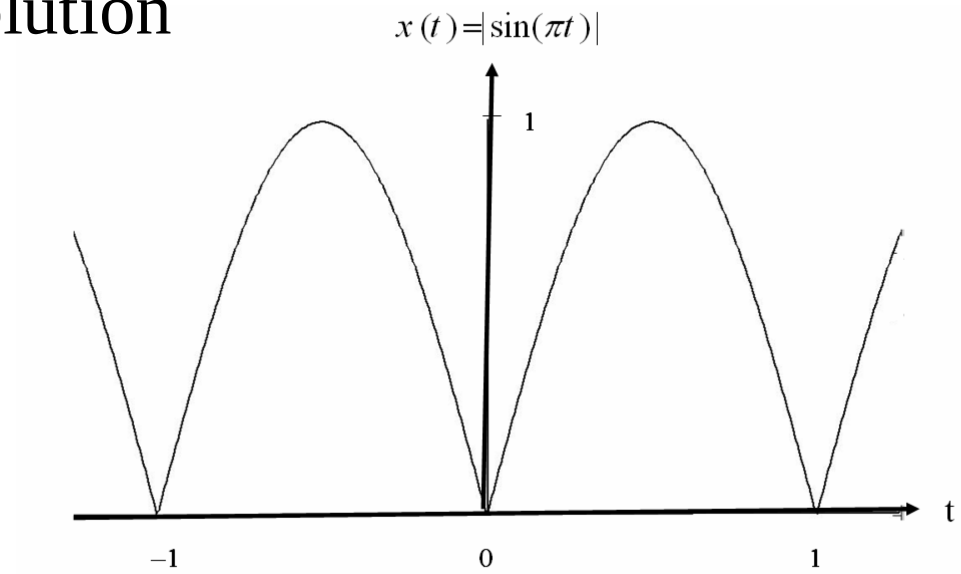
# QZ 3 -section 1 - solution

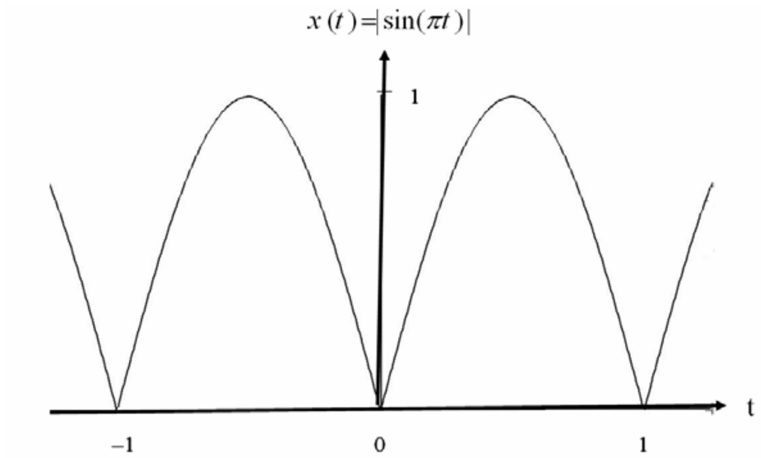



$T_0 = 1$

$x(t)$ even ➡ $b_n = 0$

$$a_0 = \frac{1}{T_0}\int_{T_0} x(t)dt = \frac{1}{1}\int_0^1 \sin(\pi t)dt = -\frac{\cos(\pi t)}{\pi}\Bigg|_0^1$$

$$= -\frac{\cos(\pi(1)) - \cos(\pi(0))}{\pi} = -\frac{-1-1}{\pi} = \frac{2}{\pi}$$




