Section 3.4 *Derivatives of trigonometric functions*

Learning outcomes

After completing this section, you will inshaAllah be able to

1. calculate limits of expressions involving trigonometric functions
    a. specially using $\lim_{x\to 0}\frac{\sin x}{x}=1$
2. perform differentiation of trigonometric functions

Practical techniques of computing limits of trigonometric functions

General idea

- Direct substitution
- Using ideas like $\lim_{x\to a}\sin\big(g(x)\big)=\sin\Big(\lim_{x\to a}g(x)\Big)$

Like Section 2.5

See example 1 done in class

- If direct substitution gives $\left(\frac{k}{0}\right)$ 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 $\left(\frac{0}{0}\right)$ form

Use the limit $\lim_{x\to 0}\frac{\sin x}{x}=1$

- 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

- $\frac{d}{dx}(\sin x) = \cos x$
- $\frac{d}{dx}(\cos x) = -\sin x$
- $\frac{d}{dx}(\tan x) = \sec^2 x$
- $\frac{d}{dx}(\cot x) = -\csc^2 x$
- $\frac{d}{dx}(\sec x) = \sec x \tan x$
- $\frac{d}{dx}(\csc x) = -\csc x \cot x$

See examples 7, 8, 9 done in class

End of 3.4