

Surface area of a triangular prism is the total area of all its external faces. It means adding the two triangle ends and the three sides of the rectangle together. Surface area of a triangular prism is easy to find when you know the base, height and length of the shape. This is an interesting topic for geometry, and it helps the students to learn the 3D shapes easily.

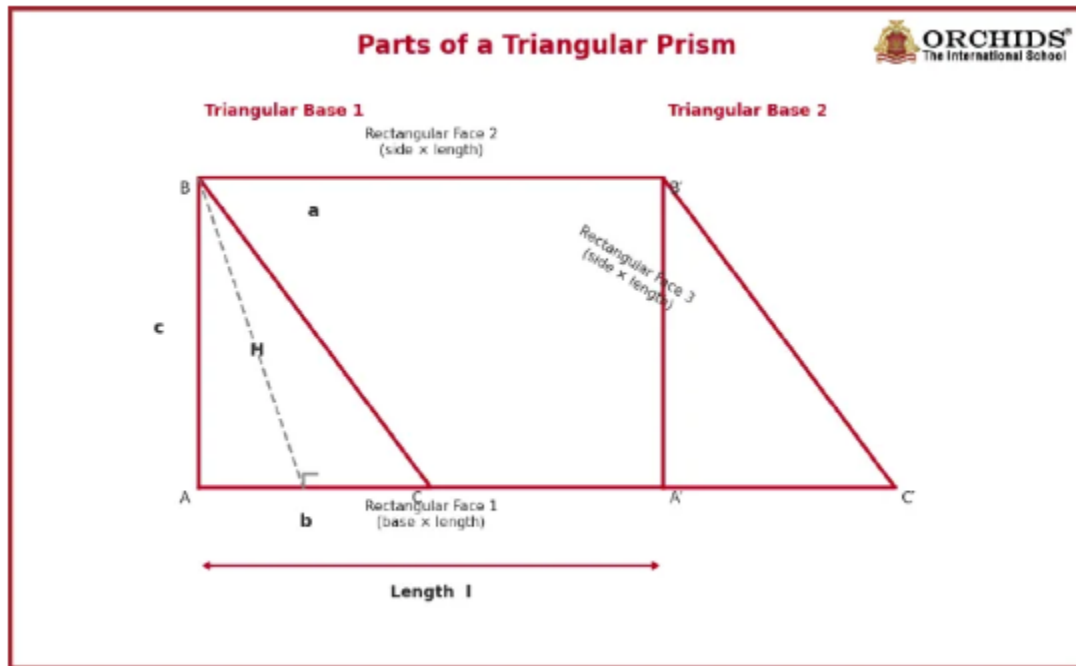
Table of Contents

- [What Is the Surface Area of a Triangular Prism?](#)
- [Surface Area of a Triangular Prism Formula](#)
- [How to Find the Surface Area of a Triangular Prism](#)
- [Derivation of the Surface Area Formula](#)
- [Solved Examples on Surface Area of a Triangular Prism](#)
- [Difference Between Lateral Surface Area and Total Surface Area](#)
- [Practice Questions on Surface Area of a Triangular Prism](#)

What Is the Surface Area of a Triangular Prism?

The surface area of a triangular prism is the sum of the areas of all its outer faces. It measures the total flat surface that covers the solid from the outside. Surface area is always expressed in square units such as cm^2 , m^2 , or mm^2 . A triangular prism is a three-dimensional solid with two parallel, identical triangular faces at each end and three rectangular faces connecting them along the length.

Parts of a Triangular Prism



The five faces are:

- 2 triangular bases: identical, one at each end
- 3 rectangular lateral faces: one for each side of the triangle, running along the full length

The key measurements are:

- a, b, c - the three sides of the triangular base
- l - the length (or height) of the prism
- H - the perpendicular height of the triangular base
- s - the semi-perimeter (used in Heron's formula when needed)

Surface Area of a Triangular Prism Formula

Total Surface Area (TSA) Formula

The Total Surface Area of a triangular prism includes both triangular bases and all three rectangular faces.

$$\text{TSA} = (b \times H) + (a + b + c) \times l$$

or equivalently:

$$\text{TSA} = 2 \times \text{Area of Triangle} + \text{Perimeter of Triangle} \times l$$

$$\text{TSA} = 2A + (a + b + c) \times l$$

where:

- A = area of one triangular base = $(1/2) \times b \times H$
- a, b, c = the three sides of the triangular base
- l = the length of the prism

Lateral Surface Area (LSA) Formula

The Lateral Surface Area covers only the three rectangular faces excluding the two triangular bases.

