1) Evaluate $\int_{-\pi}^{\pi} \sin(nt)dt$, where n is an integer.

2) Evaluate $\int_{-\pi}^{\pi} \cos(nt)dt$, where n is an integer.

3) Using the results from problem 1 and problem 2, integrate both sides of the equation $f(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty}\left(a_n \cos(nt) + b_n \sin(nt)\right)$ from $-\pi$ to π. Then simplify the result in terms of a_0. Divide the result in half and simplify in terms of $\frac{a_0}{2}$.

4) Using trigonometric identity $\sin(nt)\cos(mt) = \frac{1}{2}\left(\sin(n+m)t + \sin(n-m)t\right)$, evaluate $\int_{-\pi}^{\pi} \sin(nt)\cos(mt)dt$ where n and m are any integers.

5) Evaluate $\int_{-\pi}^{\pi} \cos(nt)\cos(mt)dt$ where n and m are any integers and $n \neq m$.

6) Evaluate $\int_{-\pi}^{\pi} \cos(nt)\cos(mt)dt$ where n and m are any integers and $n = m$ and $n \neq 0$, in other words evaluate $\int_{-\pi}^{\pi} \cos^2(nt)dt$.

7) Evaluate $\int_{-\pi}^{\pi} \cos(nt)\cos(mt)dt$ when $n = m = 0$

8) In a similar way to 5- 7, evaluate $\int_{-\pi}^{\pi} \sin(nt)\sin(mt)dt$ for the cases where $n \neq m, n = m \neq 0, n = m = 0$,

Hints: Use identity $\sin(nt)\sin(mt) = \frac{1}{2}\left(\cos(n-m)t - \cos(n+m)t\right)$ for the case when $n \neq m$ and use identity $\cos(2\theta) = 1 - 2\sin^2\theta$ for which $\theta = nt$ for the case when $n = m \neq 0$.