2)(b) i) $(f,g) = \int_0^1 f g \, w \, dx = \int_0^1 (1-2x)\,dx$ (3)

$= [x - x^2]_0^1 = 0.$

ii) $(f,g) = \int_0^1 x^2 e^x e^{-x} dx = \int_0^1 x^2 \, dx$

$= \left[\frac{x^3}{3}\right]_0^1 = \frac{1}{3}$

iii) $(f,g) = \int e^{-x/2} \sin\frac{\pi x}{2} \, e^{-x/2} \sin\frac{3\pi x}{2} \, e^x dx$

$= \int_0^1 \sin\frac{\pi x}{2} \sin\frac{3\pi x}{2} dx$

$= \frac{1}{2}\int_0^1 \cos\left(\frac{\pi x}{2} - \frac{3\pi x}{2}\right) - \cos\left(\frac{\pi x}{2} + \frac{3\pi x}{2}\right) dx$

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

$= \frac{1}{2}\left[\frac{1}{\pi}\sin\pi x - \frac{1}{2}\sin 2\pi x\right]_0^1 = 0$

(iv) $(f,g) = \int e^x \cos\frac{\pi x}{2}$

$= \frac{\left(e^x\left(\frac{\pi}{2}\sin\frac{\pi x}{2} + \cos\frac{\pi x}{2}\right)\right)^1}{1+\pi^2/4}$

$= \frac{e\left(\frac{\pi}{2}\right) - (1)}{1+\pi^2/4} = \frac{2\pi e - 4}{4+\pi^2}$