RD Sharma Solutions Class 11 Maths Chapter 5 Ex 5.3

Chapter 5 Trigonometric Functions Ex 5.3 Q 1 i

$$\sin\frac{5\pi}{3} = \sin\left(2\pi - \frac{\pi}{3}\right)$$

$$= -\sin\frac{\pi}{3} \qquad \left(\because \sin(2\pi-\theta) = -\sin\theta\right)$$

$$= \frac{-\sqrt{3}}{2}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1 ii

$$3060^\circ = 17\pi \qquad \left(\because \pi = 180^\circ\right)$$

$$\therefore \sin 3060^\circ = \sin 17\pi$$

$$= 0 \qquad \left(\because \sin n\pi = 0 \text{ for all } n \in z\right)$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1 iii

$$\tan\frac{11\pi}{6} = \tan\left(2\pi - \frac{\pi}{6}\right)$$

$$= -\tan\frac{\pi}{6} \qquad \left(\because \tan(2\pi-\theta) = -\tan\theta\right)$$

$$= \frac{-1}{\sqrt{3}}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1 iv

$$1125^\circ = 6\pi + \frac{\pi}{4}\left(\pi = 180^\circ\right)$$

$$\cos\left(-1125^\circ\right) = \cos\left(-\left(6\pi + \frac{\pi}{4}\right)\right)$$

$$= \cos\left(6\pi + \frac{\pi}{4}\right) \qquad \left(\because \cos(-\theta) = \cos\theta\right)$$

$$= \cos\left(2\times 3\pi + \frac{\pi}{4}\right)$$

$$= \cos\frac{\pi}{4} \qquad \left(\because \cos(2k\pi+\theta) = \cos\theta, k \in n\right)$$

$$= \frac{1}{\sqrt{2}}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.v

$$\tan 315^\circ = \tan\left(2\pi - \frac{\pi}{4}\right)$$
$$= -\tan\frac{\pi}{4} \qquad \left(\because \tan(2\pi - \theta) = -\tan\theta\right)$$
$$= -1$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.vi

$$\sin 510^\circ = \sin\left(3\pi - \frac{\pi}{6}\right)$$
$$= \sin\frac{(\pi)}{6} \qquad \left(\because 3\pi - \frac{\pi}{6} \text{ lies in second quadrant}\right)$$
$$= \frac{1}{2}$$

Alternative solution

$$\sin 510^\circ = \sin\left(3\pi - \frac{\pi}{6}\right)$$
$$= \sin\left(2\pi + \left(\pi - \frac{\pi}{6}\right)\right)$$
$$= \sin\left(\pi - \frac{\pi}{6}\right) \qquad \left(\because \sin(2\pi + \theta) = \sin\theta, \text{ as sine is periodic with period } 2\pi\right)$$
$$= \sin\frac{\pi}{6} \qquad \left(\because \sin(\pi - \theta) = \sin\theta\right)$$
$$= \frac{1}{2}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.vii

$$\cos 570^\circ = \cos\left(3\pi + \frac{\pi}{6}\right)$$
$$= \cos\left(2\pi + \left(\pi + \frac{\pi}{6}\right)\right)$$
$$= \cos\left(\pi + \frac{\pi}{6}\right) \qquad \left(\begin{array}{l}\because \cos(2\pi + \theta) = \cos\theta, \text{ as cosine} \\ \text{is periodoc with period } 2\pi\end{array}\right)$$
$$= -\cos\frac{\pi}{6} \qquad \left(\because \cos(\pi + \theta) = -\cos\theta\right)$$
$$= \frac{-\sqrt{3}}{2}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.viii

$$\sin(-330^\circ) = \sin\left(-\left(2\pi - \frac{\pi}{6}\right)\right)$$
$$= \sin\left(2\pi - \frac{\pi}{6}\right) \qquad \left(\because \sin(-\theta) = -\sin\theta\right)$$
$$= -\left(-\sin\frac{\pi}{6}\right) \qquad \left(\because \sin(2\pi - \theta) = -\sin\theta\right)$$
$$= \sin\frac{\pi}{6}$$
$$= \frac{1}{2}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.ix

