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Surface area of a triangular prism with a rectangular base

Mark, a math enthusiast, loves writing tutorials for stumped students and those who need to brush up on their math skills. What Is a Prism? A prism is a three-dimensional object whose two end faces are identical and whose sides are parallelograms (a four-sided shape with two pairs of parallel sides). The type of prism is determined by the shape of its ends. Hence, a prism with a triangle at each end is called a triangular prism. It doesn't matter if that prism is right-angled or isosceles, the way we find the surface area is the same for both types. How Do We Find the Surface Area? The surface area of any prism is the total area of all its sides and faces. A triangular prism has three rectangular sides and two triangular faces. To find the area of the rectangular sides, use the formula $A = lw$, where $A = \text{area}$, $l = \text{length}$, and $w = \text{width}$. To find the area of the triangular faces, use the formula $A = \frac{1}{2}bh$, where $A = \text{area}$, $b = \text{base}$, and $h = \text{height}$. Once you have the areas of all sides and faces, you simply add them together to get the surface area. Formulas You'll Need to Complete This Lesson
Shape Formula
Area of a triangle $A = \frac{1}{2}bh$
Area of a rectangle $A = lw$
Surface area of triangular prism $SA = bh + (s_1 + s_2 + s_3)H$
Example 1: Find the Surface Area of the Right-Angled Triangular Prism Above.
Let's begin with the triangular faces. Both faces have the same area because they are congruent! Just multiply the base and height and divide the answer by 2.
Area of triangular faces $= \frac{1}{2}(\text{base} \times \text{height}) = \frac{1}{2}(3 \times 4) = 6 \text{ cm}^2$
Next work out the area of the rectangular sides. Each side is a different size, and can be calculated by multiplying the length by the width.
Area of sloping rectangular sides $= \text{length} \times \text{width} = 11 \times 5 = 55 \text{ cm}^2$
Area of back sides $= 11 \times 3 = 33 \text{ cm}^2$
Area of bottom side $= 11 \times 4 = 44 \text{ cm}^2$
All you need to do is total all these areas: $6 + 6 + 55 + 33 + 44 = 144 \text{ cm}^2$
So the total surface area of this triangular prism is 144 cm^2 .
What Is the Perimeter of a Shape? The perimeter is the total distance around a two-dimensional shape. For example, a triangle whose sides are all 3 inches long has a perimeter of 9 inches ($3 + 3 + 3$, or 3×3). Using a Formula to Find the Surface Area
Now that we've covered the basics, it's time to introduce a less tedious method. There is a single formula you can use to calculate the surface area of a triangular prism: $SA = bh + (s_1 + s_2 + s_3)H$
In the above formula, $b = \text{the base}$ and $h = \text{the height}$ of the triangle, s_1 , s_2 , and $s_3 = \text{the length of each side of the triangle}$, and $H = \text{the prism's height}$ (which is the same as the rectangles' length). You might be wondering how we came up with this formula. Well, it's pretty simple. If you'll recall, the surface area is found by adding together the area of each side and face. Let's start with the two triangles on the ends. The area of each triangle is $\frac{1}{2}bh$. Since they are both identical, we can double this formula to find both of their areas at the same time. The area of both triangles $= 2(\frac{1}{2}bh) = 2/2bh = bh$
Typically to work out the area of the three rectangular sides, you would multiply each one's length by its respective width. However, this isn't necessary because the sides of the triangles are equal to the widths of the three rectangles. Similarly, the prism's height, H , is equal to the length of each rectangle. Therefore, multiplying the height, H , of the prism (length of the rectangles) by the perimeter (the three rectangular widths) of its base will give us the area of each rectangle. The area of the rectangular sides $= (s_1 + s_2 + s_3)H$
Therefore, the area of a triangular prism $= \text{the area of the triangular faces} + \text{the area of the rectangular sides} = bh + (s_1 + s_2 + s_3)H$
Example 1. Let's use our new formula to redo the example above! The surface area $= bh + (s_1 + s_2 + s_3)H = 4(3) + (3 + 5 + 4)(11) = 12 + 12(11) = 12 + 132 = 144 \text{ cm}^2$
As you can see, our answer matches the one above. Now that we know our formula works, let's put it to use in the next example.
