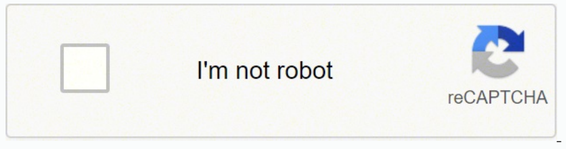

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This theorem is applicable to all types of triangles. An angle bisector is a straight line drawn from the vertex of a triangle to its opposite side in such a way, that it divides the angle into two equal or congruent angles. What if you were told that a ray was an angle bisector of a triangle? Angle Bisector Theorem Converse: If a factor is with inside the indoors of a perspective and equidistant from the sides, then it lies at the bisector of the perspective. " In any triangle, when the angle bisector of one angle of a triangle is extended to meet the side opposite to that angle, the angle bisector divides the opposite sides in such a way that they are proportional to the other two sides of the triangle". Figure \(\PageIndex{7}\) Figure \(\PageIndex{8}\) Solve for the unknown variable. Applying angle bisector theorem to triangle ABC, we get \[\frac{BD}{CD} = \frac{AB}{AC}\]It is given that BD = 2 cm and CD = 5 cm. Angle Bisector Theorem The angle bisector theorem states that if a point is on the bisector of an angle, then the point is equidistant from the sides of the angle. The centroid can be defined as the intersection of bisectors of the interior side of the triangle, the point equidistant from the sides of the triangle, and the intersection of the central axis and the innermost transform point. Angle bisectors divide triangles proportionally. Thus the relative lengths of the opposite side (divided by angle bisector) are equated to the lengths of the other two sides of the triangle. Figure \(\PageIndex{4}\) Solution The ray is the angle bisector and it splits the opposite side in the same ratio as the other two sides. Ratio A ratio is a comparison of two quantities that can be written in fraction form, with a colon or with the word "to". When an angle within a triangle is bisected, the bisector divides the triangle proportionally. Video: Using the Properties of the Triangle Angle Bisector Theorem to Determine Unknown Values Activities: Proportions with Angle Bisectors Discussion Questions Study Aids: Proportionality Relationships Study Guide Real World: Triangle Proportionality LICENSED UNDER Angle bisector theorem is one of the most important theorems in geometry. Example \(\PageIndex{1}\) Fill in the missing variable: Figure \(\PageIndex{2}\) Solution Set up a proportion and solve. Substituting the values of AC, BD and CD in the above equation, we get \[\frac{2}{3} = \frac{AB}{10 − AB}\]2 (10 - AB) = 5 AB20 - 2 AB = 5 AB20 = 5 AB + 2 AB7 AB = 20 AB = 20/7 cmAC = 10 - ABAC = 10 - 20/7AC = 50/7 cmFun Facts:Problems involving angle bisector theorem examples demand the basic knowledge of ratio and proportions.Apart from using the sine rule, there are various other approaches to arrive at the Angle bisector theorem proof. The basic knowledge of a few terminologies is required to understand the angle bisector theorem. Figure \(\PageIndex{1}\) If \(\Delta BAC\cong \Delta CAD\), then \(\dfrac{BC}{CD}=\dfrac{AB}{AD}\). up inside or outside the area at that specific point.What is the Application of the Angle Bisector Theorem?The incenter of a triangle is the centroid of the triangle and is a point defined for the triangle in a way that is independent of the position or size of the triangle. Figure \(\PageIndex{9}\) Figure \(\PageIndex{10}\) Figure \(\PageIndex{11}\) Figure \(\PageIndex{12}\) Figure \(\PageIndex{13}\) Figure \(\PageIndex{14}\) Figure \(\PageIndex{15}\) Figure \(\PageIndex{16}\) Figure \(\PageIndex{17}\) Figure \(\PageIndex{18}\) Figure \(\PageIndex{19}\) Figure \(\PageIndex{20}\) Figure \(\PageIndex{21}\) To see the Review answers, open this PDF file and look for section 7.10. Then, if D is strictly between B and C, one and only one of B1 or C1 lies inside triangle ABC and it can be without loss of generality that B1 does. Figure \(\PageIndex{5}\) Solution You can set up this proportion like the previous example. If AB + AC = 10, then AC = 10 - AB. The angle bisector of A is AD which divides BC into