



Lesson 30: One-Step Problems in the Real World

Student Outcomes

- Students calculate missing angle measures by writing and solving equations.

Lesson Notes

This is an application lesson based on understandings developed in Grade 4. The three standards applied in this lesson include the following:

- 4.MD.C.5** Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:
- An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through $1/360$ of a circle is called a “one-degree angle,” and can be used to measure angles.
 - An angle that turns through n one-degree angles is said to have an angle measure of n degrees.
- 4.MD.C.6** Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.
- 4.MD.C.7** Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real-world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.

This lesson focuses, in particular, on **4.MD.C.7**.

Classwork

Fluency Exercise (5 minutes): Subtraction of Decimals

Sprint: Refer to Sprints and Sprint Delivery Script sections in the Module Overview for directions on how to administer a Sprint.

Opening Exercise (3 minutes)

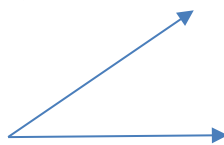
Students start the lesson with a review of key angle terms from Grade 4.

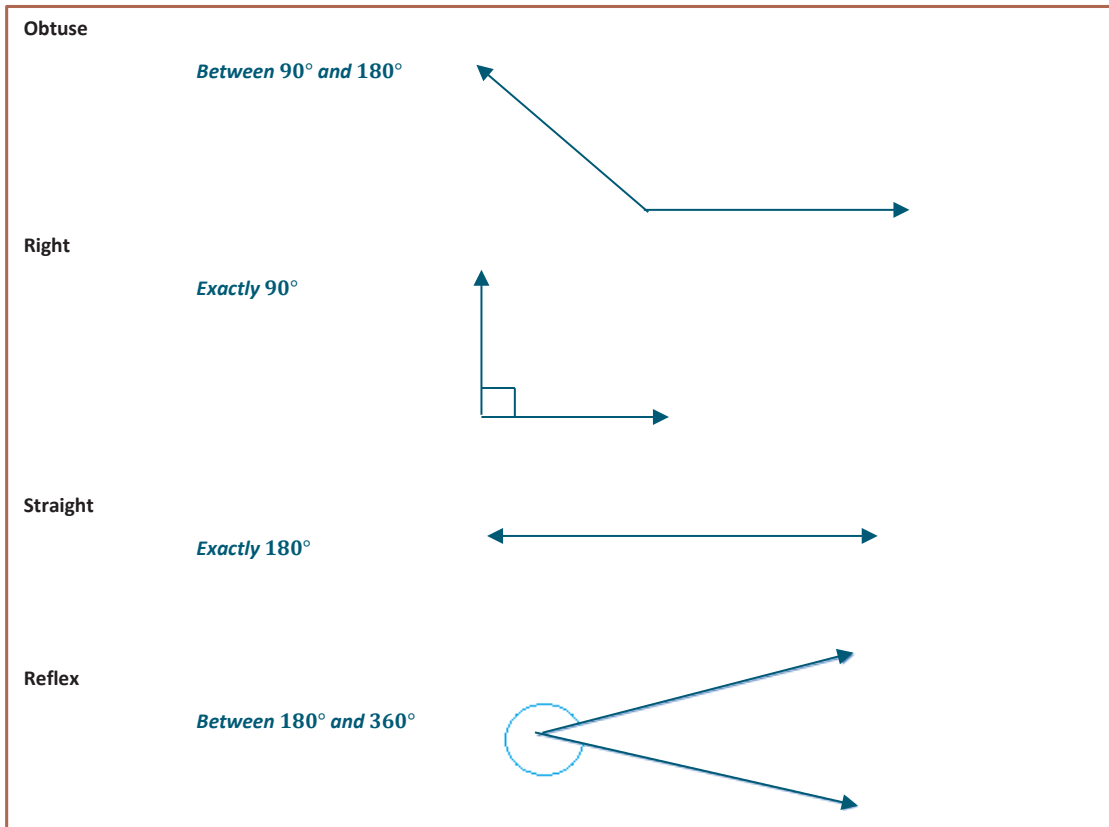
Opening Exercise

Draw an example of each term, and write a brief description.

