sin 12° sin24° sin 48° sin 96°

Example cos 20° cos 40° cos 80°

$$= \frac{2\sin 20^\circ \cos 20^\circ \cos 40^\circ \cos 80^\circ}{2\sin 20^\circ}$$

$$= \frac{2\sin 40^\circ \cos 40^\circ \cos 80^\circ}{4\sin 20^\circ}$$

$$= \frac{2\sin 80^\circ \cos 80^\circ}{8\sin 20^\circ}$$

$$= \frac{\sin 160^\circ}{8\sin 20^\circ} = \frac{1}{8}$$

Example cos 36° cos 72°

$$= \frac{2\sin 36^\circ \cos 36^\circ \cos 72^\circ}{2\sin 36^\circ}$$

$$= \frac{2\sin 72^\circ \cos 72^\circ}{4\sin 36^\circ}$$

$$= \frac{\sin 144^\circ}{4\sin 36^\circ} = \frac{1}{4}$$

Example cos 12° cos 24° cos 48° cos 96°

$$= \frac{2\sin 12^\circ \cos 12^\circ \cos 24^\circ \cos 48^\circ \cos 96^\circ}{2\sin 12^\circ}$$

$$= \frac{2\sin 24^\circ \cos 24^\circ \cos 48^\circ \cos 96^\circ}{4\sin 12^\circ}$$

$$= \frac{2\sin 48^\circ \cos 48^\circ \cos 96^\circ}{8\sin 12^\circ}$$

$$= \frac{2\sin 96^\circ \cos 96^\circ}{16\sin 12^\circ}$$

$$= \frac{\sin 192^\circ}{16\sin 12^\circ} = -\frac{1}{16}$$

Example sin 12° sin 24° sin 48° sin 96°

= (sin 12° sin 48°) (sin 24° sin 96°)

$$= \frac{1}{4}\left(\cos 36^\circ - \cos 60^\circ\right)\left(\cos 72^\circ - \cos 120^\circ\right)$$

$$= \frac{1}{4}\left(\cos 36^\circ - \frac{1}{2}\right)\left(\cos 72^\circ + \frac{1}{2}\right)$$

$$= \frac{1}{16}\left(4\cos 36^\circ \cos 72^\circ + 2\cos 36^\circ - 2\cos 72^\circ - 1\right)$$

$$= \frac{1}{16}\left(1 + \frac{2\sin 36^\circ \cos 36^\circ - 2\sin 36^\circ \cos 72^\circ}{\sin 36^\circ} - 1\right)$$

$$= \frac{1}{16}\left(\frac{\sin 72^\circ - \sin 108^\circ + \sin 36^\circ}{\sin 36^\circ}\right) = \frac{1}{16}$$