Collegedunia NCERT Formula Sheet

Class 9 Maths Formula Sheet (Ganita Manjari, NCERT 2026-27)

Chapter 6: Perimeter and Area

Also see for this chapter: NCERT Solutions | Revision Notes

Shape	Perimeter	Area
Square (side a)	$4a$	a^2
Rectangle (sides $a,\ b$)	$2(a+b)$	ab
Equilateral triangle (side a)	$3a$	$\frac{\sqrt{3}}{4}a^2$
Triangle (sides a, b, c)	$a+b+c$	$\frac{1}{2}bh$
Parallelogram (base b, height h)	sum of all sides	bh
Rhombus (side a, diagonals d_1, d_2)	$4a$	$\frac{1}{2}d_1d_2$
Trapezium (parallel sides a, b)	sum of all sides	$\frac{1}{2}(a+b)h$
Circle (radius r)	$2\pi r$	πr^2

This chapter measures flat shapes in two ways. The perimeter is the total length around a border. The area is the amount of space a region covers. The book takes π as about $\frac{22}{7}$ or 3.14, and calls Pythagoras the **Baudhayana-Pythagoras Theorem**. Every result below uses the units of the given lengths.

1 Perimeter and the Circle

This section covers the perimeter of straight-sided shapes, the circumference of a circle, and the meaning of the constant π.

What is perimeter?

The **perimeter** of a shape is the total length around its border, the distance a tiny insect would travel walking once around the edge and back to its start. For a curved shape like a circle, this length is called the **circumference**.

Perimeter of straight-sided shapes

Square (side a): $P = 4a$

Equilateral triangle (side a): $P = 3a$

Rectangle (length a, width b): $P = 2(a + b)$

Add up all the side lengths. The square is a **special case** of the rectangle with $a = b$, so $2(a + a) = 4a$.

Circumference of a circle

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

where d = diameter, r = radius, and $d = 2r$.

The distance once around a circle. It grows in direct proportion to the radius, so doubling r doubles C.

The number π

$\pi = \frac{C}{d}$ (same for every circle)

$\pi \approx \frac{22}{7} \approx 3.14$

π is the fixed circumference-to-diameter ratio. It is an **irrational** number, so its decimals never end or repeat; $\frac{22}{7}$ is only a handy approximation, not the exact value.

Radius, not diameter

In $C = 2\pi r$ the letter r is the **radius**. If you are given the diameter d, first halve it: $r = \frac{d}{2}$. Putting the diameter straight into $2\pi r$ doubles the answer.

2 Arcs and Sectors: Length

This section covers the length of part of a circle: semicircles, quarter circles, a general arc, and the perimeter of a sector.

Semicircle and quarter-circle arcs

Semicircle arc: $\frac{2\pi r}{2} = \pi r$

Quarter-circle arc: $\frac{2\pi r}{4} = \frac{\pi r}{2}$

A semicircle is half the way round, a quarter circle is one-fourth. Take that fraction of the full circumference $2\pi r$.

Length of an arc

$l = 2\pi r \times \frac{\theta^\circ}{360^\circ}$

where θ° is the angle the arc subtends at the centre.

The arc is the fraction $\frac{\theta}{360}$ of the whole circle, so take that fraction of the circumference.

Perimeter of a sector

$P = \underbrace{2\pi r \times \frac{\theta^\circ}{360^\circ}}_{\text{arc}} + 2r$

A sector is a "slice" of the disc. Its border is the curved arc plus the **two straight radii**, so add $2r$ to the arc length.

Comparing two circles

If two circles have radii in the ratio $r_1 : r_2$, then their circumferences are in the same ratio $r_1 : r_2$, since $C = 2\pi r$. So a perimeter ratio of $5 : 4$ means a radius ratio of $5 : 4$ too. A useful foundation for scaling problems in later grades.

3 Area of Quadrilaterals

This section covers area itself, then the area of rectangles, squares, parallelograms, trapeziums, rhombuses, and kites.

What is area?

