4.6 求下列周期信号的基波角频率 Ω 和周期 T：

(1) e^{j100t}　　(2) $\cos\left[\frac{\pi}{2}(t-3)\right]$　　(3) $\cos(2t)+\sin(4t)$

解：(1) $\Omega = 100\ rad/s$　　$T = \frac{2\pi}{\Omega} = \frac{2\pi}{100} = \frac{\pi}{50}\ s$

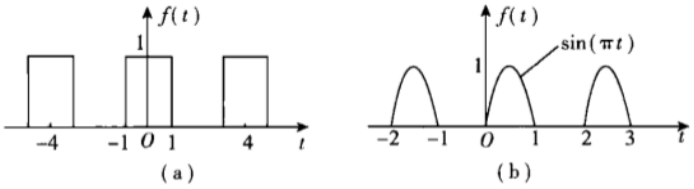
(3) $\cos(2t)$ 的周期 $T_1 = \frac{2\pi}{2} = \pi$

$\sin(4t)$ 的周期 $T_2 = \frac{2\pi}{4} = \frac{\pi}{2}$

$\because$ π 和 $\frac{\pi}{2}$ 的最小公倍数为 π　　$\therefore T = \pi$

$\therefore \Omega = \frac{2\pi}{T} = \frac{2\pi}{\pi} = 2\ rad/s$

4.7 用直接计算傅里叶系数的方法，求题 4.7 图所示周期函数的傅里叶系数（三角形式或指数形式）。



解：$T = 4$，$\Omega = \frac{2\pi}{4} = \frac{\pi}{2}$

$$\therefore f(t) = \begin{cases} 1, & 4k-1 \le t \le 4k+1 \\ 0, & 4k+1 < t < 4k+3 \end{cases}$$

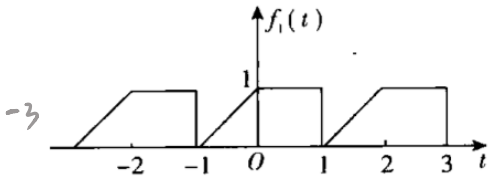
由 $a_0 = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(t)\cos(n\Omega t)\,dt$，　$b_n = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(t)\sin(n\Omega t)\,dt$

得：$a_0 = \frac{1}{2}\int_{-2}^{2} f(t)\cos\left(\frac{\pi}{2}nt\right)dt = \frac{1}{2}\int_{-1}^{1}\cos\left(\frac{\pi}{2}nt\right)dt = \frac{2}{n\pi}\sin\left(\frac{n\pi}{2}\right)$，

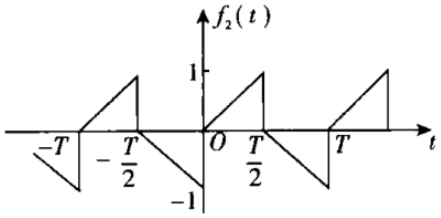
$n = 0, 1, 2\cdots$

$b_n = \frac{1}{2}\int_{-2}^{2} f(t)\sin\left(\frac{\pi}{2}nt\right)dt = \frac{1}{2}\int_{-1}^{1}\sin\left(\frac{\pi}{2}nt\right) = 0$，　$n = 1, 2\cdots$

4.9 试画出题4.9图所示信号的奇分量和偶分量。



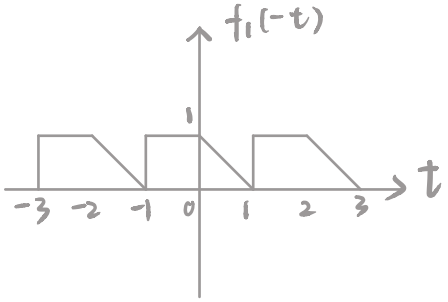
(a)



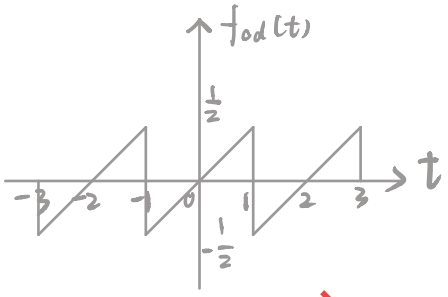
(b)

题4.9图

解：$f_1(-t)$波形为：



奇分量 $f_{od}(t)=\frac{f_1(t)-f_1(-t)}{2}$ 波形为：



奇分量 $f_{ov}(t)=\frac{f_1(t)+f_1(-t)}{2}$ 波形为：