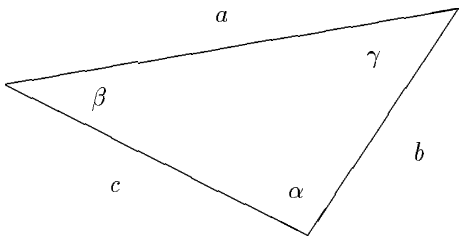

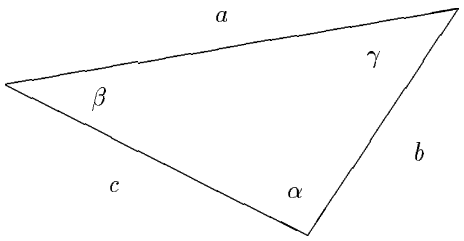

Semiperimeter = $s = \frac{1}{2}(a+b+c)$

Law of Sines

$$\frac{\sin\alpha}{a} = \frac{\sin\beta}{b} = \frac{\sin\gamma}{c}$$

Law of Cosines

$$a^2 = b^2 + c^2 - 2bc\cos\alpha$$

$$b^2 = a^2 + c^2 - 2ac\cos\beta$$

$$c^2 = a^2 + b^2 - 2ab\cos\gamma$$

Law of Tangents

$$\frac{a+b}{a-b} = \frac{\tan\frac{1}{2}(\alpha+\beta)}{\tan\frac{1}{2}(\alpha-\beta)}$$

$$\frac{a+c}{a-c} = \frac{\tan\frac{1}{2}(\alpha+\gamma)}{\tan\frac{1}{2}(\alpha-\gamma)}$$

$$\frac{b+c}{b-c} = \frac{\tan\frac{1}{2}(\beta+\gamma)}{\tan\frac{1}{2}(\beta-\gamma)}$$

Mollweide's Formulas

$$\frac{b-c}{a} = \frac{\sin\frac{1}{2}(\beta-\gamma)}{\cos\frac{1}{2}\alpha}$$

$$\frac{c-a}{b} = \frac{\sin\frac{1}{2}(\gamma-\alpha)}{\cos\frac{1}{2}\beta}$$

$$\frac{a-b}{c} = \frac{\sin\frac{1}{2}(\alpha-\beta)}{\cos\frac{1}{2}\gamma}$$

Newton's Formulas

$$\frac{b+c}{a} = \frac{\cos\frac{1}{2}(\beta-\gamma)}{\sin\frac{1}{2}\alpha}$$

$$\frac{c+a}{b} = \frac{\cos\frac{1}{2}(\gamma-\alpha)}{\sin\frac{1}{2}\beta}$$

$$\frac{a+b}{c} = \frac{\cos\frac{1}{2}(\alpha-\beta)}{\sin\frac{1}{2}\gamma}$$

Heron's Formula

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

Other Area Formulas

$$\text{Area} = \frac{bc\sin\alpha}{2} = \frac{ac\sin\beta}{2} = \frac{ab\sin\gamma}{2}$$

$$\begin{aligned}\text{Area} &= \frac{c^2\sin\alpha\sin\beta}{2\sin\gamma} \\ &= \frac{b^2\sin\alpha\sin\gamma}{2\sin\beta} \\ &= \frac{a^2\sin\beta\sin\gamma}{2\sin\alpha}\end{aligned}$$

Triangle Sides

$$a = b\cos\gamma + c\cos\beta$$

$$b = c\cos\beta + a\cos\alpha$$

$$c = a\cos\alpha + b\cos\gamma$$

Radius of Inscribed Circle

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

Radius of Circumscribed Circle

$$R = \frac{a}{2\sin\alpha} = \frac{b}{2\sin\beta} = \frac{c}{2\sin\gamma} = \frac{abc}{4(\text{Area})}$$

Angles

$$\sin\alpha = \frac{2}{bc}\,(\text{Area})$$

$$\cos\alpha = \frac{c^2+b^2-a^2}{2bc}$$

$$\sin\frac{\alpha}{2} = \sqrt{\frac{(s-b)(s-c)}{bc}}$$

$$\cos\frac{\alpha}{2} = \sqrt{\frac{s(s-a)}{bc}}$$

Analogous formulas hold for other angles.