Identify Angle Pairs

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7.1 Identify Angle Pairs

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[Figure 1]

Joey is a member of the Search and Rescue team. They receive a lot of calls to find people who get lost while hiking on the mountain trails. His German shepherd dog has a keen sense of smell so Joey wants to train him to follow the scent trail left by a human being. He plans out the following tracking trail to use for training Rufus.
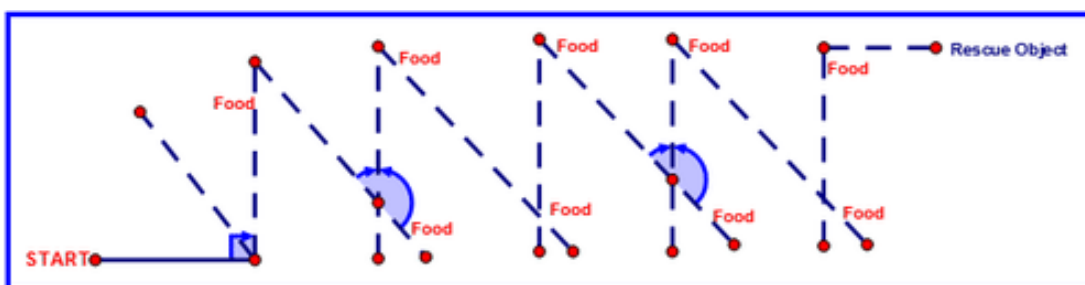
[Figure 2]

Joey looks at the tracking trail and wonders what kind of angle pairs he has created in the trail. How can he figure out the relationship between the angle pairs indicated on the trail?

In this concept, you will learn to identify angle pairs as being complementary, supplementary or neither.

Angle Pairs

An **angle** is the intersection of two non-collinear rays at a common endpoint. The rays are called the sides or arms of the angle and the common endpoint is called the vertex. Here is an angle with its parts labelled.
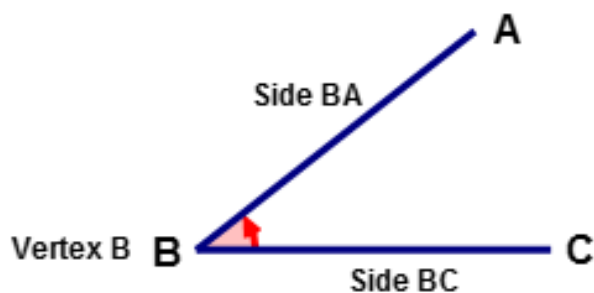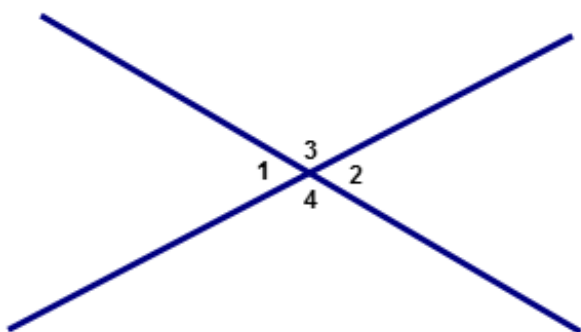
[Figure 3]

A single angle that measures 180° is called a **straight angle**. The following diagram shows a straight angle with its vertex B.

[Figure 4]

If sides BA and BC were extended such that they intersected at B, then the diagram would look like this:

[Figure 5]

The intersecting lines have created four angles with each angle having the intersection point its vertex. The angles are numbered $\angle 1$, $\angle 2$, $\angle 3$, $\angle 4$. The intersection of the two lines has created angle pairs. **Angle pairs** are two angles that share a unique relationship. The angle pairs in this diagram have a measure that equals 180° which is the measure of a straight angle. Angle pairs that have a sum of 180° are called **supplementary angles**.