Example 2: Find the Surface Area of the Isosceles Triangular Prism Above.
First, plug the known values into the equation. $SA = bh + (s_1 + s_2 + s_3)H = 4(6) + (4 + 7 + 7)(12)$
Next, calculate the perimeter of the triangles (add together the three sides), followed by their area (base times height). $SA = 24 + 18(12)$
Then, multiply the perimeter by the height of the prism. $SA = 24 + 216$
Finally, add the remaining values together to get your answer. $SA = 240 \text{ cm}^2$
Example 2.1: Let's Check Our Work!
Our answers match! Great job!
Triangular Face (TF1) TF2
Rectangular Side 1 (RS1) RS2
Rectangular Base Total $A = \frac{1}{2}bh_A = \frac{1}{2}bh_A = lw_A = lw_A = lw_A = \frac{1}{2}(4 \times 6)A = \frac{1}{2}(4 \times 6)A = 12(7)A = 12(7)A = 12(4)A = 12A = 12A = 84A = 84A = 4812 + 12 + 84 + 84 + 48 = 240 \text{ cm}^2$
Still Stumped? Here's a Great Tutorial on Calculating Surface Area Using a Net
Review Questions
I. Use the diagram below to solve the following problems.
Alan wants to surprise his sister with a giant Toblerone for passing her math class (Fig. 1). Alan needs to know the surface area of the Toblerone to buy the right amount of wrapping paper. What is its surface area? John just bought a brand new roof for his shed. Unfortunately, he hates that it's neon green. He would like to repaint his roof but doesn't know how much paint he should buy. He is on a pretty tight budget. Using the image above (Fig. 2), find the surface area of the roof (including the bottom). Jackie wants to build a tent for her daughter. She has already constructed its frame but does not know how much fabric she needs to cover it. Find the surface area of the tent (Fig. 3) using the image above. Katie's boss wants her to purchase concrete for the ramp that they are building. He gave her the blueprints, but she is still stumped. Find the surface area of the image above (Fig. 4) so Katie doesn't lose her job.
II. Find the surface area of the following:
A prism whose triangular ends have a height of 6 inches with a 4-inch base and each rectangular side is 5 inches long and 6 inches wide. A prism whose triangular ends have a height of 10 meters with a 5-meter base and each rectangular side is 4 meters long and 10 meters wide. A prism whose triangular ends have a height of 10 inches with a 15-inch base and each rectangular side is 12 inches long and 10 inches wide. A prism whose triangular ends have a height of 6 meters with an 8-meter base and each rectangular side is 15 meters long and 6 meters wide.
Answers
Section 13.702 cm² 62 ft² 150 ft² 60 m² Section III 14 in² 170 m² 510 in² 318 m²
Questions & Answers
Question: What is the formula for finding the Total Surface Area of a Prism?
Answer: It depends on the type of prism, so there isn't one formula which works for all.
Question: How do you find the surface area of the right triangular prism with two numbers?
Answer: You may need to apply Pythagoras on the triangular face to work out a missing side length if you are only given two lengths to start off with.
Question: The base length of the triangular face is 5 cm, the perpendicular height is 2.4 cm and the length of the prism is 7, how to calculate the surface area of that triangular prism?
Answer: The area of the triangular face is 5 times 2.4 divided by 2 which is 6cm². The area of the triangular face at the back of the prism is also 6cm². The area of the rectangular bottom face is 5 times 7 which is 35cm². The area of the rectangular vertical face is 2.4 times 7 which is 16.8 cm². Before you can work out the rectangular sloping face apply Pythagoras to give the other side length which will be 5.5cm. So the sloping rectangular face will be 5.5 times 7 which is 38.5 cm². Adding up these areas will give a final answer of 102.3 cm².
