

Question 1

Let

$$f(x) = \sin(x) \cos(x) + \tan(x)$$

- (a) Find $f'(x)$, the derivative of $f(x)$, using standard derivative rules.
- (b) Simplify the result as much as possible.

Question 1 - Solution

We are given:

$$f(x) = \sin(x) \cos(x) + \tan(x)$$

(a) Differentiate each term:

We apply the product rule to the first term $\sin(x) \cos(x)$, and recall the derivative of $\tan(x)$ is $\sec^2(x)$:

$$\frac{d}{dx} [\sin(x) \cos(x)] = \cos(x) \cos(x) + \sin(x)(-\sin(x)) = \cos^2(x) - \sin^2(x)$$

So the derivative of the entire function is:

$$f'(x) = \cos^2(x) - \sin^2(x) + \sec^2(x)$$

(b) Simplify the result:

Note that:

$$\cos^2(x) - \sin^2(x) = \cos(2x)$$

Thus:

$$\boxed{f'(x) = \cos(2x) + \sec^2(x)}$$