

1. Периодические сигналы



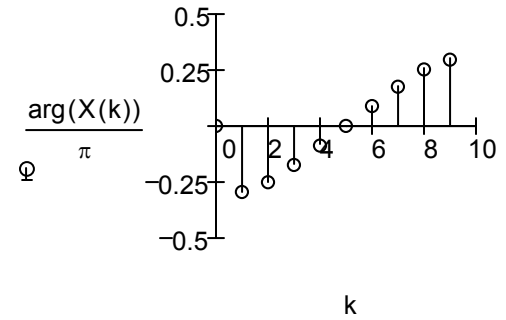
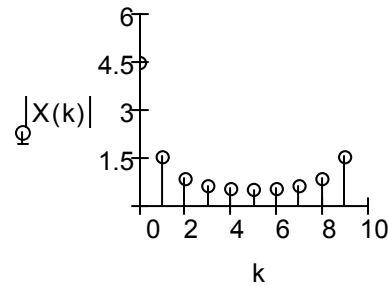
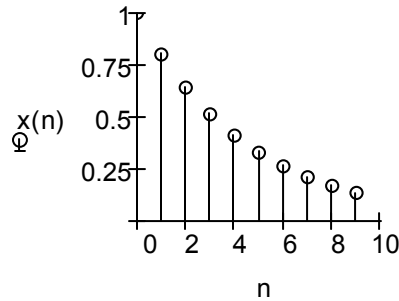
1.1 Показательный импульс

$a := 0.8$ $T := 10$

$n := 0..T-1$ $k := 0..T-1$

$x(n) := a^n$

$$X(k) := \sum_{n=0}^{T-1} \left(x(n) \cdot e^{-i \frac{2\pi}{T} \cdot n \cdot k} \right)$$

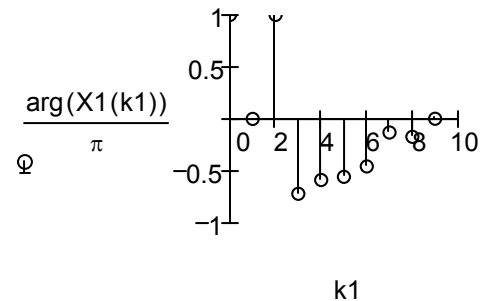
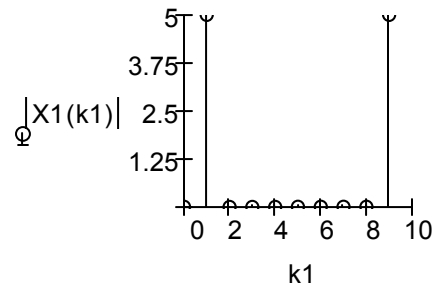
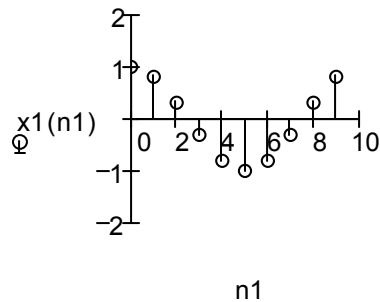


1.2 Косинусоидальное колебание

$T1 := 10$ $n1 := 0..T1-1$ $k1 := 0..T1-1$

$x1(n1) := \cos\left(\frac{2 \cdot \pi}{T1} \cdot n1\right)$

$$X1(k1) := \sum_{n1=0}^{T1-1} \left(x1(n1) \cdot e^{-i \frac{2\pi}{T1} \cdot n1 \cdot k1} \right)$$

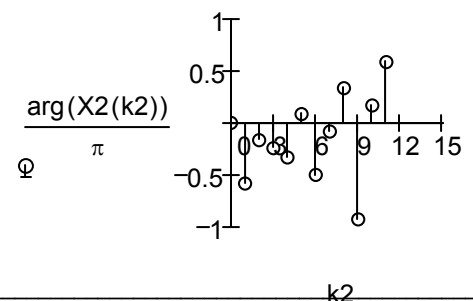
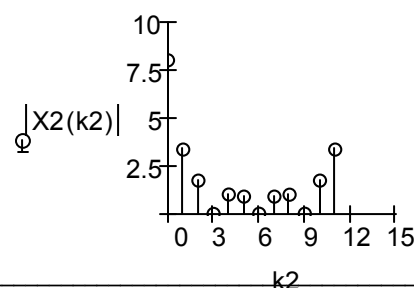
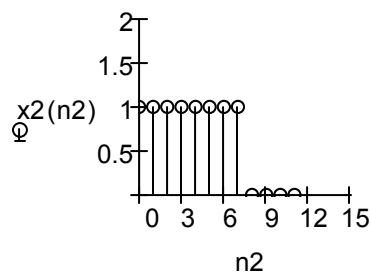


