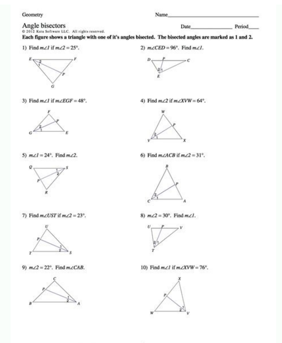
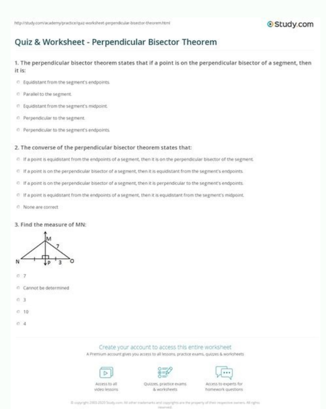
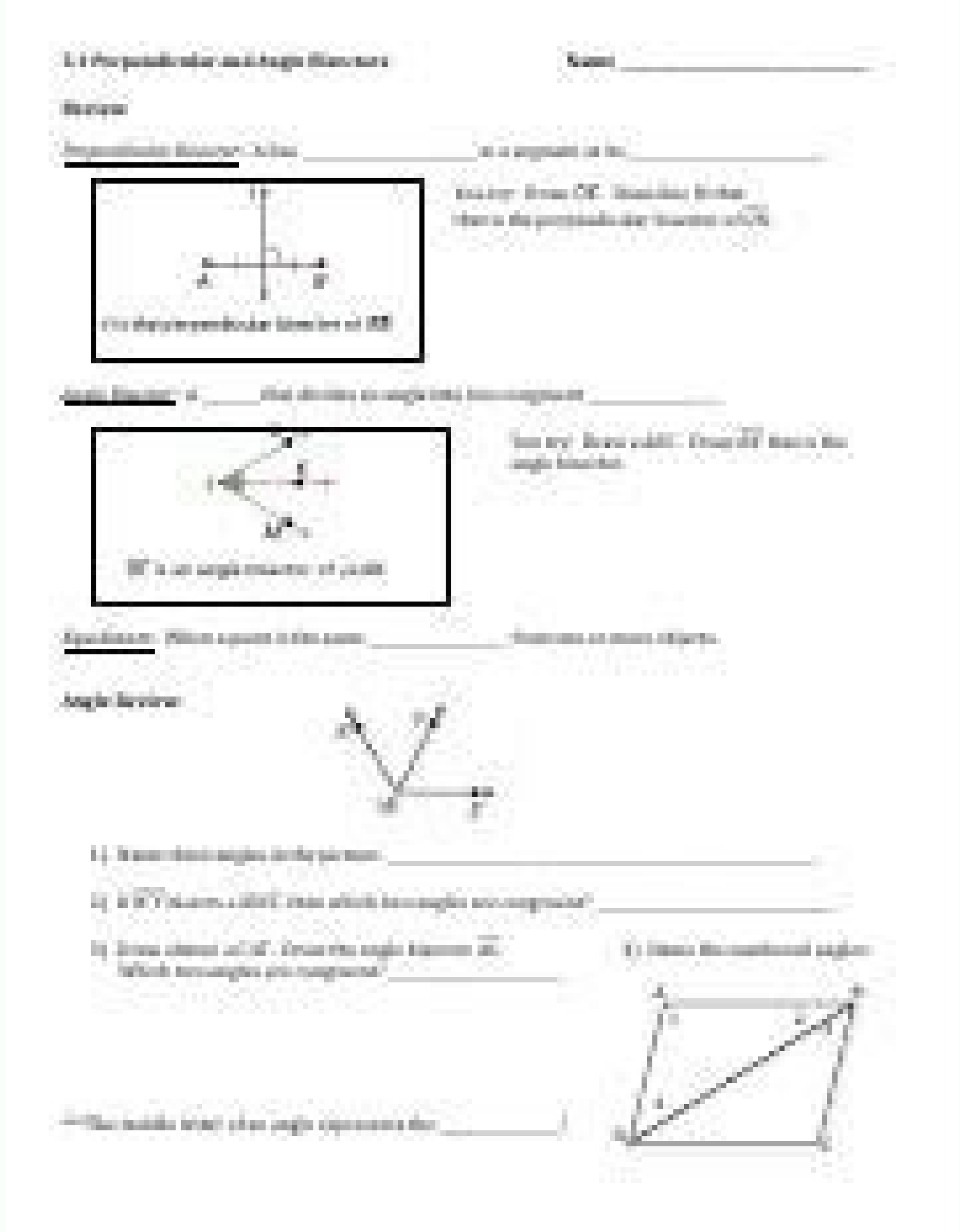
