1. (a) $f(x) = \frac{1}{2} - \frac{2}{\pi}\sum_{n=1^\infty} \frac{sin((2n-1)\pi x/L)}{2n-1}$

   (b) $f(x) = \frac{3L}{4} + \sum_{n=1}^{\infty}\left(\frac{2L\cos((2n-1)\pi x/L)}{(2n-1)^2\pi^2} + \frac{(-1)^{n+1}L\sin(n\pi x/L)}{n\pi}\right)$

2. $f(x) = \frac{4}{\pi}\sum_{n=1}^{\infty}\frac{\sin((2n-1)\pi x)}{2n-1}$

3. $f(x) = \sum_{n=1}^{\infty}\frac{2}{n\pi}\left(-\cos n\pi + \frac{2}{n\pi}\sin\frac{n\pi}{2}\right)\sin\frac{n\pi x}{2}$

4. (a) $X'' - \lambda x X = 0, \quad T' + \lambda t T = 0$

   (b) $X'' - \lambda(X' + X) = 0, \quad T' + \lambda T = 0$

5. (a) $u(x,t) = \frac{100}{\pi}\sum_{n=1}^{\infty}\frac{1-\cos n\pi}{n}e^{-n^2\pi^2 t/1600}\sin\frac{n\pi x}{40}$

   (b) $u(x,t) = \frac{160}{\pi^2}\sum_{n=1}^{\infty}\frac{\sin(n\pi/2)}{n^2}e^{-n^2\pi^2 t/1600}\sin\frac{n\pi x}{40}$

6. (a) $aw_{xx} - bw_t + (c - b\delta)w = 0$

   (b) $\delta = c/b$, if $b \neq 0$

7. $X'' + \mu^2 X = 0, \quad Y'' + (\lambda^2 - \mu^2)Y = 0, \quad T' + \alpha^2\lambda^2 T = 0$