$$f(t) = 3 + \sin\left(\frac{2\pi t}{5}\right)$$

$$\sin\left(\frac{2\pi}{P}t\right) = \sin(\omega t)$$

$$A_0 = 3$$
$$B_1 = 1$$

$$A_0 = \frac{1}{P}\int_0^P f(t)dt = \frac{1}{5}\int_0^5 \left[3 + \sin\left(\frac{2\pi t}{5}\right)\right] dt$$

$$\frac{1}{5}\int_0^5 \sin\left(\frac{2\pi t}{5}\right) dt = \frac{1}{5}\left(\frac{5}{2\pi}\right)\left[-\cos\left(\frac{2\pi t}{5}\right)\right]_0^5$$

$$\frac{1}{2\pi}\left[-\cos(2\pi) - (-\cos(0))\right] = \frac{1}{2\pi}\left[-1+1\right] = 0$$

$$A_0 = 3 + 0 = 3$$

$$A_1 = \frac{2}{P}\int_0^P f(t)\ \cos\left(\frac{2\pi t}{P}\right) dt = \frac{2}{5}\int_0^P \left[3 + \sin\left(\frac{2\pi t}{5}\right)\right]\cos\left(\frac{2\pi t}{5}\right) dt$$
$$B_1 = \frac{2}{P}\int_0^P f(t)\ \sin\left(\frac{2\pi t}{P}\right) dt = \frac{2}{5}\int_0^P \left[3 + \sin\left(\frac{2\pi t}{5}\right)\right]\sin\left(\frac{2\pi t}{5}\right) dt$$

$$A_1 = \frac{2}{5}\int_0^P 3\cos\left(\frac{2\pi t}{5}\right) dt + \frac{2}{5}\int_0^P \sin\left(\frac{2\pi t}{5}\right)\cos\left(\frac{2\pi t}{5}\right) dt$$

$$A_1 = \frac{6}{5}\left(\frac{5}{2\pi}\right)\sin\left[\frac{2\pi t}{5}\right]_0^5 = \frac{6}{2\pi}\left[\sin(2\pi) - \sin(0)\right] = 0$$

$$A_1 = 0$$

$$B_1 = \frac{2}{5}\int_0^5 3\sin\left(\frac{2\pi t}{5}\right) dt + \frac{2}{5}\int_0^5 \sin\left(\frac{2\pi t}{5}\right)\sin\left(\frac{2\pi t}{5}\right) dt$$

$$B_1 = \frac{6}{5}\left(-\frac{5}{2\pi}\right)\cos\left[\frac{2\pi t}{5}\right]_0^5 + \frac{2}{5}\int_0^5 \frac{1}{2}\left[1 - \cos\left(\frac{4\pi t}{5}\right)\right] dt$$

$$B_1 = \frac{6}{5}\left[\cos(2\pi) - \cos(0)\right] + \frac{1}{5}\int_0^5 dt - \frac{1}{5}\int_0^5 \cos\left(\frac{4\pi t}{5}\right) dt$$

$$B_1 \quad = \quad 0 \quad + \quad 1 \quad - \quad \frac{1}{5}\left(\frac{5}{4\pi}\right)\sin\left[\frac{4\pi t}{5}\right]_0^5$$

$$B_1 \quad = \quad 0 \quad + \quad 1 \quad - \quad \frac{1}{5}\left(\frac{5}{4\pi}\right)[\sin(4\pi) - \sin(0)]$$

$$B_1 \quad = \quad 0 \quad + \quad 1 \quad - \quad 0 \quad = \quad 1$$

$$f(t) \quad = \quad \begin{cases} 1 & 0 \le t \le 1 \\ 0 & 1 \le t \le 2 \end{cases}$$

$$A_0 \quad = \quad \frac{1}{P}\int_0^P f(t)dt \quad = \quad \frac{1}{2}\int_0^1 (1)dt \quad + \quad \frac{1}{2}\int_1^2 (0)dt$$

$$A_1 \quad = \quad \frac{2}{P}\int_0^P f(t)\cos\left(\frac{2\pi}{P}t\right)dt \quad = \quad \int_0^1 1\cos(\pi t)dt \quad + \quad \int_1^2 0\cos(\pi t)dt$$

$$B_1 \quad = \quad \frac{2}{P}\int_0^P f(t)\sin\left(\frac{2\pi}{P}t\right)dt \quad = \quad \int_0^1 1\sin(\pi t)dt \quad + \quad \int_1^2 0\sin(\pi t)dt$$