Area is the amount of space a flat region covers, measured against a chosen **unit square** of side 1 (area 1 sq. unit). The area of a shape counts how many such unit squares fit inside it.

Rectangle and square

Rectangle (sides a, b): $A = ab$

Square (side a): $A = a^2$

Multiply the two side lengths. The square is again a special case of the rectangle with $b = a$, giving $a \times a = a^2$.

Parallelogram

$A = b \times h = bh$

where b = base and h = height (the perpendicular distance between the base and the opposite side).

A parallelogram can be cut and rearranged into a rectangle of the same base and height, so it has the same area. The slant side is **not** the height.

Trapezium

$A = \frac{1}{2}(a + b)\, h$

where a, b are the two parallel sides and h is the distance between them.

Half the sum of the parallel sides times the height. Two copies of a trapezium join to make a parallelogram, which explains the $\frac{1}{2}$.

Rhombus and kite

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

where d_1, d_2 are the two diagonals.

For both a rhombus and a kite the area is **half the product of the diagonals**, because the diagonals cut the figure into right triangles.

4 Area of a Triangle

This section covers the base-height area, Heron's formula from the three sides, special triangles, and the circle-based area formulas.

Base and height

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

where b = base, h = perpendicular height to that base.

A triangle is exactly half of a parallelogram (or rectangle) with the same base and height. Any of the three sides can be the base, with its own matching height.

Heron's formula

$s = \frac{a+b+c}{2}$ (semi-perimeter)

$A = \sqrt{s(s-a)(s-b)(s-c)}$

Finds the area from the **three side lengths alone**, with no height needed. First compute the semi-perimeter s, then substitute.

Special triangles

Equilateral (side a): $A = \frac{\sqrt{3}}{4}a^2$

Isosceles (equal sides a, base $2b$): $A = b\sqrt{a^2 - b^2}$

Shortcuts that Heron's formula produces for these two common shapes. The height comes from the Baudhayana-Pythagoras Theorem.

Using the circumcircle and incircle

Circumradius R: $A = \frac{abc}{4R}$

Inradius r: $A = \frac{r(a+b+c)}{2}$

R is the radius of the circle through all three vertices; r is the radius of the circle touching all three sides. Both link a triangle's area to a circle.

A median halves the area

A **median** joins a vertex to the midpoint of the opposite side. It splits the triangle into two smaller triangles of **equal area**, because they share the same height and have equal bases, even though the two pieces look different.

5 Area of a Circle

This section covers the area of a full circle, its half and quarter discs, a general sector, and the region called a segment.

Area of a circle

$A = \pi r^2 = \frac{1}{2} \times C \times r$

where $C = 2\pi r$ is the circumference.

The disc can be sliced and rearranged into a near-parallelogram of base πr (half the circumference) and height r, giving $\pi r \times r = \pi r^2$.

Semicircle and quadrant discs

Semicircular disc: $A = \frac{1}{2}\pi r^2$

Quarter (quadrant) disc: $A = \frac{1}{4}\pi r^2$

Half or one-fourth of the full disc, by the reflection and quarter-turn symmetry of a circle.

Sector of a circle

$A = \pi r^2 \times \frac{\theta^\circ}{360^\circ}$

where θ° is the angle at the centre.

A sector is the region between an arc and its two radii. Take the fraction $\frac{\theta}{360}$ of the whole disc's area.

Segment of a circle

Area of segment

$=$ (area of sector) $-$ (area of triangle)

A segment is bounded by an arc and its chord. Cut the triangle (vertex at the centre, chord as base) away from the sector to leave the segment.

The idea behind $A = \pi r^2$

For any regular polygon, area $= \frac{1}{2} \times$ (perimeter) $\times$ (radius of the inscribed circle). As the number of sides grows, the polygon fills the circle, the perimeter tends to $2\pi r$, and this becomes $\frac{1}{2}(2\pi r)r = \pi r^2$. This is the reasoning Archimedes used.

6 Beyond the Basics

This section covers Brahmagupta's four-side area formula, the "squaring a rectangle" identity, and how the ratio of perimeter squared to area is fixed for each shape.

