Isosceles triangle proofs worksheet pdf

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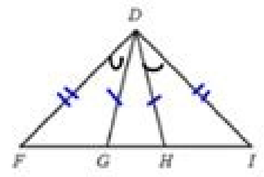
4. **Given:** ΔDGH is isosceles with base $\overline{GH}$;
$\overline{DF} \cong \overline{DI}$; $\angle FDG \cong \angle IDH$.
Prove: $\Delta FGD \cong \Delta IHD$

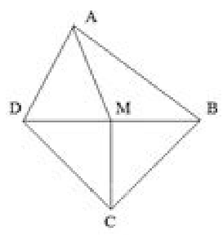


ΔDGH is isosceles with base $\overline{GH}$;	
$\overline{DF} \cong \overline{DI}$; $\angle FDG \cong \angle IDH$. $\Delta FGD \cong \Delta IHD$	

Proving a Median of a Triangle: Example

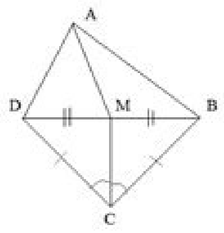
Given: $\overline{CM}$ bisects $\angle BCD$
$\overline{DC} \cong \overline{BC}$

Prove: $\overline{AM}$ is a median of $\triangle BDA$



Step 1: "Label the picture."

$\overline{CM}$ bisects $\angle BCD$
$\overline{DC} \cong \overline{BC}$



What are we trying to prove? $\overline{DM} \cong \overline{MB}$
(definition of a median)

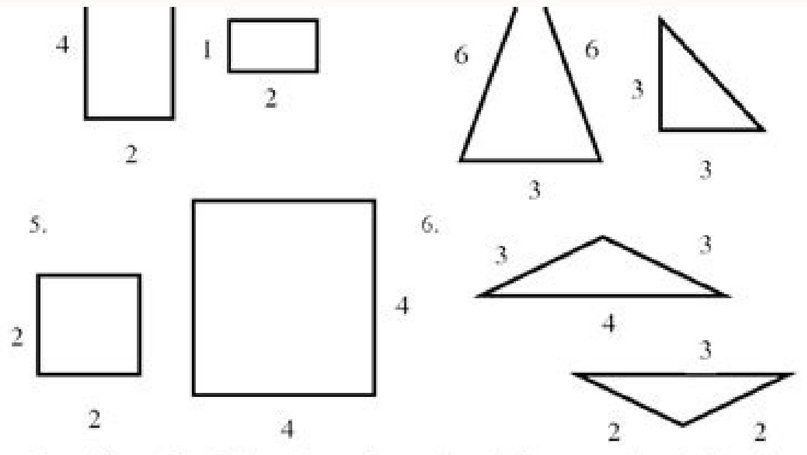
Step 2: Determine a Strategy

To prove a median, I need to show a segment bisects the opposite side. (def. of a median).

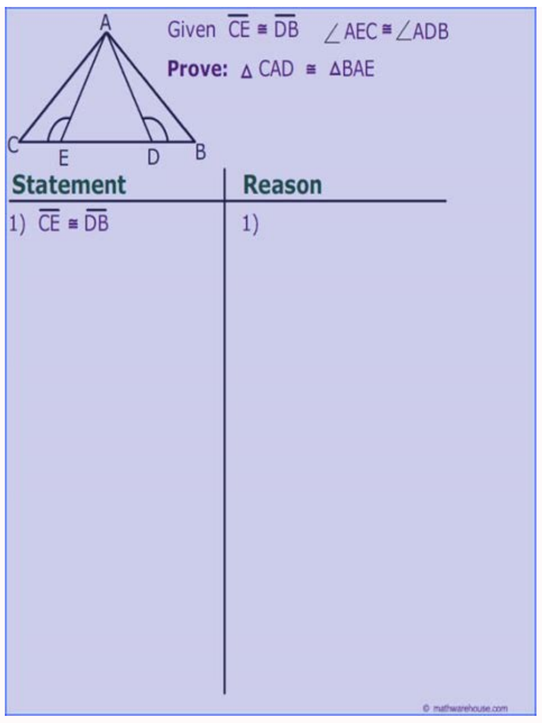
Notice triangles CMD & CMB. They include DM & MB. If I can show CMD = CMB, then I can use CPCTC to prove that DM = MB.