BD and CD.To Prove:\[\frac{BD}{CD} = \frac{AB}{AC}\]Angle Bisector Theorem Proof: StatementReason\[\frac{BD}{\sin \angle BAD} = \frac{AB}{\sin \angle ADB}\]Applying Sine rule to the sides BD and AB in triangle ADB\[\frac{BD}{AB} = \frac{\sin \angle BAD}{\sin \angle ADB}\] →(1)Rearranging the equation\[\frac{DC}{\sin \angle DAC} = \frac{AC}{\sin \angle ADC}\]Applying Sine rule to the sides DC and AC in triangle ADC\[\frac{DC}{AC} = \frac{\sin \angle DAC}{\sin \angle ADC}\] →(2)Rearranging the equation\[\sin \angle DAC = \sin \angle BAD\] → (3)∠DAC = ∠BAD as AD is the angle bisector of ∠A\[\sin \angle ADB = \sin \angle ADC\] → (4)∠ADB and ∠ADC are supplementary angles as they form a linear pair. \(\begin{aligned}\dfrac{12}{z}&=\dfrac{15}{9−z} \\ 15z&=12(9−z) \\ 15z&=108-12z \\ 27z&=108 \\ z&=4\end{aligned}\) Example \(\PageIndex{3}\) Find \(x\). Find AB and AC such that BD = 2 cm, CD = 5 cm, and AB + AC = 10 cm.Solution:The above problem is one of the angle bisector theorem examples. Now let us see, what is the angle bisector theorem. \(\begin{aligned} \dfrac{20}{y}&=\dfrac{15}{28−y} \\ 15y&=20(28−y) \\ 15y&=560−20y \\ 35y&=560 \\ y&=16\end{aligned}\) Example \(\PageIndex{2}\) Fill in the missing variable: Figure \(\PageIndex{3}\) Solution Set up a proportion and solve. This idea is called the Angle Bisector Theorem. Term Definition angle bisector A ray that divides an angle into two congruent angles. An angle is a separation between any two line segments. The inscribed circle touches each side of the triangle. It is one of the four centres of the triangle known to the ancient Greeks, with the centroid, the circumcenter, and the orthogonal centre, and it is the only one not foundHow is the Converse of the Angle Bisector Theorem Applied If the Point is in the Exterior of the Angle?The converse of this theorem is likewise real. Because the Angle Bisector Theorem and its communication are each real we have a No biconditional statement.How to State and Prove Angle Bisector Theorem:Angle bisector theorem is obtained by the law of sine or Sine rule in trigonometry. Angle Bisector Theorem Statement:The angle bisector of one angle of a triangle divides the side opposite to it at a particular point such that the ratio in which the side is divided is equal to the ratio of the other two sides of the triangle.(Image will be Uploaded soon)Given Data to State and Prove Angle Bisector Theorem:ABC is a triangle with sides AB, BC, and AC. It is written mathematically as:\[\frac{BD}{DC} = \frac{AB}{AC}\] when∠CADConverse of Angle Bisector Theorem Statement:The converse statement of the angle bisector theorem says that if in a triangle ABC, D is a point on BC such that the ratio of BD and CD and that of AB and AC are the same, then AD is the angle bisector of A.In other words, if an interior point is equidistant from the two sides of a triangle, then the point lies on the angle bisector of the angle formed by these two lines in any triangle. Explanation:If D is a point in the interior of the triangle ABC such that it is at the same distance from the sides AB and AC, then the point D lies on the angle bisector of the angle A.Let D be a point on the line BC, not equal to B or C and such that AD is not an altitude of triangle ABC.Let B1 be the base of the altitude in the triangle ABD through B and let C1 be the base of the altitude in the triangle ACD through C. If the angle of separation between the two lines is 900, then the two lines are said to be perpendicular to each other. If D lies outside of segment BC, then neither B1 nor C1 lies inside the triangle.