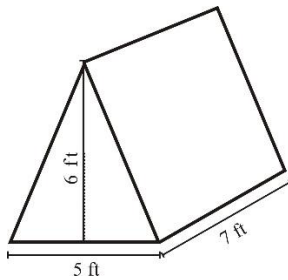


MATHCOUNTS[®] Problem of the Week Archive

Tent Geometry – August 5, 2024

Problems & Solutions

Veronica bought a tent for her camping trip this weekend. The shape of the tent is a right triangular prism lying on its side, as shown. (The front and back sides of the tent, which are the prism's bases, are isosceles triangles.) If the height of the tent is 6 feet at the tallest point, the front base of the tent is 5 feet across and the tent is 7 feet long, what is the volume of Veronica's new tent, in cubic feet?



The volume of a right triangular prism can be found using the formula $V = B \times h$, where B = the area of the base and h = the height of the prism. So, given the measurements above, we can calculate the volume to be $V = B \times h = (1/2)(5)(6) \times 7 = \mathbf{105}$ cubic feet.

Veronica's tent came with a fly to put over the tent to provide additional protection in the rain. If the fly covers all of the sides of the tent (except the bottom) perfectly, how many square feet is the fly?

The front and back of the tent each have an area of $(1/2)(5)(6) = 15$ square feet. Now, to figure out the area of the two slanted sides of the tent, we must determine the slant height of the tent. By drawing in the height of the front of the tent, we get two right triangles, so we can use the Pythagorean Theorem to determine the slant height: $\sqrt{6^2 + (5/2)^2} = \sqrt{36 + (25/4)} = 13/2$ feet. This tells us that each slanted side of the tent has an area of $7 \times (13/2) = 91/2$ square feet. Therefore, since the fly covers the sides of the tent perfectly, the fly must be $(15)(2) + (91/2)(2) = 30 + 91 = \mathbf{121}$ square feet.

Veronica plans to put an air mattress under her sleeping bag for extra cushion. When the mattress is full of air, it is 4 inches thick, contains 6 cubic feet of air and forms a right rectangular prism. When lying flat on the ground parallel to the position of the tent floor, the mattress fits completely inside of the tent. If the length and width are each an integer number of feet, what are the dimensions of the base of the mattress?

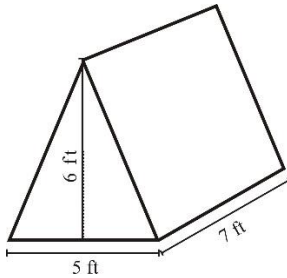
Since the volume of a rectangular prism is length \times width \times height, we can say that $6 = l \times w \times (1/3)$, since 4 inches is the same as $1/3$ of a foot. This tells us that $l \times w = 18$ square inches. If the length and width are both integers and it must fit within the 5 feet by 7 feet base of the tent, the dimensions of the base of the mattress must be **6 feet by 3 feet**.

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