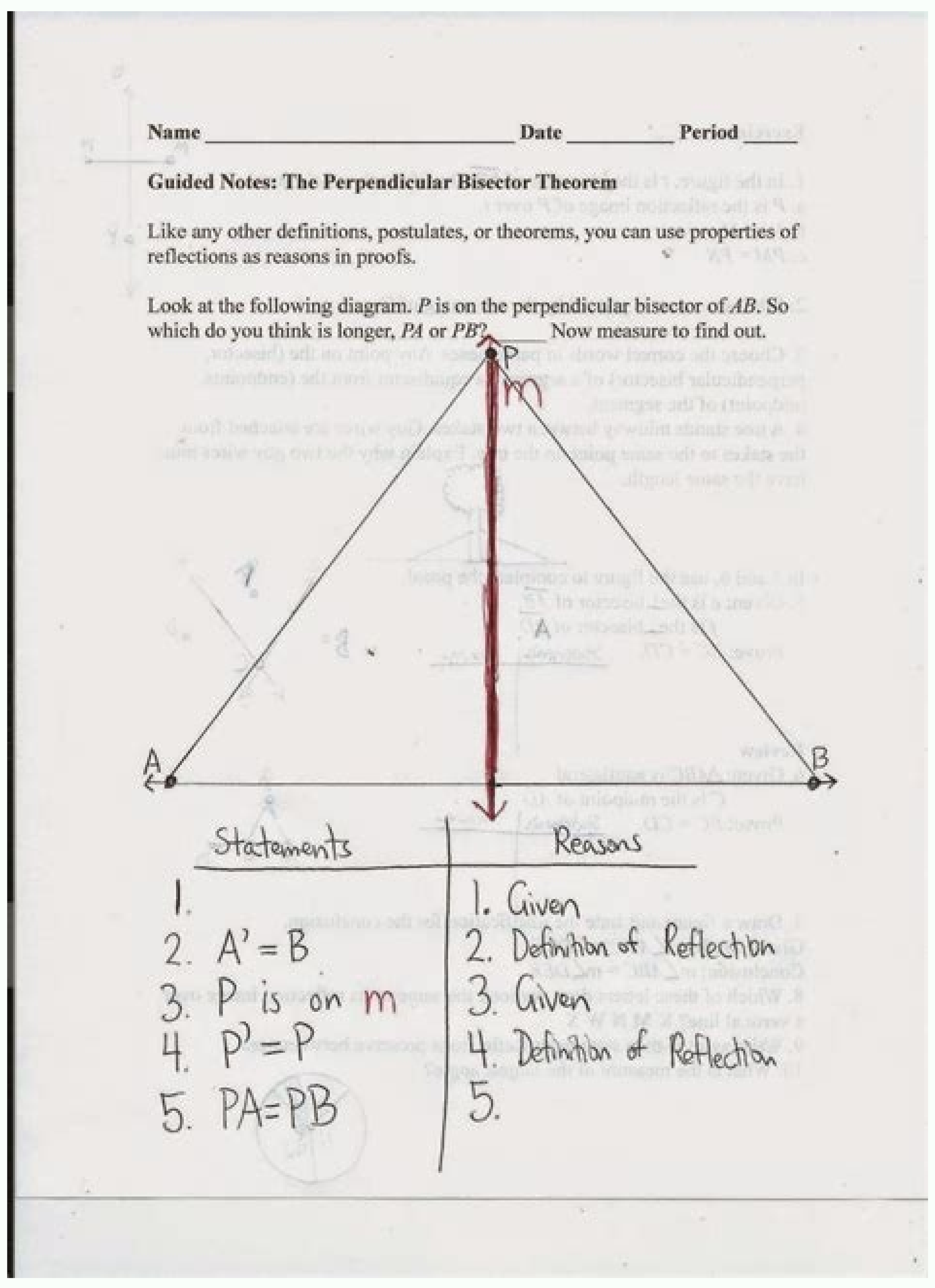
Perpendicular bisector theorem worksheet answers





