

## Trigonometric Limits Warm up

$$\begin{aligned} 1. \lim_{x \rightarrow 0} \frac{\sin 3x}{8x} \\ &= \lim_{x \rightarrow 0} \frac{\sin 3x}{3x} \left( \frac{3}{8} \right) \\ &= 1 \cdot \frac{3}{8} = \frac{3}{8} \end{aligned}$$

$$\begin{aligned} 2. \lim_{x \rightarrow 0} \frac{2x}{\sin 5x} \\ &= \lim_{x \rightarrow 0} \left( \frac{5x}{\sin 5x} \right) \left( \frac{2}{5} \right) \\ &= \lim_{x \rightarrow 0} \frac{1}{\frac{\sin 5x}{5x}} \left( \frac{2}{5} \right) = \frac{1}{1} \cdot \frac{2}{5} = \boxed{\frac{2}{5}} \end{aligned}$$

$$\begin{aligned} 3. \lim_{x \rightarrow 0} \frac{7x^2}{1 - \cos x} \quad \left( \frac{0}{0} \right) \\ &= \lim_{x \rightarrow 0} \frac{7x^2}{(1 - \cos x)(1 + \cos x)} \end{aligned}$$

$$= \lim_{x \rightarrow 0} \frac{7x^2(1 + \cos x)}{1 - \cos^2 x}$$

$$= \lim_{x \rightarrow 0} \frac{7x^2(1 + \cos x)}{\sin^2 x}$$

$$= \lim_{x \rightarrow 0} \frac{x}{\sin x} \cdot \frac{x}{\sin x} \cdot 7(1 + \cos x)$$

$$= 1 \cdot 1 \cdot 7 \cdot (1 + 1) = \boxed{14}$$

$$4. \lim_{x \rightarrow 0} \frac{\tan 2x}{\cos x}$$

$$= \lim_{x \rightarrow 0} \left( \frac{\sin 2x}{\cos 2x} \right) \cdot \frac{1}{\cos x}$$

$$= \lim_{x \rightarrow 0} \frac{\sin 2x}{\cos 2x} \cdot \lim_{x \rightarrow 0} \frac{1}{\cos x}$$

$$= \frac{0}{1} \cdot \frac{1}{1} = \boxed{0}$$