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| Explore |
| Macintosh HD:Users:kylie.findley:Desktop:Screen Shot 2015-02-23 at 8.44.42 AM.png | 1. What measurements are we given from the triangle to the left?

*All sides (SSS)*1. Why can we not use the Law of Sines to determine the measures of the missing angles?

*To use the law of sines we must know at least one angle in the triangle. (AAS, ASA, SSA)* |
| Law of Cosines |
| Macintosh HD:Users:kylie.findley:Desktop:tri19_36740_lg.gif*We can use the law of cosines with SSS and SAS*For ,  |
| Discovering the Law of Cosines |
| Macintosh HD:Users:kylie.findley:Desktop:Screen Shot 2015-02-23 at 8.57.35 AM.pngTo develop the law of cosines, begin with . From vertex *C*, altitude *k* is drawn and separates side *c* into segments *x* and *c-x*.1. The altitude separates ∆*ABC* into two right triangles. Use the Pythagorean theorem to write two equations, one relating *k*, *b*, and *c* – *x*, and another relating *a*, *k*, and *x*.

*(c-x)2+k2=b2 and k2+x2=a2*1. Notice that both equations contain *k*2. Solve each equation for *k*2.

*k2=b2-(c-x)2 and k2=a2-x2*1. Set both equations equal to each other in Question 2 to create a new equation.

*b2-(c-x)2 =a2-x2*1. Expand the quantity *(c-x)2*.

*b2-c2+2cx –x2=a2-x2*1. Solve the equation in Question 4 for *b2*.

*b2 =a2-x2+c2-2cx +x2 b2 =a2+c2-2cx* 1. To eliminate *x*, we will attempt to write an equivalent expression. Write an equation involving cos*B* and *x*.

*cosB=x/a*1. Solve the equation from Question 6 for *x*.

*x=acosB*1. Substitute the equivalent expression in for *x* into the equation from Question 5. This equation is called the **Law of Cosines**.

*b2 =a2+c2-2cacosB* |
| Inverse Trigonometric Ratios: In some cases, you may know the value of a trigonometric ratio and want to know the measure of the associated angle. For this, we use inverse trigonometric ratios. |
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| Using the Law of Cosines |
| 101318ABCCan we use the law of cosines to solve the triangle? Why?Yes, we can use the law of cosines because we have SSS*Finding :**a2=b2+c2-2bc(cosA)**102=182+132-2(18)(13)(cosA)**100=324+169-468cosA**100=493-468cosA**-393=-468cosA**.83974=cosA cos-1(.839744)=32.9o**Finding :**b2=a2+c2-2ac(cosB)**182=102+132-2(10)(13)(cosB)**324=100+169-260cosB**324=269-260cosB**55=-260cosB**-.211538=cosB cos-1(-.211538)=102.2o**Finding :**c2=b2+a2-2ba(cosC)**132=182+102-2(18)(10)(cosC)**169=324+100-360cosC**169=424-360cosC**-255=-360cosC**.70833=cosC cos-1(.708333)=44.9o* |
| Law of Cosines with Vectors |
| Review of Vectors:Vectors are defined with Magnitude and Direction Vector Magnitude: Direction: angle measured counter clockwise from the positive x-axisDot Product: Properties of Dot Products:    |
| Construct a Triangle Using VectorsBe sure to label appropriatley \**Have students draw and label their own triangle out of vectors and corresponding angles* |
| Rewriting Law of Cosines using Vector Properties\**Talk about why magnitude works here and using the properties to get to the final form showing equality.**\* Talk about why we can conclude that*  |
| Verifying Law of Cosines with Geogebra1. Create using the vector tool.
2. Hide point labels and rename the vectors A, B, and C.
3. Measure all three angles using the angle tool.
4. If angle marked is exterior, change the angle measure to in between and
5. Make sure labeling is correct and angles correspond to their sides.
6. Change the colors of the component vectors and their corresponding angles so that they match.
7. Drag different vertices around to ensure the measurements change with the changing magnitude of vectors.
8. Now we will use the input bar to verify that the Law of Cosines holds.
9. First measurement to enter:

 Use command abs for magnitude This will show as number a1. Second measurement to enter:

 This will show as number b  Check that a=b1. Third measurement to enter:

 This will show as number c Check to see that a=b=c1. Fourth measurement to enter:

 Use command dot to get the dot product This will show as number d Check that a=b=c=d1. Fifth measurement to enter:

 This will show as number e Check that a=b=c=d=e1. We have shown that all five of these are equivalent measurements. Your measurements should show this. Drag around different vertices to ensure that they all remain equal.

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| Challenge:Using Vectors and their properties, verify the Law of Sines |