Quiz & Worksheet - Perpendicular Bisector Theorem





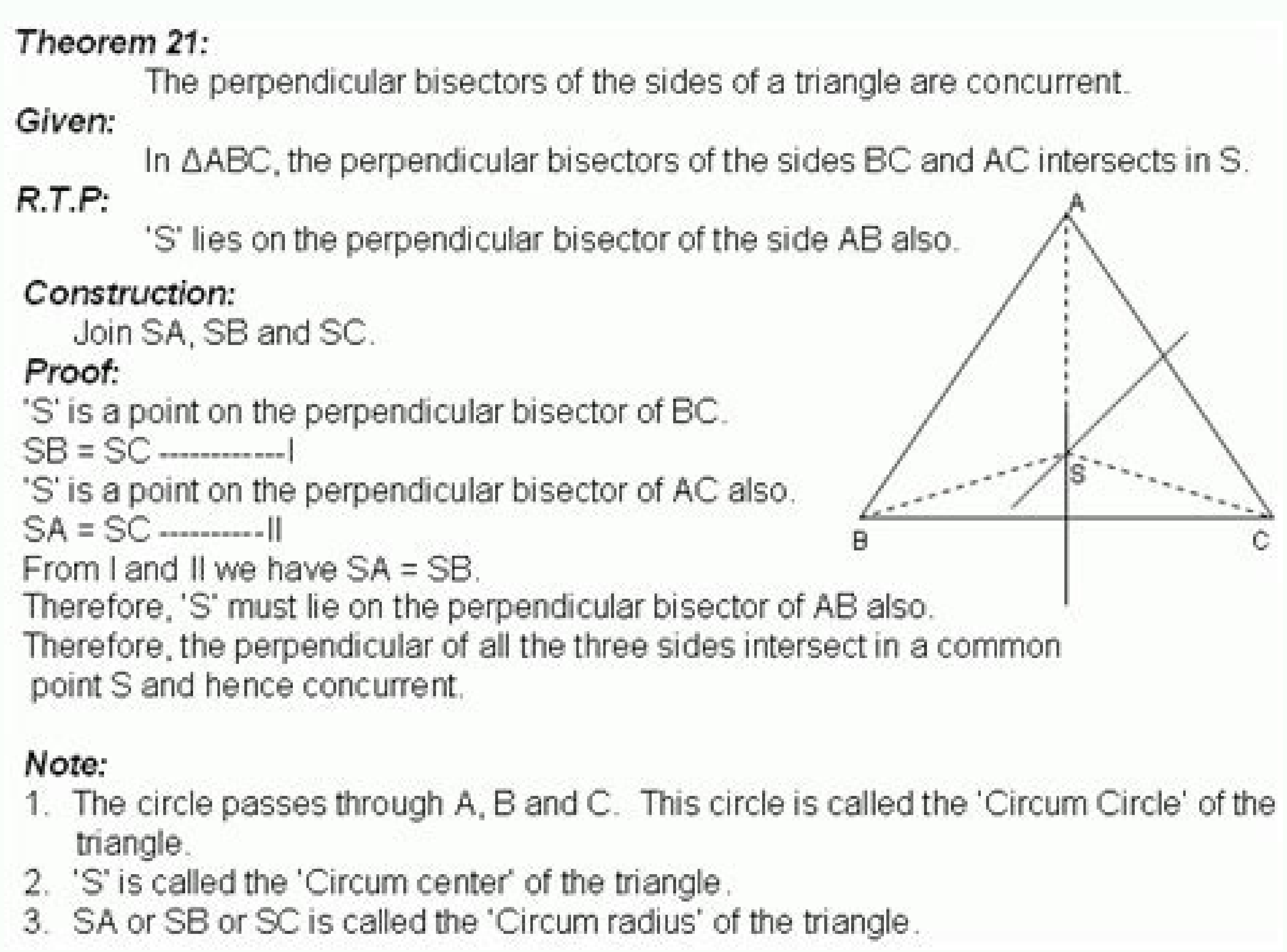
Name ____________________________ Date __________ Period ______

