$t = tg(x/2)$

$\sin(2a) = 2\sin(a)\cos(a)$

$$\sin(x) = \sin\left(2 \cdot \frac{x}{2}\right) = \frac{2\sin\left(\frac{x}{2}\right)\cos\left(\frac{x}{2}\right)}{1 = \sin^2\frac{x}{2} + \cos^2\frac{x}{2}} \cdot \frac{\frac{1}{\cos^2\frac{x}{2}}}{\frac{1}{\cos^2\frac{x}{2}}} = \frac{\frac{2\sin\frac{x}{2}\cos\frac{x}{2}}{\cos\frac{x}{2}\cos\frac{x}{2}}}{\frac{\sin^2\frac{x}{2}}{\cos^2\frac{x}{2}} + \frac{\cos^2\frac{x}{2}}{\cos^2\frac{x}{2}}}$$

$tg\left(\frac{x}{2}\right)$ $\quad 1$ $\quad tg^2\left(\frac{x}{2}\right)$ $\quad 1$

$$= \frac{2\,tg\left(\frac{x}{2}\right)}{tg^2\left(\frac{x}{2}\right) + 1} = \frac{2t}{t^2 + 1}$$

$\cos(2a) = \cos^2(a) - \sin^2(a)$

$$\cos(x) = \cos\left(2 \cdot \frac{x}{2}\right) = \frac{\cos^2\frac{x}{2} - \sin^2\frac{x}{2}}{1 = \sin^2\frac{x}{2} + \cos^2\frac{x}{2}} \cdot \frac{\frac{1}{\cos^2\frac{x}{2}}}{\frac{1}{\cos^2\frac{x}{2}}} = \frac{\frac{\cos^2\frac{x}{2}}{\cos^2\frac{x}{2}} - \frac{\sin^2\frac{x}{2}}{\cos^2\frac{x}{2}}}{\frac{\sin^2\frac{x}{2}}{\cos^2\frac{x}{2}} + \frac{\cos^2\frac{x}{2}}{\cos^2\frac{x}{2}}} = \frac{1 - tg^2\frac{x}{2}}{tg^2\frac{x}{2} + 1} = \frac{1 - t^2}{t^2 + 1}$$

$t = tg(x)$

$$\sin^2 x = \frac{\sin^2 x}{1} = \frac{\sin^2 x}{\sin^2 x + \cos^2 x} \frac{\frac{1}{\cos^2 x}}{\frac{1}{\cos^2 x}} = \frac{\frac{\sin^2 x}{\cos^2 x}}{\frac{\sin^2 x}{\cos^2 x} + \frac{\cos^2 x}{\cos^2 x}} = \frac{tg^2 x}{tg^2 x + 1} = \frac{t^2}{t^2 + 1}$$

$$\cos^2 x = \frac{\cos^2 x}{1} = \frac{\cos^2 x}{\sin^2 x + \cos^2 x} \frac{\frac{1}{\cos^2 x}}{\frac{1}{\cos^2 x}} = \frac{\frac{\cos^2 x}{\cos^2 x}}{\frac{\sin^2 x}{\cos^2 x} + \frac{\cos^2 x}{\cos^2 x}} = \frac{1}{tg^2 x + 1} = \frac{1}{t^2 + 1}$$