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Sine and cosine rule questions

September 9, 2019 corbettmaths Click here to answer Advanced Trigonometry Level 6-7 Looking at the triangle below, the sine rule is: \dfrac{\textcolor{limegreen}{a}}{sin \textcolor{limegreen}{A}}=\dfrac{\textcolor{blue}{b}}{\sin \textcolor{blue}{B}}=\dfrac{\textcolor{red}{c}}{{sin \textcolor{red}{C} In this topic, We will go through examples of how to use the sinus rule to find missing angles and missing pages. Use the sine rule to find the side length marked x to 3 s.f. [2 tags] First we need to match the letters in the formula with the pages we want here: a=x, A=21\degree, b=23 and B=35\degree Next, we are ready to replace the values in the formula. Doing so gives us: \dfrac{x}{\sin(21°)}=\dfrac{23}{\sin(35°)} Multiplying both sides \sin(21°): x=\dfrac{23}{\sin(35°)}\times\sin(21°) Putting into calculator we get: x =14.37029543... x =14.4 (3 sf) As in previous topics, there is no need to evaluate sinus functions until the last step. Use the sine rule to locate the blunt angle marked x up to 2 s.f. [2 tags] Since we have been asked to find the missing angle, we can use a different version of the sine rule: \dfrac{\sin A}{a}=\dfrac{\sin B}{b}=\dfrac{\sin C}{c} A=x, a=43, B=33\degree, b=25. To replace these values in a formula, we get: \dfrac{\sin x}{43}=\dfrac{\sin(33°)}{25} Multiply both sides by 43 to get: \sin x=\dfrac{43\sin(33°)}{25} After taking \sin^{-1} from both sides, we get: x = \sin ^{-1}\bigg(\dfrac{43\sin(33°)}{25}\bigg) x=69.5175049...° However, the question asked for a blunt angle, but we have an acute answer - why? This is because we can draw two different (but both correct) triangles using the information we received at the beginning. This is an ambiguous case of sinus rule, and it occurs when you have 2 sides and an angle that does not lies between them. To find the blunt angle, simply subtract the acute angle from 180: 180-69.5175049=110.4824951 x=110\degree (2 sf) First, we need to find an angle opposite to the missing side, because it is not mentioned in the question. Use all angles of the triangle to add to the 180 degrees we get, that: A = 180 / grade-40 grade-94 degree = 46 ° degree Now we have enough information to correctly mark the triangle and replace the values in the sine rule: \dfrac{x}{\sin(46\degree)}} =\dfrac{10.5}{\sin(94\degree)} Solution x we get: x=\dfrac{10.5}{\sin(94\degree)}}\times\sin(46\degree)=7.571511726... x=7.57 (3 sf). Here we can apply the sine rule immediately: \dfrac{x}{\sin(30\degree)}=\dfrac{5}{\sin(80\degree)} Multiply both sides of equation \sin(30 \degree): x=\dfrac{5}{\sin(80\degree)}\times\sin(30\degree)=2.538566... x=2.54 cm (3 sf). Here we can apply the sine rule immediately: \dfrac{\sin(x\degree)}{12}=\dfrac{\sin(15\degree)}{7} Multiplying both sides of the equation by 12 we find: \sin(x)=\dfrac{12\times\sin(15\degree)}{7}=0.4436897916 Use sine of both sides: x=\sin^{-1}(0.4436897916)=26.33954244\degree However, the angle is clearly blunt (more than 90 degrees) relative to the diagram. This is an ambiguous case of the sine rule and it occurs when you have 2 sides and an angle that does not lies between them. To find a blunt angle, simply subtract the acute angle from 180:180\degree-26.33954244\degree =153.6604576 =154\degree (3 sf). Instead of entering an in-whole number into the calculator for each calculation step, you can use the ANS button to save time. We are able to apply the sine rule immediately: \dfrac{\sin(x\degree)}{6.5}=\dfrac{\sin(52\degree)}{12} Multiplying both sides of equation 6.5 to find out that: \sin(x)=6.5 \times \dfrac{\sin(52\degree)}{12} =0.4268391582 With the inverse sine of both pages and maintaining the answer from the previous step on our calculator. we get: x=\sin^{-1}(ANS)=25,26713177 x=25.3 \degree (3 sf). To apply the sine rule: \dfrac{x}{\sin(35\degree)}=\dfrac{6}{\sin(68\degree)} Multiply both sides of the equation \sin(1 35\degree), we find: x=\dfrac{6}{\sin(68\degree)}\times\sin(35\degree)=3.711732685... x=3.71 cm (3 sf). Try the review tab on this topic. Page 2 Level 6-7 For 3D Pythagoras, there's a new equation we can use that only uses Pythagoras' phrase twice. In the diagram that appears, find the length of \text color{red}{d} [3 tags] We already know that equation 1: \text color{limegreen}{a}^2 + \text color{orange}{b}^2 = \text color{black}{e}^2 and see that