In the above diagram the supplementary angles are:

$\angle 1$ and $\angle 3$, $\angle 1$ and $\angle 4$, $\angle 2$ and $\angle 3$, $\angle 2$ and $\angle 4$. Therefore,

$$\angle 1 + \angle 3 = 180°, \ \angle 1 + \angle 4 = 180°, \ \angle 2 + \angle 3 = 180°, \ \angle 2 + \angle 4 = 180°$$

The following diagram shows supplementary angles:
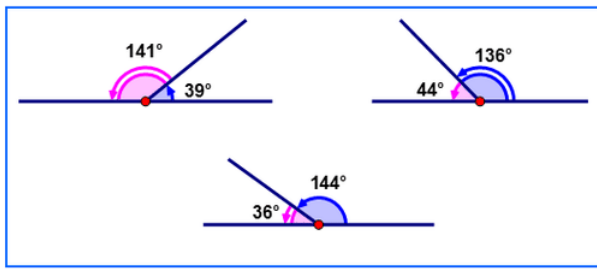
[Figure 6]

A single angle that measures 90° is called a **right angle**. The following diagram shows a right angle with its vertex B.
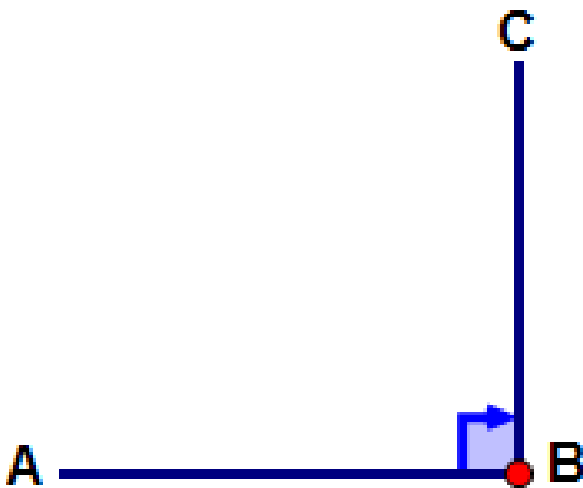
[Figure 7]

. $\angle 1 + \angle 2 = 90°$. Therefore, $\angle 2$ and $\angle 1$. In the following diagram the complementary angles are **complementary angles**The angle pair shown in the following diagram have a measure equal to 90° which is the measure of a right angle. Angle pairs that have a sum of 90° are called
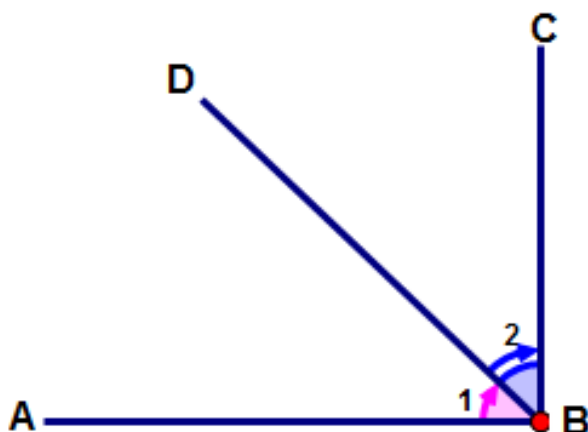
[Figure 8]

The following diagram shows complementary angles:
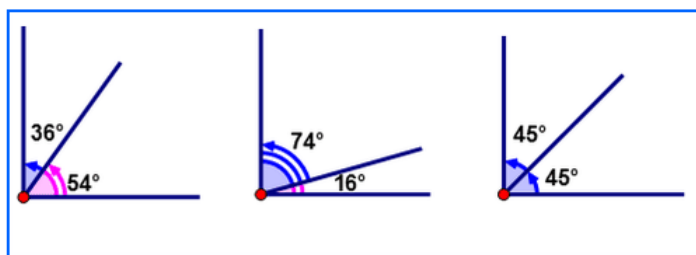
[Figure 9]

Now you can identify supplementary or complementary angles based on the sum of the angle pairs. Identify the following angle pairs as either complementary or supplementary.

