Mathematics 3830H – A Survey of the History of Mathematics
Trent University, Winter 2025
Assignment #4
Triangle Area Formulas
Due on Friday, 7 March.*

Heron's Formula, mentioned in class, lets one compute the area of a triangle just knowing the lengths of its sides.

Heron's Formula. If a triangle has sides of length a, b, and c, respectively, then the area of the triangle is given by

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

where $s = \dfrac{a+b+c}{2}$ is the *semiperimeter* of the triangle.

1. Prove that Heron's Formula works. *[5]*

Heron's formula has a number of extensions and relatives, notably Brahmagupta's formula for the area of a cyclic quadrilateral. As we will see Brahmagupta's Formula in class, here is a formula equivalent to Heron's formula that we would not otherwise encounter in this course. It is due to the Chinese mathematician Qin Jiushao, also known as Daogu, who gave it in his *Mathematical Treatise in Nine Sections*, which was published about 1247 A.D.

2. Show that if a triangle has sides of length a, b, and c, respectively, then the area of the triangle is given by

$$\text{Area} = \frac{1}{2}\sqrt{a^2 c^2 - \left(\frac{a^2 + c^2 - b^2}{2}\right)^2}. \ \textit{[5]}$$