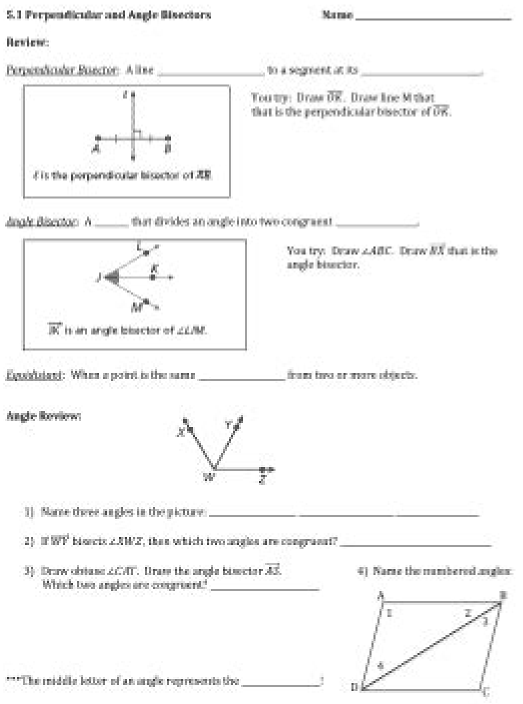
Perpendicular And Angle Bisectors Answer Key



5.1 Perpendicular and Angle Bisectors **Name** ________________________

Review:

Perpendicular Bisector: A line ________________ to a segment at its ________________.

ℓ is the perpendicular bisector of $\overline{AB}$.

You try: Draw $\overline{OK}$. Draw line M that that is the perpendicular bisector of $\overline{OK}$.

Angle Bisector: A ______ that divides an angle into two congruent ____________.

$\overrightarrow{JK}$ is an angle bisector of $\angle LJM$.

You try: Draw $\angle ABC$. Draw $\overrightarrow{BX}$ that is the angle bisector.

Equidistant: When a point is the same ____________ from two or more objects.

Angle Review:

1) Name three angles in the picture: ____________ ____________ ____________

2) If $\overrightarrow{WY}$ bisects $\angle XWZ$, then which two angles are congruent? ____________________

3) Draw obtuse $\angle CAT$. Draw the angle bisector $\overrightarrow{AS}$.
Which two angles are congruent? ______________

4) Name the numbered angles:

***The middle letter of an angle represents the ____________!

Perpendicular and angle bisectors answer key is an essential concept in geometry that helps students understand the relationships between various geometric figures. In this article, we will explore the definitions, properties, and applications of perpendicular and angle bisectors, as well as provide an answer key to common problems involving these concepts. As we delve deeper, we will cover various aspects, including how to construct perpendicular bisectors, properties of angle bisectors, and real-world applications.

Understanding Perpendicular Bisectors

Definition

A perpendicular bisector of a line segment is a line that intersects the segment at its midpoint and is perpendicular to it. This means that if you have a line segment AB, the perpendicular bisector will meet AB at a point M such that AM = MB, and the angle formed between the bisector and the segment is 90 degrees.

Properties of Perpendicular Bisectors

1. Equidistance Property: Any point on the perpendicular bisector of a line segment is equidistant from the endpoints of the segment. This means that if point P lies on the

perpendicular bisector of AB, then PA = PB.

2. Construction: To construct a perpendicular bisector:
- Find the midpoint of the line segment.
- Use a compass to draw arcs from both endpoints that intersect above and below the segment.
- Draw a line through the intersection points of the arcs.

3. Application in Triangle Construction: The perpendicular bisectors of a triangle intersect at a point known as the circumcenter, which is equidistant from all three vertices of the triangle.

Understanding Angle Bisectors

Definition

An angle bisector is a line or ray that divides an angle into two equal parts. For an angle $\angle ABC$, the angle bisector will create two angles, $\angle ABX$ and $\angle CBX$, that are equal in measure.

Properties of Angle Bisectors

1. Angle Bisector Theorem: This theorem states that the angle bisector of an angle in a triangle divides the opposite side into segments that are proportional to the lengths of the other two sides. For triangle ABC, if D is on side BC and AD is the angle bisector, then:

$$
\frac{BD}{DC} = \frac{AB}{AC}
$$

2. Construction: To construct an angle bisector:
- Use a compass to draw arcs from the vertex of the angle that intersects both rays.
- Without changing the compass width, draw arcs from the points where the first arc intersects the rays.
- The intersection of these two arcs will be on the angle bisector.

