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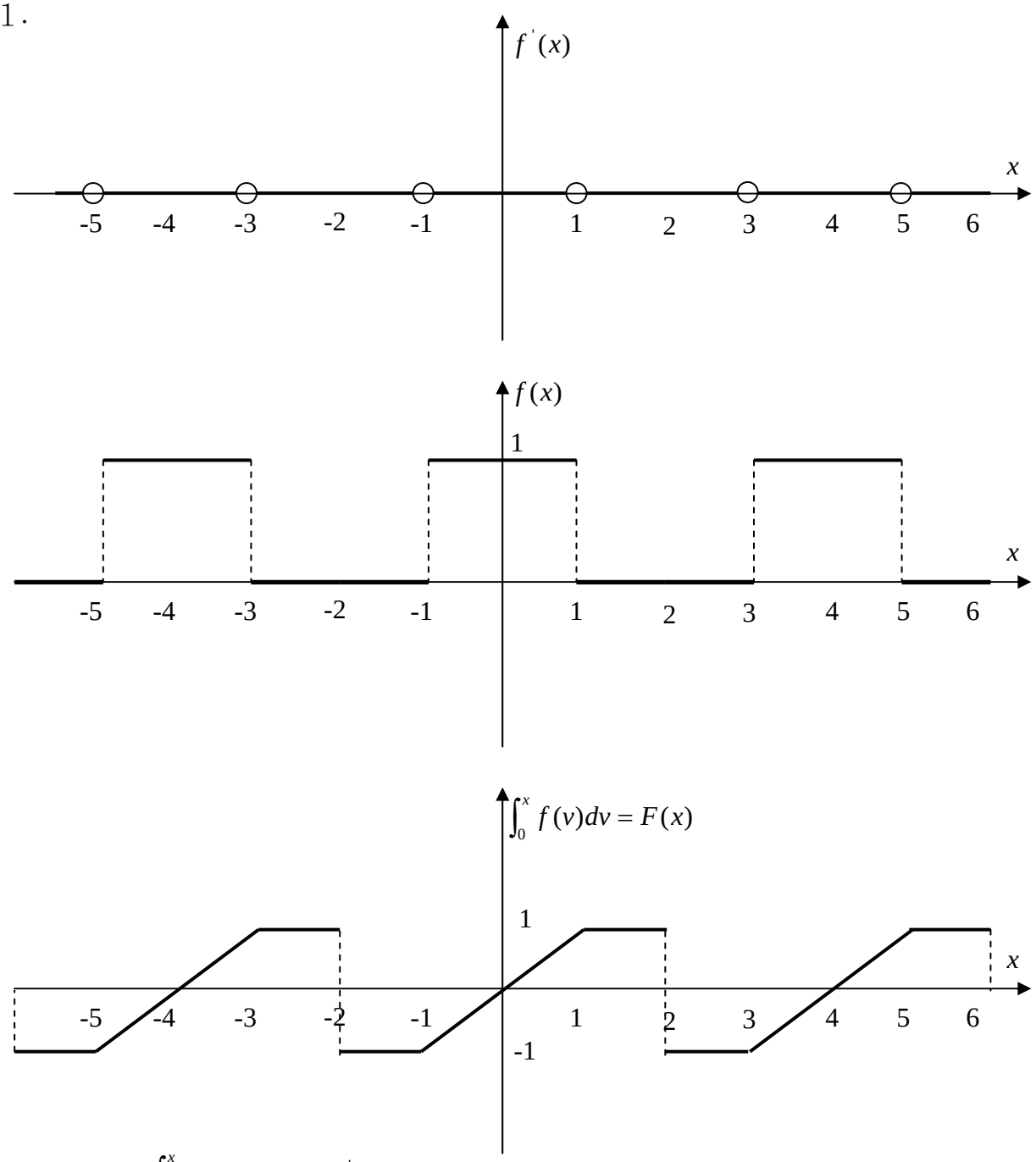
國立台灣海洋大學河海工程學系２００４工程數學（三）第五次作業解答

1.