$$\operatorname{cosec}(-1200^\circ) = \operatorname{cosec}\left(-\left(7\pi - \frac{\pi}{3}\right)\right)$$
$$= \operatorname{cosec}\left(7\pi - \frac{\pi}{3}\right) \qquad \left(\because \operatorname{cosec}(-\theta) = -\operatorname{cosec}\theta\right)$$
$$= -\operatorname{cosec}\left(2\times 3\pi + \left(\pi - \frac{\pi}{3}\right)\right)$$
$$= -\operatorname{cosec}\left(\pi - \frac{\pi}{3}\right) \qquad \left(\begin{array}{l}\because \operatorname{cosec} \text{ is periodic of period } 2\pi, \\ \therefore \operatorname{cosec}(2\pi + \theta) = \operatorname{cosec}(2n\pi + \theta) \\ \qquad = \operatorname{cosec}\theta \text{ for all } n \in N\end{array}\right)$$
$$= -\operatorname{cosec}\frac{\pi}{3} \qquad \left(\therefore \operatorname{cosec}(\pi - \theta) = \operatorname{cosec}\theta\right)$$
$$= \frac{-2}{\sqrt{3}}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.x

$$\tan(-585^\circ) = -\tan(585) \qquad \left(\because \tan(-\theta) = -\tan\theta\right)$$
$$= -\tan\left(3\pi + \frac{\pi}{4}\right)$$
$$= -\tan\left(2\pi + \left(\pi + \frac{\pi}{4}\right)\right) \qquad \left(\because \tan(2\pi + \theta) = \tan\theta\right)$$
$$= -\tan\frac{\pi}{4} \qquad \left(\because \tan(\pi + \theta) = \tan\theta\right)$$
$$= -1$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.xi

$$\cos\left(855^\circ\right) = \cos\left(5\pi - \frac{\pi}{4}\right)$$
$$= \cos\left(2\times 2\pi + \left(\pi - \frac{\pi}{4}\right)\right)$$
$$= \cos\left(\pi - \frac{\pi}{4}\right) \qquad \left(\because\ \cos\left(2k\pi+\theta\right) = \cos\theta \text{ for all } k \in N\right)$$
$$= -\cos\frac{\pi}{4} \qquad \left(\because\ \cos\left(\pi-\theta\right) = -\cos\theta\right)$$
$$= \frac{-1}{\sqrt{2}}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.xii

$$\sin 1845^\circ = \sin\left(10\pi + \frac{\pi}{4}\right)$$
$$= \left(2\times 5\pi + \frac{\pi}{4}\right)$$
$$= \sin\pi \qquad \left(\because\ \sin\left(2k\pi+\theta\right) = \sin\theta,\ \text{for all } k \in N\right)$$
$$= \frac{1}{\sqrt{2}}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.xiii

$$\cos 1755^\circ = \cos\left(10\pi - \frac{\pi}{4}\right)$$
$$= \cos\left(2\times 5\pi - \frac{\pi}{4}\right)$$
$$= \cos\frac{\pi}{4} \qquad \left(\because\ \cos\left(2k\pi-\theta\right) = \cos\theta, k \in N\right)$$
$$= \frac{1}{\sqrt{2}}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 1.xiv

$$4530^\circ = \left(25\pi + \frac{\pi}{6}\right)$$
$$\therefore\ \sin 4530 = \sin\left(25\pi + \frac{\pi}{6}\right)$$
$$= \sin\left(2\times 12\pi + \left(\pi + \frac{\pi}{6}\right)\right)$$
$$= \sin\left(\pi \frac{\pi}{6}\right) \qquad \left(\because\ \sin\left(2k\pi+\theta\right) = \sin\theta, k \in N\right)$$
$$= -\sin\frac{\pi}{6} \qquad \left(\because\ \sin\left(\pi+\theta\right) = -\sin\theta\right)$$
$$= \frac{-1}{2}$$

