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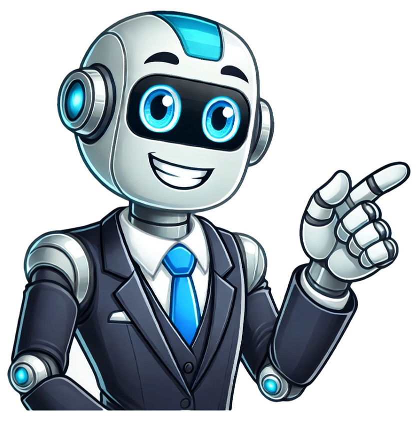

Bogna Szyk and Hanna Pamuła, PhDHanna (Hania) Pamuła holds a Ph.D. in Bioacoustics / Mechanical Engineering, obtained at AGH University of Science and Technology. She has participated in research work in labs in France and the UK and presented papers at several international conferences. Hania has a penchant for photography and graphic design. When not in the office, she's probably traveling, hiking, or out in the field, watching birds and recording their calls. See full profileCheck our editorial policySteven WoodingSteven Wooding is a physicist by training with a degree from the University of Surrey specializing in nuclear physics. He loves data analysis and computer programming. He has worked on exciting projects such as environmentally aware radar, using genetic algorithms to tune radar, and building the UK vaccine queue calculator. Steve is now the Editorial Quality Assurance Coordinator here at Omni Calculator, making sure every calculator meets the standards our users expect. In his spare time, he enjoys cycling, photography, wildlife watching, and long walks. See full profileCheck our editorial policy and Borys Kuca, PhDPhD, Jagiellonian University, Cracow, PolandA mathematician at the Jagiellonian University in Cracow, Poland, fascinated with patterns in numbers. Always keen to know more, read more, and see more, he has turned learning into a way of life. When he is not busy proving new theorems, you can find him discussing books with friends, hiking nearby mountains, or sipping green tea. He never refuses dark chocolate with chili – the spicier, the merrier. See full profileCheck our editorial policy496 people find this calculator helpfulThis law of sines calculator is a handy tool for solving problems that include lengths of sides or angles of a triangle. We will explain the law of sines formula and give you a list of cases in which this rule can be useful. Thanks to this triangle calculator, you will now be able to solve some trigonometry problems (more elaborate than using the Pythagorean theorem). However, if you don't know what the sine is, first check out our sine calculator. Prefer watching over reading? Learn all you need in 90 seconds with this video we made for you: Watch this on YouTube The law of sines states that the proportion between the length of a side of a triangle to the sine of the opposite angle is equal for each side: a / sin(α) = b / sin(β) = c / sin(γ) This ratio is also equal to the diameter of the triangle's circumcircle (circle circumscribed on this triangle). In contrast to the Pythagorean theorem, you can use this law for any triangle, not just the right triangle. If you are only interested in solving problems related to right triangles, our right triangle calculator might be more useful for you.You can transform the law of sines formulas to solve some problems of triangulation (solving a triangle). You can use them to find: The remaining sides of a triangle, knowing two angles and one side. The third side of a triangle, knowing two sides and one of the non-enclosed angles. In some cases (ambiguous cases), there may be two solutions to the same triangle. If the following conditions are fulfilled, your triangle may be an ambiguous case: You only know the angle α and sides a and c; Angle α is acute (α < 90°); a is shorter than c (a < c); and a is longer than the altitude h from angle β, where h = c × sin(α) (or a > c × sin(α)). You can also combine these equations with the law of cosines to solve all other problems involving triangles. Start with formulating your problem. For example, you may know two angles and one side of the triangle and be looking for the remaining sides. Input the known values into the appropriate boxes of this triangle calculator. Remember to double-check with the figure above whether you denoted the sides and angles with the correct symbols. Watch our law of sines calculator perform all calculations for you! FAQsYes, the law of sines works for all triangles. To use it, you need to know either two sides and an angle opposite to one of these sides or two angles and one side of the triangle.Use the law of sines when you know either: Two angles and one side; or Two sides and an angle opposite to one of these angles. Use the law of cosines when you know either: Three sides; or Two sides and the angle between them. To find side a given side b and the angles α and β that are opposite to a and b, respectively, we apply the law of sines