$$LSA = (a + b + c) \times l$$

$$LSA = \text{Perimeter of triangular base} \times \text{length of prism}$$

Meaning of Each Variable

Variable	Meaning
a, b, c	Three sides of the triangular base
l	Length (height) of the prism
H	Perpendicular height of the triangle
A	Area of one triangular base
P	Perimeter of the triangular base = $a + b + c$
TSA	Total Surface Area
LSA	Lateral Surface Area

How to Find the Surface Area of a Triangular Prism

Step 1: Find the Area of the Triangular Base

Use the formula: Area of Triangle (A) = $(1/2) \times \text{base} \times \text{height} = (1/2) \times b \times H$

If all three sides are known but height is not given, use Heron's Formula: $s = (a + b + c) / 2$
 $A = \sqrt{s(s-a)(s-b)(s-c)}$

Step 2: Find the Perimeter of the Base

$$\text{Perimeter (P)} = a + b + c$$

Add all three side lengths of the triangular base.

Step 3: Calculate the Lateral Surface Area

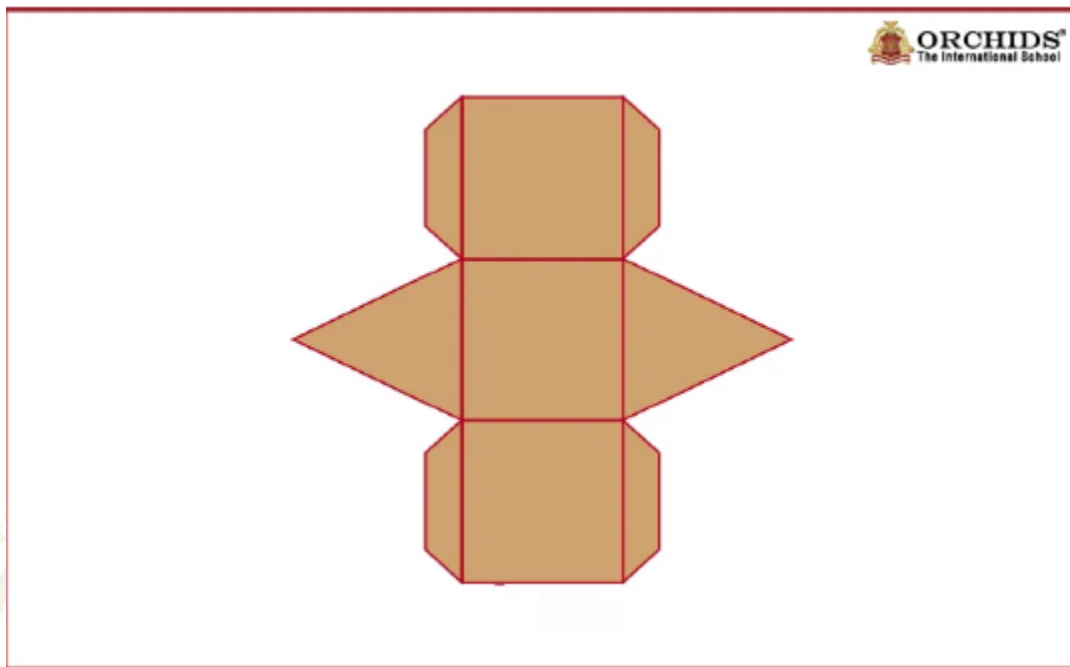
$$\text{LSA} = P \times l = (a + b + c) \times l$$

Multiply the perimeter of the triangular base by the length of the prism.

Step 4: Add the Areas to Get the Total Surface Area

$$\text{TSA} = 2A + \text{LSA} = 2A + (a + b + c) \times l$$

Add the area of both triangular bases (2A) to the lateral surface area.



Derivation of the Surface Area Formula

Area of Two Triangular Bases

A triangular prism has exactly two triangular bases one at each end. Both are identical.

Area of one triangle = $(1/2) \times b \times H$

Area of two triangles = $2 \times (1/2) \times b \times H = b \times H$

This can also be written as $2A$, where A is the area of one triangular base.

Area of the Three Rectangular Faces

Each rectangular face has:

- Width = one side of the triangular base
- Length = l (the length of the prism)

Area of Rectangle 1 = $a \times l$ Area of Rectangle 2 = $b \times l$ Area of Rectangle 3 = $c \times l$

Total area of three rectangles = $al + bl + cl = (a + b + c) \times l = P \times l$

Final Formula

Adding both components:

$$TSA = 2A + (a + b + c) \times l$$

or

$$TSA = bH + (a + b + c) \times l$$

where $bH = 2 \times \text{area of one triangle} = b \times H$ (not $(1/2)bH$, because there are two bases).

