

$$\frac{\pi}{6} \left( \frac{\sqrt{3}}{2}, \frac{1}{2} \right) \quad \frac{\pi}{4} \left( \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \right) \quad \frac{\pi}{3} \left( \frac{1}{2}, \frac{\sqrt{3}}{2} \right)$$

Honors Pre-Calculus

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Name

Key

### Evaluating $\tan(x)$ , $\sec(x)$ , $\csc(x)$ , and $\cot(x)$

Find the exact value of each trigonometric function.

1)  $\tan 420^\circ = \tan(60) = \frac{\sin(60)}{\cos(60)} = \frac{(\frac{\sqrt{3}}{2})}{(\frac{1}{2})}$       2)  $\csc \frac{11\pi}{3} = \csc(\frac{5\pi}{3}) = \frac{1}{\sin(\frac{5\pi}{3})}$

$$\frac{420}{-360} \quad \frac{\sqrt{3}}{2} \cdot \frac{2}{1} = \boxed{\sqrt{3}}$$

$$\frac{11\pi}{3} - 2\pi = \frac{5\pi}{3} \quad = \frac{1}{(-\frac{\sqrt{3}}{2})} = \frac{1}{1} \cdot \frac{-2}{\sqrt{3}} = \boxed{-\frac{2\sqrt{3}}{3}}$$

3)  $\tan \frac{21\pi}{4} = \tan(\frac{5\pi}{4}) = \frac{(-\frac{\sqrt{2}}{2})}{(-\frac{\sqrt{2}}{2})} = \boxed{1}$       4)  $\cot 90^\circ$

$$\frac{21\pi}{4} - 2\pi - 2\pi = \frac{5\pi}{4} \quad = \frac{\cos(90)}{\sin(90)} = \frac{0}{1} = \boxed{0}$$

5)  $\csc -135^\circ = \csc(225) = \frac{1}{\sin(225)} = \frac{1}{(-\frac{\sqrt{2}}{2})}$       6)  $\cot -405^\circ = \cot(315) = \frac{\cos(315)}{\sin(315)} = \frac{(\frac{\sqrt{2}}{2})}{(-\frac{\sqrt{2}}{2})}$

$$\frac{-135}{+360} \quad \frac{1}{1} \cdot \frac{-2}{\sqrt{2}} = \frac{-2\sqrt{2}}{2} = \boxed{-\sqrt{2}}$$

$$\frac{-405}{+360} \quad = \frac{1}{-1} = \boxed{-1}$$

7)  $\csc -180^\circ = \csc(180) = \frac{1}{\sin 180} = \frac{1}{0}$       8)  $\sec 810^\circ = \sec(90) = \frac{1}{\cos(90)} = \frac{1}{0}$

$$\frac{-180}{+360} \quad \boxed{\text{Undefined}}$$

$$\frac{810}{-360} \quad \boxed{\text{Undefined}}$$

9)  $\cot \frac{29\pi}{6} = \cot(\frac{5\pi}{6}) = \frac{\cos(\frac{5\pi}{6})}{\sin(\frac{5\pi}{6})} = \frac{(-\frac{\sqrt{3}}{2})}{(\frac{1}{2})}$       10)  $\sec -720^\circ = \sec(0) = \frac{1}{\cos(0)} = \frac{1}{1} = \boxed{1}$

$$\frac{29\pi}{6} - 2\pi - 2\pi = \frac{5\pi}{6} \quad \frac{-\sqrt{3}}{2} \cdot \frac{2}{1} = \boxed{-\sqrt{3}}$$

$$\frac{-720}{+360} \quad \frac{+360}{+360} \quad \frac{0}{0}$$

11)  $\cot 135^\circ = \frac{\cos(135)}{\sin(135)} = \frac{(-\frac{\sqrt{2}}{2})}{(\frac{\sqrt{2}}{2})} = \boxed{-1}$       12)  $\tan -390^\circ = \tan(330) = \frac{\sin 330}{\cos 330} = \frac{(-\frac{1}{2})}{(\frac{\sqrt{3}}{2})}$