1.3 Прямоугольные импульсы

$n1 := 8$ $T2 := 12$ $n2 := 0..T2-1$ $k2 := 0..T2-1$

$x2(n2) := \Phi(n2) - \Phi[n2 - (n1)]$

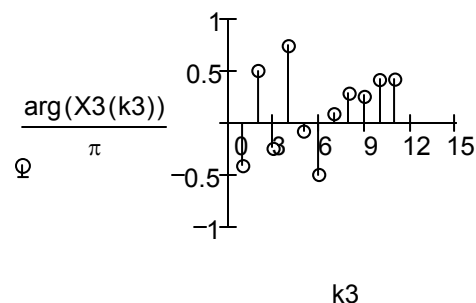
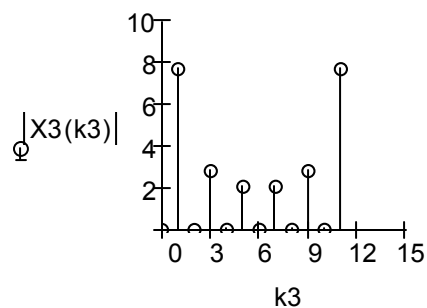
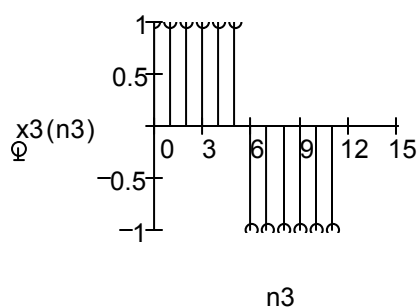
$$X2(k2) := \sum_{n2=0}^{T2-1} \left(x2(n2) \cdot e^{-i \frac{2\pi}{T2} \cdot n2 \cdot k2} \right)$$



1.4 Меандр

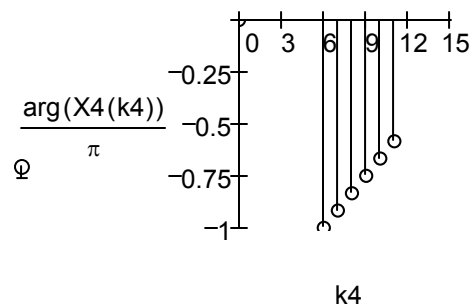
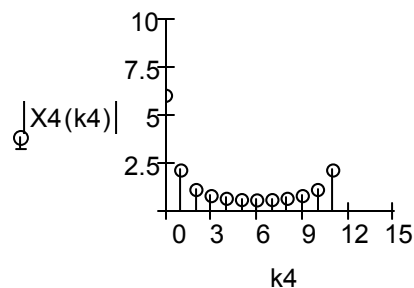
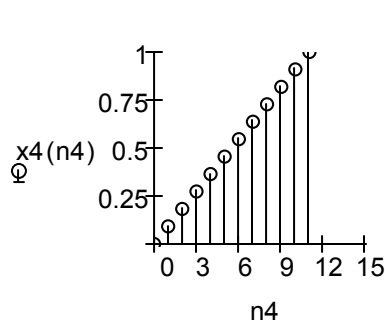
$$T_3 := 12 \quad n_3 := 0..T_3 - 1 \quad k_3 := 0..T_3 - 1$$

$$x_3(n_3) := \left(\Phi(n_3) - \Phi\left(n_3 - \frac{T_3}{2}\right) \right) - \left(\Phi\left(n_3 - \frac{T_3}{2}\right) - \Phi(n_3 - T_3) \right) \quad X_3(k_3) := \sum_{n_3=0}^{T_3-1} \left(x_3(n_3) \cdot e^{-i \frac{2\pi}{T_3} n_3 k_3} \right)$$



1.5 Пилообразные импульсы

$$T_4 := 12 \quad n_4 := 0..T_4 - 1 \quad k_4 := 0..T_4 - 1 \quad x_4(n_4) := \frac{n_4}{T_4 - 1} \quad X_4(k_4) := \sum_{n_4=0}^{T_4-1} \left(x_4(n_4) \cdot e^{-i \frac{2\pi}{T_4} n_4 k_4} \right)$$

