$$\textit{sine} \text{ of } A = \sin A = \frac{a}{c} = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\textit{cosine} \text{ of } A = \cos A = \frac{b}{c} = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\textit{tangent} \text{ of } A = \tan A = \frac{a}{b} = \frac{\text{opposite}}{\text{adjacent}}$$

$$\textit{cotangent} \text{ of } A = \cot A = \frac{b}{a} = \frac{\text{adjacent}}{\text{opposite}}$$

$$\textit{secant} \text{ of } A = \sec A = \frac{c}{b} = \frac{\text{hypotenuse}}{\text{adjacent}}$$

$$\textit{cosecant} \text{ of } A = \csc A = \frac{c}{a} = \frac{\text{hypotenuse}}{\text{opposite}}$$

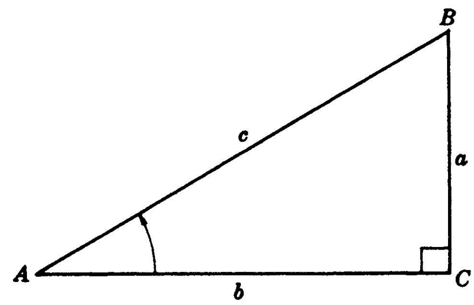

Fig. 12-1

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A = 1 - 2\sin^2 A = 2\cos^2 A - 1$$

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

$$\tan A = \frac{\sin A}{\cos A}$$

$$\cot A = \frac{1}{\tan A} = \frac{\cos A}{\sin A}$$

$$\sec A = \frac{1}{\cos A}$$

$$\csc A = \frac{1}{\sin A}$$

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A - \tan^2 A = 1$$

$$\csc^2 A - \cot^2 A = 1$$

$$\sin^2 A = \tfrac{1}{2} - \tfrac{1}{2}\cos 2A$$

$$\cos^2 A = \tfrac{1}{2} + \tfrac{1}{2}\cos 2A$$

$$\sin^3 A = \tfrac{3}{4}\sin A - \tfrac{1}{4}\sin 3A$$

$$\cos^3 A = \tfrac{3}{4}\cos A + \tfrac{1}{4}\cos 3A$$

$$\sin^4 A = \tfrac{3}{8} - \tfrac{1}{2}\cos 2A + \tfrac{1}{8}\cos 4A$$

$$\cos^4 A = \tfrac{3}{8} + \tfrac{1}{2}\cos 2A + \tfrac{1}{8}\cos 4A$$

$$\sin^5 A = \tfrac{5}{8}\sin A - \tfrac{5}{16}\sin 3A + \tfrac{1}{16}\sin 5A$$

$$\cos^5 A = \tfrac{5}{8}\cos A + \tfrac{5}{16}\cos 3A + \tfrac{1}{16}\cos 5A$$

$$\sin 3A = 3\sin A - 4\sin^3 A$$

$$\cos 3A = 4\cos^3 A - 3\cos A$$

$$\tan 3A = \frac{3\tan A - \tan^3 A}{1 - 3\tan^2 A}$$

$$\sin 4A = 4\sin A\cos A - 8\sin^3 A\cos A$$

$$\cos 4A = 8\cos^4 A - 8\cos^2 A + 1$$

$$\tan 4A = \frac{4\tan A - 4\tan^3 A}{1 - 6\tan^2 A + \tan^4 A}$$

$$\sin 5A = 5\sin A - 20\sin^3 A + 16\sin^5 A$$

$$\cos 5A = 16\cos^5 A - 20\cos^3 A + 5\cos A$$

$$\tan 5A = \frac{\tan^5 A - 10\tan^3 A + 5\tan A}{1 - 10\tan^2 A + 5\tan^4 A}$$

$$\sin A + \sin B = 2\sin\tfrac{1}{2}(A+B)\cos\tfrac{1}{2}(A-B)$$

$$\sin A - \sin B = 2\cos\tfrac{1}{2}(A+B)\sin\tfrac{1}{2}(A-B)$$

$$\cos A + \cos B = 2\cos\tfrac{1}{2}(A+B)\cos\tfrac{1}{2}(A-B)$$

$$\cos A - \cos B = 2\sin\tfrac{1}{2}(A+B)\sin\tfrac{1}{2}(B-A)$$

$$\sin A\sin B = \tfrac{1}{2}\{\cos(A-B) - \cos(A-B)\}$$

$$\cos A\cos B = \tfrac{1}{2}\{\cos(A-B) + \cos(A+B)\}$$

$$\sin A\cos B = \tfrac{1}{2}\{\sin(A-B) + \sin(A+B)\}$$

$$\sin(A \pm B) = \sin A\cos B \pm \cos A\sin B$$

$$\cos(A \pm B) = \cos A\cos B \mp \sin A\sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A\tan B}$$

$$\cot(A \pm B) = \frac{\cot A\cot B \mp 1}{\cot B \pm \cot A}$$

$$\sin^{-1} x + \cos^{-1} x = \pi/2$$

$$\tan^{-1} x + \cot^{-1} x = \pi/2$$

$$\sec^{-1} x + \csc^{-1} x = \pi/2$$

$$\csc^{-1} x = \sin^{-1}(1/x)$$

$$\sec^{-1} x = \cos^{-1}(1/x)$$

$$\cot^{-1} x = \tan^{-1}(1/x)$$

$$\sin^{-1}(-x) = -\sin^{-1} x$$

$$\cos^{-1}(-x) = \pi - \cos^{-1} x$$

$$\tan^{-1}(-x) = -\tan^{-1} x$$

$$\cot^{-1}(-x) = \pi - \cot^{-1} x$$

$$\sec^{-1}(-x) = \pi - \sec^{-1} x$$

$$\csc^{-1}(-x) = -\csc^{-1} x$$

$$\sin\frac{A}{2} = \pm\sqrt{\frac{1-\cos A}{2}} \quad \begin{bmatrix} + \text{ if } A/2 \text{ is in quadrant I or II} \\ - \text{ if } A/2 \text{ is in quadrant III or IV} \end{bmatrix}$$

$$\cos\frac{A}{2} = \pm\sqrt{\frac{1+\cos A}{2}} \quad \begin{bmatrix} + \text{ if } A/2 \text{ is in quadrant I or IV} \\ - \text{ if } A/2 \text{ is in quadrant II or III} \end{bmatrix}$$

$$\tan\frac{A}{2} = \pm\sqrt{\frac{1-\cos A}{1+\cos A}} \quad \begin{bmatrix} + \text{ if } A/2 \text{ is in quadrant I or III} \\ - \text{ if } A/2 \text{ is in quadrant II or IV} \end{bmatrix}$$

$$= \frac{\sin A}{1+\cos A} = \frac{1-\cos A}{\sin A} = \csc A - \cot A$$