

Assignment 1

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Q.6(c) [ICSE 2018] : Prove that,

$$(1 + \cot \theta - \csc \theta)(1 + \tan \theta + \sec \theta) = 2$$

Solution :

$$\text{L.H.S.} = (1 + \cot \theta - \csc \theta)(1 + \tan \theta + \sec \theta)$$

(1)

$$\begin{aligned} &= 1 + \cot \theta - \csc \theta + \tan \theta + \tan \theta \cot \theta \\ &\quad - \tan \theta \csc \theta + \sec \theta + \sec \theta \cot \theta \\ &\quad - \sec \theta \csc \theta \end{aligned}$$

(2)

$$\begin{aligned} &= 2 + \cot \theta - \csc \theta + \tan \theta \\ &\quad - \frac{\sin \theta}{\cos \theta} \frac{1}{\sin \theta} + \sec \theta + \frac{1}{\cancel{\cos \theta}} \frac{\cancel{\cos \theta}}{\sin \theta} \\ &\quad - \sec \theta \csc \theta \end{aligned} \quad (3)$$

$$\begin{aligned} &= 2 + \cot \theta - \cancel{\csc \theta} + \tan \theta - \cancel{\sec \theta} \\ &\quad + \cancel{\sec \theta} + \cancel{\csc \theta} - \sec \theta \times \csc \theta \end{aligned} \quad (4)$$

$$= 2 + \frac{\cos \theta}{\sin \theta} + \frac{\sin \theta}{\cos \theta} - \sec \theta \times \csc \theta \quad (5)$$

$$= 2 + \frac{\cos^2 \theta + \sin^2 \theta}{\sin \theta \times \cos \theta} - \sec \theta \times \csc \theta \quad (6)$$

$$\begin{aligned} &= 2 + \frac{1}{\sin \theta \times \cos \theta} - \sec \theta \times \csc \theta \\ &\quad (\because \cos^2 \theta + \sin^2 \theta = 1) \end{aligned} \quad (7)$$

$$= 2 + \cancel{\csc \theta \times \sec \theta} - \cancel{\sec \theta \times \csc \theta} \quad (8)$$

$$= 2 \quad (9)$$

Output

Below is the output of a C program to verify the trigonometric identity at some values of theta.

```
theta = 0.300000 , expression = 2.000000
theta = 0.600000 , expression = 2.000000
theta = 0.900000 , expression = 2.000000
theta = 1.200000 , expression = 2.000000
theta = 1.500000 , expression = 2.000000
theta = 1.800000 , expression = 2.000000
theta = 2.100000 , expression = 2.000000
theta = 2.400000 , expression = 2.000000
theta = 2.700000 , expression = 2.000000
theta = 3.000000 , expression = 2.000000
theta = 3.300000 , expression = 2.000000
theta = 3.600000 , expression = 2.000000
theta = 3.900000 , expression = 2.000000
theta = 4.200000 , expression = 2.000000
theta = 4.500000 , expression = 2.000000
theta = 4.800000 , expression = 2.000000
theta = 5.100000 , expression = 2.000000
theta = 5.400001 , expression = 2.000000
theta = 5.700001 , expression = 2.000000
theta = 6.000001 , expression = 2.000000
```

Fig. 1: Value of trigonometric expression at some values of theta