Acute

Less than 90°





Example 1 (3 minutes)

Example 1

$\angle ABC$ measures 90° . The angle has been separated into two angles. If one angle measures 57° , what is the measure of the other angle?

- In this lesson, we will be using algebra to help us determine unknown measures of angles.

How are these two angles related?

The two angles have a sum of 90° .

What equation could we use to solve for x ?

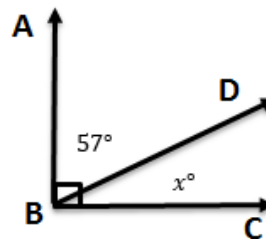
$$x^\circ + 57^\circ = 90^\circ$$

Now let's solve.

$$x^\circ + 57^\circ - 57^\circ = 90^\circ - 57^\circ$$

$$x^\circ = 33^\circ$$

The unknown angle is 33° .



MP.4

Example 2 (3 minutes)

Example 2

Michelle is designing a parking lot. She has determined that one of the angles should be 115° . What is the measure of angle x and angle y ?

How is angle x related to the 115° angle?

The two angles form a straight line. Therefore, they should add up to 180° .

What equation would we use to show this?

$$x^\circ + 115^\circ = 180^\circ$$

How would you solve this equation?

115 was added to the x , so I will take away 115 to get back to just x .

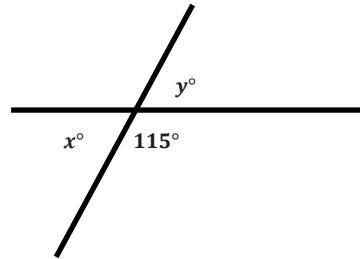
$$\begin{aligned} x^\circ + 115^\circ - 115^\circ &= 180^\circ - 115^\circ \\ x^\circ &= 65^\circ \end{aligned}$$

The angle next to 115° , labeled with an x , is equal to 65° .

How is angle y related to the angle that measures 115° ?

These two angles also form a straight line and must add up to 180° .

Therefore, x and y must both be equal to 65° .

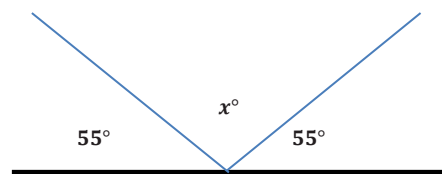


MP.4

Example 3 (3 minutes)

Example 3

A beam of light is reflected off a mirror. Below is a diagram of the reflected beam. Determine the missing angle measure.



How are the angles in this question related?

There are three angles that when all placed together form a straight line. This means that the three angles have a sum of 180° .

What equation could we write to represent the situation?

$$55^\circ + x^\circ + 55^\circ = 180^\circ$$

MP.4

How would you solve an equation like this?

We can combine the two angles that we do know.

$$\begin{aligned} 55^\circ + 55^\circ + x^\circ &= 180^\circ \\ 110^\circ + x^\circ &= 180^\circ \\ 110^\circ - 110^\circ + x^\circ &= 180^\circ - 110^\circ \\ x^\circ &= 70^\circ \end{aligned}$$

The angle of the bounce is 70° .

Exercises 1–5 (18 minutes)

Students will work independently.

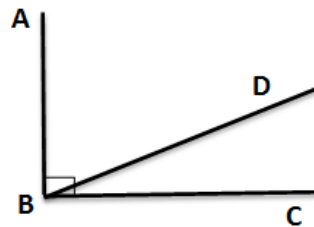
Exercises 1–5

Write and solve an equation in each of the problems.

