Brahmagupta's Formula

Brahmagupta's Theorem: Where a, b, c, and d are the lengths of the sides of a cyclic quadrilateral and the semiperimeter of the quadrilateral is s = $\frac{1}{2}$(a + b + c + d), the area of the quadrilateral is

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

To recognize that Heron's Formula is a corollary of the one above, the reader needs to suppose that the length of one of the sides of the quadrilateral diminishes in length. If, for instance, the length d of oneside approaches 0 (written d $\rightarrow$ 0), then the semiperimeter of the resulting triangle is s = $\frac{1}{2}$(a + b + c + 0) or s = $\frac{1}{2}$(a + b + c) and the area of the triangle by $A = \sqrt{s(s-a)(s-b)(s-c)}$.

PROBLEMS related to Brahmagupta's Formula.

(1) Which type of quadrilateral must be cyclic?
    Square   Trapezoid   Rectangle   Rhombus
(2) Use Brahmagupta's Formula to find the area of a square with sides of length 6 inches
(3) Use Brahmagupta's Formula to find the area of a rectangle with a length of 8 cm and a width of 6 cm.
(4) Find the length of the diameter of the circle in which quadrilateral ABCD is inscribed. Note that AB = 25, BC = 60, CD = 52, and DA = 39.
    [Hint: The diameter of the circle is the hypotenuse of each of the right triangles shown.]
(5) Use Brahmagupta's Formula to find the area of the cyclic quadrilateral ABCD. Lengths of sides are given in problem 4.

Exercises 4-5

ANSWERS to PROBLEMS

(1) Square and Rectangle   (2) 36 in^2 (3) 48 cm^2
(4) 65 units   (5) 1764 $units^2$