Question: How do you work out the surface area for a right-angled triangular prism?
Answer: Work out the area of the triangles at the front and back of the prism, using 1/2 times base times height. (These triangles will have the same area). Next work out the area of the 3 rectangular faces of the prism using length times width for each rectangle. Now add up the 5 areas to give the surface area of the triangular prism.
Question: How do I find the total surface area of a cube?
Answer: Work out the area of one of the square faces (length times width). Then multiply this answer by 6, as there are 6 square faces which make the cube.
Question: How would you work out the surface area of a scalene triangle, and what if that is a prism?
Answer: It's very similar to the right-angled triangular prism. Work out the area of the two triangles at either end and then add on the area of the three rectangles around the middle. Get a Widget for this Calculator
 $a = \text{side length}$ $b = \text{side length}$ $b = \text{bottom triangle base}$ $c = \text{side length}$ $c = \text{height of prism}$ $H = \text{height of bottom triangle}$ $V = \text{volume}$ $A_{\text{tot}} = \text{total surface area} = \text{all sides}$ $A_{\text{lat}} = \text{lateral surface area} = \text{all rectangular sides}$ $A_{\text{top}} = \text{top surface area} = \text{top triangle}$ $A_{\text{bot}} = \text{bottom surface area} = \text{bottom triangle}$
A triangular prism is a geometric solid shape with a triangle as its base. It's a three-sided prism where the base and top are equal triangles and the remaining 3 sides are rectangles. Calculator Use This calculator finds the volume, surface area and height of a triangular prism. Surface area calculations include top, bottom, lateral sides and total surface area. Height is calculated from known volume or lateral surface area. Units: Units are shown for convenience but do not affect calculations. Answers will be the same whether in feet, ft2, ft3, or meters, m2, m3, or any other unit measure. Significant Figures: Choose the number of significant figures or leave on auto to let the calculator determine number precision. Triangular Prism Formulas in terms of height and triangle side lengths a , b and c : Volume of a Triangular Prism Formula Finds the 3-dimensional space occupied by a triangular prism. $V = \frac{1}{3}Ah$ $V = \frac{1}{3}h \sqrt{\frac{(a+b+c)(b+c-a)(c+a-b)(a+b-c)}{4}}$ $V = \frac{1}{3}h \sqrt{\frac{(c+a-b)(a+b-c)}{4} \times \frac{(a+b+c)(b+c-a)}{4}}$ Top Surface Area of a Triangular Prism Formula Finds the area contained by the triangular surface at the top of the prism. This is the same area as the bottom surface area. $A_{\text{top}} = \frac{1}{2}(a+b+c)(b+c-a)(c+a-b)(a+b-c) \sqrt{4}$ $A_{\text{top}} = \frac{1}{2}(a+b+c) \sqrt{\frac{(a+b+c)(b+c-a)(c+a-b)(a+b-c)}{4}}$ Bottom Surface Area of a Triangular Prism Formula Finds the area contained by the triangular surface at the bottom of the prism. This is the same area as the top surface area. $A_{\text{bot}} = \frac{1}{2}(a+b+c)(b+c-a)(c+a-b)(a+b-c) \sqrt{4}$ $A_{\text{bot}} = \frac{1}{2}(a+b+c) \sqrt{\frac{(a+b+c)(b+c-a)(c+a-b)(a+b-c)}{4}}$ Lateral Surface Area of a Triangular Prism Formula Finds the total area contained by the three rectangular sides of the prism. You can think of the lateral surface area as the total surface area of the prism minus the two triangular areas at the top and bottom of the prism. $A_{\text{lat}} = h(a+b+c) \sqrt{4}$ Total Surface Area of a Triangular Prism Formula Finds the total area of all sides of a triangular prism. Total surface area of a prism includes the area of the top and bottom triangle sides of the prism, plus the area of all 3 rectangular sides. $A_{\text{tot}} = A_{\text{top}} + A_{\text{bot}} + A_{\text{lat}}$ Height of a Triangular Prism Formula in Terms of Volume Finds the height of a triangular prism by solving the Volume Formula for height. Height, h , is calculated from volume, V , and side lengths a , b and c . $h = \frac{3V}{a+b+c} \sqrt{\frac{(a+b+c)(b+c-a)(c+a-b)(a+b-c)}{4}}$ $h = \frac{3V}{a+b+c} \sqrt{\frac{(a+b+c)(b+c-a)(c+a-b)(a+b-c)}{4}}$ Height of a Triangular Prism Formula in Terms of Lateral Surface Area Finds the height of a triangular prism by solving the Lateral Surface Area