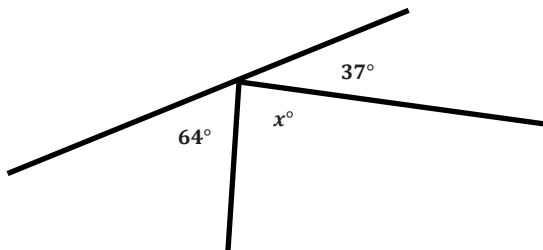
1. $\angle ABC$ measures 90° . It has been split into two angles, $\angle ABD$ and $\angle DBC$. The measure of the two angles is in a ratio of 2:1. What are the measures of each angle?

$$\begin{aligned} x^\circ + 2x^\circ &= 90^\circ \\ 3x^\circ &= 90^\circ \\ \frac{3x^\circ}{3} &= \frac{90^\circ}{3} \\ x^\circ &= 30^\circ \end{aligned}$$

One of the angles measures 30° , and the other measures 60° .

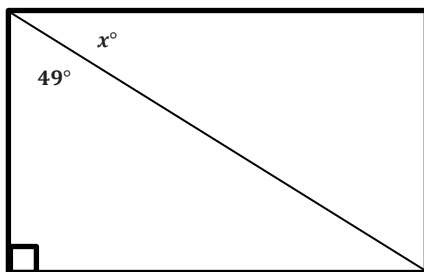


2. Solve for x .



$$\begin{aligned} x^\circ + 64^\circ + 37^\circ &= 180^\circ \\ x^\circ + 101^\circ &= 180^\circ \\ x^\circ + 101^\circ - 101^\circ &= 180^\circ - 101^\circ \\ x^\circ &= 79^\circ \end{aligned}$$

3. Candice is building a rectangular piece of a fence according to the plans her boss gave her. One of the angles is not labeled. Write an equation and use it to determine the measure of the unknown angle.



$$\begin{aligned} x^\circ + 49^\circ &= 90^\circ \\ x^\circ + 49^\circ - 49^\circ &= 90^\circ - 49^\circ \\ x^\circ &= 41^\circ \end{aligned}$$

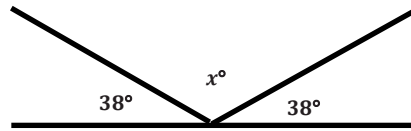
4. Rashid hit a hockey puck against the wall at a 38° angle. The puck hit the wall and traveled in a new direction. Determine the missing angle in the diagram.

$$38^\circ + x^\circ + 38^\circ = 180^\circ$$

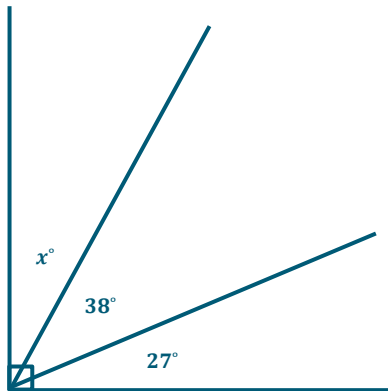
$$76^\circ + x^\circ = 180^\circ$$

$$76^\circ - 76^\circ + x^\circ = 180^\circ - 76^\circ$$

$$x^\circ = 104^\circ$$



5. Jaxon is creating a mosaic design on a rectangular table. He has added two pieces to one of the corners. The first piece has an angle measuring 38° and is placed in the corner. A second piece has an angle measuring 27° and is also placed in the corner. Draw a diagram to model the situation. Then, write an equation and use it to determine the measure of the unknown angle in a third piece that could be added to the corner of the table.



$$x^\circ + 38^\circ + 27^\circ = 90^\circ$$

$$x^\circ + 65^\circ = 90^\circ$$

$$x^\circ + 65^\circ - 65^\circ = 90^\circ - 65^\circ$$

$$x^\circ = 25^\circ$$

Closing (3 minutes)

- Explain how you determined the equation you used to solve for the missing angle or variable.
 - *I used the descriptions in the word problems. For example, if it said “the sum of the angles,” I knew to add the measures together.*
 - *I also used my knowledge of angles to know the total angle measure. For example, I know a straight angle has a measure of 180° and a right angle or a corner has a measure of 90° .*

Exit Ticket (7 minutes)

