

1ZA3 (SECTION C01) Exercise from Lecture 15

- ENGINEERING MATHEMATICS I

Exercise Find the critical numbers of

$$f(x) = 2\sin(x) + \cos(2x) \quad \text{on } [0, 2\pi].$$

Solution We're looking for x -values with $f'(x) = 0$ or $f'(x)$ undefined.

$$\begin{aligned} \text{So first find } f'(x) &= 2\cos(x) - 2\sin(2x) \\ &= 2\cos(x) - 4\sin(x)\cos(x) \\ &= 2\cos(x)(1 - 2\sin(x)) \end{aligned}$$

So $f'(x)$ is defined everywhere on $[0, 2\pi]$, and

$$f'(x) = 0 \quad \text{when } \cos(x) = 0$$

$$\text{i.e. when } x = \frac{\pi}{2} \text{ and } \frac{3\pi}{2}.$$

$$\text{and when } 1 - 2\sin(x) = 0$$

$$\text{i.e. when } \sin(x) = \frac{1}{2}$$

$$\text{i.e. when } x = \frac{\pi}{6} \text{ and } \frac{5\pi}{6}.$$

(If you were to draw the graph, you would see that it looks something like this: with local max. at $\frac{\pi}{6}, \frac{5\pi}{6}$ and local min. at $\frac{\pi}{2}, \frac{3\pi}{2}$.)