$$\frac{-1}{2} \cdot \frac{2}{\sqrt{3}} = \frac{-1}{\sqrt{3}} = \boxed{-\frac{\sqrt{3}}{3}}$$

$$\frac{-390}{+360} \quad \frac{+360}{+360} \quad \frac{330}{330}$$

$$13) \cot -\frac{\pi}{4} = \cot\left(\frac{7\pi}{4}\right) = \frac{\cos\left(\frac{7\pi}{4}\right)}{\sin\left(\frac{7\pi}{4}\right)}$$

$$\frac{-\pi}{4} + 2\pi = \frac{7\pi}{4} = \frac{\left(\frac{\sqrt{2}}{2}\right)}{\left(-\frac{\sqrt{2}}{2}\right)} = \boxed{-1}$$

$$14) \csc 315^\circ = \frac{1}{\sin(315)} = \frac{1}{(-\sqrt{2}/2)}$$

$$\frac{1}{1} \cdot \frac{-2}{\sqrt{2}} = \frac{-2}{\sqrt{2}} = \frac{-2\sqrt{2}}{2} = \boxed{-\sqrt{2}}$$

$$15) \csc -780^\circ = \csc(300) = \frac{1}{\sin(300)}$$

$$\begin{array}{r} -780 \\ +360 \\ +360 \\ +360 \\ \hline 300 \end{array} \quad \frac{1}{\left(-\frac{\sqrt{3}}{2}\right)} = \frac{-2}{\sqrt{3}} = \boxed{\frac{-2\sqrt{3}}{3}}$$

$$16) \cot -\frac{17\pi}{4} = \cot\left(\frac{7\pi}{4}\right) = \frac{\cos\left(\frac{7\pi}{4}\right)}{\sin\left(\frac{7\pi}{4}\right)} = \frac{\left(\frac{\sqrt{2}}{2}\right)}{\left(-\frac{\sqrt{2}}{2}\right)}$$

$$\frac{-\frac{17\pi}{4} + 2\pi}{+2\pi} = \frac{-\frac{9\pi}{4} + 2\pi}{+2\pi} = \frac{-\frac{\pi}{4}}{\frac{\pi}{2}} = \boxed{-1}$$

$$17) \csc \frac{8\pi}{3} = \csc\left(\frac{2\pi}{3}\right) = \frac{1}{\sin\left(\frac{2\pi}{3}\right)} = \frac{1}{\frac{\sqrt{3}}{2}}$$

$$\frac{\frac{8\pi}{3} - 2\pi}{\frac{2\pi}{3}} \cdot \frac{2}{\sqrt{3}} = \frac{\frac{2\pi}{3}}{\frac{2\pi}{3}} \cdot \frac{2}{\sqrt{3}} = \boxed{\frac{2\sqrt{3}}{3}}$$

$$18) \sec -\frac{\pi}{4} = \sec\left(\frac{7\pi}{4}\right) = \frac{1}{\cos\left(\frac{7\pi}{4}\right)}$$

$$\frac{1}{\left(\frac{\sqrt{2}}{2}\right)} = \frac{2}{\sqrt{2}} = \frac{2\sqrt{2}}{2} = \boxed{\sqrt{2}}$$

$$19) \csc \frac{13\pi}{3} = \csc\left(\frac{\pi}{3}\right) = \frac{1}{\sin\left(\frac{\pi}{3}\right)}$$

$$\frac{\frac{13\pi}{3} - 2\pi - 2\pi}{\frac{\pi}{3}} = \frac{\frac{\pi}{3}}{\frac{\pi}{3}} = \frac{1}{\left(\frac{\sqrt{3}}{2}\right)} = \frac{2}{\sqrt{3}} = \boxed{\frac{2\sqrt{3}}{3}}$$

$$20) \csc 210^\circ = \frac{1}{\sin(210)} = \frac{1}{(-1/2)}$$

$$1 \cdot \frac{-2}{1} = \boxed{-2}$$