Chapter 5 Trigonometric Functions Ex 5.3 Q 2.i

$$\text{LHS} = \tan 225^\circ\ \cot 405^\circ + \tan 765^\circ\ \cot 675^\circ$$
$$= \tan\left(\pi + \frac{\pi}{4}\right)\cot\left(2\pi + \frac{\pi}{4}\right) + \tan\left(4\pi + \frac{\pi}{4}\right)\cot\left(4\pi - \frac{\pi}{4}\right)$$
$$= \tan\frac{\pi}{4}.\ \cot\frac{\pi}{4} + \tan\frac{\pi}{4}\times\left(-\cot\frac{\pi}{4}\right) \qquad \left(\because\ \cot\left(4\pi - \frac{\pi}{4}\right) = -\cot\frac{\pi}{4}\right)$$
$$= 1.1 + 1.\left(-1\right)$$
$$= 0$$
$$= \text{RHS}$$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 2.ii

$$\text{LHS} = \sin\frac{8\pi}{3}\cos\frac{23\pi}{6} + \cos\frac{13\pi}{3}\sin\frac{35\pi}{6}$$
$$= \sin\left(3\pi - \frac{\pi}{3}\right)\cos\left(4\pi - \frac{\pi}{6}\right) + \cos\left(4\pi + \frac{\pi}{3}\right)\sin\left(6\pi - \frac{\pi}{6}\right)$$
$$= \sin\frac{\pi}{3}\cos\frac{\pi}{6} + \cos\frac{\pi}{3}\left(-\sin\frac{\pi}{6}\right) \qquad \left(\because\ \sin\left(6\pi-\theta\right) = -\sin\theta\right)$$
$$= \frac{\sqrt{3}}{2}\times\frac{\sqrt{3}}{22} + \frac{1}{2}\times\left(\frac{-1}{2}\right)$$
$$= \frac{3}{4} - \frac{1}{4}$$
$$= \frac{2}{4}$$
$$= \frac{1}{2}$$
$$= \text{RHS}$$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 2.iii

$$\text{LHS} = \cos 24^\circ + \cos 55^\circ + \cos 125^\circ + \cos 204^\circ + \cos 300^\circ$$
$$= \cos 24^\circ + \cos 204^\circ + \cos 55^\circ + \cos 125^\circ + \cos 300^\circ$$

$= \cos 24^\circ + \cos 204^\circ + \cos 55^\circ + \cos 125^\circ + \cos 300^\circ$

$= \cos 24^\circ + \cos\left(\pi + 24^\circ\right) + \cos 55^\circ + \cos\left(\pi - 55^\circ\right) + \cos\left(2\pi - \frac{\pi}{3}\right)$

$= \cos 24^\circ - \cos 24^\circ + \cos 55^\circ - \cos 55^\circ + \cos\frac{\pi}{3}$

$= \cos\frac{\pi}{3}$

$= \frac{1}{2}$

= RHS

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 1 2.iv

LHS $= \tan\left(-225^\circ\right)\cot\left(-405^\circ\right) - \tan\left(-765^\circ\right)\cot\left(675^\circ\right)$

$= -\tan 225^\circ\left(-\cot 405^\circ\right) + \tan 765^\circ \cot 765^\circ \qquad \left(\because \tan(-\theta) = -\tan\theta \text{ \& } \cot(-\theta) = -\cot\theta\right)$

$= \tan\left(\pi + \frac{\pi}{4}\right)\cot\left(2\pi \frac{\pi}{4}\right) + \tan\left(4\pi + \frac{\pi}{4}\right)\cot\left(4\pi - \frac{\pi}{4}\right)$

$= \tan\frac{\pi}{4}\cot\frac{\pi}{4} + \tan\frac{\pi}{4} \times \left(-\cot\frac{\pi}{4}\right) \qquad \left(\because \cot(4\pi - \theta) = -\cot\theta\right)$

$= 1.1 + 1(-1)$

$= 1 - 1$

$= 0$

= RHS

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 2.v

LHS $= \cos 570^\circ \sin 510^\circ + \sin\left(-330^\circ\right)\cos\left(-390^\circ\right)$

$= \cos\left(3\pi + \frac{\pi}{6}\right)\sin\left(3\pi - \frac{\pi}{6}\right) - \sin 330^\circ \cos 390^\circ \qquad \left(\because \sin(-\theta) = -\sin\theta \text{ and } \cos(-\theta) = \cos\theta\right)$

$= -\cos\frac{\pi}{6}\sin\frac{\pi}{6} - \sin\left(2\pi - \frac{\pi}{6}\right)\cos\left(2\pi + \frac{\pi}{6}\right)$

