

$$= \frac{x}{2} \sin 2x + \frac{1}{4} \cos 2x + C$$

$$\text{So } \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} x \cos 2x \, dx$$

$$= \left(\frac{x}{2} \sin 2x + \frac{1}{4} \cos 2x \right) \Big|_{-\frac{\pi}{2}}^{\frac{\pi}{2}}$$

$$= \left(\frac{\pi}{2} \sin \pi + \frac{1}{4} \cos \pi \right) - \left(-\frac{\pi}{2} \sin(-\pi) + \frac{1}{4} \cos(\pi) \right)$$

$$= 0$$

$$\text{So } f_{\text{ave}} = \frac{0}{\pi} = \boxed{0}$$