∠ DB1B and ∠ DC1C are right angles, while the angles ∠ B1DB and ∠ C1DC are congruent if D lies on the segment BC (that is, between B and C) and they are identical in the other cases being considered, so the triangles DB1B and DC1C are similar (AAA), which hence proves the angel bisector theorem.As per the Angle Bisector theorem, the angle bisector of a triangle bisects the opposite side in such a way that the ratio of the two line-segments is proportional to the ratio of the other two sides. \(\begin{aligned}\dfrac{12}{4}&=\dfrac{x}{3} \\ 36&=4x \\ x&=9\end{aligned}\) Find the value of the missing variable(s). Angle Bisector Theorem: If a ray bisects an angle of a triangle, then it divides the opposite side into segments that are proportional to the lengths of the other two sides. An angle bisector is a line that divides an angle into two congruent parts. The proportion is: \(\begin{aligned} \dfrac{9}{x}&=\dfrac{21}{14} \\ 21x&=126 \\ x&=6\end{aligned}\) Example \(\PageIndex{4}\) Find the value of \(x\) that would make the proportion true. A burnt triangle and the centre of the triangle's inscribed circle. The intersection of the bisectors of the three vertices of triangle ABC is the centroid. However, there are a few other complex methods to understand how to state and prove angle bisector theorems.Angle Bisector Theorem Examples:If in a triangle ABC, AD is the angular bisector of ∠A which touches the side BC at D. According to Heath, a comparative explanation for the double point was given by Robert Simson who realized that Pappus expected this result without certainty. Sine of the supplementary angles are equal. \[\frac{Sin \angle DAC}{ Sin \angle ADC} = \frac{Sin \angle BAD}{ Sin \angle ADB}\] →(5)Dividing equation (3) by (4)\[\frac{BD}{AB} = \frac{DC}{AC}\]Comparing equations (1) and (2) with (5), RHS are equal and hence LHS should also be equal.\[\frac{BD}{CD} = \frac{AB}{AC} \]Rearranging the equation to obtain the desired resultThis is the easiest method to arrive at the Angle bisector theorem proof. This case is depicted in the adjacent diagram. In a triangle, if the interior point is equidistant from the two sides of the triangle then that point lies on the angle bisector of the angle formed by the two line segments.What is the History of the Angle Bisector Theorem?The hypothesis of a double point is seen as Proposition 3 for Book VI in Euclid's Elements. How would you use this fact to find unknown values regarding the triangle's side lengths? Proportion A proportion is an equation that shows two equivalent ratios. Bisect in English means to divide into two equal halves. Then, according to the angle bisector theorem, AD divides BC in such a way that the quotient of BD and DC is equal to the quotient of AB and AC. \(\begin{aligned} \dfrac{5}{3}&=\dfrac{4x+1}{15} \\ 75&=3(4x+1) \\ 75&=12x+3 \\ 72&=12x \\ 6&=x\end{aligned}\) Example \(\PageIndex{5}\) Find the missing variable: Figure \(\PageIndex{6}\) Solution Set up a proportion and solve like in the previous examples. In other words, the angle bisector theorem statement can be rephrased as 'if a point is on the angle bisector of an angle in a triangle, then the point is equidistant from the sides of the angle'.(Image will be Uploaded soon)Explanation of what is Angle Bisector Theorem Converse:In a triangle ABC as shown in the figure above, AD is the angle bisector of the angle A touching the side BC opposite to angle A. Heath goes on to say that Augustus De Morgan suggested that the two beliefs should be grouped as follows: Assuming that the point of a triangle is divided into or by a straight line that cuts the opposite side or the opposite side is introduced, the pieces of that side will have the same value as the different sides of the triangle; and, assuming that the side of the triangle is divided internally or remotely so that its parts have the same value as the different sides of the triangle, a straight line drawn from the area to the opposite rakish area on the main pointed side will be cut. The perpendicular bisector of a line is that line which is perpendicular to the given line and divides the line into two identical halves.Angle Bisector Theorem Statement:The angle bisector theorem establishes a relationship between the lengths of the 2 sides of a triangle and the line segments formed when the angle bisector of the angle opposite to the third side is extended to meet the third side in a triangle. The Angle Bisector theorem statement is as follows.

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