$$\cancel{\frac{1}{4\pi}\left(-j\frac{\cos(2\pi(2-k))+j\sin(2\pi(2-k))-1}{2-k}+j\frac{\cos(2\pi(2+k))-j\sin(2\pi(2+k))-1}{2+k}-\frac{\cos(2\pi(3-k))+j\sin(2\pi(3-k))-1}{}+\cos(2\pi(3+k))-j\sin(2\pi(3+k))-1\right)}$$

$$=\frac{1}{4\pi}\left(-j\frac{\overbrace{\cos(2\pi(2-k))}^{1}+j\sin(2\pi(2-k))-1}{2-k}+j\frac{\overbrace{\cos(2\pi(2+k))}^{1}-j\sin(2\pi(2+k))-1}{2+k}-\frac{\overbrace{\cos(2\pi(3-k))}^{1}+j\sin(2\pi(3-k))-1}{3-k}-\frac{\overbrace{\cos(2\pi(3+k))}^{1}-j\sin(2\pi(3+k))-1}{3+k}\right)=$$

$$=\frac{1}{4\pi}\left(+1\cdot\frac{2\pi\sin(2\pi(2-k))}{2\pi(2-k)}+\frac{2\pi\sin(2\pi(2+k))}{2\pi(2+k)}-j\frac{2\pi\sin(2\pi(3-k))}{2\pi(3-k)}+j\frac{2\pi\sin(2\pi(3+k))}{2\pi(3+k)}\right)=$$

$$=\cancel{\frac{1}{4\pi}}\ \frac{1}{2}\Big(\operatorname{sinc}(2(2-k))+\operatorname{sinc}(2(2+k))-j\operatorname{sinc}(2(3-k))+j\operatorname{sinc}(2(3+k))\Big)=$$

$$=\frac{1}{2}\Big(\delta[2-k]+\delta[2+k]-j\delta[3-k]+j\delta[3+k]\Big)$$

$$=\boxed{a_k=\begin{cases}\frac{1}{2} & \text{if } k\in\{-2,2\}\\ \frac{-j}{2} & \text{if } k=3\\ \frac{j}{2} & \text{if } k=-3\\ 0 & \text{otherwise}\end{cases}}$$