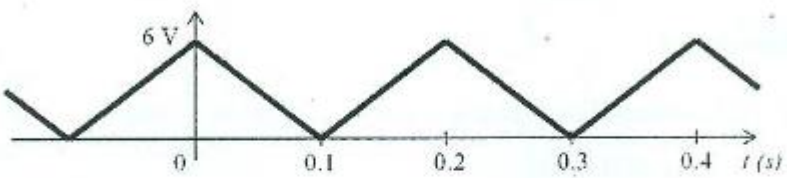
Answer on Question #57024 – Math – Calculus

please help me this question
http://i1376.photobucket.com/albums/ah26/john1x96/ex1_zpsmltfronf.png

Question 5 *(20 marks)*
The figure below shows a 'sawtooth' voltage signal $V(t)$. Find the Fourier series for $V(t)$.



Question 6
Find the Fourier transforms of the given functions:
(a) *(10 marks)*

$$f(t) = \begin{cases} 1 & |t| < 1 \\ 0 & |t| > 1. \end{cases}$$

(b) *(10 marks)*

$$g(t) = \begin{cases} \sin t & |t| \le \pi \\ 0 & |t| > \pi. \end{cases}$$

Hint: You may wish to use the formula

$$\sin A \sin B = \tfrac{1}{2}\left[\cos(A - B) - \cos(A + B)\right].$$

Solution

5. $\boldsymbol{f(t) = a_0 + \sum_{n=1}^{\infty}\left(a_n cos\frac{2\pi nt}{L} + b_n sinn\frac{2\pi nt}{L}\right)}$ **where**

$$\boldsymbol{a_0 = \frac{1}{2L}\int_{-L}^{L} f(t)dt = \frac{2}{0.4}\int_0^{0.1} 60tdt = 300\frac{t^2}{2}|_{t=0}^{t=0.1} = \frac{3}{2};}$$

$$\boldsymbol{a_n = \frac{1}{L}\int_{-L}^{L} f(t)cos(\frac{2\pi nt}{L})dt = \frac{2}{0.2}\int_0^{0.1} 60tcos(\frac{2\pi nt}{0.2})dt = 6\frac{(-1)^n - 1}{\pi^2 n^2}}$$

$$b_n = \frac{1}{L}\int_{-L}^{L} f(t)sin(\frac{2\pi nt}{L})dt = \frac{2}{0.2}\int_{0}^{0.1} 60tsin(\frac{2\pi nt}{0.2})dt = 6\frac{(-1)^n}{\pi n}$$

$$f(t) = \frac{3}{2} + 6\sum_{n=1}^{\infty}\left(\frac{(-1)^n-1}{\pi^2 n^2}cos\frac{2\pi nt}{L} + \frac{(-1)^n}{\pi n}sinn\frac{2\pi nt}{L}\right)$$

6.

(a) $F(k) = \int_{-\infty}^{\infty} e^{-2\pi ikt} f(t)\,dt = \int_{-1}^{1} e^{-2\pi ikt}\,dt = -\frac{1}{2\pi ik}e^{-2\pi ikt}|_{t=-1}^{t=1} = \frac{sin2\pi k}{2\pi k}$

(b) $G(k) = \int_{-\infty}^{\infty} e^{-2\pi ikt} g(t)\,dt = \int_{-\pi}^{\pi} e^{-2\pi ikt} sint\,dt =$

$= \int_{-\pi}^{\pi}(cos2\pi kt - isin2\pi kt)sint\,dt = \int_{-\pi}^{\pi} cos2\pi ktsint\,dt -$

$-i\int_{-\pi}^{\pi} sin2\pi ktsint\,dt = -\frac{isin2\pi^2 k}{4\pi^2 k^2 - 1}$