Perimeter & Area

Matthew Williams • Math • May 6, 2026

Perimeter and area both measure shapes, but they answer different questions. Perimeter measures the distance around the boundary; area measures the amount of flat space inside. Many mistakes happen because students use an area formula when the question asks for fencing, edging, or distance around a shape.

In CSEC, this topic appears in both direct calculations and multi-step word problems. When a diagram is made from several shapes, break it into familiar pieces, label each piece, and then combine the results. Your written explanation should make it clear why you added, subtracted, or split the shape.

Perimeter is the distance AROUND a closed shape. It's the total length of all sides.

Perimeter of Polygons

Perimeter is a boundary measurement, so trace the outside of the shape with your eyes or pencil. If a side is inside the figure, it usually should not be counted as part of the perimeter.

For any polygon, just add up the lengths of all sides.

$$\text{Perimeter} = \text{sum of all side lengths}$$

📋 **Example**

Rectangle with length 8 cm and width 5 cm:

$$P = 2l + 2w = 2(8) + 2(5) = 16 + 10 = 26 \text{ cm}$$

Or: Add all sides = 8 + 5 + 8 + 5 = 26 cm

📋 **Example**

Square with side 6 cm:

$$P = 4s = 4(6) = 24 \text{ cm}$$

Or: 6 + 6 + 6 + 6 = 24 cm

📋 **Example**

Triangle with sides 3 cm, 4 cm, 5 cm:

$$P = 3 + 4 + 5 = 12 \text{ cm}$$

Circumference of a Circle

Circles do not have straight sides to add, so their perimeter needs a formula. Use the radius formula when you are given the distance from the centre, and use the diameter formula when you are given the full distance across the circle.

The perimeter of a circle is called the **circumference**.

$$C = 2\pi r = \pi d$$

Where:

- r = radius (distance from center to edge)
- d = diameter (distance across center) = $2r$
- $\pi \approx 3.14$ or use 3.142 or $\frac{22}{7}$

📋 **Example**

Circle with radius 7 cm:

$$C = 2\pi r = 2\pi(7) = 14\pi \approx 44.0 \text{ cm}$$

Using $\pi \approx 3.14$: $C = 14 \times 3.14 = 43.96 \approx 44 \text{ cm}$

📋 **Example**

Circle with diameter 10 cm:

$$C = \pi d = \pi(10) = 10\pi \approx 31.4 \text{ cm}$$

🧠 **Remember**

- **Circumference uses the radius or diameter**
- **Perimeter is just adding all side lengths**
- The radius is always half the diameter: $r = \frac{d}{2}$

Perimeter of Combined Shapes

Combined shapes require judgment. Count only the exposed outer edges, and replace curved edges with the correct fraction of a circle's circumference.

When shapes are combined, find the outer edges only (don't count internal boundaries).

> 📋 **Example**
>
> **Rectangle with a semicircle on top:**
>
> If rectangle has width 6 cm and height 4 cm, with semicircle on top:
>
> Perimeter = 2 lengths + 1 width + semicircle arc
>
> - Two sides of rectangle: $2 \times 4 = 8$ cm
> - One side of rectangle: 6 cm
> - Semicircle arc (half circumference): $\frac{1}{2} \times 2\pi r = \pi r = \pi(3) = 3\pi \approx 9.4$ cm
>
> Total: $8 + 6 + 9.4 = 23.4$ cm

Area

Area answers use square units because they count two-dimensional space. If your answer is in cm instead of cm^2, you have written a length, not an area.

Area is the amount of surface a shape covers. It's measured in square units (cm^2, m^2, etc.).

Area of Rectangles and Squares

Rectangles and squares are the starting point for many area problems. The formula works because the shape can be counted as rows and columns of square units.

$$A = l \times w \quad \text{(rectangle)}$$

$$A = s^2 \quad \text{(square)}$$

> 📋 **Example**
>
> **Rectangle: length 8 cm, width 5 cm**
>
> $$A = 8 \times 5 = 40 \text{ cm}^2$$

📋 **Example**

Square: side 6 cm

$$A = 6^2 = 36 \text{ cm}^2$$

Area of Parallelograms

The slanted side of a parallelogram does not measure its height. The height must be perpendicular to the base, because area measures how much vertical space is stacked above the base.

$$A = b \times h$$

Where b = base, h = perpendicular height (NOT the slant side).

📋 **Example**

Parallelogram: base 10 cm, height 6 cm

$$A = 10 \times 6 = 60 \text{ cm}^2$$

Note: The slant side length doesn't matter,only the perpendicular height!

Area of Trapeziums

For a trapezium, the two parallel sides usually have different lengths. The formula uses their average length, then multiplies by the perpendicular height.

$$A = \tfrac{1}{2}(a + b) \times h$$

Where a and b = the two parallel sides, h = perpendicular height.

📋 **Example**

Trapezium with parallel sides 8 cm and 12 cm, height 5 cm:

$$A = \frac{1}{2}(8 + 12) \times 5 = \frac{1}{2}(20) \times 5 = 10 \times 5 = 50 \text{ cm}^2$$

Area of Rhombus

A rhombus can be treated through its diagonals because the diagonals split it into four right triangles. That is why multiplying the diagonals and halving gives the area.

$$A = \frac{1}{2} \times d_1 \times d_2$$

Where $d1$ and $d2$ = the two diagonals.

> 📋 **Example**
> **Rhombus with diagonals 8 cm and 6 cm:**
>
> $$A = \frac{1}{2} \times 8 \times 6 = \frac{1}{2} \times 48 = 24 \text{ cm}^2$$

Area of Triangles

A triangle is half of a related parallelogram or rectangle, which is why the formula includes $\frac{1}{2}$. Always check that the height is perpendicular to the chosen base.

Basic formula:

$$A = \frac{1}{2} \times b \times h$$

Where b = base, h = perpendicular height.

> 📋 **Example**
> **Triangle: base 10 cm, height 6 cm:**
>
> $$A = \frac{1}{2} \times 10 \times 6 = \frac{1}{2} \times 60 = 30 \text{ cm}^2$$

When given two sides and included angle (Optional objective):

$$A = \frac{1}{2}ab \sin C$$

Where a and b = two sides, C = angle between them.

📋 **Example**

Triangle with sides 8 cm and 6 cm, included angle 45°:

$$A = \frac{1}{2} \times 8 \times 6 \times \sin(45^\circ)$$

$$A = \frac{1}{2} \times 8 \times 6 \times 0.707$$

$$A = 24 \times 0.707 = 16.97 \approx 17 \text{ cm}^2$$

Area of Circles

Circle area measures the space inside the circle, not the distance around it. Since the radius controls the circle in every direction, the radius is squared in the area formula.

$$A = \pi r^2$$

Where r = radius.

📋 **Example**

Circle with radius 5 cm:

$$A = \pi r^2 = \pi(5)^2 = 25\pi \approx 78.5 \text{ cm}^2$$

Using $\pi \approx 3.14$: $A = 25 \times 3.14 = 78.5$ cm²

🧠 **Remember**

Area formula summary:

- Rectangle/Square: $A = l \times w$ or s^2
- Parallelogram: $A = b \times h$ (perpendicular height!)
- Trapezium: $A = \frac{1}{2}(a + b) \times h$
- Rhombus: $A = \frac{1}{2}d1 \times d2$
- Triangle: $A = \frac{1}{2}b \times h$
- Circle: $A = \pi r^2$