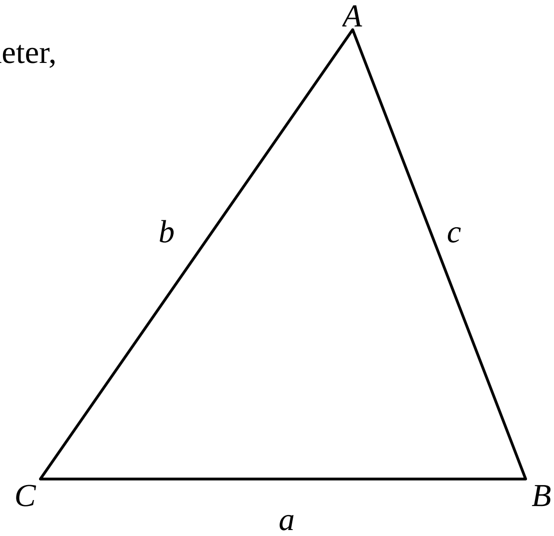
The **Heron's formula** ---- the area of a triangle, given 3 sides.



In ΔABC, let $s = \frac{1}{2}(a+b+c)$, half of a perimeter,

then the area $= \sqrt{s(s-a)(s-b)(s-c)}$.

Proof: By cosine rule $\cos C = \dfrac{a^2+b^2-c^2}{2ab}$

$$1-\cos^2 C = 1-\left(\frac{a^2+b^2-c^2}{2ab}\right)^2$$

$$\sin^2 C = \frac{4a^2b^2-(a^2+b^2-c^2)^2}{4a^2b^2}$$

$$= \frac{(2ab+a^2+b^2-c^2)(2ab-a^2-b^2+c^2)}{4a^2b^2}$$

$$= \frac{[(a+b)^2-c^2][c^2-(a-b)^2]}{4a^2b^2}$$

$$= \frac{(a+b+c)(a+b-c)(a-b+c)(-a+b+c)}{4a^2b^2}$$

$$= \frac{(a+b+c)(a+b+c-2c)(a+b+c-2b)(a+b+c-2a)}{4a^2b^2}$$

$$= \frac{2s(2s-2c)(2s-2b)(2s-2a)}{4a^2b^2} = \frac{4s(s-a)(s-b)(s-c)}{a^2b^2}$$

$$\text{area} = \frac{1}{2}ab\sin C$$

$$= \frac{1}{2}ab\sqrt{\frac{4s(s-a)(s-b)(s-c)}{a^2b^2}} = \sqrt{s(s-a)(s-b)(s-c)}$$

As an example, let $a = 5$, $b = 6$, $c = 7$. then $s = \frac{1}{2}(5+6+7) = 9$

$s - a = 9 - 5 = 4$, $s - b = 9 - 6 = 3$, $s - c = 9 - 7 = 2$

area $= \sqrt{9\times 4\times 3\times 2} = 6\sqrt{6}$