We determine the Fourier coefficients, a_0, a_n and b_n from the inner products:

$$
\begin{aligned}
a_0 &= \frac{1}{\pi}\left\langle f(\theta), 1\right\rangle = \frac{1}{\pi}\int_{\theta=\theta_1}^{\theta=\theta_2} f(\theta)d\theta = \frac{1}{\pi}\int_{\theta=0}^{\theta=2\pi} f(\theta)d\theta \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/2} f(\theta)d\theta + \int_{\theta=\pi/2}^{\theta=3\pi/2} f(\theta)d\theta + \int_{\theta=3\pi/2}^{\theta=2\pi} f(\theta)d\theta\right] \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/2} (\tfrac{2}{\pi})\theta d\theta + \int_{\theta=\pi/2}^{\theta=3\pi/2} \left((\tfrac{-2}{\pi})\theta + 2\right)d\theta + \int_{\theta=3\pi/2}^{\theta=2\pi} \left((\tfrac{2}{\pi})\theta - 4\right)d\theta\right] \\
&= \frac{1}{\pi}\left[(\tfrac{2}{\pi})\tfrac{1}{2}\theta^2 \,\Big|_0^{\pi/2} + [(\tfrac{-2}{\pi})\tfrac{1}{2}\theta^2 + 2\theta]\,\Big|_{\pi/2}^{3\pi/2} + [(\tfrac{2}{\pi})\tfrac{1}{2}\theta^2 - 4\theta]\,\Big|_{3\pi/2}^{2\pi}\right] \\
&= \frac{1}{\pi}\left[\tfrac{1}{\pi}\left[\tfrac{1}{4}\pi^2 - \tfrac{9}{4}\pi^2 + \tfrac{1}{4}\pi^2 + 4\pi^2 - \tfrac{9}{4}\pi^2\right] + \left[3\pi - \pi - 8\pi + 6\pi\right]\right] = 0
\end{aligned}
$$

Since this waveform is ***bipolar***, it has no d.c. offset, thus $a_0 = 0$.

The Fourier coefficients, a_n and b_n for $n > 0$ are:

$$
\begin{aligned}
a_n &= \frac{1}{\pi}\left\langle f(\theta), \cos(\theta_n)\right\rangle = \frac{1}{\pi}\int_{\theta=\theta_1}^{\theta=\theta_2} f(\theta)\cos(\theta_n)d\theta = \frac{1}{\pi}\int_{\theta=0}^{\theta=2\pi} f(\theta)\cos(n\theta)d\theta \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/2} f(\theta)\cos(n\theta)d\theta + \int_{\theta=\pi/2}^{\theta=3\pi/2} f(\theta)\cos(n\theta)d\theta + \int_{\theta=3\pi/2}^{\theta=2\pi} f(\theta)\cos(n\theta)d\theta\right] \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/2} (\tfrac{2}{\pi})\theta\cos(n\theta)d\theta + \int_{\theta=\pi/2}^{\theta=3\pi/2} \left((\tfrac{-2}{\pi})\theta + 2\right)\cos(n\theta)d\theta + \int_{\theta=3\pi/2}^{\theta=2\pi} \left((\tfrac{2}{\pi})\theta - 4\right)\cos(n\theta)d\theta\right]
\end{aligned}
$$

$$
\begin{aligned}
b_n &= \frac{1}{\pi}\left\langle f(\theta), \sin(\theta_n)\right\rangle = \frac{1}{\pi}\int_{\theta=\theta_1}^{\theta=\theta_2} f(\theta)\sin(\theta_n)d\theta = \frac{1}{\pi}\int_{\theta=0}^{\theta=2\pi} f(\theta)\sin(n\theta)d\theta \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/2} f(\theta)\sin(n\theta)d\theta + \int_{\theta=\pi/2}^{\theta=3\pi/2} f(\theta)\sin(n\theta)d\theta + \int_{\theta=3\pi/2}^{\theta=2\pi} f(\theta)\sin(n\theta)d\theta\right] \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/2} (\tfrac{2}{\pi})\theta\sin(n\theta)d\theta + \int_{\theta=\pi/2}^{\theta=3\pi/2} \left((\tfrac{-2}{\pi})\theta + 2\right)\sin(n\theta)d\theta + \int_{\theta=3\pi/2}^{\theta=2\pi} \left((\tfrac{2}{\pi})\theta - 4\right)\sin(n\theta)d\theta\right]
\end{aligned}
$$

Now the *indefinite* integrals:

$$\int \cos(n\theta)d\theta = +\frac{\sin(n\theta)}{n} \qquad \int \sin(n\theta)d\theta = -\frac{\cos(n\theta)}{n}$$

$$\int \theta\cos(n\theta)d\theta = \frac{\cos(n\theta)}{n^2} + \frac{\theta\sin(n\theta)}{n} \qquad \int \theta\sin(n\theta)d\theta = \frac{\sin(n\theta)}{n^2} - \frac{\theta\cos(n\theta)}{n}$$