$= -\sin\frac{\pi}{6}\cos\frac{\pi}{6} + \sin\frac{\pi}{6}.\cos\frac{\pi}{6} \qquad \left(\because \sin(2\pi - \theta) = -\sin\theta\right)$

$= 0$

= RHS

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 2.vi

LHS $= \tan\frac{11\pi}{3} - 2\sin\frac{4\pi}{6} - \frac{3}{4}\operatorname{cosec}^2\frac{\pi}{4} + 4\cos^2\frac{17\pi}{6}$

$= \tan\left(4\pi - \frac{\pi}{3}\right) - 2\sin\frac{2\pi}{3} - \frac{3}{4} \times \left(\sqrt{2}\right)^2 + 4\cos^2\left(3\pi - \frac{\pi}{6}\right)$

$= -\tan\frac{\pi}{3} - 2\sin\left(\pi - \frac{\pi}{3}\right) - \frac{3}{4} \times 2 + 4\cos^2\frac{\pi}{6}$

$\left(\because \tan\left(4\pi - \frac{\pi}{3}\right) = -\tan\frac{\pi}{3}, \cos\left(3\pi - \frac{\pi}{6}\right) = -\cos\frac{\pi}{6}\right)$

$= -\sqrt{3} - 2\sin\frac{\pi}{3} - \frac{3}{2} + 4 \times \left(\frac{\sqrt{3}}{2}\right)^2$

$= -\sqrt{3} - 2 \times \frac{\sqrt{3}}{2} - \frac{3}{2} + 4 \times \frac{3}{4}$

$= -\sqrt{3} - \sqrt{3} - \frac{3}{2} + 3$

$= -2\sqrt{3}\,\frac{-3+6}{2}$

$= -2\sqrt{3} + \frac{3}{2}$

$= \frac{3 - 4\sqrt{3}}{2}$

= RHS

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 2.vii

LHS $= 3\sin\frac{\pi}{6}\sec\frac{\pi}{3} - 4\sin\frac{5\pi}{6}\cot\frac{\pi}{4}$

$= 3 \times \frac{1}{2} \times 2 - 4\sin\left(\pi - \frac{\pi}{6}\right) \times 1$

$= 3 - 4\sin\frac{\pi}{6} \qquad \left(\because \sin(\pi - \theta) = \sin\theta\right)$

$= 3 - 4 \times \frac{1}{}$

$= 3 - 2^2$

$= 1$

$= RHS$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 3.i

$$LHS = \frac{\cos(2\pi+\theta)\operatorname{cosec}(2\pi+\theta)\tan\left(\frac{\pi}{2}+\theta\right)}{\sec\left(\frac{\pi}{2}+\theta\right)\cos\theta\cot(\pi+\theta)}$$

$$= \frac{\cos\theta \times \operatorname{cosec}\theta(-\cot\theta)}{-\operatorname{cosec}\theta.\cos\theta\cot\theta} \qquad \left(\begin{array}{l}\because \tan\left(\frac{\pi}{2}+\theta\right) = -\cot\theta \\ \& \sec\left(\frac{\pi}{2}+\theta\right) = -\operatorname{cosec}\theta\end{array}\right)$$

$= 1$

$= RHS$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 3.ii

$$LHS = \frac{\operatorname{cosec}(90^\circ+\theta)+\cot(450^\circ+\theta)}{\operatorname{cosec}(90^\circ-\theta)+\tan(180^\circ-\theta)} + \frac{\tan(180^\circ+\theta)+\sec(180^\circ-\theta)}{\tan(360^\circ+\theta)-\sec(-\theta)}$$

$$= \frac{\sec\theta+\cot\left(2\pi+\frac{\pi}{2}+\theta\right)}{\sec\theta-\tan\theta} + \frac{\tan\theta-\sec\theta}{\tan\theta-\sec\theta}$$

$$\left(\because \operatorname{cosec}(90^\circ+\theta) = \sec\theta, \operatorname{cosec}(90^\circ+\theta) = \sec\theta, \tan(180^\circ-\theta) = -\tan\theta \sec(-\theta) = \sec\theta\right)$$

$$= \frac{\sec\theta+\cot\left(\frac{\pi}{2}+\theta\right)}{\sec\theta-\tan\theta}+1 \qquad \left(\because \cot(2\pi+\theta) = \cot\theta\right)$$

$$= \frac{\sec\theta-\tan\theta}{\sec\theta-\tan\theta}+1 \qquad \left(\because \cot\left(\frac{\pi}{2}+\theta\right) = -\tan\theta\right)$$