Name _____

Date _____

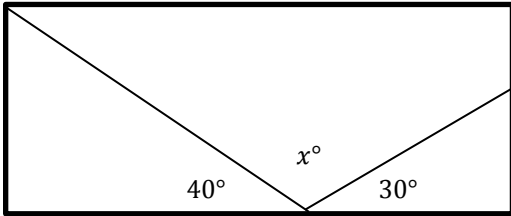
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Exit Ticket

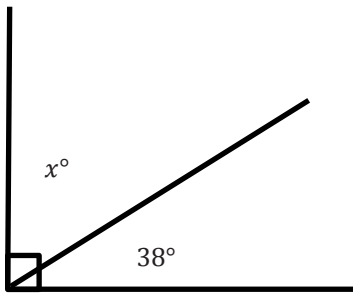
Write an equation, and solve for the missing angle in each question.

1. Alejandro is repairing a stained glass window. He needs to take it apart to repair it. Before taking it apart, he makes a sketch with angle measures to put it back together.

Write an equation, and use it to determine the measure of the unknown angle.



2. Hannah is putting in a tile floor. She needs to determine the angles that should be cut in the tiles to fit in the corner. The angle in the corner measures 90° . One piece of the tile will have a measure of 38° . Write an equation, and use it to determine the measure of the unknown angle.



Exit Ticket Sample Solutions

Write an equation, and solve for the missing angle in each question.

- Alejandro is repairing a stained glass window. He needs to take it apart to repair it. Before taking it apart, he makes a sketch with angle measures to put it back together.

Write an equation, and use it to determine the measure of the unknown angle.

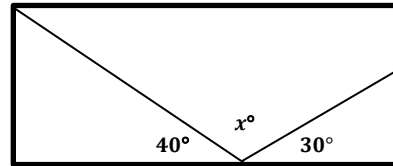
$$40^\circ + x^\circ + 30^\circ = 180^\circ$$

$$x^\circ + 40^\circ + 30^\circ = 180^\circ$$

$$x^\circ + 70^\circ = 180^\circ$$

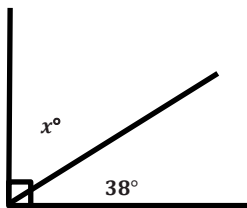
$$x^\circ + 70^\circ - 70^\circ = 180^\circ - 70^\circ$$

$$x^\circ = 110^\circ$$



The missing angle measures 110° .

- Hannah is putting in a tile floor. She needs to determine the angles that should be cut in the tiles to fit in the corner. The angle in the corner measures 90° . One piece of the tile will have a measure of 38° . Write an equation, and use it to determine the measure of the unknown angle.



$$x^\circ + 38^\circ = 90^\circ$$

$$x^\circ + 38^\circ - 38^\circ = 90^\circ - 38^\circ$$

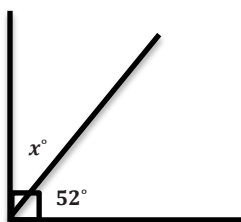
$$x^\circ = 52^\circ$$

The unknown angle is 52° .

Problem Set Sample Solutions

Write and solve an equation for each problem.

- Solve for x .

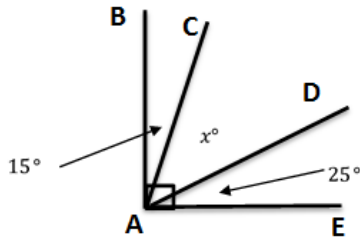


$$x^\circ + 52^\circ = 90^\circ$$

$$x^\circ + 52^\circ - 52^\circ = 90^\circ - 52^\circ$$

$$x^\circ = 38^\circ$$

2. $\angle BAE$ measures 90° . Solve for x .



