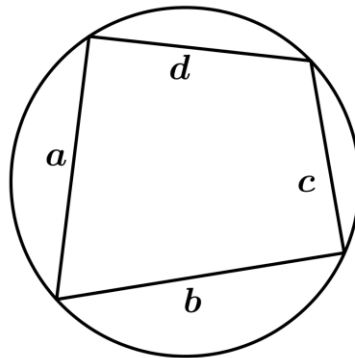


## Brahmagupta's formula

In geometry, Brahmagupta's formula finds the area of any quadrilateral given the lengths of the sides and some of their angles. In its most common form, it yields the area of quadrilaterals that can be inscribed in a circle.

### Basic form



Brahmagupta's formula gives the area of a cyclic quadrilateral whose sides have lengths  $a, b, c, d$  as

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

where  $s$ , the semiperimeter, is

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

This formula generalizes **Heron's formula** for the area of a triangle. (When  $d = 0$ , the quadrilateral reduces to a triangle and it gives us the Heron's formula)

Example:

Find the area of the shaded region (cyclic quadrilateral).

*Solution:*

$$s = \frac{6 + 8 + 10 + 13}{2} = 18.5$$

The Area of shaded region

$$\begin{aligned} &= \sqrt{(18.5 - 6)(18.5 - 8)(18.5 - 10)(18.5 - 13)} \\ &= \sqrt{12.5(10.5)(8.5)(5.5)} \\ &= 78.3 \text{ (3 sig. fig.)} \end{aligned}$$