(1) Expresses $\int_0^x f(v)dv$ and $f'(x)$ into series expansion using term by term integration and term by term differentiation,respectively.

(2) Plot the figures and compare with the above two figures.

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$$f(x) = a_0 + \sum_{n=1}^{\infty} a_n \cos(\frac{n\pi}{2}x) + b_n \sin(\frac{n\pi}{2}x)$$

$$a_0 = \frac{1}{4}\int_{-2}^{2} f(x)dx = \frac{1}{2}, \quad a_n = \frac{1}{2}\int_{-2}^{2} f(x)\cos(\frac{n\pi}{2}x)dx = \frac{2}{n\pi}\sin(\frac{n\pi}{2}), \quad b_n = 0$$

$$f(x) = \frac{1}{2} + \sum_{n=1}^{\infty} \frac{2}{n\pi}\sin(\frac{n\pi}{2})\cos(\frac{n\pi}{2}x)$$

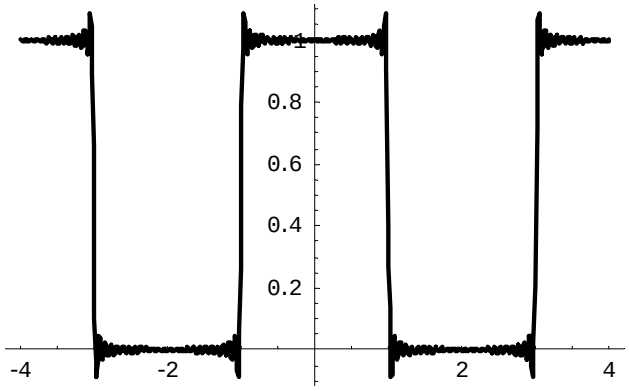
$$f'(x) = \sum_{n=1}^{\infty} -\sin(\frac{n\pi}{2})\sin(\frac{n\pi}{2}x) = g(x)$$

$$\int_0^x f(x)dx = \frac{1}{2}x + \sum_{n=1}^{\infty} (\frac{2}{n\pi})^2 \sin(\frac{n\pi}{2})\sin(\frac{n\pi}{2}x) = h(x)$$

$$f[x\_] := \frac{1}{2} + \sum_{n=1}^{m} \frac{2}{n\pi} * Sin[\frac{n\pi}{2}] * Cos[\frac{n\pi}{2}x];$$

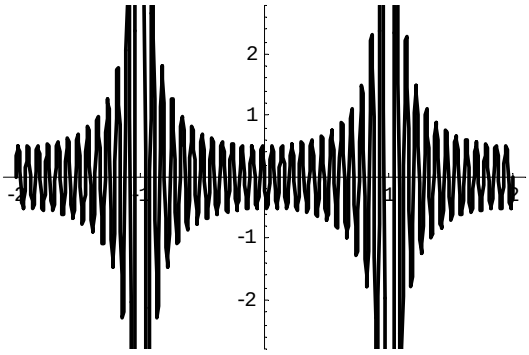
$$g[x\_] := \sum_{n=1}^{m} -Sin[\frac{n\pi}{2}] * Sin[\frac{n\pi}{2}x]$$

m=50



origin

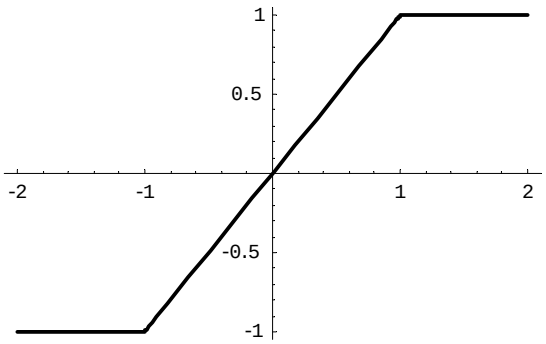
m=50



differential

$$h[x\_] := \frac{1}{2}x + \sum_{n=1}^{m} \left(\frac{2}{n\pi}\right)^2 * Sin[\frac{n\pi}{2}] * Sin[\frac{n\pi}{2}x]$$

m=50



integral