$$A_1 \quad = \quad \frac{1}{\pi}\sin\big[\pi t\big]_0^1 \quad = \quad \frac{1}{\pi}(0-0) \quad = \quad 0$$

$$B_1 \quad = \quad -\frac{1}{\pi}\cos\big[\pi t\big]_0^1 \quad = \quad -\frac{1}{\pi}(-1-(1)) \quad = \quad -\frac{1}{\pi}(-2) \quad = \quad \frac{2}{\pi}$$

$$A_2 \quad = \quad \frac{2}{P}\int_0^P f(t)\cos\left(\frac{2\pi \cdot 2}{P}t\right)dt \quad = \quad \int_0^1 1\cos(2\pi t)dt \quad + \quad \int_1^2 0\cos(2\pi t)dt$$

$$B_2 \quad = \quad \frac{2}{P}\int_0^P f(t)\sin\left(\frac{2\pi \cdot 2}{P}t\right)dt \quad = \quad \int_0^1 1\sin(2\pi t)dt \quad + \quad \int_1^2 0\sin(2\pi t)dt$$

$$A_3 \quad = \quad \frac{2}{P}\int_0^P f(t)\cos\left(\frac{2\pi \cdot 3}{P}t\right)dt \quad = \quad \int_0^1 1\cos(3\pi t)dt \quad + \quad \int_1^2 0\cos(3\pi t)dt$$

$$B_3 \quad = \quad \frac{2}{P}\int_0^P f(t)\sin\left(\frac{2\pi \cdot 3}{P}t\right)dt \quad = \quad \int_0^1 1\sin(3\pi t)dt \quad + \quad \int_1^2 0\sin(3\pi t)dt$$

$$A_2 = \frac{1}{2\pi}\sin\big[2\pi t\big]_0^1 = \frac{1}{2\pi}(0-0) = 0$$

$$B_2 = -\frac{1}{2\pi}\cos\big[2\pi t\big]_0^1 = -\frac{1}{2\pi}(1-1) = 0$$

$$A_3 = \frac{1}{3\pi}\sin\big[3\pi t\big]_0^1 = \frac{1}{3\pi}(0-0) = 0$$

$$B_3 = -\frac{1}{3\pi}\cos\big[3\pi t\big]_0^1 = -\frac{1}{3\pi}(-1-(1)) = \frac{2}{3\pi}$$

$$f(t) \sim \frac{1}{2} + \frac{2}{\pi}\sin(\pi t) + \frac{2}{3\pi}\sin(3\pi t)$$

$$A_4 = \frac{2}{P}\int_0^P f(t)\cos\left(\frac{2\pi\cdot 4}{P}t\right)dt = \int_0^1 1\cos(4\pi t)dt + \int_1^2 0\cos(4\pi t)dt$$

$$B_4 = \frac{2}{P}\int_0^P f(t)\sin\left(\frac{2\pi\cdot 4}{P}t\right)dt = \int_0^1 1\sin(4\pi t)dt + \int_1^2 0\sin(4\pi t)dt$$

$$A_5 = \frac{2}{P}\int_0^P f(t)\cos\left(\frac{2\pi\cdot 5}{P}t\right)dt = \int_0^1 1\cos(5\pi t)dt + \int_1^2 0\cos(5\pi t)dt$$

$$B_5 = \frac{2}{P}\int_0^P f(t)\sin\left(\frac{2\pi\cdot 5}{P}t\right)dt = \int_0^1 1\sin(5\pi t)dt + \int_1^2 0\sin(5\pi t)dt$$

$$A_4 = \frac{1}{4\pi}\sin\big[4\pi t\big]_0^1 = \frac{1}{4\pi}(0-0) = 0$$

$$B_4 = -\frac{1}{4\pi}\cos\big[4\pi t\big]_0^1 = -\frac{1}{4\pi}(1-1) = 0$$

$$A_5 = \frac{1}{5\pi}\sin\big[5\pi t\big]_0^1 = \frac{1}{5\pi}(0-0) = 0$$

$$B_5 = -\frac{1}{5\pi}\cos\big[5\pi t\big]_0^1 = -\frac{1}{5\pi}(-1-(1)) = \frac{2}{5\pi}$$

$$f(t) \sim \frac{1}{2} + \frac{2}{\pi}\sin(\pi t) + \frac{2}{3\pi}\sin(3\pi t) + \frac{2}{5\pi}\sin(5\pi t)$$