Guided Notes: The Perpendicular Bisector Theorem

Like any other definitions, postulates, or theorems, you can use properties of reflections as reasons in proofs.

Look at the following diagram. *P* is on the perpendicular bisector of *AB*. So which do you think is longer, *PA* or *PB*? ______ Now measure to find out.

Statements	Reasons
1.	1. Given
2. A' = B	2. Definition of Reflection
3. P is on m	3. Given
4. P' = P	4. Definition of Reflection
5. PA = PB	5.



Theorem 21:

The perpendicular bisectors of the sides of a triangle are concurrent.

Given:

In ΔABC, the perpendicular bisectors of the sides BC and AC intersects in S.

R.T.P:

'S' lies on the perpendicular bisector of the side AB also.

Construction:

Join SA, SB and SC.

Proof:

'S' is a point on the perpendicular bisector of BC.
SB = SC -------------I
'S' is a point on the perpendicular bisector of AC also.
SA = SC -----------II
From I and II we have SA = SB.
Therefore, 'S' must lie on the perpendicular bisector of AB also.
Therefore, the perpendicular of all the three sides intersect in a common point S and hence concurrent.

Note:

1. The circle passes through A, B and C. This circle is called the 'Circum Circle' of the triangle.
2. 'S' is called the 'Circum center' of the triangle.
3. SA or SB or SC is called the 'Circum radius' of the triangle.

What does the perpendicular bisector theorem mean. What is a perpendicular bisector theorem.

