1(b)   Since this is an even signal.

$$b_n = 0$$

$$a_0 = \frac{1}{T} \int_0^T g_2(t)\, dt$$

$$= \frac{1}{T}\left[\int_0^{T/4} 1\, dt + \int_{T/4}^{3T/4}(-1)\, dt + \int_{3T/4}^{T} 1\cdot dt \right]$$

$$= \frac{1}{T}\left[\frac{T}{4} - \frac{3T}{4} + \frac{T}{4} + T - \frac{3T}{4} \right]$$

$$= \frac{1}{T}\left[\frac{3T}{2} - \frac{3T}{2} \right] = 0$$

$$\therefore a_0 = 0, \quad b_n = 0$$

$$a_n = \frac{2}{T} \int_0^T g_2(t)\, \cos\left(\frac{2\pi n t}{T}\right) dt$$

$$= \frac{2}{T}\left[\int_0^{T/4} \cos\left(\frac{2\pi n t}{T}\right) dt + \int_{T/4}^{3T/4}(-1)\cos\left(\frac{2\pi n t}{T}\right) dt \right.$$

$$\left. + \int_{3T/4}^{T} 1\cdot \cos\left(\frac{2\pi n t}{T}\right) dt \right]$$

$$= \frac{2}{T}\left[\frac{\sin\left(\frac{2\pi n t}{T}\right)}{\frac{2\pi n}{T}}\bigg|_0^{T/4} - \frac{\sin\left(\frac{2\pi n t}{T}\right)}{\frac{2\pi n}{T}}\bigg|_{T/4}^{3T/4} + \frac{\sin\frac{2\pi n t}{T}}{\frac{2\pi n}{T}}\bigg|_{3T/4}^{T} \right]$$

$(-1)^{\left(\frac{n-1}{2}\right)}$

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$$= \frac{2}{T}\left[\frac{T}{2\pi n}\left[\sin\frac{n\pi}{2}\right] + -\frac{T}{2\pi n}\left[\frac{\sin 3\pi n}{2} - \sin\left(\frac{n\pi}{2}\right)\right]\right]$$

$$+ \frac{T}{2\pi n}\left[\sin(2\pi n) - \sin\left(\frac{2\pi n}{2}\right)\right] \quad\text{---- eq}\textcircled{1}$$

$$a_n = \frac{1}{\pi n}\left[(-1)^{\frac{n-1}{2}} - (-1)^{\left(\frac{3n-1}{2}\right)} + (-1)^{\frac{n-1}{2}} - (-1)^{\left(\frac{3n-1}{2}\right)}\right]$$

$$a_n = \frac{1}{n\pi}\left[2(-1)^{\frac{n-1}{2}} - 2(-1)^{\left(\frac{3n-1}{2}\right)}\right]$$

$$= \frac{2}{n\pi}\left[(-1)^{\frac{n-1}{2}} - (-1)^{\left(\frac{3n-1}{2}\right)}\right]$$

$$a_1 = \frac{2}{\pi}\left[1 - (-1)\right]$$

$$= \frac{4}{\pi}$$

$$a_3 = \frac{2}{3\pi}\left[-1-1\right]$$

$$= \frac{4}{3\pi}$$

$$a_n = \frac{4}{n\pi}(-1)^{\left(\frac{n-1}{2}\right)} \quad\text{for odd } n$$

$$= 0 \qquad \text{for even } n \quad \text{as eq}\textcircled{1}\text{ is } 0 \text{ for even } n.$$

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$$g_2(t) = \frac{4}{\pi} \cos \omega t - \frac{4}{3\pi} \cos 3\omega t + \frac{4}{5\pi} \cos 5\omega t \cdots$$