$= 1 + 1$

$= 2$

$= RHS$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 3.iii

$$LHS = \frac{\sin(180^\circ+\theta)\cos(90^\circ+\theta)\tan(270^\circ-\theta)\cot(360^\circ-\theta)}{\sin(360^\circ-\theta)\cos(360^\circ+\theta)\operatorname{cosec}(-\theta)\sin(270^\circ+\theta)}$$

$$= \frac{\sin\theta(-\sin\theta)\cot\theta(-\cot\theta)}{-\sin\theta\cos\theta(-\operatorname{cosec}\theta)(-\cos\theta)} \qquad \left(\begin{array}{l}\because \tan(270^\circ-\theta) = \cot\theta \\ \& \sin(270^\circ+\theta) = -\cos\theta\end{array}\right)$$

$$= \frac{-\sin\theta\times\sin\theta\times\cos\theta\times\cos\theta\times\sin\theta}{-\sin\theta\times\cos\theta\times\sin\theta\times\sin\theta\times\cos\theta} \qquad \left(\begin{array}{l}\because \cot\theta = \frac{\cos\theta}{\sin\theta} \\ \& \operatorname{cosec}\theta = \frac{1}{\sin\theta}\end{array}\right)$$

$= 1$

$= RHS$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 3.iv

$$LHS = \left\{1+\cot\theta-\sec\left(\frac{\pi}{2}+\theta\right)\right\}\left\{1+\cot\theta+\sec\left(\frac{\pi}{2}+\theta\right)\right\}$$

$$= \{1+\cot\theta-(-\operatorname{cosec}\theta)\}\{1+\cot\theta-\operatorname{cosec}\theta\}$$

$$\left(\because \sec\left(\frac{\pi}{2}+\theta\right) = -\operatorname{cosec}\theta\right)$$

$$= \{(1+\cot\theta)+\operatorname{cosec}\theta\}\{(1+\cot\theta)-\operatorname{cosec}\theta\}$$

$$= (1+\cot\theta)^2-\operatorname{cosec}^2\theta$$

$$= 1+\cot^2\theta+2\cot\theta-\operatorname{cosec}^2\theta$$

$$= \operatorname{cosec}^2+2\cot\theta-\operatorname{cosec}^2 \quad \left(\because 1+\cot^2\theta = \operatorname{cosec}^2\theta\right)$$

$= 2\cot\theta$

$= RHS$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 3 v

$$\text{LHS} = \frac{\tan\left(90^\circ - \theta\right)\sec\left(180^\circ - \theta\right)\sin\left(-\theta\right)}{\sin\left(180^\circ + \theta\right)\cot\left(360^\circ - \theta\right)\operatorname{cosec}\left(90^\circ - \theta\right)}$$

$$= \frac{\cot\theta \times \left(-\sec\theta\right) \times \left(-\sin\theta\right)}{-\sin\theta \times \left(-\cot\theta\right) \times \sec\theta}$$

$= 1$

$= \text{RHS}$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 4

$$\text{LHS} = \sin^2\frac{\pi}{18} + \sin^2\frac{\pi}{9} + \sin^2\frac{7\pi}{18} + \sin^2\frac{4\pi}{9}$$

$$= \sin^2\frac{\pi}{18} + \sin^2\frac{4\pi}{9} + \sin^2\frac{\pi}{9} + \sin^2\frac{7\pi}{18}$$

$$= \sin^2\left(\frac{\pi}{2} - \frac{4\pi}{9}\right) + \sin^2\frac{4\pi}{9} + \sin^2\frac{\pi}{9} + \sin^2\left(\frac{\pi}{2} - \frac{\pi}{9}\right) \qquad \left(\because \frac{\pi}{18} = \frac{\pi}{2} - \frac{4\pi}{9} \text{ and } \frac{7\pi}{18} = \frac{\pi}{2} - \frac{\pi}{9}\right)$$

