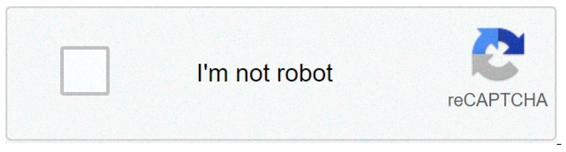

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45-45-90 triangles find the missing side lengths worksheet

When the Pythagorean theorem fails, special right triangles are your new best friend. Jenn, Founder Calcworkshop®, 15+ Years Experience (Licensed & Certified Teacher) It’s true! That’s what today’s geometry lesson is all about, so let’s get started. What Are Special Right Triangles Two very special right triangle relationships will continually appear throughout the study of mathematics: 45-45-90 Triangle 30-60-90 Triangle In an isosceles right triangle, the angle measures are 45°-45°-90°, and the side lengths create a ratio where the measure of the hypotenuse is sqrt(2) times the measure of each leg as seen in the diagram below. 45-45-90 Triangle Ratio And with a 30°-60°-90°, the measure of the hypotenuse is two times that of the leg opposite the 30° angle, and the measure of the other leg is sqrt(3) times that of the leg opposite the 30° also seen in the diagram below. 30-60-90 Triangle Ratio Together we will look at how easy it is to use these ratios to find missing side lengths, no matter if we are given a leg or hypotenuse. Moreover, we will discover that no matter the size of our special right triangle, these ratios will always work. But why do we need them if we have the Pythagorean theorem for finding side lengths of a right triangle? Well, one of the greatest assets to knowing the special right triangle ratios is that it provides us with an alternative to our calculations when finding missing side lengths of a right triangle. Rather than always having to rely on the Pythagorean theorem, we can use a particular ratio and save time with our calculations as Online Math Learning nicely states. Additionally, there are times when we are only given one side length, and we are asked to find the other two sides. The Pythagorean theorem requires us to know two-side lengths; therefore, we can’t always rely on it to solve a right triangle for missing sides. Consequently, knowing these ratios will help us to arrive at our answer quickly, but will also be vital in many circumstances. How To Solve Special Right Triangles Example #1 Solve the right triangle for the missing side length and hypotenuse, using 45-45-90 special right triangle ratios. Solving a 45 45 90 Triangle for Side Lengths Example #2 Solve the right triangle for the missing side lengths, using special right triangle ratios. Special Right Triangles with Radicals In the video below, you will also explore the 30-60-90 triangle ratios and use them to solve triangles. Additionally, you will discover why it’s very important on how you choose your side lengths. (HINT: Order Matters!) Common Questions Q: How to find the hypotenuse in special right triangles? A: The hypotenuse is always the longest side of a right triangle. We can find the hypotenuse by using the Pythagorean theorem or trigonometric ratios by fist ordering side lengths in increasing value, as seen in the video. Q: How to do multi-step special right triangles? A: If we are given a right triangle with one acute angle and side length known, we will first utilize our special right triangle ratios to find one missing side length (either a leg or hypotenuse). Then we will use the Pythagorean theorem to find the remaining side length. Q: What is the 3:4:5 triangle rule? A: The 3-4-5 triangle rule uses this well known pythagorean triple. In other words, 3:4:5 refers to a right triangle with side length of 3, 4, and 5, where the hypotenuse is the length of 5 and the legs are 3 and 4, respectively. Consequently, if we are given these three side lengths we know it refers to a right triangle. Additionally, all multiples are also right triangles. For example, 30:40:50 or 6:8:10 are both multiples of 3:4:5 and both indicate right triangle measurements. Q: How do you know if it’s a pythagorean triple? A: A right triangle whose side lengths are all positive integers, such as a 3:4:5 triangle or 5:12:13 triangle or 7:24:25 triangle. Q: How to use pythagorean theorem with only one side? A: If only one side length is known, we are unable to use the Pythagorean theorem. Therefore, we must first use our trigonometric ratios to find a second side length and then we can use the Pythagorean theorem to find our final missing side. Video – Lesson & Examples 1 hr 6 min 00:10:39 – Given the special right triangle, find the unknown measures (Examples #1-6) 00:22:20 – Find the missing measures for the given problems (Examples #7-11) 00:36:27 – How to find trig ratios (Examples #12-15) 00:49:42 – Find the indicated measure given an equilateral triangle and square (Examples #16-17) 00:57:50 – Solve the word problem (Examples #18-19) Practice Problems with Step-by-Step Solutions Chapter Tests with Video Solutions Get access to all the courses and over 150 HD videos with your subscription Monthly, Half-Yearly, and Yearly Plans Available Get My Subscription Now Not yet ready to subscribe? Take Calcworkshop for a spin with our FREE limits course Something special in geometryis the 45, 45, 90 triangle.Well, a 45, 45, 90 triangle is an isoscelesright triangle where these two legsare congruent to each other.The reason why it's 45, 45, 90 is becauseif we know that these two angles arecongruent to each other, because theisosceles triangle theorem, thenwe can say that 180 degrees is equalto 90, plus X plus X. So ifI add these up, I'm going to have 180is equal to 90, plus 2 X, so I'mgoing to subtract 90 from both sidesand I get 90 is equal to 2X, andthen I'm going to divide by 2 tosolve for X. And 90 divided by2 is 45, which means each of these anglesthat are congruent to each otherhave to be 45 degrees.So in an isosceles right triangle you'regoing to have a 45 degree, a 45 degreeand a 90 degree.So that's we mean whenwe say 45, 45, 90.Now something is going on withthese angles and sides.And if I wrote in that these were both X andI would say that this is my hypotenuseC, let's apply the Pythagoreantheorem and see what happens.Pythagorean theorem says A squared plusB squared equals C squared and A andB here are both X. So I'm going towrite that X squared plus X squaredis equal to C squared.I can combine like terms here and X squaredplus X squared is 2X squared.So