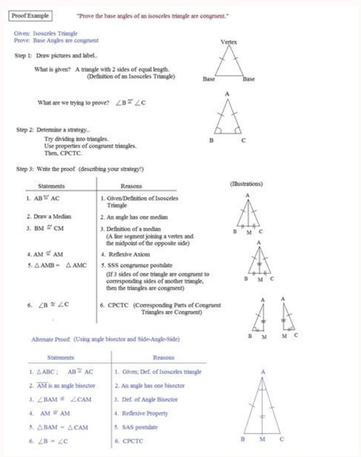
Step 3: Write the Proof (describing your approach and strategy)

Statements	Reasons
1) $\overline{DC} = \overline{BC}$ CM bisects $\angle BCD$	1) Given
2) $\angle DCM = \angle BCM$	2) Definition of Angle Bisector
3) $\overline{MC} = \overline{MC}$	3) Reflexive Property
4) $\triangle DCM = \triangle BCM$	4) Side-Angle-Side (SAS) postulate
5) $\overline{DM} = \overline{BM}$	5) Corresponding Parts of Congruent Triangles are Congruent (CPCTC)
6) AM is median of $\triangle ABD$	6) Definition of a Median (A line segment joining vertex of triangle to midpoint of opposite side)



Bonus/Extension: Using what you know about similar rectangles and triangles, write a Y if you think these polygons are similar and write an N if you do not think they are similar.





