

Problem statement a) Suppose that m and n are integers. Compute $\int_0^{2\pi} (\cos(mx))(\cos(nx)) dx$.
(Be careful: there will be two different results, one when $m = n$ and one when $m \neq n$.)

b) Suppose $f(x) = A \cos(x) + B \cos(2x) + C \cos(3x)$, and that you also know

$$\int_0^{2\pi} f(x) \cos(x) dx = 5; \quad \int_0^{2\pi} f(x) \cos(2x) dx = 6; \quad \int_0^{2\pi} f(x) \cos(3x) dx = 7.$$

Find A and B and C .

Note The ideas of this computation are used often with Fourier series, a standard method of analyzing periodic phenomena.