Solved Examples on Surface Area Of A Triangular Prism

Example 1: Right Triangular Prism

Question: A right triangular prism has a triangular base with base = 6 cm, height = 4 cm, and the two other sides are 5 cm and 5 cm. The length of the prism is 10 cm. Find the TSA.

Solution:

Step 1: Area of triangular base $A = (1/2) \times 6 \times 4 = 12 \text{ cm}^2$

Step 2: Perimeter of triangular base $P = 6 + 5 + 5 = 16 \text{ cm}$

Step 3: Lateral Surface Area $LSA = P \times l = 16 \times 10 = 160 \text{ cm}^2$

Step 4: Total Surface Area $TSA = 2A + LSA = 2(12) + 160 = 24 + 160 = 184 \text{ cm}^2$

Example 2: Isosceles Triangular Prism

Question: An isosceles triangular prism has base sides of 8 cm, 8 cm, and 6 cm, with a triangular height of 5.29 cm. The prism length is 12 cm. Find TSA and LSA.

Solution:

Step 1: Area of base $A = (1/2) \times 6 \times 5.29 = 15.87 \text{ cm}^2$

Step 2: Perimeter $P = 8 + 8 + 6 = 22 \text{ cm}$

Step 3: LSA $LSA = 22 \times 12 = 264 \text{ cm}^2$

Step 4: TSA $TSA = 2(15.87) + 264 = 31.74 + 264 = 295.74 \text{ cm}^2$

Example 3: Prism with Given Side Lengths

Question: A triangular prism has sides 3 cm, 4 cm, and 5 cm, and a length of 8 cm. Use Heron's Formula to find the area of the base, then find TSA.

Solution:

Step 1: Find area using Heron's Formula $s = (3 + 4 + 5)/2 = 6$

$A = \sqrt{[6(6-3)(6-4)(6-5)]} = \sqrt{[6 \times 3 \times 2 \times 1]} = \sqrt{36} = 6 \text{ cm}^2$

Step 2: Perimeter $P = 3 + 4 + 5 = 12 \text{ cm}$

Step 3: LSA $LSA = 12 \times 8 = 96 \text{ cm}^2$

Step 4: TSA $TSA = 2(6) + 96 = 12 + 96 = 108 \text{ cm}^2$

Example 4: Word Problem

Question: A tent is shaped like a triangular prism. The triangular front face has a base of 3 m and a height of 2 m. The tent is 5 m long. Find the total canvas needed to make the tent (including the two triangular ends but excluding the floor).

Solution:

Step 1: Area of one triangular end $A = (1/2) \times 3 \times 2 = 3 \text{ m}^2$

Two triangular ends $= 2 \times 3 = 6 \text{ m}^2$

Step 2: The tent has three sides the floor is excluded, so only two rectangular slant sides are covered.

For a triangular prism tent with a base of 3 m and equal slant sides:

Using Pythagoras (slant height): each slant $= \sqrt{(1.5^2 + 2^2)} = \sqrt{(2.25 + 4)} = \sqrt{6.25} = 2.5 \text{ m}$

Two slant rectangles $= 2 \times (2.5 \times 5) = 2 \times 12.5 = 25 \text{ m}^2$

Step 3: Total canvas $= \text{two triangular ends} + \text{two slant sides} = 6 + 25 = 31 \text{ m}^2$

Difference Between Lateral Surface Area and Total Surface Area

Comparison Table

Feature	Lateral Surface Area (LSA)	Total Surface Area (TSA)
What it includes	Only the 3 rectangular faces	All 5 faces (3 rectangles + 2 triangles)
Formula	$(a + b + c) \times l$	$2A + (a + b + c) \times l$
Use case	Painting the sides of a pillar	Wrapping a 3D solid completely
Result	Always less than TSA	Always greater than LSA

When to Use Each Formula

Use LSA when:

- Only the side surfaces need to be covered or painted
- The two ends (bases) are open or not being considered
- A tunnel or pipeline is being lined on the sides only

Use TSA when:

- The complete outer surface must be covered
- Calculating material to wrap or coat the entire prism
- Finding the area for painting or manufacturing a closed box

Practice Questions on Surface Area Of A Triangular Prism

Q1: Find the TSA of a triangular prism with triangle base = 4 cm, triangle height = 3 cm, all three triangle sides = 4 cm, and prism length = 7 cm.

