In KLM, The Measure Of M=90, LK = 97, ML = 65, And KM = 72. What Is The Value Of The Sine Of L To The

In KLM, The Measure Of M=90, LK = 97, ML = 65, And KM = 72. What Is The Value Of The Sine Of L To The is a classic problem in triangle geometry that involves understanding the relationships between side lengths and angles within a triangle. This type of problem is common in geometry sections of mathematics exams and is particularly relevant for students preparing for competitive exams or those seeking to deepen their understanding of trigonometry principles.

In this comprehensive article, we will explore the process of solving this problem step-by-step, including the application of the Law of Sines, Law of Cosines, and other geometric concepts. We will also provide detailed explanations of key concepts, formulas, and methods for calculating the sine of an angle in a triangle when given certain side lengths and angles.

Understanding Triangle KLM and the Given Data

Before diving into calculations, it's essential to understand the problem setup and what each given value represents in triangle KLM.

Given Data Recap

- The measure of angle M = 90°, indicating that triangle KLM is a right-angled triangle at vertex M.
- Side LK = 97 units
- Side ML = 65 units
- Side KM = 72 units

Note: The notation suggests that:
- K, L, and M are the vertices of the triangle.
- The sides are labeled opposite the respective vertices: for example, side LK is opposite vertex M, side ML is opposite vertex K, and side KM is opposite vertex L.

Analyzing the Triangle: Right-Angled at M

Since angle M = 90°, triangle KLM is a right triangle with M as the right angle.

Implication:
- The sides connected to M are the legs of the right triangle.
- The hypotenuse is the side opposite the right angle, which is KM.

Verifying the hypotenuse:
- Given side KM = 72, which should be the hypotenuse if M is the right angle.

However, note:
- The side LK = 97 units.
- The side ML = 65 units.
- The side KM = 72 units.

Since M is a right angle, the sides adjacent to M are ML and MK, and the side LK is between vertices L and K.

Conclusion:
- The triangle's sides are:
- ML = 65 (adjacent to M)
- KM = 72 (adjacent to M)
- LK = 97 (hypotenuse, since it's opposite M)

Applying the Pythagorean Theorem

Given that triangle KLM is right-angled at M, the Pythagorean theorem relates the sides:

$$ LK^2 = ML^2 + KM^2 $$

Let's verify if this holds:

$$
97^2 = 65^2 + 72^2
$$

Calculations:

$$
97^2 = 9409
$$
$$
65^2 = 4225
$$
$$
72^2 = 5184
$$
Sum:

\[

$$
4225 + 5184 = 9409
$$

Since both sides equal 9409, the Pythagorean theorem confirms that the triangle is right-angled at M, with side LK as the hypotenuse.

Finding the Measure of Angle L

The goal is to find the value of $\sin L$. To do so, we need to understand the relationship between angle L and the sides of the triangle.

In triangle KLM:

- Angle L is at vertex L.
- The side opposite angle L is KM.
- The sides adjacent to angle L are LK and ML.

Step 1: Identify the sides relative to angle L:

- Opposite L: KM = 72
- Adjacent to L: ML = 65
- Hypotenuse: LK = 97

Step 2: Use the definition of sine:

$$
\sin L = \frac{\text{Opposite side to L}}{\text{Hypotenuse}} = \frac{KM}{LK}
$$

Because:

- Opposite L: side KM
- Hypotenuse: side LK

Calculating $\sin L$

Given the side lengths:

$$
\sin L = \frac{KM}{LK} = \frac{72}{97}
$$

Expressed as a decimal:

$$
\sin L \approx 0.7423
$$

Final answer:

$$
\boxed{\sin L = \frac{72}{97}}
$$

or approximately 0.7423.

Additional Methods and Considerations

While the calculation above directly uses the definitions based on the triangle's sides, here are other methods and concepts useful in similar problems:

Using the Law of Sines

The Law of Sines states:

$$
\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}
$$

In our triangle:

- $\angle M = 90^\circ$,
- side $LK = 97$ is opposite $\angle M$,
- sides $ML = 65$ and $KM = 72$ are opposite $\angle K$ and $\angle L$, respectively.

Applying Law of Sines:

$$
\frac{\sin K}{ML} = \frac{\sin L}{KM} = \frac{\sin M}{LK}
$$

Since $\sin M = 1$ (because $M=90^\circ$):

$$
\frac{1}{97} = \frac{\sin K}{65} = \frac{\sin L}{72}
$$

From which:

$$
\sin L = \frac{72}{97}
$$

matching our previous calculation.

Summary of Key Concepts

- Right-Angled Triangle: When a triangle has a 90° angle, the sides follow the Pythagorean theorem.
- Hypotenuse: The longest side, opposite the right angle.
- Sine of an Angle: Ratio of the length of the side opposite the angle to the hypotenuse.
- Law of Sines: Relates angles and sides in any triangle, useful for non-right triangles or confirming side relationships.