a / sin(α) = b / sin(β). Solving for a we arrive at a = b × sin(α) / sin(β).To find the angle α given the side a opposite to α as well as the side b and its opposite angle β, we apply the formula derived from the law of sines: sin(α) = a × sin(β) / b, which we can further transform to α = arcsin(a × sin(β) / b), where arcsin is the arcsine function.Let's say a is the side opposite to angle 30°, b to angle 60°, and c to 90°. The law of sines says that a / sin(30°) = b / sin(60°) = c / sin(90°). Plugging in the values of sines, we obtain 2a = 2b/√3 = c. Now, you can express each of a,b,c with the help of any other of them. For instance, b and c expressed with the help of a read: c = 2 × a and b = √3 × a. Which formula do you want to use?Check out 21 similar trigonometry calculators The Triangle Calculator is a tool that helps you determine missing sides, angles, area, and perimeter of a triangle based on the values you provide. Whether you have three sides, two sides and an angle, or Other known measurements, this calculator simplifies the process. How the Triangle Calculator Works The calculator uses mathematical formulas such as the Law of Sines, Law of Cosines, and Heron's Formula to compute unknown properties of a triangle. By selecting what you know about the triangle and entering the values, you can get instant results. Law of Sines: \(\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}\) Law of Cosines: \(c^2 = a^2 + b^2 - 2ab \cdot \cos(C)\) Heron's Formula for Area: \(\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}\) where \(s \) is the semiperimeter: \(s = \frac{a + b + c}{2} \). How to Use the Triangle Calculator Select the type of information you have about the triangle (e.g., three sides, two sides and an angle, etc.). Enter the known values into the corresponding input fields. Choose the desired precision for decimal places. Click the "Calculate" button to get the missing sides, angles, and other properties. If needed, enable "Show Calculation Steps" to see how the results were derived. Features of the Triangle Calculator Supports various triangle types: scalene, isosceles, equilateral, and right triangles. Allows different input options, including sides, angles, perimeter, and area. Provides quick calculations using trigonometric formulas. Displays a visual representation of the triangle. Includes an option to show step-by-step solutions. Handles special cases like ambiguous SSA triangles. Why Use a Triangle Calculator? This calculator is useful for students, engineers, architects, and anyone working with Geometry. It saves time by eliminating manual calculations and helps verify answers quickly. Whether for homework, design, or real-world measurements, this tool provides accurate results instantly. Frequently Asked Questions (FAQ) What if I don't know all the sides? The calculator can work with various input types. If you know two sides and an included angle, or two angles and a side, you can still find the missing values. Can this calculator handle right triangles? Yes! It includes a special mode for right triangles, allowing you to input legs, hypotenuse, or angles to find the missing measurements. How accurate are the results? The results are precise and can be adjusted for decimal places. The calculations are based on well-established trigonometric formulas. Is this calculator useful for real-world applications? Absolutely! Whether you're calculating roof angles, land measurements, or any other geometric problem, this tool provides quick and reliable answers. Does the Triangle Calculator show how the calculations are done? Yes! You can enable the "Show Calculation Steps" option to see the formulas used and how the results were determined. Conclusion The Triangle Calculator is a practical and powerful tool for solving triangles effortlessly. It helps users quickly find unknown sides, angles, area, and other properties using reliable mathematical formulas. Whether for education, construction, or general problem-solving, this calculator makes geometry easy. Hanna Pamuła, PhDHanna (Hania) Pamuła holds a Ph.D. in Bioacoustics / Mechanical Engineering, obtained at AGH University of Science and Technology. She has participated in research work in labs in France and the UK and presented papers at several international conferences. Hania has a penchant for photography and graphic design. When not in the office, she's probably traveling, hiking, or out in the field, watching birds and recording their calls. See full profileCheck our editorial policyBogna