edc also forms a right triangle, so we know Equation 2: \text color{black}{e}^2 + \text color{blue}{c}^2 =\text color{red}{d}^2 So it means that we can combine equations 1 and 2 to make our 3D Pythagoras equations. \text color{limegreen}{a}^2 + \text color{orange}{b}^2 +\text color{blue}{c}^2 =\textcolor{red}{d}^2 With 3D trigonometry there is no trick, you need to solve each section in increments, which makes the topic difficult. Example: The shape of ABCDEFG is a quasi. [3 brands] Find the length of side FC, marked in red, at 3 sf. First, the shape is a flower, which means that each corner is the right angle. First we need to find fh, this will give us the basis of a rectangular triangle FHC that will allow us to find FC. To find side-length FH, we need to use trigonometry Adjacent FE=9\text{ cm} Hypotenuse =x This means that we will use CAH \cos(26) = \dfrac{\text{Adjacent}}{\text {Hypotenuse}} = \dfrac{9}{FH} FH \times \cos(26) = 9 FH = 9 \div \cos(26) = 10,013... cm We now know FH, our first triangle, FCH, looks like this: Now, we know the two-sided length of this triangle, we can use Pythagoras' sentence to find the third , FC, which is the answer to the whole question. (FC)^2 = 5^2 + (10,013...) ^2 FC = \sqrt{5^{2} + (10.013...) ^{2}} = 11.2 cm (3 sf). If we draw a line from the top to E to the center of the base, then this line represents a perpendicular because we know that the top is directly above the center. Consider the triangle formed by this line, the line that goes from the center to the C, and the EC line. We know the hypotension, but we need more information. Here we observe the distance from center to C is half the distance from A to C. Since we know the width of the square triangle, we can find the length of the AC, half, and then use the result as part of the pythagoras' sentence to find a perpendicular height. For finding AC, consider the ABC triangle. Therefore, the distance from the center of the base to C 5\sqrt{2}. Finally, again, we take into account the first triangle, which we now know has a base of 5\sqrt{2} cm and calculates the perpendicular height. 12^2 = (\text{HEIGHT})^2 + (5\sqrt{2})^2 (\text{HEIGHT})^2 = 12^2 - (5\sqrt{2})^2 = 144 - 50 = 94 \text{HEIGHT } = \sqrt{94} cm. Here we use 3D Pythagoras to find out that AY is AY^2=9^2+6^2+6^2 AY=Sqrt{81+36+36}=sqrt{153}=3 sqrt{17} cm. Here we use 3D Pythagoras to find out that ce is CE ^ 2 = 9 ^ 2 + 6 ^ 2 + 12 ^ 2 CE = sqrt {81 + 36 + 144 } = sqrt{261} = 3 sqrt{29} cm. First, we can find out the length of the DB Pythagoras or by acknowledging that the diagonal of the square is \sqrt{2} \times \text{ page length}, i.e.: DB = 14 \ sqrt{2} Therefore, the length from D to the center of the square, O, is half of this value DO = 7 \ sqrt{2} Now we have enough information to find the desired angle , \tan(EDB) = \dfrac{O}{A} = \dfrac{11}{7\sqrt{2}}= \text {Angle} \, EDB = tan^{-1} \bigg(\dfrac{11}{7\sqrt{2}} \bigg)=48.0\degree Try revising the tab on this topic. Since this site is in development, we find any feedback very valuable. Click here to fill out a very short form that allows you to make comments about the page or simply confirm that everything is working properly. Produced by AJ Reynolds July 2010 we appreciate all the comments you have about Step-Up Section 4. We are particularly interested in mathematical errors or aspects of the site that could be confusing. 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To find a page when you know the other two sides and the angle between them, use: \({a^2} = {b^2} + {c^2} - 2bc\cos A\) To find the angle, when you know they are using three pages: \(\cos A = \frac{{{b^1 2} + {c^2} - {a^2}}}{{2bc}}\) Sine and Cosine Rule Sine and Cosine Rule - Test Questions Show detailed solution to the Cosine Rule (Finding Length) How to find the length of a triangle page using a cosine rule? Cosine Rule (Finding Angle) How to find the angle of a triangle using a cosine rule? View Step-by-Step Solutions A-Level Mathematics Edexcel C2 January 2008 Q6a ExamSolutions This question is on the cosine rule Show step-by-step solutions A-Level Mathematics Edexcel C2 January 2007 Q9(a) : ExamSolutions Worked the solution above Core 2 question to find angle in radians using cosine. See step-by-step solutions Try the free Mathway calculator and problem solver below to practice different math topics. 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