Answer: $A = (1/2)(4)(3) = 6 \text{ cm}^2$. $P = 4 + 4 + 4 = 12 \text{ cm}$. $TSA = 2(6) + 12 \times 7 = 12 + 84 = 96 \text{ cm}^2$

Q2: Find the LSA of a prism with triangular base sides 5 cm, 7 cm, 9 cm and prism length 10 cm.

Answer: $LSA = (5 + 7 + 9) \times 10 = 21 \times 10 = 210 \text{ cm}^2$

Q3: A triangular prism has TSA = 240 cm² and LSA = 180 cm². Find the area of each triangular base.

Answer: $2A = \text{TSA} - \text{LSA} = 240 - 180 = 60 \text{ cm}^2$ $A = 30 \text{ cm}^2$ per triangular base.

Q4: A triangular prism has a right-angled triangular base with legs 9 cm and 12 cm (hypotenuse = 15 cm). The length of the prism is 20 cm. Find the TSA.

Answer: $A = (1/2)(9)(12) = 54 \text{ cm}^2$ $P = 9 + 12 + 15 = 36 \text{ cm}$ $\text{TSA} = 2(54) + 36 \times 20 = 108 + 720 = 828 \text{ cm}^2$

Q5: Find the total surface area of a prism whose triangular base has sides 6 cm, 8 cm, 10 cm and height 4.8 cm (for the 10 cm base), and the prism length is 15 cm.

Answer: $A = (1/2)(10)(4.8) = 24 \text{ cm}^2$ $P = 6 + 8 + 10 = 24 \text{ cm}$ $\text{TSA} = 2(24) + 24 \times 15 = 48 + 360 = 408 \text{ cm}^2$

Q6: A triangular prism has an equilateral triangular base with side 6 cm. The length of the prism is 14 cm. Find the TSA. (Height of equilateral triangle = $3\sqrt{3}$ cm)

Answer: $A = (1/2)(6)(3\sqrt{3}) = 9\sqrt{3} \text{ cm}^2$ $P = 6 + 6 + 6 = 18 \text{ cm}$ $\text{TSA} = 2(9\sqrt{3}) + 18 \times 14 = 18\sqrt{3} + 252 \approx 31.18 + 252 = 283.18 \text{ cm}^2$

Q7: The LSA of a triangular prism is 360 cm² and the prism length is 12 cm. Find the perimeter of the triangular base.

Answer: $\text{LSA} = P \times l$ $360 = P \times 12$ $P = 30 \text{ cm}$

Q8: A chocolate manufacturer makes Toblerone-shaped boxes. Each box is a triangular prism with an equilateral triangular cross-section of side 4 cm and a length of 20 cm. Find the total cardboard needed for one box. (Height of equilateral triangle ≈ 3.46 cm)

Answer: $A = (1/2)(4)(3.46) = 6.92 \text{ cm}^2$ $P = 4 + 4 + 4 = 12 \text{ cm}$ $\text{TSA} = 2(6.92) + 12 \times 20 = 13.84 + 240 = 253.84 \text{ cm}^2$

Q9: A swimming pool has a triangular cross-section with base 10 m and height 2 m. The pool is 25 m long. Find the area of the walls and floor (exclude the open top, exclude one triangular end that is the entry point include only 1 triangular end wall, 3 rectangular sides).

Answer: Area of 1 triangular end = $(1/2)(10)(2) = 10 \text{ m}^2$

For a triangular prism with base = 10 m, height = 2 m, and slant sides: $\text{Slant} = \sqrt{(5^2 + 2^2)} = \sqrt{29} \approx 5.39 \text{ m}$

Rectangular faces: Floor = $10 \times 25 = 250 \text{ m}^2$ Left slant wall = $5.39 \times 25 = 134.75 \text{ m}^2$ Right slant wall = $5.39 \times 25 = 134.75 \text{ m}^2$

$$\text{Total} = 10 + 250 + 134.75 + 134.75 = 529.5 \text{ m}^2$$

Q10: The surface area of a triangular prism is 550 cm^2 . The triangular base has an area of 30 cm^2 and a perimeter of 22 cm . Find the length of the prism.

Answer: $\text{TSA} = 2A + P \times l$ $550 = 2(30) + 22 \times l$

$$550 = 2 \times 30 + 22 \times l$$

$$550 = 60 + 22l$$

$$22l = 550 - 60$$

$$22l = 490$$

$$l = 490 \div 22$$

$$l = 245/11 \approx 22.27 \text{ cm}$$