$$= \cos^2\frac{4\pi}{9} + \sin^2\frac{4\pi}{9} + \sin^2\frac{\pi}{9} + \cos^2\frac{\pi}{9} \qquad \left(\because \sin\left(\frac{\pi}{2} - \theta\right) = \cos\theta\right)$$

$$= 1 + 1 \quad \left(\because \sin^2\theta + \cos^2\theta = 1\right)$$

$= 2$

$= \text{RHS}$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 5

$$\text{LHS} = \sec\left(\frac{3\pi}{2} - \theta\right)\sec\left(\theta - \frac{5\pi}{2}\right) + \tan\left(\frac{5\pi}{2} + \theta\right)\tan\left(\theta - \frac{3\pi}{2}\right)$$

$$= \sec\left(\frac{3\pi}{2} - \theta\right)\sec\left(-\left(\frac{5\pi}{2} - \theta\right)\right) + \tan\left(\frac{5\pi}{2} + \theta\right)\tan\left(-\left(\frac{3\pi}{2} - \theta\right)\right)$$

$$= -\operatorname{cosec}\theta . \sec\left(\frac{5\pi}{2} - \theta\right) - \cot\theta \times (-)\tan\left(\frac{3\pi}{2} - \theta\right)$$

$$\left[\because \left(\sec\left(\frac{3\pi}{2} - \theta\right)\right) = -\operatorname{cosec}\theta,\ \sec(-\theta) = \sec\theta, \tan\left(\frac{5\pi}{2} + \theta\right) = -\cot\theta \ \& \tan(-\theta) = -\tan\theta\right]$$

$$= -\operatorname{cosec}\theta \times \operatorname{cosec}\theta - \cot\theta \times (-1) \times \cot\theta \qquad \left[\left(\because \sec\left(\frac{5\pi}{2} - \theta\right)\right) = \operatorname{cosec}\theta \ \& \tan\left(\frac{3\pi}{2} - \theta\right) = \cot\theta\right]$$

$$= -\operatorname{cosec}^2\theta + \cot^2\theta$$

$$= -\operatorname{cosec}^2\theta + \operatorname{cosec}^2\theta - 1 \qquad \left(\because \operatorname{cosec}^2\theta = 1 + \cot^2\theta\right)$$

$= -1$

$= \text{RHS}$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 6

We have $A + B + C = \pi$ $\quad \left(\because \text{sum of 3 angles of a triangle is } \pi = 180^\circ\right)$

$\Rightarrow \quad A + B = \pi - C$

$\Rightarrow \quad \cos\left(A + B\right) = \cos\left(\pi - C\right)$

$\Rightarrow \quad = -\cos C \qquad \left(\because \cos\left(\pi - \theta\right) = -\cos\theta\right)$

$\Rightarrow \quad \cos\left(A + B\right) + \cos C = 0$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 6 ii

We have $A + B + C = \pi$ $\quad \left(\because \text{sum of 3 angles of a triangle is } \pi = 180^\circ\right)$

$\Rightarrow \quad A + B = \pi - C$

$\Rightarrow \quad \frac{A + B}{2} = \frac{\pi - C}{2}$

$\Rightarrow \quad \frac{A + B}{2} = \frac{\pi}{2} - \frac{C}{2}$

$\Rightarrow \quad \cos = \left(\frac{A + B}{2}\right) = \cos\left(\frac{\pi}{2} - \frac{C}{2}\right)$

$\Rightarrow \quad = \sin\frac{C}{2} \qquad \left(\because \cos\left(\frac{\pi}{2} - \theta\right) = \sin\theta\right)$

Hence $\cos\left(\frac{A + B}{2}\right) = \sin\frac{C}{2}$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 6 iii

We have $A + B + C = \pi$ $\quad \left(\because \text{sum of 3 angles of a triangle is } \pi = 180^\circ\right)$

We have $A + B + C = \pi$ $\left(\because \text{ sum of 3 angles of a triangle is } \pi = 180°\right)$

$\Rightarrow \quad A + B = \pi - C$

$\Rightarrow \quad \frac{A+B}{2} = \frac{\pi - C}{2}$

$\Rightarrow \quad \frac{A+B}{2} = \frac{\pi}{2} - \frac{C}{2}$

$\Rightarrow \quad \tan\left(\frac{A+B}{2}\right) = \tan\left(\frac{\pi}{2} - \frac{C}{2}\right)$