Szyk and Adena BennAdena Benn is a Guyanese teacher with a degree in computer science who is always reading and learning. She loves problem-solving, everything tech, and working with teenagers. She has a passion for education and is especially interested in how children learn and the teaching methods that best suit their learning styles. She grew up on a farm in Pomeroon, Guyana, where she worked alongside her parents and siblings. As such, she is just as comfortable growing plants as teaching in the classroom. In her early life, she also gained expertise as a seamstress, which she learned from her mother. By grade 9, she had already acquired her dressmaker's certificate. Today she uses her skills to design many items for her family. In her free time, Adena loves to read, take long walks, write children's stories and poetry, travel, or spend time with her family. See full profileCheck our editorial policy1 177 people find this calculator helpfulCheck out 19 similar triangle calculators There are several methods to find the missing side of a triangle. Depending upon the type of given information, you can choose one of the following:Fig 1: Triangle with sides a,b,c and angles α, β, γ.If two sides and one angle are known If we know, the measurements of the two sides and the opposite angle to one of them, we can use the Law of Sines to find the missing side.asin(α)=bsin(β)=csin(γ)\footnotesize \frac{a}{\text{sin} (\alpha)} = \frac{b}{\text{sin} (\beta)}=\frac{c}{\text{sin} (\gamma)} \\sin(α)a=sin(β)b=sin(γ)c We can use any pair of the above ratios to solve for the third side. On the other hand, if we know two sides and the angle between them, we can use the Law of Cosines to find the remaining side.a2=b2+c2−2bc cos(α)b2=a2+c2−2ac cos(β)c2=a2+b2−2ab cos(γ)\footnotesize a^2 = b^2 + c^2 - 2bc\ \text{cos} (\alpha)\\ \\ b^2 = a^2 + c^2 - 2ac\ \text{cos} (\beta)\\ \\ c^2 = a^2 + b^2 - 2ab\ \text{cos} (\gamma) a2=b2+c2−2bc cos(α)b2=a2+c2−2ac cos(β)c2=a2+b2−2ab cos(γ)If two angles and one side are known We know that the sum of the three angles of a triangle is 180°180\degree180°. Hence if we know the measurement of the two angles, we can find the third angle using the equation:α+β+γ=180°\footnotesize \alpha + \beta + \gamma = 180\degree \\α+β+γ=180°Once we know the third angle, we can easily calculate the missing side using the Law of Sines mentioned above.If two sides and the perimeter are known This is the most simple scenario. As we know that the perimeter of a triangle is just the sum of its three sides, i.e.,Perimeter=a+b+c\scriptsize \text{Perimeter} = a + b +c Perimeter=a+b+cThis means that if we know the measurement of two sides of a triangle (say aaa and bbb), we can calculate the length of the third side as:c=Perimeter−(a+b)\scriptsize c = \text{Perimeter} - (a + b) c=Perimeter−(a+b)In the next section, we will see an example of how to calculate the sides of a triangle. home / math / triangle calculator Please provide 3 values including at least one side to the following 6 fields, and click the "Calculate" button. When radians are selected as the angle unit, it can take values such as pi/2, pi/4, etc. A triangle is a polygon that has three vertices. A vertex is a point where two or more curves, lines, or edges meet; in the case of a triangle, the three vertices are joined by three line segments called edges. A triangle is usually referred to by its vertices. Hence, a triangle with vertices a, b, and c is typically denoted as Δabc. Furthermore, triangles tend to be described based on the length of their sides, as well as their internal angles. For example, a triangle in which all three sides have equal lengths is called an equilateral triangle while a triangle in which two sides have equal lengths is called isosceles. When none of the sides of a triangle have equal lengths, it is referred to as scalene, as depicted below. Tick marks on the edge of a triangle are a common notation that reflects the length of the side, where the same number of ticks means equal length. Similar notation exists for the internal angles of a triangle, denoted by differing numbers of concentric arcs located at the triangle's vertices. As can be seen from the triangles above, the length and internal angles of a triangle are directly related, so it makes sense that an equilateral triangle has three equal internal angles, and three equal length sides. Note that the triangle provided in the calculator is not shown to scale; while it looks equilateral (and has angle markings that typically would be read as