

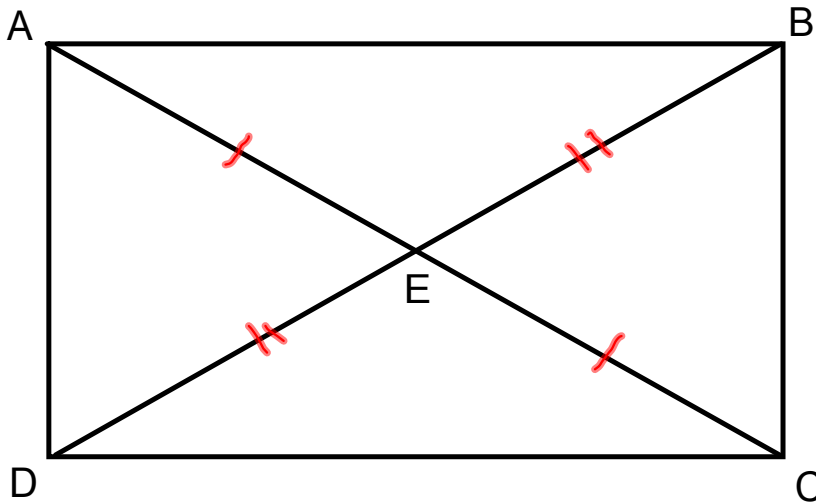
# Proofs and Deductive Reasoning

Goal:

- to use deductive reasoning to prove geometric statements
- to use proper structure to construct geometric proofs

Do the diagonals in every rectangle bisect each other?

↳ cut into two equal parts



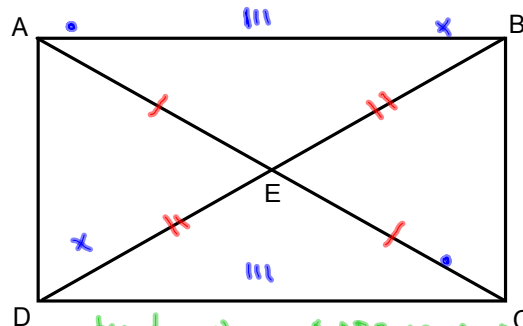
Can you prove it? Yes by showing that

$\triangle AED \cong \triangle BEC$  or  $\triangle ABE \cong \triangle CDE$   
↑  
congruent

In order to prove a geometric statement (like the diagonals in any rectangle bisect each other) we use a specific proof structure:

Hypothesis: List all the information that is given.  
 (IF...)  
 - ABCD is a rectangle  
 - diagonals  $\overline{AC}$ ,  $\overline{BD}$  meet at E.  
 If... is true

Conclusion: statement to be proved.  
 (THEN...)  
 -  $\overline{AE} \cong \overline{EC}$   
 -  $\overline{DE} \cong \overline{BE}$   
 AC and BD are bisected.  
 Then... is also true.

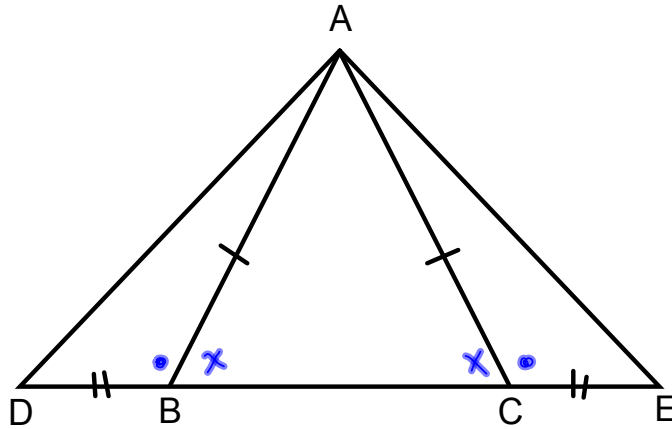


Proof: try to show  $\triangle ABE \cong \triangle CDE$   
 - ~~SSS~~, ~~SAS~~, ASA

Statements and Justifications

- |   |  |
|---|--|
| 1. $\angle BAE \cong \angle DCE$  | 1. Alternate-interior angles formed by transversal and parallel lines are congruent. |
| 2. $\overline{AB} \cong \overline{CD}$  | 2. opposite sides in rectangle are congruent.  |
| 3. $\angle ABE \cong \angle CDE$  | 3. Alternate-interior angles formed by .... are congruent.                           |
| 4. $\triangle ABE \cong \triangle CDE$  | 4. By ASA  |
| 5. $\overline{AE} \cong \overline{CE}$<br>$\overline{BE} \cong \overline{DE}$ | 5. Corresponding elements (matching) in congruent triangles are congruent.           |

Ex: Triangle ABC is isosceles with main vertex A.  
 If segments BD and CE are congruent, prove that  
 triangles ABD and ACE are also congruent.



Hypothesis: -  $\triangle ABC$  is isosceles ( $\overline{AB} \cong \overline{AC}$ )  
 (If) -  $\overline{BD} \cong \overline{CE}$

Conclusion: -  $\triangle ABD \cong \triangle ACE$   
 (then)

Statements

Justifications

- |  |  |
|--|--|
| 1. $\overline{AB} \cong \overline{AC}$ | 1. $\triangle ABC$ is isosceles                |
| 2. $\angle ABC \cong \angle ACB$       | 2. $\triangle ABC$ is isosceles                |
| 3. $\angle ABD \cong \angle ACE$       | 3. Both are supplementary to congruent angles. |
| 4. $\overline{DB} \cong \overline{CE}$ | 4. Given in hypothesis                         |
| 5. $\triangle ABD \cong \triangle ACE$ | 5. By SAS                                      |

Homework: p. 165 #13