$= \cot\frac{C}{2} \qquad \left(\because \tan\left(\frac{\pi}{2} - \theta\right) = \cot\theta\right)$

Hence $\tan\left(\frac{A+B}{2}\right) = \cot\frac{C}{2}$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 7

$\because$ A, B, C, D are the angles of a cyclic quadrilateral in order,

$\therefore$ $A + C = \pi$ & $B + D = \pi$

$\Rightarrow \quad \pi - A = C$ & $\pi - D = B$

$\Rightarrow \quad \cos(\pi - A) = \cos C$ ....(i)

& $\cos(\pi - D) = \cos B$ ....(ii)

Now, $\cos(180° - A) + \cos(180° + B) + (180° + C) - \sin(90° + D)$

$= \cos C + (-\cos B) - \cos C - \cos D$

$\left(\because \cos(180° + B) = -\cos B, \cos(180° + C) = -\cos C \text{ \& using (i)}\right)$

$= -\cos B - \cos D$

$= -\cos B - (-\cos B) \quad$ (using (ii))

$= -\cos B + \cos B$

$= 0$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 8i.

$\operatorname{cosec}(90° + \theta) + x\cos\theta\cot(90° + \theta) = \sin(90° + \theta)$

$\Rightarrow \quad \sec\theta + x\cos\theta \times (-\tan\theta) = \cos\theta$

$\Rightarrow \quad \frac{1}{\cos\theta} + x\cos\theta \times \frac{(-\sin\theta)}{\cos\theta} = \cos\theta$

$\Rightarrow \quad \frac{1}{\cos\theta} - x\sin\theta = \cos\theta$

$\Rightarrow \quad \frac{1 - x\sin\theta\cos\theta}{\cos\theta} = \cos\theta$

$\Rightarrow \quad 1 - x\sin\theta\cos\theta = \cos^2\theta$

$\Rightarrow \quad 1 - \cos^2\theta = x\sin\theta\cos\theta$

$\Rightarrow \quad \sin^2\theta = x\sin\theta\cos\theta$

$\Rightarrow \quad \sin\theta = x\cos\theta$

$\Rightarrow \quad x = \frac{\sin\theta}{\cos\theta}$

$= \tan\theta$

Hence $x = \tan\theta$

Chapter 5 Trigonometric Functions Ex 5.3 Q 8. ii.

We have $x\cot(90° + \theta) + \tan(90° + \theta)\sin\theta + \operatorname{cosec}(90° + \theta) = 0$

$\Rightarrow \quad x(-\tan\theta) - \cot\theta \times \sin\theta + \sec\theta = 0$

$\Rightarrow \quad -x\tan\theta - \frac{\cos\theta}{\sin\theta} \times \sin\theta + \frac{1}{\cos\theta} = 0$

$\Rightarrow \quad -x\frac{\sin\theta}{\cos\theta} - \cos\theta + \frac{1}{\cos\theta} = 0$

$\Rightarrow \quad \frac{-x\sin\theta - \cos^2\theta + 1}{\cos\theta} = 0$

$\Rightarrow \quad -x\sin\theta + 1 - \cos^2\theta = 0$

$\Rightarrow \quad -x\sin\theta + \sin^2\theta = 0$

$\Rightarrow \quad x\sin\theta = \sin^2\theta$

$\Rightarrow \quad x = \frac{\sin^2\theta}{\sin\theta}$

$\Rightarrow \quad x = \sin\theta$

Chapter 5 Trigonometric Functions Ex 5.3 Q 9. i.

$$\text{LHS} = \tan 720^\circ - \cos 270^\circ - \sin 150^\circ \cos 120^\circ$$
$$= \tan 4\pi - \cos\left(\frac{3\pi}{2}\right) - \sin\left(\pi \frac{\pi}{6}\right)\cos\left(\frac{\pi}{2}+\frac{\pi}{6}\right) \quad (\because \pi = 180^\circ)$$
$$= 0 - 0 - \sin\frac{\pi}{6}\left(-\sin\frac{\pi}{6}\right) \quad \left(\because \tan n\pi = 0 \text{ for all } n \in Z \ \& \ \cos\frac{3\pi}{2} = 0\right)$$
$$= \sin^2\frac{\pi}{6}$$
$$= \left(\frac{1}{2}\right)^2$$
$$= \frac{1}{4}$$
$$= \text{RHS}$$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 9. ii.