equal), it is not necessarily equilateral and is simply a representation of a triangle. When actual values are entered, the calculator output will reflect what the shape of the input triangle should look like. Triangles classified based on their internal angles fall into two categories: right or oblique. A right triangle is a triangle in which one of the angles is 90°, and is denoted by two line segments forming a square at the vertex constituting the right angle. The longest edge of a right triangle, which is the edge opposite the right angle, is called the hypotenuse. Any triangle that is not a right triangle is classified as an oblique triangle and can either be obtuse or acute. In an obtuse triangle, one of the angles of the triangle is greater than 90°, while in an acute triangle, all of the angles are less than 90°, as shown below. Triangle facts, theorems, and laws It is not possible for a triangle to have more than one vertex with internal angle greater than or equal to 90°, or it would no longer be a triangle. The interior angles of a triangle always add up to 180° while the exterior angles of a triangle are equal to the sum of the two interior angles that are not adjacent to it. Another way to calculate the exterior angle of a triangle is to subtract the angle of the vertex of interest from 180°. The sum of the lengths of any two sides of a triangle is always larger than the length of the third side Pythagorean theorem: The Pythagorean theorem is a theorem specific to right triangles. For any right triangle, the square of the length of the hypotenuse equals the sum of the squares of the lengths of the two other sides. It follows that any triangle in which the sides satisfy this condition is a right triangle. There are also special cases of right triangles, such as the 30° 60° 90, 45° 45° 90°, and 3 4 5 right triangles that facilitate calculations. Where a and b are two sides of a triangle, and c is the hypotenuse, the Pythagorean theorem can be written as: a2 + b2 = c2 EX: Given a = 3, c = 5, find b: 32 + b2 = 52 9 + b2 = 25 b2 = 16 b = 4 Law of sines: the ratio of the length of a side of a triangle to the sine of its opposite angle is constant. Using the law of sines makes it possible to find unknown angles and sides of a triangle given enough information. Where sides a, b, c, and angles A, B, C are as depicted in the above calculator, the law of sines can be written as shown below. Thus, if b, B and C are known, it is possible to find c by relating b/sin(B) and c/sin(C). Note that there exist cases when a triangle meets certain conditions, where two different triangle configurations are possible given the same set of data. = = Given b=2, B=90°, C=45°, find c: Given the lengths of all three sides of any triangle, each angle can be calculated using the following equation. Refer to the triangle above, assuming that a, b, and c are known values. A = arccos( ) B = arccos( ) C = arccos( ) Given a=8, b=6, c=10, find B: B =arccos( ) =arccos(0.8) = 36.87° Area of a Triangle There are multiple different equations for calculating the area of a triangle, dependent on what information is known. Likely the most commonly known equation for calculating the area of a triangle involves its base, b, and height, h. The "base" refers to any side of the triangle where the height is represented by the length of the line segment drawn from the vertex opposite the base, to a point on the base that forms a perpendicular. EX: Given the length of two sides and the angle between them, the following formula can be used to determine the area of the triangle. Note that the variables used are in reference to the triangle shown in the calculator above. Given a = 9, b = 7, and C = 30°: area = ab × sin(C) = bc × sin(A) = ac × sin(B) EX: area = × 7 × 9 × sin(30°) = 15.75 Another method for calculating the area of a triangle uses Heron's formula. Unlike the previous equations, Heron's formula does not require an arbitrary choice of a side as a base, or a vertex as an origin. However, it does require that the lengths of the three sides are known. Again, in reference to the triangle provided in the calculator, if a = 3, b = 4, and c = 5: area = √s(s - a)(s - b)(s - c) area = √6(6 - 3)(6 - 4)(6 - 5) = 6 Median, inradius, and circumradius Median The median of a triangle is defined as the length of a line segment that extends from a vertex of the triangle to the midpoint of the opposing side. A triangle can have three medians, all of which will intersect at the centroid (the arithmetic mean position of all the