

Lesson 11: Angle Problems and Solving Equations

Student Outcomes

 Students use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

Related Topics: More Lesson Plans for Grade 7 Common Core Math

Lesson Notes

Lesson 11 returns where Lesson 10 ended and incorporates slightly more difficult problems. At the heart of each problem is the need to be able to model the angle relationships in an equation and then solve for the unknown angle. The diagrams are all drawn to scale; students should verify their answers by using a protractor to measure relevant angles.

Classwork

Opening Exercise (8 minutes)

Students describe the angle relationship in the diagram and set up and solve an equation that models it. Have students verify their answers by measuring the unknown angle with a protractor.





Lesson 11: Date:

Angle Problems and Solving Equations 3/19/14







Example 1 (4 minutes)

Example 1

The following figure shows three lines intersecting at a point. In a complete sentence, describe the angle relationship in the diagram. Write an equation for the angle relationship shown in the figure and solve for x. Confirm your answers by measuring the angle with a protractor.

The angles 86° and 68° and the angle between them, which is vertically opposite and equal in measure to x, are angles on a line and sum to 180° .

86 + x + 68 = 180x + 154 = 180 x + 154 - 154 = 180 - 154 x = 26°





Lesson 11: Date: Angle Problems and Solving Equations 3/19/14





Exercise 1 (5 minutes)

Exercise 1

The following figure shows four lines intersecting at a point. In a complete sentence, describe the angle relationships in the diagram. Write an equation for the angle relationship shown in the figure and solve for x and y. Confirm your answers by measuring the angle with a protractor.

The angles x° , 25° , y° , and 40° are angles on a line and sum to 180°; the angle marked y° is vertically opposite and equal to 96°.

 $y = 96^{\circ}$, vert. $\angle s$

x + 25 + (96) + 40 = 180x + 161 = 180x + 161 - 161 = 180 - 161 $x = 19^{\circ}$



Example 2

In a complete sentence, describe the angle relationships in the diagram. You may label the diagram to help describe the angle relationships. Write an equation for the angle relationship shown in the figure and solve for x. Confirm your answers by measuring the angle with a protractor.

The angle formed by adjacent angles a° and b° is vertically opposite to the 77° angle. The angles x° , a° , and b° are adjacent angles that sum to 90° (since the adjacent angle is a right angle and together the angles are on a line).

$$x + 77 = 90$$

 $x + 77 - 77 = 90 - 77$
 $x = 13^{\circ}$



25

x°

v°

96°

40°

Exercise 2 (4 minutes)

Exercise 2

In a complete sentence, describe the angle relationships in the diagram. Write an equation for the angle relationship shown in the figure and solve for x and y. Confirm your answers by measuring the angle with a protractor.

Angles x° and y° are complementary and sum to 90° ; angles x° and 27° are complementary and sum to 90°.

x + 27 = 90x + 27 - 27 = 90 - 27 $x = 63^{\circ}$ (63) + y = 9063 - 63 + y = 90 - 63 $y = 27^{\circ}$





Lesson 11:

Angle Problems and Solving Equations 3/19/14





Example 3 (5 minutes)

Example 3

In a complete sentence, describe the angle relationships in the diagram. Write an equation for the angle relationship shown in the figure and solve for x. Find the measures of $\angle JAH$ and $\angle GAF$. Confirm your answers by measuring the angle with a protractor.

The sum of the degree measurements of $\angle JAH$, $\angle GAH$, $\angle GAF$, and the arc that subtends $\angle JAF$ is 360° .

225 + 2x + 90 + 3x = 360 315 + 5x = 360 315 - 315 + 5x = 360 - 315 5x = 45 $\left(\frac{1}{5}\right)5x = \left(\frac{1}{5}\right)45$ x = 9 $m \angle JAH = 2(9^{\circ}) = 18^{\circ} \qquad m \angle GAF = 3(9^{\circ}) = 27^{\circ}$



Exercise 3 (4 minutes)

Exercise 3



Example 4 (5 minutes)



COMMON Lesson 11: A CORE Date: 3,

Angle Problems and Solving Equations 3/19/14







Find the value of x. b. 50 + x + 4x = 18050 + 5x = 1805x + 50 - 50 = 180 - 505x = 130 $\left(\frac{1}{5}\right)(5x) = \left(\frac{1}{5}\right)(130)$ $x = 26^{\circ}$ Find the measures of $\angle FBG$, $\angle CBD$, $\angle ABF$, $\angle GBE$, $\angle DBE$. c. $\angle FBG = 26^{\circ}$ $\angle CBD = 26^{\circ}$ $\angle ABF = 4(26) = 104^{\circ}$ $\angle GBE = 50^{\circ}$ $m \angle DBE = 104^{\circ}$ d. What is the measure of $\angle ABG$? Identify the angle relationship used to get your answer. $\angle ABG = \angle ABF + \angle FBG$ $\angle ABG = 104 + 26$ $m \angle ABG = 130^{\circ}$ To determine the measure of $\angle ABG$, you need to add the measures of adjacent angles $\angle ABF$ and $\angle FBG$.

Exit Ticket (6 minutes)



Angle Problems and Solving Equations 3/19/14





Name _____

Date_____

Lesson 11: Angle Problems and Solving Equations

Exit Ticket

Write an equation for the angle relationship shown in the figure and solve for x. Find the measures of $\angle RQS$ and $\angle TQU$.





Angle Problems and Solving Equations 3/19/14







Exit Ticket Sample Solutions



Problem Set Sample Solutions





Lesson 11: Date: Angle Problems and Solving Equations 3/19/14









Lesson 11: Date: Angle Problems and Solving Equations 3/19/14





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Lesson 11: Date: Angle Problems and Solving Equations 3/19/14