[Figure 10]

In the first diagram the sum of the angle pair is $30° + 60° = 90°$. Therefore, the diagram shows complementary angles.

In the second diagram the sum of the angle pair is $125° + 55° = 180°$. Therefore, the diagram shows supplementary angles.

In the third diagram the sum of the angle pair is $34° + 87° = 121°$. Therefore, the diagram shows neither supplementary nor complementary angles.

Examples

### Example 1

Earlier, you were given a problem about Joey who was training his dog. He has marked three pairs of angles on his tracking trail and is wondering what the relationship between the marked angle pairs is.

First, remember if the sum of the measures of the angles is 90° then the angles are complementary. If the sum of the measures of the angles is 180° then the angles are supplementary.

Next, identify the first angle pair marked on the tracking trail to the right of the 'Start' point.

This angle pair has a sum of 90° since the right angle is indicated by the square. These angles are complementary.

Next, identify the second angle pair marked on the first downward trail of the training track. This angle pair has a sum of 180° since the angles are on a straight line. These angles are supplementary.

Next, identify the third angle pair marked on the third downward trail of the training track. This angle pair has a sum of 180° since the angles are on a straight line. These angles are supplementary.

Example 2

Identify the following angles as being complementary, supplementary or neither.
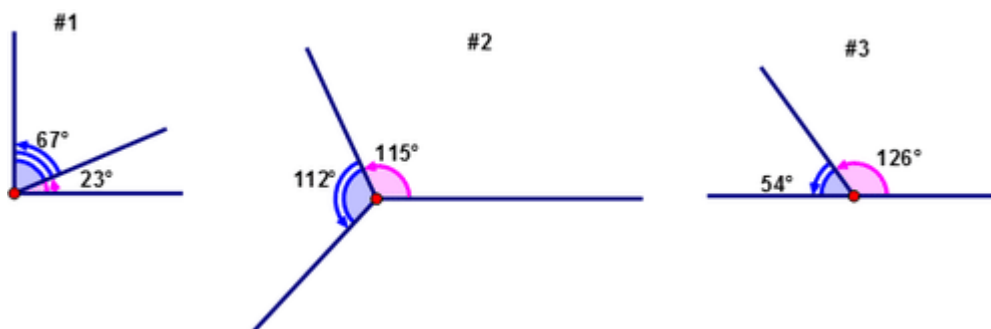
[Figure 11]

#1 - The sum of the angle pair is $23° + 67° = 90°$. The angles are complementary.

#2 - The sum of the angle pair is $115° + 112° = 227°$. The sum of the angle pair $\neq 90°$ and $\neq 180°$. The angle pair is neither complementary nor supplementary.

#3 - The sum of the angle pair is $126° + 54° = 180°$. The angles are supplementary.

Example 3

Find the measure of two complementary angles, $\angle A$ and $\angle B$, if the difference in the measure of the angle pair is 18°.

First, let 'x' represent $m\angle A$.

Next, write an equation to model the measure of the complementary angles.

$$m\angle B + x = 90$$

Next, solve the equation for $m\angle B$ by subtracting 'x' from both sides of the equation.

$$
\begin{aligned}
m\angle B + x &= 90 \\
m\angle B + x - x &= 90 - x \\
m\angle B &= 90 - x
\end{aligned}
$$

Next, write an equation to model the difference between the measures of the complementary angles.

$$m\angle B - m\angle A = 18$$

Next, substitute in the expression for $m\angle B$ and the variable for $m\angle A$.

$$
\begin{aligned}
m\angle B - m\angle A &= 18 \\
(90 - x) - x &= 18
\end{aligned}
$$

Next, multiply $1(90 - x)$ to clear the parenthesis.

$$
\begin{aligned}
1(90 - x) - x &= 18 \\
90 - x - x &= 18
\end{aligned}
$$

Next, simplify the equation.

$$
\begin{aligned}
90 - x - x &= 18 \\
90 - 2x &= 18
\end{aligned}
$$

Next, isolate the variable by subtracting 90 from both sides of the equation. Simplify the equation.

$$
\begin{aligned}
90 - 2x &= 18 \\
90 - 90 - 2x &= 18 - 90 \\
-2x &= -72
\end{aligned}
$$

Then, solve the equation for 'x' by dividing both sides of the equation by -2.

$$
\begin{aligned}
-2x &= -72 \\
\frac{\cancel{-2}^{1} x}{\cancel{-2}} &= \frac{-72}{-2} \\
x &= 36
\end{aligned}
$$

The answer is $x = 36$.

