(i) 
$$\sin 2x = 2 \sin x \cos x = \frac{2 \tan x}{1 + \tan^2 x}$$

(ii) 
$$\cos 2x = \cos^2 x - \sin^2 x = 2\cos^2 x - 1$$

$$= 1 - 2\sin^2 x = \frac{1 - \tan^2 x}{1 + \tan^2 x}$$

(iii) 
$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$$

(iv) 
$$\sin 3x = 3\sin x - 4\sin^3 x$$
  
(v)  $\cos 3x = 4\cos^3 x - 3\cos x$ 

(vi) 
$$\cos 3x = 4\cos^3 x - 3\cos x$$
  
(vi)  $\tan 3x = \frac{3\tan x - \tan^3 x}{1 - 3\tan^2 x}$ 

(vii) 
$$\sin x = 2 \sin \frac{x}{2} \cos \frac{x}{2} = \frac{2 \tan x/2}{1 + \tan^2 x/2}$$

(viii) 
$$\cos x = \cos^2 \frac{x}{2} - \sin^2 \frac{x}{2} = 2\cos^2 \frac{x}{2} - 1$$

$$= 1 - 2\sin^2\frac{x}{2} = \frac{1 - \tan^2 x / 2}{1 + \tan^2 x / 2}$$

(ix) 
$$\tan x = \frac{2 \tan x / 2}{1 - \tan^2 x / 2}$$
  
(x)  $\sin \frac{x}{2} = \pm \sqrt{\frac{1 - \cos x}{2}}$ 

(xi) 
$$\cos \frac{x}{2} = \pm \sqrt{\frac{1 + \cos x}{2}}$$

(xii) 
$$\tan \frac{x}{2} = \pm \sqrt{\frac{1 - \cos x}{1 + \cos x}}$$

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**DP Hallahan** 

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