Since this waveform has no d.c. offset, $a_0 = 0$. The Fourier coefficients, a_n and b_n are:

$$\begin{aligned}
a_n &= \frac{1}{\pi}\left\langle f(\theta), \cos(\theta_n)\right\rangle = \frac{1}{\pi}\int_{\theta=\theta_1}^{\theta=\theta_2} f(\theta)\cos(\theta_n)d\theta = \frac{1}{\pi}\int_{\theta=0}^{\theta=2\pi} f(\theta)\cos(n\theta)d\theta \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/4} f(\theta)\cos(n\theta)d\theta + \int_{\theta=\pi/4}^{\theta=7\pi/4} f(\theta)\cos(n\theta)d\theta + \int_{\theta=7\pi/4}^{\theta=2\pi} f(\theta)\cos(n\theta)d\theta\right] \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/4} (\tfrac{4}{\pi})\theta\cos(n\theta)d\theta + \int_{\theta=\pi/4}^{\theta=7\pi/4} \left((\tfrac{-4}{3\pi})\theta + \tfrac{4}{3}\right)\cos(n\theta)d\theta + \int_{\theta=7\pi/4}^{\theta=2\pi} \left((\tfrac{4}{\pi})\theta - 8\right)\cos(n\theta)d\theta\right]
\end{aligned}$$

$$\begin{aligned}
b_n &= \frac{1}{\pi}\left\langle f(\theta), \sin(\theta_n)\right\rangle = \frac{1}{\pi}\int_{\theta=\theta_1}^{\theta=\theta_2} f(\theta)\sin(\theta_n)d\theta = \frac{1}{\pi}\int_{\theta=0}^{\theta=2\pi} f(\theta)\sin(n\theta)d\theta \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/4} f(\theta)\sin(n\theta)d\theta + \int_{\theta=\pi/4}^{\theta=7\pi/4} f(\theta)\sin(n\theta)d\theta + \int_{\theta=7\pi/4}^{\theta=2\pi} f(\theta)\sin(n\theta)d\theta\right] \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=\pi/4} (\tfrac{4}{\pi})\theta\sin(n\theta)d\theta + \int_{\theta=\pi/4}^{\theta=7\pi/4} \left((\tfrac{-4}{3\pi})\theta + \tfrac{4}{3}\right)\sin(n\theta)d\theta + \int_{\theta=7\pi/4}^{\theta=2\pi} \left((\tfrac{4}{\pi})\theta - 8\right)\sin(n\theta)d\theta\right]
\end{aligned}$$

Now the *indefinite* integrals:

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

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

Using these relations in the above formulae for determining the Fourier coefficients, a_n and b_n, for $n > 0$. We obtain, after much algebra and using the fact(s) that $\sin(7n\pi/4) = -\sin(n\pi/4)$, and $\cos(7n\pi/4) = +\cos(n\pi/4)$ that the Fourier coefficients:

$$a_n = 0 \text{ for } all\ n > 0$$

and:

$$b_n = (2/3)*(4/n\pi)^2 \sin(n\pi/4) \text{ for } all\ n > 0$$

The *odd* Fourier coefficients, $b_n = +(2/3)*(4/n\pi)^2/\sqrt{2}$ for n = 1, 9, 17, 25, ... etc.
The *even* Fourier coefficients, $b_n = +(2/3)*(4/n\pi)^2$ for n = 2, 10, 18, 26, ... etc.
The *odd* Fourier coefficients, $b_n = +(2/3)*(4/n\pi)^2/\sqrt{2}$ for n = 3, 11, 19, 27, ... etc.
The *even* Fourier coefficients, $b_n = 0$ for n = 4, 12, 20, 28, ... etc.
The *odd* Fourier coefficients, $b_n = -(2/3)*(4/n\pi)^2/\sqrt{2}$ for n = 5, 13, 21, 29, ... etc.
The *even* Fourier coefficients, $b_n = -(2/3)*(4/n\pi)^2$ for n = 6, 14, 22, 30, ... etc.
The *odd* Fourier coefficients, $b_n = -(2/3)*(4/n\pi)^2/\sqrt{2}$ for n = 7, 15, 23, 31, ... etc.
The *even* Fourier coefficients, $b_n = 0$ for n = 8, 16, 24, 32, ... etc.