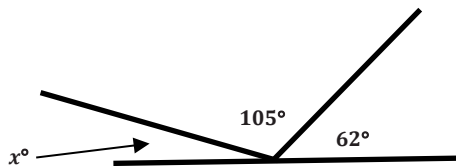
$$\begin{aligned} 15^\circ + x^\circ + 25^\circ &= 90^\circ \\ 15^\circ + 25^\circ + x^\circ &= 90^\circ \\ 40^\circ + x^\circ &= 90^\circ \\ 40^\circ - 40^\circ + x^\circ &= 90^\circ - 40^\circ \\ x^\circ &= 50^\circ \end{aligned}$$

3. Thomas is putting in a tile floor. He needs to determine the angles that should be cut in the tiles to fit in the corner. The angle in the corner measures 90° . One piece of the tile will have a measure of 24° . Write an equation, and use it to determine the measure of the unknown angle.

$$\begin{aligned} x^\circ + 24^\circ &= 90^\circ \\ x^\circ + 24^\circ - 24^\circ &= 90^\circ - 24^\circ \\ x^\circ &= 66^\circ \end{aligned}$$

The unknown angle is 66° .

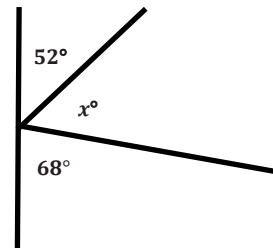
4. Solve for x .



$$\begin{aligned} x^\circ + 105^\circ + 62^\circ &= 180^\circ \\ x^\circ + 167^\circ &= 180^\circ \\ x^\circ + 167^\circ - 167^\circ &= 180^\circ - 167^\circ \\ x^\circ &= 13^\circ \end{aligned}$$

5. Aram has been studying the mathematics behind pinball machines. He made the following diagram of one of his observations. Determine the measure of the missing angle.

$$\begin{aligned} 52^\circ + x^\circ + 68^\circ &= 180^\circ \\ 120^\circ + x^\circ &= 180^\circ \\ 120^\circ + x^\circ - 120^\circ &= 180^\circ - 120^\circ \\ x^\circ &= 60^\circ \end{aligned}$$



6. The measures of two angles have a sum of 90° . The measures of the angles are in a ratio of 2: 1. Determine the measures of both angles.

$$\begin{aligned} 2x^\circ + x^\circ &= 90^\circ \\ 3x^\circ &= 90^\circ \\ \frac{3x^\circ}{3} &= \frac{90}{3} \\ x^\circ &= 30^\circ \end{aligned}$$

The angles measure 30° and 60° .

7. The measures of two angles have a sum of 180° . The measures of the angles are in a ratio of 5:1. Determine the measures of both angles.

$$5x^\circ + x^\circ = 180^\circ$$

$$6x^\circ = 180^\circ$$

$$\frac{6x^\circ}{6} = \frac{180}{6}$$

$$x^\circ = 30^\circ$$

The angles measure 30° and 150° .



Subtraction of Decimals—Round 1

Number Correct: _____

Directions: Subtract the decimals to determine the difference.

1.	$9.4 - 4.1$	
2.	$7.4 - 3.2$	
3.	$49.5 - 32.1$	
4.	$20.9 - 17.2$	
5.	$9.2 - 6.8$	
6.	$7.48 - 2.26$	
7.	$58.8 - 43.72$	
8.	$38.99 - 24.74$	
9.	$116.32 - 42.07$	
10.	$46.83 - 35.6$	
11.	$54.8 - 43.66$	
12.	$128.43 - 87.3$	
13.	$144.54 - 42.09$	
14.	$105.4 - 68.22$	
15.	$239.5 - 102.37$	

16.	$41.72 - 33.9$	
17.	$354.65 - 67.5$	
18.	$448.9 - 329.18$	
19.	$8 - 5.38$	
20.	$94.21 - 8$	
21.	$134.25 - 103.17$	
22.	$25.8 - 0.42$	
23.	$115 - 1.65$	
24.	$187.49 - 21$	
25.	$345.77 - 248.69$	
26.	$108 - 54.7$	
27.	$336.91 - 243.38$	
28.	$264 - 0.742$	
29.	$174.38 - 5.9$	
30.	$323.2 - 38.74$	



Subtraction of Decimals—Round 1 [KEY]

Directions: Subtract the decimals to determine the difference.