$$\text{LHS} = \sin 780^\circ \sin 480^\circ + \cos 120^\circ \sin 150^\circ$$
$$= \sin\left(4\pi+\frac{\pi}{3}\right)\sin\left(3\pi-\frac{\pi}{3}\right)+\cos\left(\frac{\pi}{2}+\frac{\pi}{6}\right)\sin\left(\pi-\frac{\pi}{6}\right) \quad (\because \pi = 180^\circ)$$
$$= \sin\frac{\pi}{3}\times\sin\frac{\pi}{3}+\left(-\sin\frac{\pi}{6}\right)\sin\frac{\pi}{6} \quad \left(\because \sin\left(4\pi+\frac{\pi}{3}\right) = \sin\frac{\pi}{3} \ \& \ \sin\left(3\pi-\frac{\pi}{3}\right) = \sin\frac{\pi}{3}\right)$$
$$= \frac{\sqrt{3}}{2}\times\frac{\sqrt{3}}{2}-\frac{1}{2}\times\frac{1}{2}$$
$$= \frac{3}{4}-\frac{1}{4}$$
$$= \frac{2}{4}$$
$$= \frac{1}{2}$$
$$= \text{RHS}$$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 9. iii.

$$\text{LHS} = \sin 780^\circ \sin 120^\circ + \cos 240^\circ \sin 390^\circ$$
$$= \sin\left(4\pi+\frac{\pi}{3}\right)\sin\left(\frac{\pi}{2}+\frac{\pi}{6}\right)+\cos\left(\pi+\frac{\pi}{6}\right)\sin\left(2\pi+\frac{\pi}{6}\right)$$
$$= \sin\frac{\pi}{3}\times\cos\frac{\pi}{6}-\cos\frac{\pi}{3}\times\left(+\sin\frac{\pi}{6}\right)$$
$$= \frac{\sqrt{3}}{2}\times\frac{\sqrt{3}}{2}-\frac{1}{2}\times\frac{1}{2}$$
$$= \frac{3}{4}-\frac{1}{4}$$
$$= \frac{1}{2}$$
$$= \frac{1}{2}$$
$$= \text{RHS}$$

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 9.iv.

$$\text{LHS} = \sin 600^\circ \cos 390^\circ + \cos 480^\circ \sin 150^\circ$$
$$= \sin\left(3\pi+\frac{\pi}{3}\right)\cos\left(2\pi+\frac{\pi}{6}\right)+\cos\left(3\pi-\frac{\pi}{3}\right)\sin\left(\pi-\frac{\pi}{6}\right)$$
$$= -\sin\frac{\pi}{3}\cos\frac{\pi}{6}-\cos\frac{\pi}{3}-\sin\frac{\pi}{6} \quad \left(\because \sin\left(3\pi+\frac{\pi}{3}\right) = -\sin\frac{\pi}{3} \ \& \ \cos\left(3\pi-\frac{\pi}{3}\right) = -\cos\frac{\pi}{3}\right)$$
$$= \frac{-\sqrt{3}}{2}\times\frac{-\sqrt{3}}{2}-\frac{1}{2}\times\frac{1}{2}$$
$$= \frac{-3}{4}-\frac{1}{4}$$

$= \frac{-4}{4}$

$= -1$

= RHS

Proved

Chapter 5 Trigonometric Functions Ex 5.3 Q 9.v.

LHS = $\tan 225^\circ \cot 405^\circ + \tan 765^\circ \cot 675^\circ$

$= \tan\left(\pi + \frac{\pi}{4}\right)\cot\left(2\pi + \frac{\pi}{4}\right) + \tan\left(4\pi + \frac{\pi}{4}\right)\cot\left(4\pi - \frac{\pi}{4}\right)$

$= \tan\frac{\pi}{4}\cot\frac{\pi}{4} + \tan\frac{\pi}{4}\left(-\cot\frac{\pi}{4}\right)$

$= 1.1 + 1.(-1)$

$= 1 - 1$

$= 0$

= RHS

Proved