Loading... Question 1 :In the diagram shown below, MN is the perpendicular bisector of ST. (a) What segment lengths in the diagram are equal ?(b) Explain why Q is on MN ? Question 2 :In the diagram shown below, D is on the bisector of ∠BAC, DB ⊥ AB, DC ⊥ AC. Prove that DB = DC. Question 3 :Some roofs are built with wooden trusses that are assembled in a factory and shipped to the building site. In the diagram of the roof truss shown below, we are given that AB bisects ∠CAD and that ∠ACB and ∠ADB are right angles. What can be said about BC and BD ? 1. Answer : (a) What segment lengths in the diagram are equal?(b) Explain why Q is on MN?Part (a) :MN bisects ST, so NS = NT. Because M is on the perpendicular bisector of ST, by Perpendicular Bisector Theorem,MS = MTThe diagram shows that QS = QT = 12.Part (b) :QS = QT, so Q is equidistant from S and T. By Converse of the Perpendicular Bisector Theorem Q is on the perpendicular bisector of ST, which is MN.2. Answer : Given :D is on the bisector of ∠BAC, DB ⊥ AB, DC ⊥ ACTo Prove :DB = DCPlane for Proof :Prove that ΔADB ≅ ΔADC. Then conclude that DB ≅ DC, so DB = DC.Proof :By the definition of an angle bisector, ∠BAD ≅ ∠CAD. Because ∠ABD and ∠ACD are right angles,∠ABD ≅ ∠ACDBy the Reflexive Property of Congruence, AD ≅ AD. By the AAS congruence theorem,ΔADB ≅ ΔADCBecause corresponding parts of congruent triangles are congruent, DB ≅ DCBy the definition of congruent segments,DB = DC3. Answer : Because BC and BD meet AC and AD at right angles, they are perpendicular segments to the sides of ∠CAD.This implies that their lengths represent the distances from the point B to AC and AD. Because point B is on the bisector of ∠CAD, it is equidistant from the sides of the angle.So, BC = BD, and you can conclude that So,BC ≅ BD Kindly mail your feedback to v4formath@gmail.comWe always appreciate your feedback. ©All rights reserved. onlinemath4all.com When a line divides another line segment into two equal halves through its midpoint at 90º, it is called the perpendicular of that line segment. The perpendicular bisector theorem states that any point on the perpendicular bisector is equidistant from both the endpoints of the line segment on which it is drawn. If a pillar is standing at the center of a bridge at an angle, all the points on the pillar will be equidistant from the end points of the bridge. The perpendicular bisector theorem states that any point on the perpendicular bisector is equidistant from both the endpoints of the line segment on which it is drawn. In the above figure, MT = NT MS = NS MR = NR MQ = NQ The converse of the perpendicular bisector theorem states that if a point is equidistant from both the endpoints of the line segment in the same plane, then that point is on the perpendicular bisector of the line segment. In the above image, XZ=YZ It implies ZO is the perpendicular bisector of the line segment XY. Let us look at the proof of the above two theorems on a perpendicular bisector. Perpendicular Bisector Theorem Proof Consider the following figure, in which C is an arbitrary point on the perpendicular bisector of AB (which intersects AB at D): Compare \(\Delta ACD\) and \(\Delta BCD\). We have: AD = BD CD = CD (common) ∠ADC =∠BDC = 90° We see that \(\Delta ACD \cong \Delta BCD\) by the SAS congruence criterion. CA = CB,which means that C is equidistant from A and B. Note: Refer to the SAS congruence criterion to understand why \(\Delta ACD\) and \(\Delta BCD\) are congruent. Perpendicular Bisector Theorem Converse Proof Consider CA = CB in the above figure. To prove that AD = BD. Draw a perpendicular line from point C that intersects line segment AB at point D. Now, compare \(\Delta ACD\) and \(\Delta BCD\). We have: AC= BC CD = CD(common) ∠ADC = ∠BDC = 90° We see that \(\Delta ACD \cong \Delta BCD\) by the SAS congruence criterion. Thus, AD = BD, which means that C is equidistant from A and B. Important Notes The perpendicular bisector theorem and its converse can be proved by the SAS congruency criterion. The perpendicular bisector theorem is used in the construction of buildings, bridges, etc., and in making designs where we need to build something in the center and at equal distance from the endpoints. Related Topics on Perpendicular Bisector Theorem Example 1: In a pyramid, line segment AD is the perpendicular bisector of triangle ABC on line segment BC. If AB = 20 feet and BD= 7 feet, find the length of side AC. Solution It is given that AD is the perpendicular bisector on the line segment BC. So, By Perpendicular Bisector Theorem, any point on line segment AD is at an equal distance from points B and C. It implies, AB = AC AC = 20 feet. Example 2: In any equilateral or isosceles triangle, can we say that the vertex between equal sides lies on the perpendicular bisector of the base? Solution Draw a perpendicular from vertex X that intersects segment YZ at point \(O\). If XY =XZ, Then, by converse of perpendicular bisector theorem, it is proved that OY=OZ . \(\therefore\) Vertex X lies on the perpendicular bisector of the base YZ of triangle. go to slidego to slide How can

