MULTIPLE ANGLES IN TERMS OF SIN^{-1} (X) AND COS^{-1} (X)

$$2\sin^{-1}x = -\pi - \sin^{-1}(2x\sqrt{1-x^2}), -1 \le x \le -\frac{1}{\sqrt{2}}$$
$$= \sin^{-1}(2x\sqrt{1-x^2}), -\frac{1}{\sqrt{2}} \le x \le \frac{1}{\sqrt{2}}$$
$$= \pi - \sin^{-1}(2x\sqrt{1-x^2}), \frac{1}{\sqrt{2}} \le x \le 1$$

$$2\cos^{-1}x = 2\pi - \cos^{-1}(2x^2-1), -1 \le x \le 0$$
$$= \cos^{-1}(2x^2-1), 0 \le x \le 1$$

$$3\cos^{-1}x = 2\pi + \cos^{-1}(4x^3-3x), -1 \le x < -\frac{1}{2}$$
$$= 2\pi - \cos^{-1}(4x^3-3x), -\frac{1}{2} \le x < \frac{1}{2}$$
$$= \cos^{-1}(4x^3-3x), \frac{1}{2} \le x \le 1$$

We also have inverse trigonometric counterpart to the 'universal substitution' formulae :

$$2\tan^{-1}x = -\pi - \sin^{-1}(\frac{2x}{1+x^2}), x < -1$$
$$= \sin^{-1}\frac{2x}{1+x^2}, -1 \le x \le 1$$
$$= \pi - \sin^{-1}\frac{2x}{1+x^2}, x > 1$$

$$2\tan^{-1}x = -\cos^{-1}\frac{1-x^2}{1+x^2}, -\infty < x \le 0$$
$$= \cos^{-1}\frac{1-x^2}{1+x^2}, 0 \le x < \infty$$