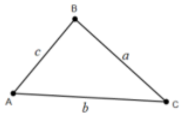
5.6 Law of Cosines

Law of Cosines

For any $\triangle ABC$, the Law of Cosines relates the length of a side to the other two sides of a triangle and the cosine of the included angle.



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

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

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

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

$\dfrac{a^2 - b^2 - c^2}{-2bc} = \dfrac{\cancel{-2bc}\cos A}{\cancel{-2bc}}$

$\cos A = \dfrac{(a^2 - b^2 - c^2)}{(-2bc)}$

$\cos^{-1}$

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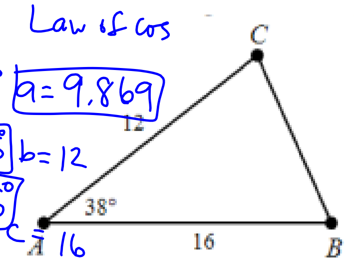
Ex 1) Law of cos

$A = 38°$ $\boxed{a = 9.869}$

$\boxed{B = 48.5°}$ $b = 12$

$\boxed{C = 93.5°}$

$c = 16$



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

$\sqrt{a^2} = \sqrt{12^2 + 16^2 - 2(12)(16)\cos(38)}$

$a = 9.689$

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$\cos B = \dfrac{b^2 - a^2 - c^2}{-2ac}$

$\cos B = \dfrac{(12^2 - 9.869^2 - 16^2)}{(-2(9.869)(16))}$

$\boxed{B = 48.5°}$

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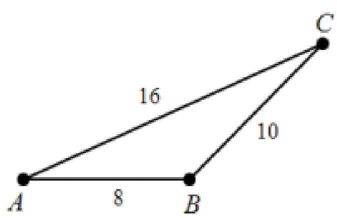
Ex 2)



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Ex 3) $a = 2, b = 5, c = 4$

(4) $\boxed{A = 22.3°}$ $a = 2$ $\cos A = \frac{(2^2 - 5^2 - 4^2)}{(-2(5)(4))}$

$\boxed{B = 108.2°}$ $b = 5$

$\boxed{C = 49.5°}$ $c = 4$ $\cos B = \frac{(5^2 - 2^2 - 4^2)}{(-2(2)(4))}$

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In the Law of Cosines formula solve for angle A..

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

1. subtract b^2 and c^2
2. divide by $-2bc$
3. do the inverse $\cos^{-1}$

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When do you use the Law of Cosines?

when you know the included angle

When do you use the Law of Sines?

when you have a matching angle and a side across

Do not change laws in the middle of a problem. Use the same method for the whole problem.

Make sure the biggest angle matches with the biggest side and the smallest angle matches with the smallest side.

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