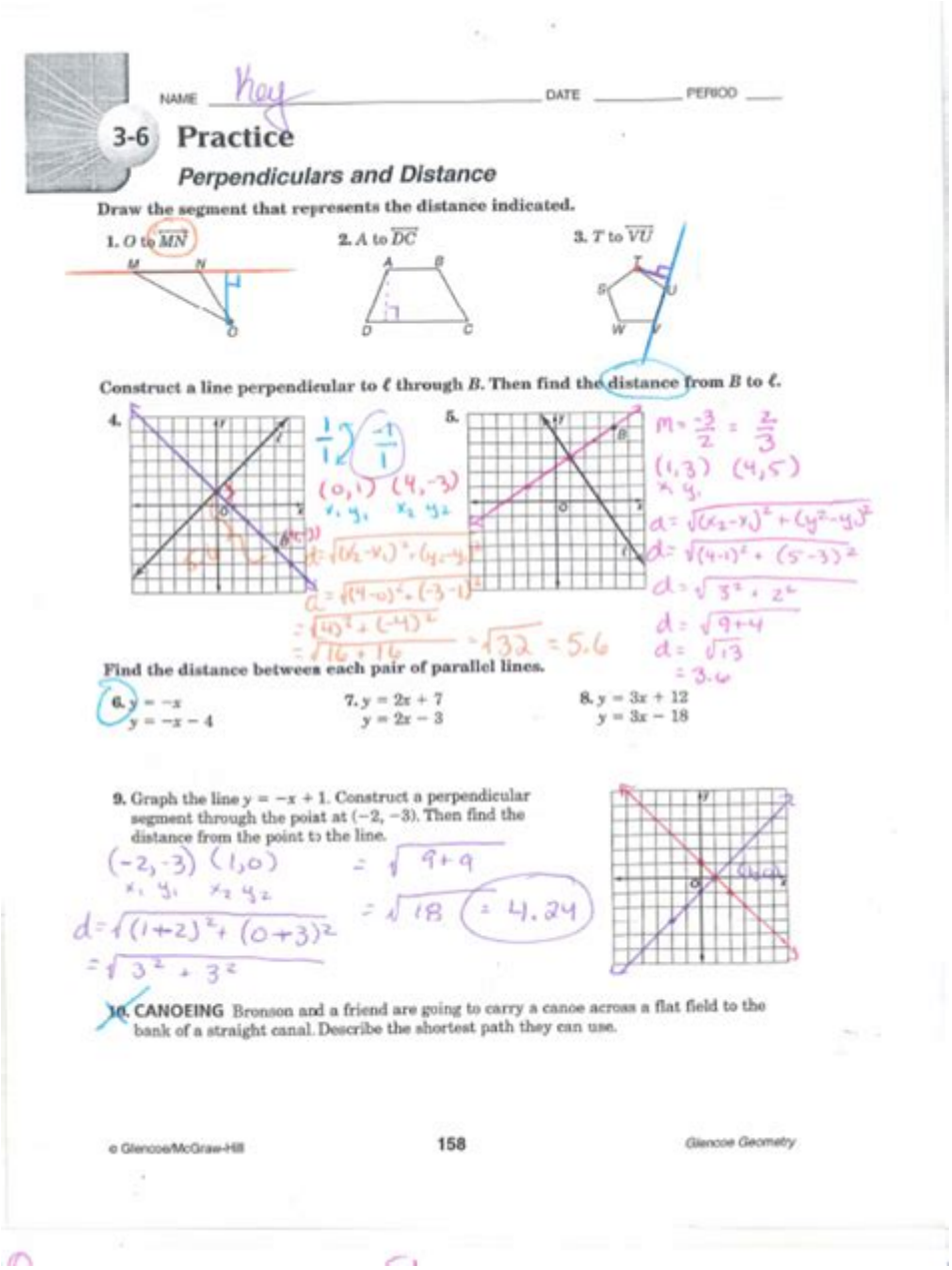
3 6 Skills Practice Perpendiculars And Distance



NAME Key DATE _____ PERIOD ____

3-6 Practice

Perpendiculars and Distance

Draw the segment that represents the distance indicated.

1. O to $\overline{MN}$ 2. A to $\overline{DC}$ 3. T to $\overline{VU}$

Construct a line perpendicular to ℓ through B. Then find the distance from B to ℓ.

4. 5.

Find the distance between each pair of parallel lines.

6. $y = -x$
   $y = -x - 4$
7. $y = 2x + 7$
   $y = 2x - 3$
8. $y = 3x + 12$
   $y = 3x - 18$

9. Graph the line $y = -x + 1$. Construct a perpendicular segment through the point at $(-2, -3)$. Then find the distance from the point to the line.

10. **CANOEING** Bronson and a friend are going to carry a canoe across a flat field to the bank of a straight canal. Describe the shortest path they can use.

3 6 skills practice perpendiculars and distance is an essential aspect of understanding geometry, particularly in the study of lines, angles, and their relationships in a two-dimensional plane. Mastery of these skills not only lays the foundation for advanced mathematical concepts but also enhances problem-solving abilities that are applicable in various real-world situations. This article will explore the definition of perpendicular lines, methods to calculate distances between points, and provide practical exercises to reinforce these concepts.

Understanding Perpendicular Lines

Perpendicular lines are two lines that intersect at a right angle (90 degrees). This concept is fundamental in

geometry and has numerous applications in engineering, architecture, and various fields of science.

Characteristics of Perpendicular Lines

1. Right Angles: The defining characteristic of perpendicular lines is that they intersect to form right angles.
2. Slope Relationships: In a Cartesian coordinate system, if two lines are perpendicular, the product of their slopes is -1. For example, if line A has a slope of m, then line B, which is perpendicular to line A, will have a slope of -1/m.
3. Symbol Representation: Perpendicular lines are often denoted by the symbol "⊥". For instance, if line AB is perpendicular to line CD, it is written as AB ⊥ CD.