your child master math concepts? Book a Free Trial Class go to slidego to slidego to slidego to slide The perpendicular bisector theorem states that any point on the perpendicular bisector is equidistant from both the endpoints of the line segment on which it is drawn. What is the Angle Bisector Theorem? The angle bisector theorem states that in a triangle, the angle bisector of any angle will divide the opposite side in the ratio of the sides containing the angle. What is an Example of a Perpendicular Bisector? The median of a triangle is the line that joins the vertex of the triangle to the midpoint of the opposite side of the vertex. The median of an equilateral triangle is an example of a perpendicular bisector. What is the Linear Pair Perpendicular Theorem? The linear pair perpendicular theorem states that if two straight lines intersect at a point and the linear pair of angles they form have an equal measure, then the two lines are perpendicular to each other. What is the Median of a Triangle? The median of a triangle is a line segment which joins a vertex to the midpoint of the opposite side, thus bisecting that particular side. Every triangle has three medians which start from each vertex and intersect each other at the centroid of the triangle. The definition and properties of the perpendicular bisector are presented along with problems and their detailed solutions. Note that the figures below are not drawn to scale and therefore the problems below are not to be solved using the sizes of angles, segments, ... in the figures. Definition of Perpendicular Bisector The perpendicular bisector of a line segment AB is a line that is perpendicular to AB and passes through the midpoint of segment AB.(see figure below). \(\overline{MA} = \overline{MB} \) To construct a perpendicular bisector of segment \(AB\), we may proceed as follows: 1 - draw two circles centered at A and B and with equal radii larger than half the length of segment \(AB \). 2 - connect the intersections P and Q of the two circles to make a line. This line is perpendicular to AB and passes through the midpoint M of segment AB.(see figure below). Perpendicular Bisector of a Triangle and Cicumcenter \(ABC \) is a triangle and \(OM_{AB}\), \(OM_{BC}\) and \(OM_{AC}\) are the perpendicular bisector of \(AB \) , \(BC \) and \(AC \) respectively. The three bisctors intersect at the same point \(O \) called the circumcenter which is the center of the circumcircle through the points \(A \) , \(B \) and \(C \). The radius of the circumcircle \(R \) is given by \[R = \dfrac{1}{2} \dfrac{a}{\sin(A)} = \dfrac{1}{2} \dfrac{b}{\sin(B)} = \dfrac{1}{2} \dfrac{c}{\sin(C)} \] Problem 1 In the figure below, \(DE \) is the perpendicular bisector to segment \(AB \) whose length is equal to \(4 \) units. a) Find the size of angle \(x \). b) Find the area of triangle \(ABC \). Solution to Problem 1 a) Since \(DE \) is the perpendicular bisector to segment \(AB \), \(DE \) and \(AB \) are perpendicular and therefore \(\angle CFA = 90^{\circ} \) and the sum of all angles of triangle \(AFC \) is equal to \(180^{\circ} \) \(36^{\circ} + \angle ACF + 90^{\circ} = 180^{\circ} \) Solve for \(\angle ACF \) to obtain \(\angle ACF = 54^{\circ} \) Angles \(\angle ACF \) and \(x \) are vertical angles and therefore congruent; hence \(x = 54^{\circ} \) b) \(FC \) is the height of triangle \(ABC \) and its length is given by \(\overline{FC} = \overline{FA} \tan(36^{\circ}) \) Since \(DE \) is a perpendicular bisector, \(\overline{AB} = 4 \) and \(\overline{FA} \) is given by \(\overline{FA} = \dfrac{1}{2} \overline{AB} = 2 \) The area \(A \) of triangle \(ABC \) is given \(A = \dfrac{1}{2} \times base \times height \) Substitute \(A = \dfrac{1}{2} \times \overline{AB} \times \overline{FC} \) Substitute