

4.11 Multiple Angle Formulas

$$414. \quad \sin 3\alpha = 3\sin \alpha - 4\sin^3 \alpha = 3\cos^2 \alpha \cdot \sin \alpha - \sin^3 \alpha$$

$$415. \quad \sin 4\alpha = 4\sin \alpha \cdot \cos \alpha - 8\sin^3 \alpha \cdot \cos \alpha$$

$$416. \quad \sin 5\alpha = 5\sin \alpha - 20\sin^3 \alpha + 16\sin^5 \alpha$$

$$417. \quad \cos 3\alpha = 4\cos^3 \alpha - 3\cos \alpha = \cos^3 \alpha - 3\cos \alpha \cdot \sin^2 \alpha$$

$$418. \quad \cos 4\alpha = 8\cos^4 \alpha - 8\cos^2 \alpha + 1$$

$$419. \quad \cos 5\alpha = 16\cos^5 \alpha - 20\cos^3 \alpha + 5\cos \alpha$$

$$420. \quad \tan 3\alpha = \frac{3\tan \alpha - \tan^3 \alpha}{1 - 3\tan^2 \alpha}$$

$$421. \quad \tan 4\alpha = \frac{4\tan \alpha - 4\tan^3 \alpha}{1 - 6\tan^2 \alpha + \tan^4 \alpha}$$

$$422. \quad \tan 5\alpha = \frac{\tan^5 \alpha - 10\tan^3 \alpha + 5\tan \alpha}{1 - 10\tan^2 \alpha + 5\tan^4 \alpha}$$

$$423. \quad \cot 3\alpha = \frac{\cot^3 \alpha - 3\cot \alpha}{3\cot^2 \alpha - 1}$$

$$424. \quad \cot 4\alpha = \frac{1 - 6\tan^2 \alpha + \tan^4 \alpha}{4\tan \alpha - 4\tan^3 \alpha}$$

$$425. \quad \cot 5\alpha = \frac{1 - 10\tan^2 \alpha + 5\tan^4 \alpha}{\tan^5 \alpha - 10\tan^3 \alpha + 5\tan \alpha}$$