

# 13 6 practice b the law of cosines answers

**13 6 Practice B The Law of Cosines Answers** is a topic that delves into one of the fundamental concepts in trigonometry, particularly useful for solving problems involving triangles. The Law of Cosines is a powerful tool that helps us relate the lengths of the sides of a triangle to the cosine of one of its angles. This law is particularly useful in non-right triangles, allowing us to find unknown side lengths or angle measures when certain other values are known. In this article, we will explore the Law of Cosines, provide explanations of its applications, and then present the answers to the 13 6 Practice B problems, ensuring a comprehensive understanding of the material.

## Understanding the Law of Cosines

The Law of Cosines states that for any triangle with sides  $a$ ,  $b$ , and  $c$ , opposite to angles  $A$ ,  $B$ , and  $C$  respectively, the following relationships hold:

$$c^2 = a^2 + b^2 - 2ab \cos(C)$$

$$b^2 = a^2 + c^2 - 2ac \cos(B)$$

$$a^2 = b^2 + c^2 - 2bc \cos(A)$$

## Key Components

- Sides: The lengths of the triangle's sides.
- Angles: The angles opposite those sides.
- Cosine Function: A trigonometric function which relates the angle to the ratios of the sides of the triangle.

## When to Use the Law of Cosines

The Law of Cosines is particularly useful in the following scenarios:

1. When you have:
  - Two sides and the included angle (SAS): You can find the third side.
  - All three sides (SSS): You can find an angle.
2. In non-right triangles where the Pythagorean theorem cannot be applied directly.

## Derivation of the Law of Cosines

To derive the Law of Cosines, consider a triangle  $ABC$  with vertices  $A$ ,  $B$ , and  $C$ . By dropping a perpendicular from vertex  $C$  to side  $AB$ , we can use the Pythagorean theorem to express the lengths of the sides in terms of the angles.

1. Let  $h$  be the height from  $C$  to  $AB$ .
2. The base  $AB$  can be expressed as  $a$ , and the segments created can be expressed in terms of  $B$  and  $C$ .
3. By applying the cosine function to relate the sides and the angles, we arrive at the Law of Cosines.

### Applications of the Law of Cosines

The Law of Cosines has various applications in geometry, physics, engineering, and computer graphics. Here are some common applications:

#### 1. Solving Triangles

When given:

- Two sides and the included angle (SAS): Use the appropriate formula to find the third side.
- Three sides (SSS): Rearrange the Law of Cosines to find any angle.

#### 2. Navigation and Surveying

In fields like navigation and surveying, the Law of Cosines is essential for calculating distances and angles between points that cannot be directly measured.

#### 3. Physics Problems

In physics, especially in problems involving vectors, the Law of Cosines can help find resultant magnitudes and directions when dealing with forces acting at angles.

### 13.6 Practice B Problems

In this section, we will outline a sample of the problems typically found in the 13.6 Practice B worksheet, along with their answers. Each problem will exemplify a scenario where the Law of Cosines can be applied.

#### Problem Breakdown

1. Problem 1: Given triangle  $ABC$  where  $a = 7$ ,  $b = 10$ , and  $C = 60^\circ$ . Find side  $c$ .

- Solution:

$$c^2 = a^2 + b^2 - 2ab \cos(C)$$

$$c^2 = 7^2 + 10^2 - 2 \cdot 7 \cdot 10 \cdot \cos(60^\circ)$$

$$c^2 = 49 + 100 - 70$$

$$c^2 = 79 \implies c = \sqrt{79} \approx 8.89$$

2. Problem 2: Given  $a = 5$ ,  $b = 8$ ,  $c = 10$ . Find angle  $C$ .

- Solution:

$$c^2 = a^2 + b^2 - 2ab \cos(C)$$

$$10^2 = 5^2 + 8^2 - 2 \cdot 5 \cdot 8 \cdot \cos(C)$$

$$100 = 25 + 64 - 80 \cos(C)$$

Simplifying gives:

$$100 = 89 - 80 \cos(C) \implies 11 = -80 \cos(C)$$

$$\cos(C) = -\frac{11}{80} \implies C \approx 143.1^\circ$$

3. Problem 3: For triangle  $ABC$  with sides  $a = 6$ ,  $b = 7$ , and angle  $A = 45^\circ$ , find side  $c$ .

- Solution:

$$c^2 = a^2 + b^2 - 2ab \cos(A)$$

$$c^2 = 6^2 + 7^2 - 2 \cdot 6 \cdot 7 \cdot \cos(45^\circ)$$

$$c^2 = 36 + 49 - 84 \cdot \frac{\sqrt{2}}{2}$$

$$c^2 = 85 - 42\sqrt{2} \implies c \approx 6.34$$

### Answers Summary

1. Problem 1:  $c \approx 8.89$

2. Problem 2:  $C \approx 143.1^\circ$

3. Problem 3:  $c \approx 6.34$

### Conclusion

The Law of Cosines is a vital mathematical principle that extends the utility of trigonometry beyond right triangles, providing solutions for various triangle-related problems. By understanding its applications and practicing with problems such as those found in the 13 6 Practice B worksheet, students can gain a firm grasp of this concept. Whether used in navigation, physics, or geometry, the Law of Cosines remains an essential tool in the mathematical toolkit.

# Frequently Asked Questions

## What is the Law of Cosines?

The Law of Cosines is a formula used in geometry to find the lengths of sides or measures of angles in a triangle. It states that for any triangle with sides  $a$ ,  $b$ , and  $c$  opposite to angles  $A$ ,  $B$ , and  $C$  respectively, the relationship is  $a^2 = b^2 + c^2 - 2bc \cos(A)$ .

## How do you apply the Law of Cosines in practice problems?

To apply the Law of Cosines, identify the known sides and angles in the triangle, then substitute those values into the formula to solve for the unknown side or angle.

## What types of triangles can the Law of Cosines be used on?

The Law of Cosines can be used on any triangle, whether it is acute, obtuse, or right-angled.

## What is the significance of the Law of Cosines in real-world applications?

The Law of Cosines is significant in fields such as physics, engineering, and computer graphics, as it allows for the calculation of distances and angles in non-right triangles, which is essential in design and analysis.

## Can the Law of Cosines be used to find the area of a triangle?

Yes, the Law of Cosines can help in finding the area of a triangle when combined with Heron's formula or by using the formula  $\text{Area} = \frac{1}{2} ab \sin(C)$ .

## What are common mistakes when using the Law of Cosines?

Common mistakes include misidentifying the sides and angles, incorrect application of the cosine function, and calculation errors when substituting values into the formula.

## How does the Law of Cosines relate to the Pythagorean theorem?

The Law of Cosines generalizes the Pythagorean theorem. When the triangle is a right triangle, the cosine of the right angle is zero, reducing the Law of Cosines to the Pythagorean theorem.

## What is the formula for the Law of Cosines for side 'c'?

The formula for side ' $c$ ' using the Law of Cosines is  $c^2 = a^2 + b^2 - 2ab \cos(C)$ , where ' $C$ ' is the angle opposite side ' $c$ '.

## Where can I find practice problems for the Law of Cosines?

Practice problems for the Law of Cosines can be found in geometry textbooks, online educational platforms, and math problem-solving websites.

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