

2D Perimeter & Area

Prepared by Nikolas Agisilaou

▷ Perimeter vs. Area

Perimeter = total length of the **boundary** (units: cm, m, ...)

Area = amount of **surface** enclosed (units: cm², m², ...)

▷ **Perimeter** = the *fence* around a garden

▷ **Area** = the *grass* inside the garden

Never confuse them — check units in your answer!

◇ Unit Conversions

Length: 1 cm = 10 mm 1 m = 100 cm 1 km = 1000 m

Area (square the conversion factor!):

- 1 cm² = **100** mm² (because 10² = 100)
- 1 m² = **10,000** cm² (because 100² = 10,000)
- 1 km² = **1,000,000** m² (because 1000² = 10⁶)

Never write 1 m² = 100 cm²!

★ Formula Reference Table

Shape	Key dimensions	Perimeter	Area
Rectangle	length ℓ , width w	$2(\ell + w)$	ℓw
Square	side s	$4s$	s^2
Triangle	base b , perp. height h , sides a, b, c	$a + b + c$	$\frac{1}{2}bh$
Parallelogram	base b , perp. height h , slant side a	$2(a + b)$	bh
Trapezium	parallel sides a, b ; height h ; legs c, d	$a + b + c + d$	$\frac{1}{2}(a + b)h$
Circle	radius r (diameter $d = 2r$)	$2\pi r = \pi d$	πr^2
Semicircle	radius r	$\pi r + 2r$	$\frac{1}{2}\pi r^2$
Sector (θ°)	radius r , central angle θ	$\frac{\theta}{360} \times 2\pi r + 2r$	$\frac{\theta}{360} \times \pi r^2$

○ Circles & Sectors

Finding a missing dimension:

- Given $C \rightarrow r = \frac{C}{2\pi}$
- Given $A \rightarrow r = \sqrt{\frac{A}{\pi}}$
- Given $d \rightarrow$ **half first:** $r = \frac{d}{2}$

Sectors = fraction $\frac{\theta}{360}$ of a full circle:

$$L = \frac{\theta}{360} \times 2\pi r \qquad A_{\text{sec}} = \frac{\theta}{360} \times \pi r^2$$

Shortcut (given A and r , find arc L):

$$L = \frac{2A}{r}$$

Sector perimeter = $L + 2r$ (arc **plus** both radii)

▣ Composite & Shaded Shapes

Composite shapes (addition):

1. Split into basic shapes
2. Find each area separately
3. **Add** the areas together
4. **Perimeter** = outer edges only (internal split lines do **not** count!)

Shaded regions (subtraction):

$$\text{Shaded} = A_{\text{outer}} - A_{\text{inner}}$$

Uniform border of width x around $\ell \times w$:

$$A_{\text{border}} = (\ell + 2x)(w + 2x) - \ell w$$

△ Common Traps & Pitfalls

1. **Height $\neq$ slant side!**
Always use the **perpendicular** height in $A = bh$ and $A = \frac{1}{2}bh$
2. **Radius $\neq$ diameter!**
If given d , write $r = d/2$ before substituting
3. **Area units need squaring:**
 $1 \text{ m}^2 = 10,000 \text{ cm}^2$, **not** 100 cm^2
4. **Semicircle perimeter includes diameter:**
 $P = \pi r + 2r$ (curved arc **plus** straight edge)
5. **Internal edges don't count** in perimeter of composite shapes

✓ Quick Exam Strategy

- **Step 1:** Read carefully — perimeter or area?
- **Step 2:** Check units — convert **before** substituting
- **Step 3:** Identify the shape(s) and select formula
- **Step 4:** For composite $\rightarrow$ split; for shaded $\rightarrow$ subtract
- **Step 5:** Keep π exact until the very last step
- **Step 6:** Write units! (cm vs cm²)
- **“Find r given area/circumference”** $\rightarrow$ rearrange the formula, then substitute
- **State reasons. Sketch the shape. Check!**