$$T_0 = 1$$
$$b_n = 0$$
$$a_0 = \frac{2}{\pi}$$

$b = 2\pi n$

$a = \pi$

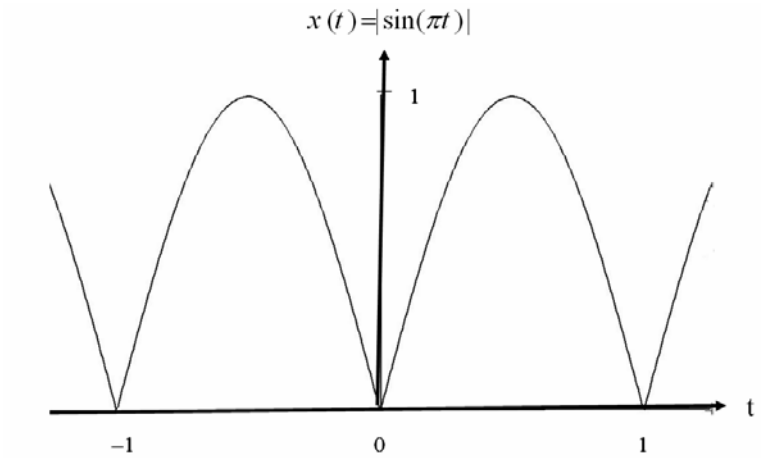
$$a_n = \frac{2}{T_0}\int_{T_0} x(t)\cos(2\pi n f_0 t)dt \quad = \frac{2}{1}\int_0^1 \sin(\pi t)\cos\left(\frac{2\pi n t}{1}\right)dt$$

From the table $\int \sin(ax)\cos(bx)dx = -\left[\frac{\cos(a-b)x}{2(a-b)} + \frac{\cos(a+b)x}{2(a+b)}\right]$

$a^2 \neq b^2$

$$a_n = -2\left[\frac{\cos(\pi-2\pi n)x}{2(\pi-2\pi n)} + \frac{\cos(\pi+2\pi n)x}{2(\pi+2\pi n)}\right]_0^1$$

$$a_n = -2\left[\frac{\cos(\pi-2\pi n)(1)-\cos(\pi-2\pi n)(0)}{2(\pi-2\pi n)} + \frac{\cos(\pi+2\pi n)(1)-\cos(\pi+2\pi n)(0)}{2(\pi+2\pi n)}\right]$$




$$T_0 = 1$$
$$b_n = 0$$
$$a_0 = \frac{2}{\pi}$$

$$a_n = -2\left[\frac{\cos(\pi-2\pi n)(1)-\cos(\pi-2\pi n)(0)}{2(\pi-2\pi n)} + \frac{\cos(\pi+2\pi n)(1)-\cos(\pi+2\pi n)(0)}{2(\pi+2\pi n)}\right]$$

$$a_n = -2\left[\frac{\cos\pi(1-2n)-\cos(0)}{2\pi(1-2n)} + \frac{\cos\pi(1+2n)-\cos(0)}{2\pi(1+2n)}\right]$$

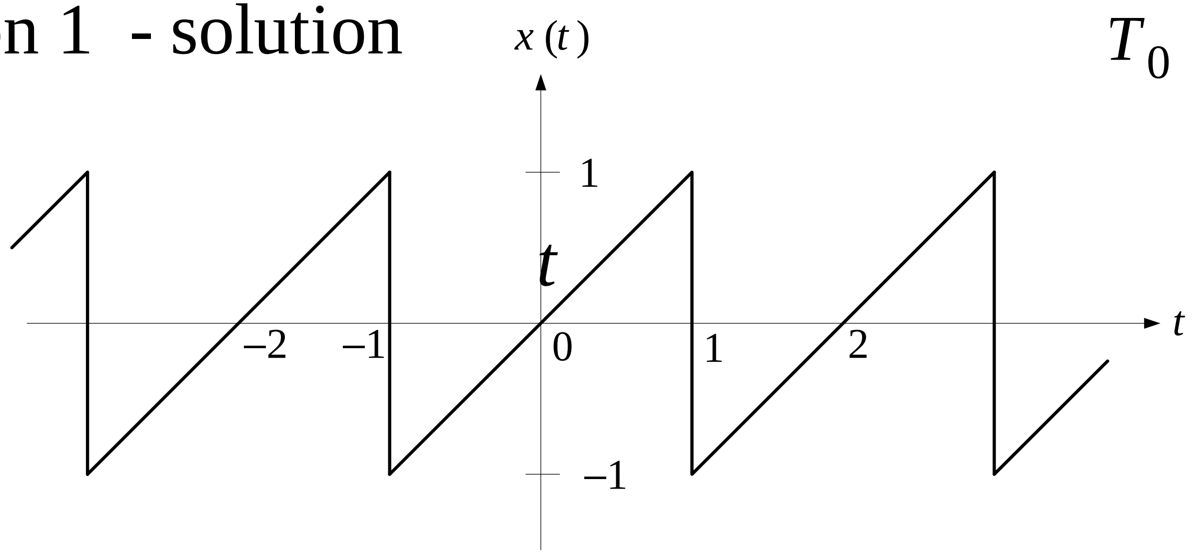
since $(1 \pm 2n)$ gives odd numbers ⇒ $\cos\pi(1 \pm 2n) = -1$