points in the triangle) of the triangle. Refer to the figure provided below for clarification. The medians of the triangle are represented by the line segments ma, mb, and mc. The length of each median can be calculated as follows: Where a, b, and c represent the length of the side of the triangle as shown in the figure above. As an example, given that a=2, b=3, and c=4, the median ma can be calculated as follows: Inradius The inradius is the radius of the largest circle that will fit inside the given polygon, in this case, a triangle. The inradius is perpendicular to each side of the polygon. In a triangle, the inradius can be determined by constructing two angle bisectors to determine the incenter of the triangle. The inradius is the perpendicular distance between the incenter and one of the sides of the triangle. Any side of the triangle can be used as long as the perpendicular distance between the side and the incenter is determined, since the incenter, by definition, is equidistant from each side of the triangle. For the purposes of this calculator, the inradius is calculated using the area (Area) and semiperimeter (s) of the triangle along with the following formulas: where a, b, and c are the sides of the triangle Circumradius The circumradius is defined as the radius of a circle that passes through all the vertices of a polygon, in this case, a triangle. The center of this circle, where all the perpendicular bisectors of each side of the triangle meet, is the circumcenter of the triangle, and is the point from which the circumradius is measured. The circumcenter of the triangle does not necessarily have to be within the triangle. It is worth noting that all triangles have a circumcircle (circle that passes through each vertex), and therefore a circumradius. For the purposes of this calculator, the circumradius is calculated using the following formula: Where a is a side of the triangle, and A is the angle opposite of side a Although side a and angle A are being used, any of the sides and their respective opposite angles can be used in the formula. If you need to find the length of one of the sides of a triangle, our free online triangle side calculator can help. Simply select the type and method that suits to your triangle, input the required values, and our calculator will automatically find the length of the unknown side. Triangle Side Formulas There are several formulas that you can use to calculate the length of a side of a triangle. Through two sides and the angle The cosine theorem in an arbitrary triangle states that one can find a side in a triangle, knowing the other two sides and the angle between them. In order to calculate the third side of the triangle, you need to extract the square root of the difference from the squares of the known sides of their double product by the cosine of the angle between them. The formula is: b = \sqrt{a^2 + c^2 - 2ac* cos(\alpha)} where a, b, and c are the lengths of the sides of the triangle, and α is the angle between sides a and c. You can rearrange the formula to solve for any of the sides. For example, to solve for side c, the formula becomes: c = \sqrt{a^2 + b^2 - 2ab* cos(\beta)} Isosceles triangle, through side and angle Knowing the lateral side of the isosceles triangle and the angle at the base, you can find the third side. To do this, draw a height falling on the base, which will divide the isosceles triangle into two identical right-angled triangles, and the base also into two equal parts. Half of the base from trigonometric relations in the new triangle will be equal to the product of the side (hypotenuse) and the cosine of the angle at the base. The formula is: b = 2acos(\alpha) where a, and b are the lengths of the sides of the triangle, and α is the angle between sides a and b.You can rearrange the formula to solve for side a. The formula becomes:a = \dfrac{b}{2cos(\alpha)} Right triangle, through sides In a right triangle, the side can be found using the Pythagorean theorem. The formula is: b = \sqrt{a^2+c^2}where a, b and c are the lengths of the sides of the triangle, b is also known as the hypotenuse.You can rearrange the formula to solve for any of the sides. For example, to solve for side c, the formula becomes: c = \sqrt{b^2 - a^2} Equilateral triangle side, through height In an equilateral triangle, as well as in the isosceles, the side can be found through height. The formula is: a = \dfrac{2}{\sqrt{3}}h where a is the length of the sides of the triangle, and h is the height. Example Problems Here are some