Learning outcomes

After completing this section, you will inshaAllah be able to

1. calculate limits of expressions involving trigonometric functions

   a. specially using $\lim\limits_{x \to 0} \dfrac{\sin x}{x} = 1$

2. perform differentiation of trigonometric functions

Practical techniques of computing limits of trigonometric functions

General idea

- Direct substitution

  Like Section 2.5

- Using ideas like $\lim\limits_{x\to a}\sin\big(g(x)\big)=\sin\Big(\lim\limits_{x\to a}g(x)\Big)$

  See example 1 done in class

- If direct substitution gives $\left(\dfrac{k}{0}\right)$ form $(k\neq 0)$ then we look at the sign and get

  the answer as ∞ or $-\infty$

  Like Section 2.2

If direct substitution gives $\left(\dfrac{0}{0}\right)$ form

Use the limit $\lim\limits_{x\to 0}\dfrac{\sin x}{x}=1$

- It is important to make **proper use** of this limit

- We learn this by examples

See examples 2, 3, 4, 5, 6 done in class

Basic differentiation formulas for trigonometric functions

- $\dfrac{d}{dx}(\sin x) = \cos x$

- $\dfrac{d}{dx}(\cos x) = -\sin x$

- $\dfrac{d}{dx}(\tan x) = \sec^2 x$

- $\dfrac{d}{dx}(\cot x) = -\csc^2 x$

- $\dfrac{d}{dx}(\sec x) = \sec x \tan x$

- $\dfrac{d}{dx}(\csc x) = -\csc x \cot x$

See examples 7, 8, 9 done in class

End of 3.3