2.4 Videos Guide

2.4a

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

Exercises:

- Differentiate.
  - $y = x^2 \sin x$
  - $y = \frac{\sin t}{t + \tan t}$

2.4b

  - $y = x^2 \sin x \tan x$
- Find the equation of the tangent line to the curve at the given point.
  $y = x + \tan x, \quad (\pi, \pi)$
- Find the points on the curve at which the tangent is horizontal.
  $$y = \frac{\cos x}{2 + \sin x}$$

2.4c

- Trigonometric limits
  - $\lim\limits_{x \to 0} \frac{\sin x}{x} = 1$ (with proof)
  - $\lim\limits_{x \to 0} \frac{\cos x - 1}{x} = 0$

2.4d

Proof:

- $\lim\limits_{x \to 0} \frac{\cos x - 1}{x} = 0$

Exercise:

- Find the limit.
  $$\lim\limits_{x \to 0} \frac{\sin 3x \sin 5x}{x^2}$$

2.4e

Proofs:

- The differentiation formula for the sine function
- The differentiation formula for the tangent function