Q13 CS:

$$a_0 = \frac{1}{2}\int_0^2 f(x)\,dx$$

$$= \frac{1}{2}\int_1^2 (x-1)\,dx = \frac{1}{2}\left[\frac{1}{2}x^2 - x\Big|_1^2\right]$$

$$= \frac{1}{2}\left[2 - 2 - \frac{1}{2} + 1\right] = \frac{1}{4}$$

$$a_n = \frac{2}{2}\int_1^2 (x-1)\cos\frac{n\pi}{2}x\,dx$$

$$= \frac{4}{n^2\pi^2}\cos\frac{n\pi}{2}x + \frac{2x}{n\pi}\sin\frac{n\pi}{2}x$$

$$- \frac{2}{n\pi}\sin\frac{n\pi}{2}x \Bigg|_1^2$$

$$= \frac{4}{n^2\pi^2}\cos n\pi + \frac{4}{n\pi}\cancel{\sin n\pi}^{\,0} - \frac{4}{n\pi}\cancel{\sin n\pi}^{\,0}$$

$$- \frac{4}{n^2\pi^2}\cos\frac{n\pi}{2} + \frac{2}{n\pi}\cancel{\sin\frac{n\pi}{2}} - \frac{2}{n\pi}\cancel{\sin\frac{n\pi}{2}}$$

$$= \frac{4}{n^2\pi^2}\left[(-1)^n - \cos\frac{n\pi}{2}\right]$$

$$\Rightarrow CS = \frac{1}{4} + \frac{4}{\pi^2}\sum_{n=1}^{\infty}\frac{1}{n^2}\left[(-1)^n - \cos\frac{n\pi}{2}\right]\cos\frac{n\pi}{2}x$$

$$SS: b_n = \frac{2}{2}\int_1^2 (x-1)\sin\frac{n\pi}{2}x\,dx$$

$$= \frac{4}{n^2\pi^2}\sin\frac{n\pi}{2}x - \frac{2x}{n\pi}\cos\frac{n\pi}{2}x\,\Big|_1^2$$

$$+ \frac{2}{n\pi}\cos\frac{n\pi}{2}x\,\Big|_1^2$$

$$= \cancel{\frac{4}{n^2\pi^2}\sin n\pi}^{\,0} - \frac{4}{n\pi}\cos n\pi + \frac{2}{n\pi}\cos n\pi - \frac{4}{n^2\pi^2}\sin\frac{n\pi}{2}$$

$$+ \cancel{\frac{2}{n\pi}\cos\frac{n\pi}{2}} - \cancel{\frac{2}{n\pi}\cos\frac{n\pi}{2}} =$$

$$= -\frac{2}{n\pi}(-1)^n - \frac{4}{n^2\pi^2}\sin\frac{n\pi}{2}$$

$$S = -2 \sum_{n=1}^{\infty} \frac{1}{n^2\pi^2}\left(n\pi(-1)^n + 2\sin\frac{n\pi}{2}\right)\sin\frac{n\pi}{2},$$