3. Application in Triangle Construction: The angle bisectors of a triangle intersect at a point called the incenter, which is the center of the inscribed circle (incircle) of the triangle.

Examples and Practice Problems

Understanding perpendicular and angle bisectors is crucial for mastering geometry. Here are some practice problems along with solutions to help reinforce these concepts.

Practice Problems

1. Perpendicular Bisector Problem: Given the endpoints of a line segment A(2, 3) and B(6, 7), find the equation of the perpendicular bisector.

2. Angle Bisector Problem: In triangle ABC, where AB = 6 cm, AC = 8 cm, and BC = 10 cm, find the ratio in which the angle bisector of ∠A divides side BC.

3. True or False: The perpendicular bisector of a segment is always the longest segment that can be drawn from the midpoint of the segment to any point on the plane.

Answer Key

1. Solution to Problem 1:
- First, find the midpoint M of segment AB:

$$
M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{2 + 6}{2}, \frac{3 + 7}{2}\right) = (4, 5)
$$

- Next, find the slope of line segment AB:

$$
\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 3}{6 - 2} = 1
$$

- The slope of the perpendicular bisector is the negative reciprocal:

$$
\text{slope of perpendicular bisector} = -1
$$

- Using point-slope form, the equation is:

$$
y - 5 = -1(x - 4) \implies y = -x + 9
$$

2. Solution to Problem 2:
- By applying the Angle Bisector Theorem:

$$
\frac{BD}{DC} = \frac{AB}{AC} = \frac{6}{8} = \frac{3}{4}
$$

- Therefore, the angle bisector divides side BC in the ratio 3:4.

3. Solution to Problem 3:
- False. The perpendicular bisector is not necessarily the longest segment. It is a line that is perpendicular to the segment at its midpoint, and it extends infinitely in both directions.

Real-World Applications

Understanding perpendicular and angle bisectors has numerous real-world applications, such as:

1. Architecture: When designing buildings, architects often use perpendicular bisectors to ensure symmetry and structural integrity.

2. Navigation: In surveying and navigation, angle bisectors help to determine the best paths and routes based on given angles.

3. Computer Graphics: Algorithms for rendering graphics often utilize bisectors to create realistic images and animations through effective use of angles and distances.

4. Robotics: In robotics, understanding these bisectors can help in pathfinding and obstacle avoidance by calculating optimal routes.

Conclusion

In summary, perpendicular and angle bisectors answer key provides crucial insights into the understanding of geometric principles. Through the exploration of definitions, properties, constructions, and practical applications, students can gain a comprehensive grasp of these concepts. Mastery of perpendicular and angle bisectors not only enhances one's mathematical skills but also lays the groundwork for further studies in geometry, trigonometry, and other related fields. By engaging with practice problems and real-world applications, learners can appreciate the significance of these geometric constructs in both academic and everyday contexts.

Frequently Asked Questions

What is the definition of a perpendicular bisector?

A perpendicular bisector is a line that divides a segment into two equal parts at a 90-degree angle.

How do you find the equation of the perpendicular bisector of a line segment?

To find the equation, first determine the midpoint of the segment, then calculate the slope of the segment, find the negative reciprocal of that slope for the perpendicular slope, and use the point-slope form to write the equation.

What is an angle bisector?

An angle bisector is a ray or line that divides an angle into two equal angles.

How can you construct the angle bisector of a given angle using a compass and straightedge?

To construct the angle bisector, draw an arc that intersects both sides of the angle, then use the intersection points to draw two more arcs that intersect each other. The line drawn from the angle's vertex to the intersection point of these arcs is the angle bisector.

What is the relationship between the perpendicular bisector and the distance from a point on it to the endpoints of the segment?

Any point on the perpendicular bisector is equidistant from the endpoints of the segment it bisects.

How can you determine if a point lies on the angle bisector of an angle?

A point lies on the angle bisector if it is equidistant from the two sides of the angle, which can be verified by measuring the perpendicular distances from the point to each side.

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