Brahmagupta's formula (cyclic 4-gon)

$$s = \frac{a+b+c+d}{2}$$

$$A = \sqrt{(s-a)(s-b)(s-c)(s-d)}$$

Area of a **cyclic** quadrilateral (all four vertices on one circle) from its four sides a, b, c, d. Setting $d = 0$ collapses it into Heron's formula for a triangle.

Squaring a rectangle

$$\left(\frac{a+b}{2}\right)^2 - \left(\frac{a-b}{2}\right)^2 = ab$$

The identity behind Baudhayana's construction of a square with the same area ab as a rectangle with sides a and b. It is the difference-of-squares result in disguise.

Perimeter-squared to area ratio

Square: $P^2 : A = 16 : 1$

Equilateral triangle: $P^2 : A = 36 : \sqrt{3}$

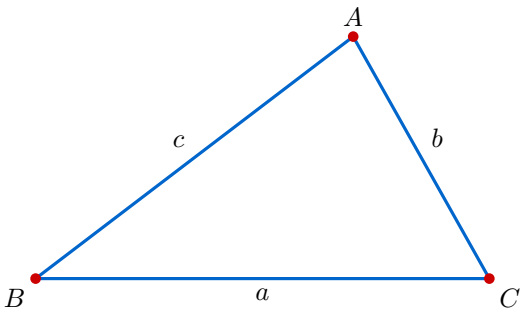
Circle: $C^2 : A = 4\pi : 1$

For a fixed shape this ratio never changes with size; it depends only on the **shape**. This is why area is proportional to the square of the perimeter.

Remembering π

Recite: *"How I wish I could recollect pi."* Count the letters in each word: $3, 1, 4, 1, 5, 9, 2$, and you get $\pi \approx 3.141592\ldots$

Solve Every Exercise: Chapter 6 NCERT Solutions →



$$s = \frac{a+b+c}{2}$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

A triangle with sides $a = BC$, $b = CA$, $c = AB$. Heron's formula gives the area from the three sides through the semi-perimeter s.

Related Collegedunia Resources

Same chapter, other resources:

- NCERT Solutions
- Revision Notes
- NCERT Book PDF
- Handwritten Notes

Continue learning:

- Ch 5: I'm Up and Down, and Round and Round
- Ch 7: The Mathematics of Maybe: Introduction to Probability
- Class 9 Mathematics - All Chapters

Quick Reference: Chapter 6 at a Glance

What you need	Formula / rule
Perimeter: square / rectangle	$4a$ / $2(a+b)$
Circumference of a circle	$C = \pi d = 2\pi r$; $\pi \approx \frac{22}{7} \approx 3.14$ (irrational)
Length of an arc	$l = 2\pi r \times \frac{\theta}{360^\circ}$; semicircle πr, quarter $\frac{\pi r}{2}$
Perimeter of a sector	arc $+ 2r = 2\pi r\frac{\theta}{360^\circ} + 2r$
Area: rectangle / square	ab / a^2
Area of a parallelogram	bh (base $\times$ perpendicular height)
Area of a trapezium	$\frac{1}{2}(a+b)h$
Area of a rhombus / kite	$\frac{1}{2}\,d_1 d_2$ (half product of diagonals)
Area of a triangle	$\frac{1}{2}bh$
Heron's formula	$\sqrt{s(s-a)(s-b)(s-c)}$, $s = \frac{a+b+c}{2}$
Equilateral / isosceles triangle	$\frac{\sqrt{3}}{4}a^2$ / $b\sqrt{a^2-b^2}$ (sides a, base $2b$)
Triangle via R / via r	$\frac{abc}{4R}$ / $\frac{r(a+b+c)}{2}$
Area of a circle	$\pi r^2 = \frac{1}{2}\,C\,r$
Sector / segment area	$\pi r^2\frac{\theta}{360^\circ}$ / sector $-$ triangle
Brahmagupta (cyclic 4-gon)	$\sqrt{(s-a)(s-b)(s-c)(s-d)}$, $s = \frac{a+b+c+d}{2}$