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Isosceles Triangle An isosceles triangle has two congruent sides and two congruent angles. The congruent angles are called the base angles and the other angle is known as the vertex angle. $$ \angle $$BAC and $$ \angle $$BCA are the base angles of the triangle picture on the left. The vertex angle is $$ \angle $$ABC Isosceles Triangle Theorems The Base Angles Theorem If two sides of a triangle are congruent, then the angles opposite those sides are congruent. Converse of the Base Angles Theorem The converse of the base angles theorem, states that if two angles of a triangle are congruent, then sides opposite those angles are congruent. A triangle that has two sides of the same measure and the third side with a different measure is known as an isosceles triangle. The isosceles triangle theorem in math states that in an isosceles triangle, the angles opposite to the equal sides are also equal in measurement. We will be learning about the isosceles triangle theorem and its converse in this article. What is Isosceles Triangle Theorem? Isosceles triangle theorem states that if two sides of a triangle are congruent, then the angles opposite to the congruent sides are also congruent. To understand the isosceles triangle theorem, we will be using the properties of an isosceles triangle for the proof as discussed below. Isosceles Triangle Theorem Proof Let's draw an isosceles triangle with two equal sides as shown in the figure below. Given: ΔABC is an isosceles triangle with AB = AC. Construction: Altitude AD from vertex A to the side BC. To Prove: ∠B = ∠C. Proof: We know, that the altitude of an isosceles triangle from the vertex is the perpendicular bisector of the third side. Thus, we can conclude that, ∠ADB = ∠ADC = 90º ---------- (1) BD = DC ---------- (2) Consider ΔADB and ΔADC AB = AC [Given] AD = AD [common side] BD = DC [From equation (2)] Thus, by SSS congruence we can say that, ΔADB ≅ ΔADC By CPCT, ∠B = ∠C. Hence, we have proved that if two sides of a triangle are congruent, then the angles opposite to the congruent sides are equal. Isosceles Triangle Theorem Converse The converse of isosceles triangle theorem states that if two angles of a triangle are congruent, then the sides opposite to the congruent angles are equal. This is exactly the reverse of the theorem we discussed above. We will be using the properties of the isosceles triangle to prove the converse as discussed below. Converse of Isosceles Triangle Theorem Proof Let's draw a triangle with two congruent angles as shown in the figure below with the markings as indicated. Given: ΔABC with ∠B = ∠C. Construction: Altitude AD from vertex A to the side BC. To Prove: AB = AC Proof: We know that the altitude of a triangle is always at a right angle with the side on which it is dropped. Hence, ∠ADB = ∠ADC = 90º ---------- (1) Consider ΔADB and ΔADC, ∠B = ∠C [Given] AD = AD [common side] ∠ADB = ∠ADC = 90º [From equation (1)] Thus, by AAS congruence we can say that, ΔADB ≅ ΔADC By CPCT, AB = AC Hence we have proved that, if two angles of a triangle are congruent, then the sides opposite to the congruent angles are equal. Related Articles Check these articles related to the concept of the isosceles triangle theorem. Isosceles Triangle Perpendicular Bisector Congruence in Triangles Example 1: In the given figure below, find the value of x using the isosceles triangle theorem. Solution: According to the given figure, In ΔXYZ, we see that XY = XZ = 12 cm According to the isosceles triangle theorem, if two sides of a triangle are congruent, then the angles opposite to the congruent sides are equal. Thus, ∠Y = ∠Z [Since XY = XZ] ∠Y = 35º, ∠Z = x Thus, ∠Y = ∠Z = 35º. Hence the value of x is 35º. Example 2: If ∠P and ∠Q of ΔPQR are equal to 70º and QR = 7.5 cm, find the value of PR. Solution: Let's draw a figure according to the given question, Given that, in ΔPQR, ∠P = ∠Q = 70º. According to the isosceles triangle theorem converse, if two angles of a triangle are congruent, then the sides opposite to the congruent angles are equal. Thus, PR = QR [Since, ∠P = ∠Q] But, QR = 7.5 cm Therefore the value of PR = 7.5 cm. View Answer > go to slidego to slide Want to build a strong foundation in Math? Go beyond memorizing formulas and understand the ‘why’ behind them. Experience Cuemath and get started. Book a Free Trial Class FAQs on Isosceles Triangle Theorem Isosceles triangle theorem states that, if two sides of an isosceles triangle are equal then the angles opposite to the equal sides will also have the same measure. How to Prove Isosceles Triangle Theorem? Isosceles triangle theorem can be proved by using the congruence properties and properties of an isosceles triangle. An isosceles triangle can be drawn, followed by constructing its altitude. The two triangles now formed with altitude as its common side can be proved congruent by SSS congruence followed by proving the angles opposite to the equal sides to be equal by CPCT. What is the Converse of Isosceles Triangle Theorem? The converse of isosceles triangle theorem states that, if two angles of a triangle are equal, then the sides opposite to the equal angles of a triangle are of the same measure. How to Prove the Converse of the Isosceles Triangle Theorem? The converse of the isosceles triangle theorem can be proved by using the congruence properties and properties of an isosceles triangle. An isosceles triangle can be drawn, followed by constructing its altitude. The two triangles now formed with altitude as its common side can be proved congruent by AAS congruence followed by proving the sides opposite to the equal angles to be equal by CPCT. How to find Angles using Isosceles Triangle Theorem? The angles of an isosceles triangle add up to 180º according to the angle sum property of a triangle. The angles opposite to the equal sides of an isosceles triangle are considered to be an unknown variable 'x'. Now, if the measure of the third (unequal) angle is given, then the three angles can be added to equate it to 180º to find the value of x that gives all the angles of a triangle. For example: Let the unequal angle of an isosceles triangle be 50º. The other angles can be considered as x each as they are equal. By using the angle sum property, 50º + x + x = 180° 2x = 180º - 50º 2x = 130º x = 65º Thus, the angles of the isosceles triangle are 65º, 65º, and 50º.

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