by numerical values \(A = \dfrac{1}{2} \overline{AB} \times 2 \times \tan(36^{\circ}) \approx 2.9\) square units Problem 2 In the figure below, \(DM \) is the perpendicular bisector to segment \(AB \) whose length is equal to \(4 \) units and \(DN \) is the perpendicular bisector to segment \(BC \) whose length is equal to \(6 \) units. Find the area of the quadrilateral \(MDNB \) if the length of segment \(BD \) is equal to \(7 \) units. Solution to Problem 2 The quadrilateral \(MDNB \) is not any of the quadrilateral whose formula of the area is known, we therefore need to split it into figures whose area may be calculated. It is here suggested to calculate the area of the quadrilateral \(MDNB \) as the sum of the areas of triangles \(BDM \) and \(BDN \). (see figure below) Since \(DM \) is a perpendicular bisector for segment \(AB \), we conclude that \(\overline{MB} = \dfrac{1}{2} \overline{AB} = 2 \) and \(BDM \) is a right triangle. (see figure below) Using the Pythagorean theorem , we can write \(\overline{BD}^2 = \overline{MB}^2 + \overline{MD}^2 \) Substitute the known quantities \(7^2 = 2^2 + \overline{MD}^2 \) Solve for \(\overline{MD} \) \(\overline{MD} = \sqrt{45} = 3 \sqrt 5\) Since \(DN \) is a perpendicular bisector for segment \(BC \), we conclude that \(\overline{NB} = \dfrac{1}{2} \overline{BC} = 3 \) and \(BDN \) is a right triangle. Use the Pythagorean theorem to write \(\overline{BD}^2 = \overline{NB}^2 + \overline{ND}^2 \) Substitute the known quantities \(7^2 = 3^2 + \overline{MD}^2 \) Solve for \(\overline{ND} \) \(\overline{ND} = \sqrt{40} = 2 \sqrt {10}\) Area of triangle \(BDM = \dfrac{1}{2} \overline{MB} \overline{MD} = \dfrac{1}{2} \times 2 \times 3 \sqrt 5 = 3 \sqrt 5 \) Area of triangle \(BDN = \dfrac{1}{2} \overline{NB} \overline{ND} = \dfrac{1}{2} \times 3 \times 2 \sqrt {10} = 3 \sqrt {10} \) The area \(A \) of the quadrilateral \(MDNB \) as the sum of the areas of triangles \(BDM \) and \(BDN \), hence \(A = 3 \sqrt 5 + 3 \sqrt {10} = 3 (\sqrt 5 + \sqrt {10}) \approx 16.2 \) square units. Problem 3 In the figure below, \(AD \) is parallel to \(BC \) and \(FE \) is the perpendicular bisector to segment \(AD \) whose length is equal to half the length of segment \(BC \). Find the ratio of the area of triangle \(AEF\) given that the area of the trapezoid \(ABCD\) is 120 square units. Solution to Problem 3 Since \(FE \) is a perpendicular bisector for segment \(AD \), we conclude that \(\overline{AF} = \dfrac{1}{2} \overline{AD}\) and \(AEF \) is a right triangle. (see figure below) The area \(A_1 \) of triangle \(AEF \) is given by \(A_1 = \dfrac{1}{2} \times \overline{AF} \times \overline{EF} \) The area \(A_2 \) of the trapezoid \(ABCD \) is given by \(A_2 = \dfrac{1}{2} \times (\overline{BC} + \overline{AD}) \times \overline{EF} \) The ratio \(\dfrac{A_2}{A_1} \) is given by \(\dfrac{A_2}{A_1} = \dfrac{\dfrac{1}{2} \times (\overline{BC} + \overline{AD}) \times \overline{EF}}{\dfrac{1}{2} \times \overline{AF} \times \overline{EF}} \) Simplify \(\dfrac{A_2}{A_1} = \dfrac{\overline{BC} + \overline{AD} }{\overline{AF} } \) We are also given that \(\overline{AD} = \dfrac{1}{2} \overline{BC} \) Hence \(\overline{AF} = \dfrac{1}{2} \overline{AD} = \dfrac{1}{4} \overline{BC}\) Substitute \(\dfrac{A_2}{A_1} = \dfrac{\overline{BC} + \dfrac{1}{2} \overline{BC} }{\dfrac{1}{4} \overline{BC}} \) Simplify \(\dfrac{A_2}{A_1} = \dfrac{ 1 + \dfrac{1}{2} }{\dfrac{1}{4}} = 6 \) Hence \(A_1 = \dfrac{A_2}{6} = \dfrac{120}{6} = 20 \) square units Slopes of Perpendicular Lines Questions Equation of a Circle Triangle, Bisectors and Radius of Circumcircle Pythagorean Theorem and Problems with Solutions Trapezoid Problems Geometry Tutorials, Problems and Interactive Applets.

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