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The outer angle of a triangle is greater than one of the outer inner angles The outer angle theorem is Proposition 1.16 of Euclid’s Elements, which states that the measurement of an outer angle of a triangle is greater than both the measurements of the outer angles. This is a fundamental result in absolute geometry because its proof does not depend on the parallel postulate. In several high school geometry studies, the term “outer angle theorem” has been applied to a different result,[1] that part of Proposition 1.32 which states that the measurement of an outer angle of a triangle is equal to the sum of the measurements of the remote inner angles. This result, which depends on Euclid’s parallel postulate, will be called the “External Angle Theorem” (HSEAT) to distinguish it from Euclid’s external angle theorem. Some authors refer to the “high school outer angle theorem” as a strong form of the outer angle theorem and the “Euclid outer angle theorem” as a weak form.[2] External angles A triangle has three angles, called vertices. The sides of a triangle (straight segments) joining at a vertex form two angles (four angles if you consider the sides of the triangle as lines instead of straight segments).[3] Only one of these angles contains the third side of the triangle inside it, and this angle is called the inner angle of the triangle.[4] In the photo below The angles ABC, BCA and CAB are the three inner angles of the triangle. An outer corner is formed by the extension of one side of the triangle; the angle between the extended side and the other side is the outer corner. In the photo, the ACD angle is an external angle. Euclid’s outer angle theorem The proof of proposition 1.16 given by Euclid is often cited as one of the places where Euclid gives an erroneous proof.[5][6][7] Euclid proves the outer angle theorem with: construct the midpoint E of segment AC, draw the radius BE, construct the point F on radius BE so that E is (also) the midpoint of B and F, draw the segment FC. From congruent triangles we can conclude that BAC = ECF and ECF is less than ECD, ECD = ACD so BAC is less than ACD and the same can be done for the angle Ã¢ Â¢ CBA bisecting BC. The defect lies in the assumption that a point (F, above) is “in” angle (ACD). No reason is given for this statement, but the accompanying diagram makes it look like a true statement. When a complete set of axioms is used for Euclidean geometry (see Fundamentals of Geometry) this statement of Euclid can be proved.[8] Not valid in spherical geometry Small triangles may behave almost Euclidean, but the outer angles at the base of the large triangle are 90°, in contradiction with the theorem of Euclidean geometry. Outer corner of Euclid. The outer angle theorem is not valid in spherical geometry or in related elliptical geometry. Consider a spherical triangle where one of the vertices is the North Pole and the other two are located on the equator. The sides of the triangle emanating from the North Pole (large circles of the sphere) both meet the equator perpendicularly, so this triangle has an outer angle equal to a remote inner angle. The other inner corner (at the North Pole) can be made bigger than 90°, further highlighting the failure of this claim. However, since Euclid’s outer angle theorem is a theorem of absolute geometry, it is automatically valid in hyperbolic geometry. High School External Angle Theorem The High School External Angle Theorem (HSEAT) says that the size of an external angle at the vertex of a triangle is equal to the sum of the dimensions of the internal angles at the other two vertices of the triangle (remote internal angles). in the photo, the size of the ACD angle is equal to the size of the ABC angle plus the size of the CAB angle. HSEAT is logically equivalent to the euclidea claim that the sum of corners of aIt’s 180°. If it is known that the sum of the measurements of the angles in a triangle is 180Â°, then the hseat is shown as follows: B + D = 180Â¢ ~ {\ DisplayStyle B + D = 180 ^ {\ Circ}}}}} B + D = B + A + C {\ DisplayStyle B + D = B + A + C} Ã ’d = a + c. {\ DisplayStyle \ Therefore D = A + C.