The $m\angle A = 36°$.

Then, use the value to determine $m\angle B$.

$$
\begin{aligned}
m\angle B &= 90 - x \\
m\angle B &= 90 - 36 \\
m\angle B &= 54°
\end{aligned}
$$

Example 4

Find the measure of two supplementary angles, $\angle A$ and $\angle B$, if the difference in the measure of the angle pair is 32°.

First, let 'x' represent $m\angle A$.

Next, write an equation to model the measure of the complementary angles.

$$m\angle B + x = 180$$

Next, solve the equation for $m\angle B$ by subtracting 'x' from both sides of the equation.

$$
\begin{aligned}
m\angle B + x &= 180 \\
m\angle B + x - x &= 180 - x \\
m\angle B &= 180 - x
\end{aligned}
$$

Next, write an equation to model the difference between the measures of the complementary angles.

$$m\angle B - m\angle A = 32$$

Next, substitute in the expression for $m\angle B$ and the variable for $m\angle A$.

$$
\begin{aligned}
m\angle B - m\angle A &= 32 \\
(180 - x) - x &= 32
\end{aligned}
$$

Next, multiply $1(180 - x)$ to clear the parenthesis.

$$1(180 - x) - x \quad = \quad 32$$
$$180 - x - x \quad = \quad 32$$

Next, simplify the equation.

$$180 - x - x \quad = \quad 32$$
$$180 - 2x \quad = \quad 32$$

Next, isolate the variable by subtracting 90 from both sides of the equation. Simplify the equation.

$$180 - 2x \quad = \quad 32$$
$$180 - 180 - 2x \quad = \quad 32 - 180$$
$$-2x \quad = \quad -148$$

Then, solve the equation for 'x' by dividing both sides of the equation by -2.

$$-2x \quad = \quad -148$$
$$\frac{\overset{1}{\cancel{-2}}\,x}{\cancel{-2}} \quad = \quad \frac{-148}{-2}$$
$$x \quad = \quad 74$$

The answer is $x = 74$.

The $m\angle A = 74°$.

Then, use the value to determine $m\angle B$.

$$m\angle B \quad = \quad 180 - x$$
$$m\angle B \quad = \quad 180 - 74$$
$$m\angle B \quad = \quad 106°$$

Review

If the following angle pairs are complementary, then what is the measure of the missing angle?

1. If $\angle A = 55°$ then $\angle B =$?

2. If $\angle C = 33°$ then $\angle D =$?

3. If $\angle E = 83°$ then $\angle F =$?

4. If $\angle G = 73°$ then $\angle H =$?

If the following angle pairs are supplementary, then what is the measure of the missing angle?

5. If $\angle A = 10°$ then $\angle B =$?

6. If $\angle A = 80°$ then $\angle B =$?

7. If $\angle C = 30°$ then $\angle F =$?

8. If $\angle D = 15°$ then $\angle E =$?

9. If $\angle M = 112°$ then $\angle N =$?

10. If $\angle O = 2°$ then $\angle P =$?

State whether the following statements are True or False.

11. Complementary angles are equal to 180°.

12. Complementary angles are equal to 90°.

13. Supplementary angles are equal to 90°.

14. Supplementary angles are equal to 180°.

15. Angle pairs less than 90 degrees are neither supplementary nor complementary.

Review (Answers)

To see the review answers, return to the Table of Contents and select 'Other Versions' or 'Resources'.

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1.0 REFERENCES

| Image	Attributions
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