$$\therefore f(x) = \sum_{m=0}^{\infty} \frac{32}{\pi^3(2m+1)^3}\sin(2m+1)x$$

$$f(x) = \frac{32}{\pi^3}\sum_{m=0}^{\infty}\frac{1}{(2m+1)^3}\sin(2m+1)x$$

Hence

$$\int_0^\pi f^2(x)\,dx = \frac{1024}{\pi^6}\int_0^\pi \sum_{m=0}\sum_{k=0}\frac{\sin(2m+1)x\,\sin(2k+1)x}{(2m+1)^3(2k+1)^3}\,dx$$

$$= \frac{1024}{\pi^6}\sum_{m=0}\sum_{k=0}\frac{1}{(2m+1)^3(2k+1)^3}\int_0^\pi \sin(2m+1)x\,\sin(2k+1)x\,dx$$

$\sin(2m+1)x$ & $\sin(2k+1)$ are orthogonal on $[0,\pi]$ so the integral is zero unless $k=m$

$$\int_0^\pi \sin^2(2m+1)x\,dx = \int_0^\pi \frac{+1 - \cos 2(2m+1)x}{2}\,dx$$

$$= \left[+\frac{x}{2} - \frac{\sin 2(2m+1)x}{4(2m+1)}\right]_0^\pi$$

$$= +\frac{\pi}{2}$$

$$\therefore \int_0^\pi f^2(x)\,dx = \frac{1024}{\pi^6}\sum_{k=0}^{\infty}\frac{\pi}{2(2k+1)^6}$$

$$= \frac{512}{\pi^5}\sum_{k=0}^{\infty}\frac{1}{(2k+1)^6}$$

$$\int_0^\pi f^2(x)\,dx = \int_0^\pi \left(1 - \frac{4}{\pi^2}\left(x-\pi/2\right)^2\right)^2 dx$$

$$= \int_0^\pi 1 - \frac{8}{\pi^2}\left(x-\pi/2\right)^2 + \frac{16}{\pi^4}\left(x-\pi/2\right)^4\,dx$$