

MULTIPLE ANGLES WS

1) $\sin 3x = 1$

$$\begin{array}{l} \textcircled{1} \quad 3x = \frac{\pi}{2} \\ \textcircled{2} \quad \quad \quad \frac{5\pi}{2} \\ \textcircled{3} \quad \quad \quad \frac{9\pi}{2} \end{array} \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \\ \textcircled{3} \end{array}} \right\} \begin{array}{l} x = \frac{\pi}{6} \\ x = \frac{5\pi}{6} \\ x = \frac{9\pi}{6} = \frac{3\pi}{2} \end{array}$$

2) $\cos 2x = \frac{\sqrt{3}}{2}$

$$\begin{array}{l} \textcircled{1} \quad 2x = \frac{\pi}{6}, \frac{11\pi}{6} \\ \textcircled{2} \quad \quad \quad \frac{13\pi}{6}, \frac{23\pi}{6} \end{array} \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \end{array}} \right\} x = \frac{\pi}{12}, \frac{11\pi}{12}, \frac{13\pi}{12}, \frac{23\pi}{12}$$

3) $\tan 2x = -1$

$$\begin{array}{l} \textcircled{1} \quad 2x = \frac{3\pi}{4}, \frac{7\pi}{4} \\ \textcircled{2} \quad \quad \quad = \frac{11\pi}{4}, \frac{15\pi}{4} \end{array} \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \end{array}} \right\} x = \frac{3\pi}{8}, \frac{7\pi}{8}, \frac{11\pi}{8}, \frac{15\pi}{8}$$

4) $\sec 3x = 2$
 $\cos 3x = \frac{1}{2}$

$$\begin{array}{l} \textcircled{1} \quad 3x = \frac{\pi}{3}, \frac{5\pi}{3} \\ \textcircled{2} \quad \quad \quad \frac{7\pi}{3}, \frac{11\pi}{3} \\ \textcircled{3} \quad \quad \quad \frac{13\pi}{3}, \frac{17\pi}{3} \end{array} \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \\ \textcircled{3} \end{array}} \right\} x = \frac{\pi}{9}, \frac{5\pi}{9}, \frac{7\pi}{9}, \frac{11\pi}{9}, \frac{13\pi}{9}, \frac{17\pi}{9}$$

5) $\cot 3x = 1$

$$\begin{array}{l} \textcircled{1} \quad 3x = \frac{\pi}{4}, \frac{5\pi}{4} \\ \textcircled{2} \quad \quad \quad \frac{9\pi}{4}, \frac{13\pi}{4} \\ \textcircled{3} \quad \quad \quad \frac{17\pi}{4}, \frac{21\pi}{4} \end{array} \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \\ \textcircled{3} \end{array}} \right\} x = \frac{\pi}{12}, \frac{5\pi}{12}, \frac{9\pi}{12}, \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{21\pi}{12} \rightarrow \frac{7\pi}{4}$$

$\frac{2\pi}{4}$

$$6) \sin 2x = -\frac{\sqrt{3}}{2}$$

$$\begin{array}{l} \textcircled{1} \quad 2x = \frac{4\pi}{3}, \frac{5\pi}{3} \\ \textcircled{2} \quad \quad \quad \frac{10\pi}{3}, \frac{11\pi}{3} \end{array} \quad \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \end{array}} \right\} x = \frac{2\pi}{3}, \frac{5\pi}{6}, \frac{5\pi}{3}, \frac{11\pi}{6}$$

$$7) \cos 3x = -\frac{1}{2}$$

$$\begin{array}{l} \textcircled{1} \quad 3x = \frac{2\pi}{3}, \frac{4\pi}{3} \\ \textcircled{2} \quad \quad \quad \frac{8\pi}{3}, \frac{10\pi}{3} \\ \textcircled{3} \quad \quad \quad \frac{14\pi}{3}, \frac{16\pi}{3} \end{array} \quad \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \\ \textcircled{3} \end{array}} \right\} x = \frac{2\pi}{9}, \frac{4\pi}{9}, \frac{8\pi}{9}, \frac{10\pi}{9}, \frac{14\pi}{9}, \frac{16\pi}{9}$$

$$8) \csc 2x = -\sqrt{2}$$

$$\sin 2x = -\frac{\sqrt{2}}{2}$$

$$\begin{array}{l} \textcircled{1} \quad 2x = \frac{5\pi}{4}, \frac{7\pi}{4} \\ \textcircled{2} \quad \quad \quad \frac{13\pi}{4}, \frac{15\pi}{4} \end{array} \quad \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \end{array}} \right\} x = \frac{5\pi}{8}, \frac{7\pi}{8}, \frac{13\pi}{8}, \frac{15\pi}{8}$$

$$9) \cos^2 2x = \frac{1}{2}$$

$$\cos 2x = \pm \frac{\sqrt{2}}{2}$$

$$\begin{array}{l} \textcircled{1} \quad 2x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4} \\ \textcircled{2} \quad \quad \quad \frac{9\pi}{4}, \frac{11\pi}{4}, \frac{13\pi}{4}, \frac{15\pi}{4} \end{array} \quad \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \end{array}} \right\} x = \frac{\pi}{8}, \frac{3\pi}{8}, \frac{5\pi}{8}, \frac{7\pi}{8}, \frac{9\pi}{8}, \frac{11\pi}{8}, \frac{13\pi}{8}, \frac{15\pi}{8}$$

$$10) \tan^2 2x = \frac{1}{3}$$

$$\tan 2x = \pm \frac{1}{\sqrt{3}}$$

$$\begin{array}{l} \textcircled{1} \quad 2x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6} \\ \textcircled{2} \quad \quad \quad \frac{13\pi}{6}, \frac{17\pi}{6}, \frac{19\pi}{6}, \frac{23\pi}{6} \end{array} \quad \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \end{array}} \right\} x = \frac{\pi}{12}, \frac{5\pi}{12}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{19\pi}{12}, \frac{23\pi}{12}$$