known to be valid.

proof
A mathematical argument showing that a statement is valid in all cases, or that no counterexample exists.

transitive property
If two quantities are equal to the same quantity, then they are equal to each other.
If $a = b$ and $b = c$, then $a = c$.

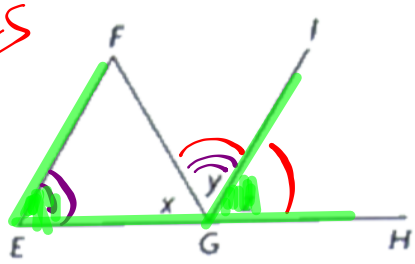
two-column proof
A presentation of a logical argument involving deductive reasoning in which the statements of the argument are written in one column and the justifications for the statements are written in the other column.

STATEMENT	JUSTIFICATION

Example #1:

2 equal pieces

In ΔEFG, GI bisects $\angle FGH$



a) *If* $\angle E = \angle y$, *then prove that* $EF \parallel GI$

① CA (F Rule)
② AIA (Z Rule)
③ CIA (C Rule)

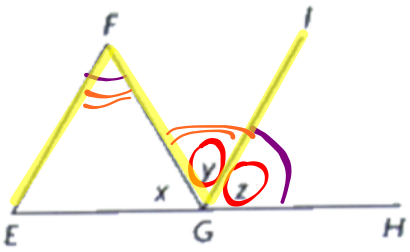
Statement	Justification
$\angle E = \angle y$	Given
$\angle y = \angle z$	Bisected
$\angle E = \angle z$	Transitive
$\therefore EF \parallel GI$	CA

Therefore

In ΔEFG, GI bisects $\angle FGH$

Ex #2

b) If $\angle F = \angle z$, then prove that $EF \parallel GI$



Statement	Justification
$\angle y = \angle z$	Bisected
$\angle F = \angle z$	Given
$\angle y = \angle F$	Transitive
$\therefore EF \parallel GI$	$A \pm A$

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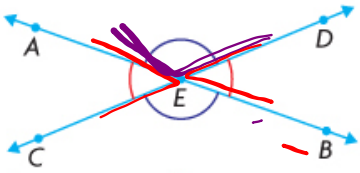
EXAMPLE 4 Using deductive reasoning to prove a geometric conjecture

Prove that when two straight lines intersect, the vertically opposite angles are equal.



Jose's Solution: Reasoning in a two-column proof

Statement	Justification
$\angle AEC + \angle AED = 180°$	Supplementary angles
$\angle AEC = 180° - \angle AED$	Subtraction property
$\angle BED + \angle AED = 180°$	Supplementary angles
$\angle BED = 180° - \angle AED$	Subtraction property
$\therefore \angle AEC = \angle BED$	**Transitive property**

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APPLY the Math

EXAMPLE 1 Reasoning about conjectures involving angles formed by transversals

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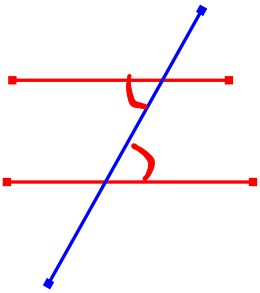
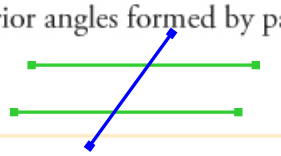


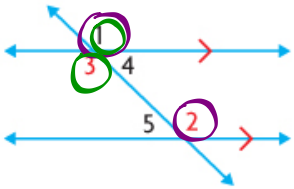
Pull for Lesson Notes

Make a conjecture that involves the interior angles formed by parallel lines and a transversal. Prove your conjecture.



Tuyet's Solution

My conjecture: When a transversal intersects a pair of parallel lines, the **alternate interior angles** are equal.



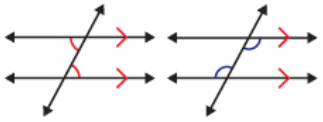
I drew two parallel lines and a transversal as shown, and I numbered the angles. I need to show that $\angle 3 = \angle 2$.

Statement	Justification	
$\angle 1 = \angle 2$	Corresponding angles (CA)	Since I know that the lines are parallel, the corresponding angles are equal.
$\angle 1 = \angle 3$	Vertically opposite angles (VAT)	When two lines intersect, the opposite angles are equal.
$\angle 3 = \angle 2$	Transitive property	$\angle 2$ and $\angle 3$ are both equal to $\angle 1$, so $\angle 2$ and $\angle 3$ are equal to each other.

My conjecture is proved.

alternate interior angles

Two non-adjacent interior angles on opposite sides of a transversal.



Homework...

p. 72: #4-6

p. 78: #2, 8, 10, 12, 20