Chapter 11

Trigonometric Functions and their Graphs

Exercise 11.1

Q.1 Find the periods of the following functions.

1. $\sin 3x$ **2.** $\cos 2x$ **3.** $\tan 4x$ **4.** $\cot \frac{x}{2}$

5. $\sin \frac{x}{3}$ **6.** $\operatorname{cosec} \frac{x}{4}$ **7.** $\sin \frac{x}{5}$ **8.** $\cos \frac{x}{6}$

9. $\tan \frac{x}{7}$ **10.** $\cot 8x$ **11.** $\sec 9x$ **12.** $\operatorname{cosec} 10x$

13. $3 \sin x$ **14.** $2 \cos x$ **15.** $3 \cos \frac{x}{5}$

Solution:

1. $\sin 3x$

$$\sin(3x + 2\pi)$$

$$\sin 3(x + \tfrac{2}{3}\pi)$$

Hence, period of $\sin 3x$ is $\frac{2}{3}\pi$

2. $\cos 2x$

$$\cos(2x + 2\pi)$$

$$\cos 2(x + \pi)$$

Hence, period of $\cos 2x$ is π.

3. $\tan 4x$

$$\tan(4x + \pi)$$

$$\tan 4\left(x+\frac{\pi}{4}\right)$$

Hence, period of $\tan 4x$ is $\frac{\pi}{4}$

4.cot $\frac{x}{2}$

$$\cot \frac{x}{2}+\pi$$

$$\cot \frac{1}{2}(x+2\pi)$$

Hence, period of $\cot \frac{x}{2}$ is 2π.

5.sin $\frac{x}{3}$

$$\sin\left(\frac{x}{3}+2\pi\right)$$

$$\text{Sin } \frac{1}{3}(x+6\pi)$$

Hence, the period of $\sin \frac{x}{3}$ is 6π.

6.cosec $\frac{x}{4}$

$$\text{cosec}\left(\frac{x}{4}+2\pi\right)$$

$$\text{cosec } \frac{1}{4}(x+8\pi)$$

Hence, the period of $\text{cosec } \frac{x}{4}$ is 8π.

7. sin $\frac{x}{5}$

$$\sin\left(\frac{x}{5}+2\pi\right)$$

$$\sin \frac{1}{5}(x+10\pi)$$

$$\sin \tfrac{1}{5}(x + 10\pi)$$

Hence, the period of $\sin \frac{x}{5}$ is 10π.

8. $\cos \frac{x}{6}$

$$\cos \left(\tfrac{x}{6} + 2\pi\right)$$

$$\cos \tfrac{1}{6}(x + 12\pi)$$

Hence, the period of $\cos \frac{x}{6}$ is 12π.

9. $\tan \frac{x}{7}$

$$\tan \left(\tfrac{x}{7} + \pi\right)$$

$$\tan \tfrac{1}{7}(x + 7\pi)$$

Hence, the period of $\tan \frac{x}{7}$ is 7π.

10. $\cot 8x$

$$\cot (8x + \pi)$$

$$\cot 8\left(x + \tfrac{\pi}{8}\right)$$

Hence, the period of $\cot 8x$ is $\frac{\pi}{8}$.

11. $\sec 9x$

$$\sec (9x + 2\pi)$$

$$\sec 9\left(x + \tfrac{2\pi}{9}\right)$$

Hence, the period of $\sec 9x$ is $\frac{2\pi}{9}$.

12. cosec $10x$

$$\text{cosec}\,(10x + 2\pi)$$

$$\text{cosec}\ 10\left(x + \frac{\pi}{5}\right)$$

Hence, the period of cosec $10x$ is $\frac{\pi}{5}$.

13. $3\sin x$

$$3\sin(x + 2\pi)$$

$$3\sin(x + 2\pi)$$

Hence, the period of $3\sin x$ is 2π.

14. $2\cos x$

$$2\cos(x + 2\pi)$$

$$2\cos(x + 2\pi)$$

Hence, the period of $2\cos x$ *is* 2π.

15. $3\cos\frac{x}{5}$

$$3\cos\left(\frac{x}{5} + 2\pi\right)$$

$$3\cos\tfrac{1}{5}(x + 10\pi)$$

Hence, the period of $3\cos\frac{x}{5}$ is 10π.