if I want to solve for my hypotenuseC, I'm going to take the square rootof both sides, and the square rootof X squared is X, and there is nowhole number square root of 2. SoC is equal to X times the squareroot of 2. Well, that's a littledifficult to understand.So let's say we had an isosceles right trianglewith sides of length 1 and I'mtrying to find the hypotenuse.So maybe this will make sensewith this triangle.Here we'll have 1 squared plus 1squared is equal to C squaredWell, 1 plus 1 is 2. So if I take thesquare root of both sides, I findthat my hypotenuse is equal to thesquare root of 2. So now whatI see it's talking about is if you knowthe side of one of your legs, ifyou know that length, you're going to.multiply it by the square root of 2.So to get from the leg in a 45, 45, 90.triangle, you're going to multiply bythe square root of 2.Let's say, however, you don't know what thatleg is. And you know the hypotenuse.So I'm going to draw anothertriangle over here.45, 45, 90, and let's say you said thiswas 3. To go from your hypotenuseto your leg, you're going to undo multiplyingby the square root of 2.So you're going to divide by the squareroot of 2. So this answerright here will be 3 divided by thesquare root of 2.And we can'thave a square root in our denominator here.So now this is becoming quite a chore.We're going to multiply by square rootof 2. Multiply by the square rootof 2. So we'll have in our numerator3 times the square root of2. Square root of 2 times square root of 2is 2 because you'll have the square rootof 4. So this is actually 3 times.the square root of 2 divided by 2.So if we go back to our originaldrawing here where we said.for any right triangle where you havetwo legs that are congruent, to gofrom your leg to your hypotenuse, allyou need to do is take that numberand multiply it by the square root of2. So if X is 5, your hypotenuseis 5 times the squareroot of 2. To go from your hypotenuse back to one ofyour legs, you're going to divide bythe square root of 2.So keep that in mind and solving for missingsides, an isosceles right triangleis pretty simple. If you're seeing this message, it means we're having trouble loading external resources on our website. If you're behind a web filter, please make sure that the domains *.kastatic.org and *.kasandbox.org are unblocked. 45 45 90 triangle calculator is a dedicated tool to solve this special right triangle. Find out what are the sides, hypotenuse, area and perimeter of your shape and learn about 45 45 90 triangle formula, ratio and rules. If you want to know more about another popular right triangles, check out this 30 60 90 triangle tool and the calculator for special right triangles. If you are wondering how to find the formula for 45 45 90 triangle hypotenuse, you're at a right place. If the leg of the triangle is equal to a, then: the second leg is also equal to a the hypotenuse is a√2 the area is equal to a²/2 the perimeter equals a(2 + √2) OK, looks easy, but where does it come from? There are a couple of methods to prove that equation, the most popular between them are: Using the Pythagorean theorem As you know one leg length a, you the know the length of the other as well, as both of them are equal. Find the hypotenuse from the Pythagorean theorem: a² + b² = c² => a² + a² = c² so c = √(2a²) = a√2 Using the properties of the square Did you notice that the 45 45 90 triangle is half of a square, cut along the square's diagonal? Again, we know that both legs are equal to a As you probably remember, the diagonal of the square is equal to side times square root of 2 - a√2. In our case, this diagonal is equal to the hypotenuse. That was quick! If you heard about trigonometry, you could use the properties of sine and cosine. For this special angle of 45°, both of them are equal to √2/2. So: a/c = √2/2 so c = a√2 To find the area of such triangle, use the basic triangle area formula is area = base * height / 2. In our case, one leg is a base and the other is the height, as there is a right angle between them. So the area of 45 45 90 triangles is: `area = a² / 2` To calculate the perimeter, simply add all 45 45 90 triangle sides: perimeter = a + b + c = a + a + a√2 = a(2 + √2) The legs of such a triangle are equal, the hypotenuse is calculated immediately from the equation c = a√2. If the hypotenuse value is given, the side length will be equal to a = c√2/2. Triangles (set squares). The red one is the 45 45 90 degree angle triangle The most important rule is that this triangle has one right angle, and two other angles are equal to 45°. It implies that two sides - legs - are equal in length and the hypotenuse can be easily calculated. The other interesting properties of the 45 45 90 triangles are: It's the only possible right triangle that is also an isosceles triangle It has the smallest ratio of the hypotenuse to the sum of the legs It has the greatest ratio of the altitude from the hypotenuse to the sum of the legs In a 45 45 90 triangle, the ratios are equal to: 1 : 1 : 2 for angles (45° : 45° : 90°) 1 : 1 : √2 for sides (a : a : a√2) Have a look at this real-life example to catch on the 45 45 90 triangle rules. Assume we want to solve the isosceles triangle from a triangle set. Type the given value. In our case, the easiest way is to type the length of the part with the scale. The usual leg length is 9 inches, so type that value into a or b box. The 45 45 90 triangle calculator shows the remaining parameters. Now you know: hypotenuse length - 9 in * √2 = 12.73 in area - 9 in * 9 in / 2 = 40.5 in² perimeter - 9 in + 9 in + 9 in * √2 = 30.73 in Remember that every time you can change the units displayed by simply clicking on the unit name. Also, don't forget that our calculator is a flexible tool - if you only know the area, the hypotenuse or even the perimeter, it can calculate the remaining parameters as well. Awesome! 45-45-90 Special Right Triangle - Practice/HWby This worksheet is only over 45-45-90 special right triangles. I have 2 example problems at the top of the page. One example is for if given a leg, find the missing leg and hypotenuse. The other example is for if given the hypotenuse, find the missing legs. There are a total of 12 problems on this Types:Page 2

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