1.	$9.4 - 4.1$	5.3
2.	$7.4 - 3.2$	4.2
3.	$49.5 - 32.1$	17.4
4.	$20.9 - 17.2$	3.7
5.	$9.2 - 6.8$	2.4
6.	$7.48 - 2.26$	5.22
7.	$58.8 - 43.72$	15.08
8.	$38.99 - 24.74$	14.25
9.	$116.32 - 42.07$	74.25
10.	$46.83 - 35.6$	11.23
11.	$54.8 - 43.66$	11.14
12.	$128.43 - 87.3$	41.13
13.	$144.54 - 42.09$	102.45
14.	$105.4 - 68.22$	37.18
15.	$239.5 - 102.37$	137.13

16.	$41.72 - 33.9$	7.82
17.	$354.65 - 67.5$	287.15
18.	$448.9 - 329.18$	119.72
19.	$8 - 5.38$	2.62
20.	$94.21 - 8$	86.21
21.	$134.25 - 103.17$	31.08
22.	$25.8 - 0.42$	25.38
23.	$115 - 1.65$	113.35
24.	$187.49 - 21$	166.49
25.	$345.77 - 248.69$	97.08
26.	$108 - 54.7$	53.3
27.	$336.91 - 243.38$	93.53
28.	$264 - 0.742$	263.258
29.	$174.38 - 5.9$	168.48
30.	$323.2 - 38.74$	284.46



Subtraction of Decimals—Round 2

Number Correct: _____

Improvement: _____

Directions: Subtract the decimals to determine the difference.

1.	$8.4 - 5.4$	
2.	$5.6 - 3.1$	
3.	$9.7 - 7.2$	
4.	$14.3 - 12.1$	
5.	$34.5 - 13.2$	
6.	$14.86 - 13.85$	
7.	$43.27 - 32.14$	
8.	$48.48 - 27.27$	
9.	$64.74 - 31.03$	
10.	$98.36 - 24.09$	
11.	$33.54 - 24.4$	
12.	$114.7 - 73.42$	
13.	$45.2 - 32.7$	
14.	$74.8 - 53.9$	
15.	$238.4 - 114.36$	

16.	$14 - 10.32$	
17.	$43.37 - 28$	
18.	$24.56 - 18.88$	
19.	$33.55 - 11.66$	
20.	$329.56 - 284.49$	
21.	$574.3 - 342.18$	
22.	$154 - 128.63$	
23.	$247.1 - 138.57$	
24.	$12 - 3.547$	
25.	$1.415 - 0.877$	
26.	$185.774 - 154.86$	
27.	$65.251 - 36.9$	
28.	$144.2 - 95.471$	
29.	$2.11 - 1.949$	
30.	$100 - 34.746$	



Subtraction of Decimals—Round 2 [KEY]

Directions: Subtract the decimals to determine the difference.

1.	$8.4 - 5.4$	3.0	16.	$14 - 10.32$	3.68
2.	$5.6 - 3.1$	2.5	17.	$43.37 - 28$	15.37
3.	$9.7 - 7.2$	2.5	18.	$24.56 - 18.88$	5.68
4.	$14.3 - 12.1$	2.2	19.	$33.55 - 11.66$	21.89
5.	$34.5 - 13.2$	21.3	20.	$329.56 - 284.49$	45.07
6.	$14.86 - 13.85$	1.01	21.	$574.3 - 342.18$	232.12
7.	$43.27 - 32.14$	11.13	22.	$154 - 128.63$	25.37
8.	$48.48 - 27.27$	21.21	23.	$247.1 - 138.57$	108.53
9.	$64.74 - 31.03$	33.71	24.	$12 - 3.547$	8.453
10.	$98.36 - 24.09$	74.27	25.	$1.415 - 0.877$	0.538
11.	$33.54 - 24.4$	9.14	26.	$185.774 - 154.86$	30.914
12.	$114.7 - 73.42$	41.28	27.	$65.251 - 36.9$	28.351
13.	$45.2 - 32.7$	12.5	28.	$144.2 - 95.471$	48.729
14.	$74.8 - 53.9$	20.9	29.	$2.11 - 1.949$	0.161
15.	$238.4 - 114.36$	124.04	30.	$100 - 34.746$	65.254