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

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

# QZ 3 -section 1 - solution

$T_0 = 2$



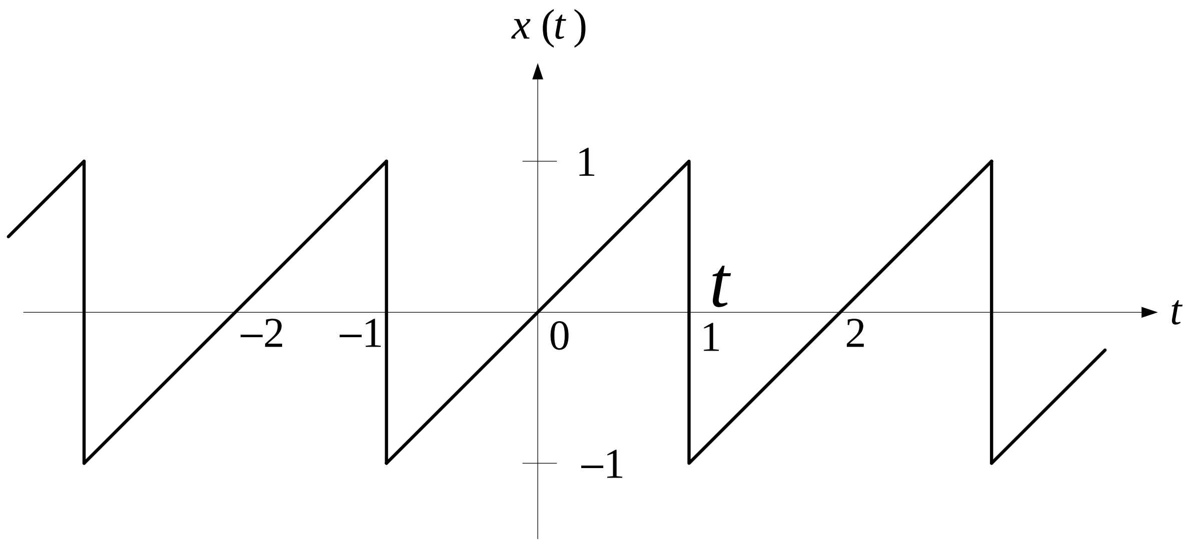

$x(t)$ odd $\Rightarrow$ $a_0 = 0 \quad a_n = 0$

$a = \pi n$

$$b_n = \frac{2}{T_0}\int_{T_0} x(t)\sin(2\pi n f_0 t)dt = \frac{2}{2}\int_{T_0} x(t)\sin(2\pi n \frac{1}{2} t)dt = \int_{-1}^{1} t\sin(\pi n t)dt$$

From the table $\int x\sin(ax)dx = \frac{[\sin(ax) - ax\cos(ax)]}{a^2}$

$$b_n = \frac{[\sin(\pi n t) - (\pi n)t\cos(\pi n t)]_{-1}^{1}}{(\pi n)^2}$$




$T_0 = 2$

$a_0 = 0$

$a_n = 0$

$$b_n = \frac{\left[\sin(\pi n t) - (\pi n) t \cos(\pi n t)\right]_{-1}^{1}}{(\pi n)^2}$$

0 for all n      0 for all n

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

$$= \frac{-2\pi n \cos(\pi n)}{(\pi n)^2} = \frac{(-1)2(-1)^n}{\pi n} = \frac{2\pi n(-1)^{n+1}}{\pi n}$$