**Answer on Question #43728-Engineering-Other**

Prove that $4\sin 3a\cos^3 a\ +4\cos 3a\sin^3 a = 3sin\ 4a$

**Solution**

We know that

$$\sin 2a = 2\sin a\cos a\,,\qquad \cos 2a = \cos^2 a - \sin^2 a$$

$$\sin 3a = 3\sin a - 4\sin^3 a\,,\qquad \cos 3a = 4\cos^3 a - 3\cos a.$$

So

$$\begin{aligned}4\sin 3a\cos^3 a\ +4\cos 3a\sin^3 a &= 4(3\sin a - 4\sin^3 a)\cos^3 a\ +4(4\cos^3 a - 3\cos a)\sin^3 a\\ &= 12\sin a\cos^3 a - 16\sin^3 a\cos^3 a + 16\sin^3 a\cos^3 a - 12\cos a\sin^3 a\\ &= 12(\sin a\cos^3 a - \cos a\sin^3 a) = 6\cdot(2\sin a\cos a)(\cos^2 a - \sin^2 a) = 6\sin 2a\cos 2a\\ &= 3\cdot(2\sin 2a\cos 2a) = 3sin\ 4a.\end{aligned}$$