examples of how to use the formulas to find the length of a side of a triangle. Example 1 Find the length of side c in a triangle where a = 3, b = 4, and angle α = 90°. We can use the Law of Cosines to solve for c: c = \sqrt{a^2 + b^2 - 2ab* cos(\alpha)} c = \sqrt{3^2 + 4^2 - 2*3*4* cos(90^0)} c = 5 Therefore, the length of side c is 5 units. Example 2 Find the length of side b in a right triangle where a = 4, c = 5. b = \sqrt{a^2+c^2} b = \sqrt{4^2+5^2} b = 6.4 Therefore, the length of side b is 6.4 units. Use our free online calculator to find the length of the unknown side of a triangle. Simply enter the required parameters, and our calculator will automatically find the length of the unknown side.Using our calculator can save you time and prevent calculation errors. Try it out today! Hanna Pamuła, PhDHanna (Hania) Pamuła holds a Ph.D. in Bioacoustics / Mechanical Engineering, obtained at AGH University of Science and Technology. She has participated in research work in labs in France and the UK and presented papers at several international conferences. Hania has a penchant for photography and graphic design. When not in the office, she's probably traveling, hiking, or out in the field, watching birds and recording their calls. See full profileCheck our editorial policyBogna Szyk and Jack Bowater8 816 people find this calculator helpfulCheck out 19 similar triangle calculators Calculators :: 2D Shapes :: Triangle Calculator This solver uses the Law of Sines, and the Law of Cosines to solve acute and obtuse triangles , i.e., to find missing angles or sides if you know any three of them. Provide any three triangle properties of an oblique triangle to find the missing side, angle or area. The calculator shows all the steps and gives a full explanation for each step. thumb_up 2.1K thumb_down Get Widget Code Oblique triangle formulas $$ A = \frac{a\,b\,\sin\gamma}{2} $$ area $$ A = \frac{b\,c\,\sin\alpha}{2} $$ area $$ A = \frac{a\,c\,\sin\beta}{2} $$ area $$ c^2 = a^2 + b^2 - 2ab \cos \gamma $$ law of cosines $$ b^2 = a^2 + c^2 - 2ac \cos \beta $$ law of cosines $$ a^2 = b^2 + c^2 - 2 b c \cos \alpha $$ law of cosines $$ \frac{a}{\sin\alpha} = \frac{b}{\sin\beta} = \frac{c}{\sin\gamma} $$ law of sines Examples A triangle has sides equal to 3m, 5m and 6m. Find angle &alpha using cosine theorem. Find the area of a triangle using Herons formula if the lengths of a sides are a=13cm, b=14cm and =15cm. If a=12in, b=18in and angle β=45º, find the angle α using the sine theorem. Use the Cosine theorem to find the side c of a triangle ABC if a=12cm, b=8cm and γ=60o Find more worked-out examples in our database of solved problems. Search our database with more than 300 calculators 452 861 664 solved problems Use the triangle calculator to solve the unknown angles, sides and area of a triangle by providing 3 known values.The lengths of the sides must be in the same unit. For instance, you cannot directly solve a triangle where the sides are 8 m, 90 cm and 2 000 mm. In order to solve such a triangle, the lengths of the sides convert must be given in the same unit.The lengths of the sides must be positive, and the angles must be greater than 0° and less than 180°.When three sides are known (SSS), an individual solution can be formed. An impossible solution is given, if the longest side is longer than the sum of the other two sides.When two angles and a side are known (ASA), an individual solution can always be formed when the sum of the angles provided is less than 180°.When two sides and the angle between them are known (SAS), an individual solution can always be provided.When two sides and the angle opposite to one side are known (SSA), the result can either be impossible or an individual solution, or two solutions. Calculators » Math » Right Triangle Our online tools will provide quick answers to your calculation and conversion needs. On this page, you can solve math problems involving right triangles. You can calculate angle, side (adjacent, opposite, hypotenuse) and area of any right-angled triangle and use it in real world to find height and distances. Calculate X using the data in the figure below.A=20A=20A=20555XXXAAABBBCCC The formula to calculate the area of a triangle is: (side * height descending from the side) /2We place the data we have into the formula to find X:20=AB×AC2 20=\frac{AB\times AC}{2} 20=2AB×AC20=x×52 20=\frac{x\times5}{2} 20=2x×5Multiply by 2 to get rid of the fraction: 5x=40 5x=40 5x=40Divide both sections by 5: 5x5=405 \frac{5x}{5}=\frac{40}{5} 55x=540x=8 x=8 x=8