Practical Applications of this Problem

Understanding how to find sine values based on side lengths in right triangles is fundamental in multiple fields:

- Engineering: Calculating forces and angles.
- Navigation: Determining directions and distances.
- Physics: Resolving vector components.
- Mathematics Education: Building foundational skills in trigonometry.

Common Mistakes to Avoid

- Confusing sides: Remember the side opposite the angle is the one directly across from it.
- Misidentifying the hypotenuse: In right triangles, always verify which side is longest.
- Ignoring given angles: Use the given angle measures to confirm calculations.
- Forgetting the Pythagorean theorem: Essential for right triangles to verify side relations.

Conclusion

The problem of determining $\sin L$ in triangle KLM where the measure of M is 90°, and given side lengths, demonstrates fundamental principles of triangle geometry and trigonometry. By recognizing the right-angled nature of the triangle and applying the definitions of sine and the Law of Sines, the calculation becomes straightforward:

$$
\boxed{\sin L = \frac{72}{97}}
$$

which approximates to 0.7423.

This understanding not only solves the specific problem but also reinforces key concepts applicable to a broad range of geometric problems and real-world applications. Mastery of these principles is essential for students and professionals dealing with spatial relationships, measurements, and design.

Keywords for SEO: Triangle KLM, sine of angle L, right triangle, Pythagorean theorem, Law of Sines, geometry problems, trigonometry, side lengths, angle measurement, mathematical solutions

Frequently Asked Questions

In triangle KLM with sides M=90, LK=97, ML=65, and KM=72, how do you find the measure of angle L?

You can use the Law of Cosines: $\cos L = (LK^2 + ML^2 - KM^2) / (2 LK ML)$. Plugging in the values: $\cos L = (97^2 + 65^2 - 72^2) / (2 97 65)$. Then, find sin L using $\sin L = \sqrt{(1 - \cos^2 L)}$.

What is the first step to calculate sin L in triangle KLM given the side lengths?

First, calculate cos L using the Law of Cosines with the known sides, then determine sin L by taking the square root of 1 minus $\cos^2 L$.

How do you apply the Law of Cosines to find cos L in the given triangle?

Use the formula $\cos L = (LK^2 + ML^2 - KM^2) / (2 LK ML)$. Substitute the given sides: $\cos L = (97^2 + 65^2 - 72^2) / (2 97 65)$.

What is the value of cos L when sides are LK=97, ML=65, and KM=72?

Calculating: cos L = $(97^2 + 65^2 - 72^2)$ / (2 97 65) = (9409 + 4225 - 5184) / (2 97 65) = (8449) / (12610) ≈ 0.670.

How do you find sin L after calculating cos L?

Calculate sin L as sin L = $\sqrt{(1 - \cos^2 L)}$. Using cos L ≈ 0.670, sin L ≈ $\sqrt{(1 - 0.670^2)}$ ≈ $\sqrt{(1 - 0.4489)}$ ≈ $\sqrt{0.5511}$ ≈ 0.742.

What is the approximate value of sin L in the triangle KLM?

The approximate value of sin L is about 0.742.

Why is it important to use the Law of Cosines in this problem?

Because the problem involves side lengths of a triangle, and the Law of Cosines allows us to find an angle's cosine when all sides are known, which then helps to determine the sine of that angle.

Additional Resources

Understanding the Geometric Context of Triangle KLM and Calculating the Sine of Angle L

When delving into the properties of triangles, especially those with given side lengths, it’s essential to approach the problem systematically. The challenge here involves a triangle KLM with side lengths M=90, LK=97, ML=65, and KM=72, and the goal is to determine the sine of angle L. To accomplish this, a thorough understanding of the triangle's structure, side relationships, and relevant trigonometric principles is necessary.

Interpreting the Given Data and Clarifying the Triangle's Configuration

Before diving into calculations, it’s vital to interpret the provided data accurately:

- Given Sides:
- M = 90
- LK = 97
- ML = 65
- KM = 72

- Potential Ambiguity:
- The notation appears somewhat inconsistent; typically, in triangle notation:
- The vertices are labeled (e.g., K, L, M)
- Sides are labeled opposite their vertices (e.g., side KL opposite M, side LM opposite K, side KM opposite L)
- It’s unclear whether each of these values corresponds directly to side lengths, or if some are lengths of segments within the triangle.

- Likely Interpretation:
- The triangle KLM has sides:
- KL = 97
- LM = 65
- KM = 72
- The number M=90 might be an angle measure or possibly a side length, but given the context, it seems more plausible that M refers to the measure of angle L, or perhaps an auxiliary value.

Assumption for clarity:
- The triangle is labeled such that:
- Sides:
- KL = 97
- LM = 65
- KM = 72
- Angles:
- Angle at L = ?, which we are asked to find the sine of.

Deciphering the Problem: What Is Being Asked?

The core question: "What is the value of the sine of angle L?"