Formula for height. Height, h , is calculated from lateral surface area, A_{lat} , and side lengths a , b and c . $h = \frac{A_{\text{lat}}}{a+b+c}$ Reference Weisstein, Eric W. "Triangle Area." From MathWorld—A Wolfram Web Resource, Triangle Area. The surface area of a right triangular prism is the total area of all of the sides and faces of a right triangular prism. Basically, a right triangular prism is a prism that has two parallel and congruent triangular faces and three rectangular faces perpendicular to the triangular faces. In this lesson, we will learn to determine the surface area of a right triangular prism. What is Surface Area of a Right Triangular Prism? The surface area of a right triangular prism is the sum of the areas of all of the faces or surfaces of the prism. A right triangular prism has three rectangular sides and two right triangular faces. In a right triangular prism, the rectangular faces are said to be lateral, while the triangular faces are called bases. If the bases of a right triangular prism are kept horizontal, they are sometimes called the top and the bottom (faces) of a right triangular prism. This prism has 6 vertices, 9 edges, and 5 faces. There are two types of surface areas in the case of the surface area of a right triangular prism: Lateral surface area Total surface area The unit of the surface area of a right triangular prism is expressed in square units, m², cm², in², or ft², etc. Formula of Surface Area of a Right Triangular Prism The formula for the surface area of a right triangular prism is calculated by adding up the area of all rectangular and triangular faces of a prism. The surface area of a right triangular prism formula is: Surface area = (Length × Perimeter) + (2 × Base Area) = (s₁ + s₂) × hL + bh where, b is the bottom edge of the base triangle, h is the height of the base triangle, L is the length of the prism and s_1 , s_2 , s_3 are the two edges of the base triangle bh is the combined area of two triangular faces. The (s₁ + s₂) × hL is the area of the three rectangular side faces. The surface area of a right triangular prism is also referred to as its total surface area. The lateral surface area of any object is calculated by removing the base area or we can say that the lateral surface area is the area of the non-base faces only. When the right triangular prism has its bases facing up and down, the lateral area is the area of the vertical faces. The lateral area of a right triangular prism can be calculated by multiplying the perimeter of the base by the length of the prism. Thus, the lateral surface area of a right triangular prism = LSA = (s₁ + s₂) × hL = (Length × Perimeter) or LSA = $l \times p$ where, l is the height of a prism p is the perimeter of the base How to Calculate Surface Area of a Right Triangular Prism? The surface area of a right triangular prism can be calculated by representing the 3-d figure into a 2-d net, to make the shapes easier to see. After expanding this 3-d shape into the 2-d shape we will get two right triangles and three rectangles. The following steps are used to calculate the surface area of a right triangular prism : Step 1: Find the area of the top and the base triangles using the formula $2 \times (\frac{1}{2} \times \text{base of the triangle} \times \text{height of the triangle})$ which becomes base × height. Step 2: Find the product of the length of the prism to the perimeter of the base triangle. Step 3: Add all the areas together. Step 4: Thus, the surface area of a right triangular prism is written in squared units. Example: Find the surface area of a right triangular prism, having a base area of 60 square units, the base perimeter of 40 units, and the length of the prism of 7 units. Solution: Given, base area = 60 square units, $p = 40$ units and length of prism = 7 units Thus, the surface area of the right triangular prism, $S = (\text{Length} \times \text{Perimeter}) + (2 \times \text{Base Area}) = S = (7 \times 40) + (2 \times 60) = S = (280 + 120) \text{ square units} = S = 400 \text{ square units}$ Thus, the surface area of the right triangular prism is 400 square units Example 1: Find the surface area of the right triangular prism shown below. Solution: Given, $b = 5$ units, the height of the triangle (h) = 12 units, length of a prism = 11, and the hypotenuse of a right triangle = 13. The surface area of a right triangular prism is $bh + (s_1 + s_2 + h)L$ On putting the values, we get $SA = 5 \times 12 + (5 + 13 + 12) \times 11 = SA = 60 + (30) \times 11 = SA = 390 \text{ squared units}$. Therefore, the surface area of a right triangular prism is 390 squared units. Example 2: Find the surface area of a right triangular prism whose area of the top and base triangles is 30 squared units each, the perimeter of the right triangle is 11 units, and the length of the prism is 25 units. Solution: Given, area of top and base triangles = 30 squared units, the perimeter of the right triangle = 11 units, and length of triangle = 25 units The combined area of the top and base triangles = (30+30) = 60 squared units. The perimeter of the right triangle = 11 units. The length of the prism = 25 units. The surface area of a right triangular prism = The combined area of the top and base triangles + (The perimeter of the right triangle) × The length of the prism. Putting the values together, The surface area of a right triangular prism = 60 + (11 × 25) = 335 square units Therefore, the surface area of a right triangular prism 335 square units. View More > go to slidego to slide Great learning in high school using simple cues Indulging in rote learning, you are likely to forget concepts. With Cuemath, you will learn visually and be surprised by the outcomes. Book a Free Trial Class FAQs on Surface Area of a Right Triangular Prism The surface area of a right triangular prism is defined as the sum of the areas of all of the faces or surfaces of the prism. We can find the total surface area and lateral surface area in the case of a right triangular prism. What is the Formula of Surface Area of a Right Triangular Prism? The formula of the surface area of a right triangular prism is $(\text{Length} \times \text{Perimeter}) + (2 \times \text{Base Area}) = (s_1 + s_2 + h)L + bh$ where b is the bottom edge of the base triangle, h is the height of the base triangle, L is the length of the prism and s_1 , s_2 are the two edges of the base triangle. L is the length of the prism and s_1 , s_2 are the two edges of the base triangle. What is the Unit of Surface Area of a Right Triangular Prism? The unit of the surface area of a right triangular prism is given in square units, for example, m², cm², in² or ft², etc. How to Find the Surface Area of a Right Triangular Prism? We use the following steps to calculate the surface area of a right triangular prism : Step 1: Determine the area of the top and the base triangles using the formula $2 \times (\frac{1}{2} \times \text{base of the triangle} \times \text{height of the triangle})$ which becomes base × height. Step 2: Determine the product of the length of the prism to the perimeter of the base triangle. Step 3: Now, add all the areas together. Step 4: The surface area of a right triangular prism is written in squared units. How to Find the Lateral Surface Area of a Right Triangular Prism? We use the following steps to calculate the lateral surface area of a right triangular prism : Step 1: Identify the length of the prism from the given dimensions. Step 2: Find the perimeter of the base of the prism. Step 3: Now, multiply them. Step 4: The lateral surface area of a right triangular prism is expressed in squared units. How to Find the Base Area of a Right Triangular Prism is Given? We use the following steps to calculate the base area if the surface area of a right triangular prism is given: Step 1: Identify the given dimensions. Step 2: Now use the formula $(\text{Length} \times \text{Perimeter}) + (2 \times \text{Base Area})$ and assume the base area is "b" Step 3: Now, substitute the values and solve for "b". Step 4: The obtained value of "b" is written in units. What Happens to the Surface Area of a Right Triangular Prism if the Length of Prism is Doubled? The surface area of the right triangular prism increases in magnitude when the length of the prism is doubled. However, the surface area of the right triangular prism does not double as the surface area of the right triangular prism does not depend entirely on the length of the prism.

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