Identifying Perpendicular Lines in a Coordinate Plane

To determine if two lines are perpendicular in a coordinate plane, follow these steps:

1. Find the Equations: Start with the equations of the lines in slope-intercept form ($y = mx + b$).
2. Calculate the Slopes: Identify the slopes ($m1$ and $m2$) of both lines.
3. Check the Product: Multiply the slopes. If $m1 \cdot m2 = -1$, then the lines are perpendicular.

Calculating Distance Between Points

Distance plays a crucial role in geometry, especially when discussing the spatial relationships between points, lines, and shapes. The distance between two points in a coordinate plane can be calculated using the distance formula.

The Distance Formula

The distance d between two points (x_1, y_1) and (x_2, y_2) can be calculated using the formula:

$$
d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}
$$

This formula is derived from the Pythagorean theorem and is essential for determining the length of the segment connecting two points.

Example of Distance Calculation

To illustrate the use of the distance formula, consider the following example:

- Points: Let point A be $(3, 4)$ and point B be $(7, 1)$.
- Calculation:
- $d = \sqrt{(7 - 3)^2 + (1 - 4)^2}$
- $d = \sqrt{(4)^2 + (-3)^2}$
- $d = \sqrt{16 + 9}$
- $d = \sqrt{25}$
- $d = 5$

Thus, the distance between points A and B is 5 units.

3 6 Skills Practice: Exercises

To enhance understanding of perpendicular lines and distance calculations, practical exercises can be beneficial. Below are various types of problems that can help reinforce these concepts.

Exercise 1: Identify Perpendicular Lines

Given the following lines, determine if they are perpendicular:

1. Line 1: $y = 2x + 3$
2. Line 2: $y = -\frac{1}{2}x + 1$

Steps:
- Find the slopes of both lines.
- Check if the product of the slopes is -1.

Solution:
1. Slope of Line 1 (m1): 2
2. Slope of Line 2 (m2): -1/2
3. Product: $2 -\frac{1}{2} = -1$

Yes, the lines are perpendicular.

Exercise 2: Calculate Distance Between Points

Calculate the distance between the following points:

1. Point A: (1, 2)
2. Point B: (4, 6)

Steps:
- Use the distance formula to find the distance.

Solution:
1. $d = \sqrt{(4 - 1)^2 + (6 - 2)^2}$
2. $d = \sqrt{(3)^2 + (4)^2}$
3. $d = \sqrt{9 + 16}$
4. $d = \sqrt{25} = 5$

The distance between points A and B is 5 units.

Exercise 3: Real-World Application

Consider a city grid where streets run parallel to the x-axis and y-axis. If a park is located at point P(2, 3) and a school is located at point S(2, 7), how far apart are they? Additionally, if a road runs perpendicular to the street connecting these two locations, what is the slope of that road?

Steps:
1. Calculate the distance between P and S.

2. Determine the slope of the road that runs perpendicular.

Solution:
1. Distance calculation:
- $d = \sqrt{(2 - 2)^2 + (7 - 3)^2}$
- $d = \sqrt{0 + 16} = 4$

The distance between the park and the school is 4 units.

2. Since points P and S have the same x-coordinate, the line connecting them is vertical (undefined slope). A road perpendicular to this line would be horizontal, which has a slope of 0.

Conclusion

3 6 skills practice perpendiculars and distance is a fundamental aspect of geometry that can significantly enhance one's understanding of spatial relationships. Mastering the concepts of perpendicular lines and distance calculations not only prepares students for more advanced mathematical topics but also equips them with skills applicable in everyday situations. By engaging in practical exercises, learners can solidify their understanding and application of these critical geometric principles. The continual practice of these skills will pave the way for success in both academic and real-world contexts.

Frequently Asked Questions

What are perpendicular lines and how can they be identified in a coordinate plane?

Perpendicular lines are lines that intersect at a right angle (90 degrees). In a coordinate plane, two lines are perpendicular if the product of their slopes is -1.

How do you calculate the distance between a point and a line?

The distance from a point (x0, y0) to a line $Ax + By + C = 0$ can be calculated using the formula: Distance = $|Ax0 + By0 + C| / \sqrt{(A^2 + B^2)}$.

What is the significance of the slope in determining perpendicularity?

The slope of a line indicates its steepness. For two lines to be perpendicular, the slope of one line must be the negative reciprocal of the slope of the other line.

How can you verify if two segments are perpendicular given their endpoints?

To verify if two segments are perpendicular, calculate the slopes of both segments using their endpoints. If the product of the slopes equals -1, then the segments are perpendicular.

In a 3D space, how is the concept of perpendicularity extended?

In 3D space, two lines are perpendicular if the dot product of their direction vectors equals zero. This indicates that the lines intersect at a right angle.

What role do perpendicular bisectors play in triangle geometry?

Perpendicular bisectors of a triangle's sides intersect at the circumcenter, which is equidistant from all three vertices, allowing for the circumcircle to be drawn.

How can you use the Pythagorean theorem in problems involving perpendicular lines?

The Pythagorean theorem can be used to find the distance between points or to verify right triangles formed by perpendicular lines by confirming that $a^2 + b^2 = c^2$.

What is the general equation for a line perpendicular to a given line?

The general equation for a line perpendicular to a line with slope m is $y - y1 = -1/m(x - x1)$, where $(x1, y1)$ is a point on the original line.

How can graphing help in understanding perpendicular lines and distances?

Graphing allows for a visual representation of lines, helping to easily identify perpendicular relationships and measure distances directly between points and lines.

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