Given the side lengths, and assuming the standard notation:
- Side KL is opposite angle M
- Side LM is opposite angle K
- Side KM is opposite angle L

Key point:
The problem asks for the sine of angle L, which is at vertex L, opposite side KM, with side lengths:

Side	Opposite Angle	Length
KL	Angle M	97
LM	Angle K	65
KM	Angle L	72

Summary:
- Side KM (72) is opposite angle L.

- To find sin L, we need:
- The measure of angle L
- Or, more specifically, the ratio of the length of the side opposite angle L to the hypotenuse in a relevant triangle configuration (if right triangle or via Law of Sines).

Applying Triangle Laws to Find $\sin L$

Since the problem involves side lengths, the Law of Sines is an appropriate tool:

$$
\frac{\text{side length}}{\sin(\text{opposite angle})} = 2R
$$

where R is the radius of the triangle's circumscribed circle. Alternatively, for directly calculating $\sin L$:

$$
\sin L = \frac{\text{opposite side}}{\text{hypotenuse in a right triangle}}
$$

But since the triangle is probably scalene and not necessarily right-angled, the Law of Cosines may be better suited for initial calculations.

Using the Law of Cosines to Find $\cos L$ and $\sin L$

Given all three sides, the Law of Cosines states:

$$
\cos L = \frac{a^2 + b^2 - c^2}{2ab}
$$

where:
- a, b are the sides adjacent to angle L
- c is the side opposite angle L (which is KM = 72)

In the triangle KLM:
- $a = KL = 97$
- $b = LM = 65$
- $c = KM = 72$

Calculating $\cos L$:

\[
\cos L = \frac{97^2 + 65^2 - 72^2}{2 \times 97 \times 65}
\]

Compute each component:

- \(97^2 = 9409\)
- \(65^2 = 4225\)
- \(72^2 = 5184\)

Plug into the formula:

\[
\cos L = \frac{9409 + 4225 - 5184}{2 \times 97 \times 65}
\]
\[
\cos L = \frac{9409 + 4225 - 5184}{2 \times 97 \times 65}
\]

Calculate numerator:

\[
9409 + 4225 = 13634
\]
\[
13634 - 5184 = 8450
\]

Calculate denominator:

\[
2 \times 97 \times 65 = 2 \times 6305 = 12610
\]

Now,

\[
\cos L = \frac{8450}{12610} \approx 0.671
\]

Calculate \(\sin L\):

Using the Pythagorean identity:

\[
\sin L = \sqrt{1 - \cos^2 L}
\]

\[
\sin L = \sqrt{1 - (0.671)^2} = \sqrt{1 - 0.45} = \sqrt{0.55} \approx 0.7416
\]

Finalizing the Calculation: $\sin L \approx 0.742$

Based on the calculations:

$$
\boxed{
\sin L \approx 0.742
}
$$

This value signifies the sine of angle L in the triangle KLM, given the side lengths.

Additional Insights and Considerations

1. Validity of the Triangle:

- The side lengths satisfy the triangle inequality:
- $97 + 65 > 72$ → 162 > 72, true
- $97 + 72 > 65$ → 169 > 65, true
- $65 + 72 > 97$ → 137 > 97, true

2. Using Law of Sines for Cross-Verification:

Calculate the ratio:

$$
\frac{\text{side}}{\sin(\text{opposite angle})}
$$

- For side KL = 97 (opposite M):

$$
\frac{97}{\sin M}
$$

- For side LM = 65 (opposite K):

$$
\frac{65}{\sin K}
$$

- For side KM = 72 (opposite L):

$$
\frac{72}{\sin L}
$$

From the previous calculation:

$$
\frac{72}{0.742} \approx 97.12
$$

This consistency supports the accuracy of the sine calculation.

3. Significance of the Result:

The value $\sin L \approx 0.742$ indicates that the angle L is approximately:

$$
L \approx \arcsin(0.742) \approx 48^\circ
$$

which aligns with expectations given the side lengths.

Conclusion: Key Takeaways and Summary

- By applying the Law of Cosines, the cosine of angle L was found to be approximately 0.671.
- Using the Pythagorean identity, the sine of angle L was calculated as approximately 0.742.
- This method demonstrates the power of classical triangle laws in solving for unknown angles based purely on side lengths.
- The calculation is self-consistent and aligns with the properties of triangles, ensuring the result's reliability.

In summary:

The measure of $\sin L$ in triangle KLM, given the side lengths of 97, 65, and 72, is approximately 0.742. This value not only provides insight into the angle's size but also exemplifies the interconnectedness of side lengths and angles in triangle geometry.

Final Note:
For precise applications or further geometric properties, one might employ more advanced tools such as coordinate geometry, vector methods, or trigonometric identities. However, the approach detailed here is robust for most standard triangle problems involving side lengths.

[In Klm The Measure Of M 90 Lk 97 Ml 65 And Km 72 What Is The Value Of The Sine Of L To The]

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