} On the other hand, if the hseat is taken as a true declaration, then: D = A + C {\ DisplayStyle D = A + C} B + D = 180 Ã¨~ {\ DisplayStyle B + D = 180 ^ {\ Circ}} Ã¨’B + A + C = 180 Ã¢~. {\ DisplayStyle \ Therefore B + A + C = 180 ^ {\ Circ}.} Illustration of the hseat test showing that the sum of the measurements of the angles of a triangle is 180 Â°. The Euclidean proof of the hseat (and simultaneously the result on the sum of the angles of a triangle) begins to construct the line parallel to the side AB by passing through point c and then using the properties of the corresponding angles and alternative internal angles of parallel lines to get the conclusion as in the illustration. [9] Hseat can be extremely useful when trying to calculate the measurements of unknown angles in a triangle. Notes ^ Henderson & TaimiÃ â A 2005, p. 110 ^ Wylie, Jr. 1964, p. 101 & p. 106 Harvnb Error: No Target: Citeterefwylie, _jr.1964 (Guide) ^ One row segment is considered the beginning side and the other the end side. The angle is formed by going counterclockwise from the start side to the end side. Choosing the line segment is the start side is arbitrary, so there are two possibilities for the angle determined by the line segments. ^ This way of defining internal angles does not assume that the sum of the angles of a triangle is 180 degrees. ^ Faber 1983, p. 113 ^ Greenberg 1974, p. 99 ^ Venema 2006, p. 10 Greenberg 1974, p. 99 ^ Heath 1956, vol. 1, p. 316 References Faber, Richard L. (1983), Foundations of Euclidean and Non-Euclidean Geometry, New York: Marcel Dekker, Inc., ISBN 0-8247-1748-1 Greenberg, Marvin Jay (1974), Euclidean and Non-Euclidean Geometries/Development and History, San Francisco: Wh Freeman, ISBN 0-7167-0454-4 Heath, Thomas L. (1956). The Thirteen Books of the Elements of Euclid (2nd ED. [Facsimile. Original publication: Cambridge University Press, 1925] â¨¬.). New York: Publications by Dover. (3 vols.): ISBN 0-486-60 088-2 (VOL. 1), ISBN 0-486-60 089-0 (VOL. 2), ISBN 0-486-60 090-4 (VOL. 3). Henderson, David w.; TaimiÃ â A, Daina (2005), Experimenting Geometry / Euclidean and Non-Euclidean with History (3rd.), Pearson / Prentice-Hall, ISBN 0-13-143 748-8 Venema, Gerard A. (2006), Foundations of Geometry, River Saddle Upper, NJ: Pearson Prentice Hall, ISBN 0-13-143 700-3 Wylie Jr., CR (1964), Foundations of Geometry, New York: McGraw-Hill Hseat References Geometry TextBook – IX Standard IX, MAHARASHTRA State of Secondary and Higher Education, Pune – 411 005, India. Core Common Geometry, ’Pearson Education: Upper Saddle River, Â© 2010, pages 171-173 | United States. Wheater, Carolyn C. (2007), Helphewt Helphers: Geometry, Franklin Lakes, NJ: Press Career, PP.Ã¨888 â¨¬ “90, ISBNÃ¨ 978-1-56 414-936-7. Retrieved from “ The measurement of an outer angle of a triangle is equal to the sum of the measurements of the two non-adjacent inner angles. (Non-adjacent interior corners can also be defined as remote interior corners.) This is a partial list of the most popular theorems, postulates and properties needed when working with Euclidean proofs. You need to have a thorough understanding of these articles. Your textbook (and your teacher) may want you to remember these theorems with a slightly different formulation. Make sure you follow the instructions from your teacher. The “I need to know now!” The entries are highlighted in blue. General: Reflective Property A quantity is congruent (equal) to itself. A = A. Symmetrical property if A = B, then B = a. Property if A = B and B = C, then a = c. Addition of postulate If equal quantities are added to equal quantities, the sums are equal. Subtraction Subtraction If the equal amounts are subtracted from equal quantities, the differences are the same. Multiplication postulate If the equal quantities are multiplied by equal quantities, the products are the same. (Even double the equal quantities are equal). The postulated division if the equal quantities are divided by equal quantities, the newspapers are the same. (Even the half of the equal quantities are the same.) Replacement postulation A quantity can be replaced by its equal in any expression. Postulate wall All is the same as the sum of its parts. Furthermore: Ã ¢ PageEess of Points: Ã, AB + BC = AVA AD AD COLOR Postulate: Ã ¢ m

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