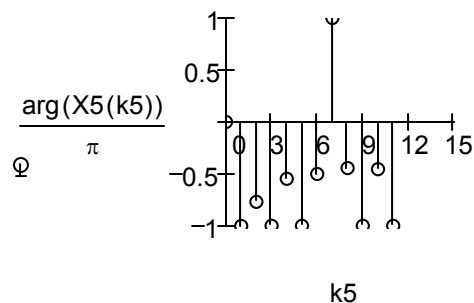
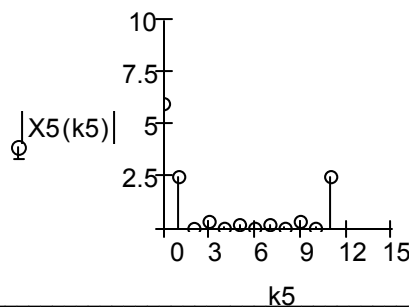
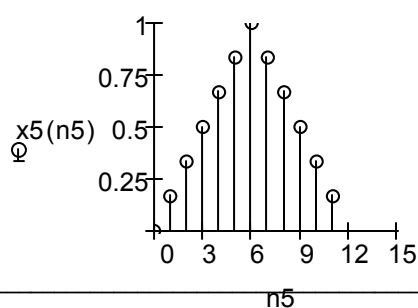


1.6 Треугольные импульсы

$$T_5 := 12 \quad n_5 := 0..T_5 - 1 \quad k_5 := 0..T_5 - 1$$

$$x_5(n_5) := \left(\frac{2}{T_5} \cdot n_5 \right) \cdot \left(\Phi(n_5) - \Phi\left(n_5 - \frac{T_5}{2}\right) \right) + \left[2 \cdot \left(1 - \frac{n_5}{T_5} \right) \right] \cdot \left(\Phi\left(n_5 - \frac{T_5}{2}\right) - \Phi(n_5 - T_5) \right)$$

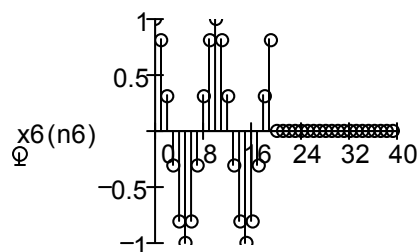
$$X_5(k_5) := \sum_{n_5=0}^{T_5-1} \left(x_5(n_5) \cdot e^{-i \frac{2\pi}{T_5} n_5 k_5} \right)$$



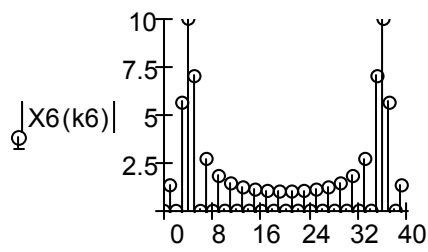
1.7 Прямоугольные радиоимпульсы

$$n_s := 1 \quad n_{s1} := 2 \cdot n_s \quad T_6 := 2 \cdot n_{s1} \quad n_6 := 0..T_6 - 1 \quad k_6 := 0..T_6 - 1 \quad x_6(n_6) := \left(\cos\left(\frac{2 \cdot \pi}{n_s} \cdot n_6\right) \right) \cdot [\Phi(n_6) - \Phi[n_6 - (n_{s1})]]$$

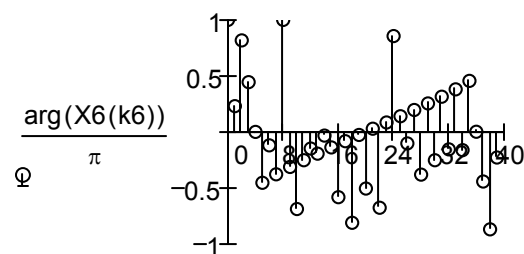
$$X_6(k_6) := \sum_{n_6=0}^{T_6-1} \left(x_6(n_6) \cdot e^{-i \frac{2 \cdot \pi}{T_6} \cdot n_6 \cdot k_6} \right)$$



n_6



k_6



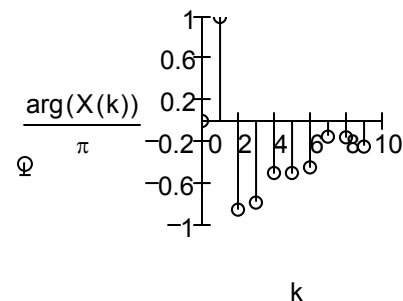
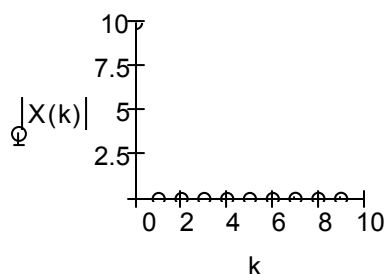
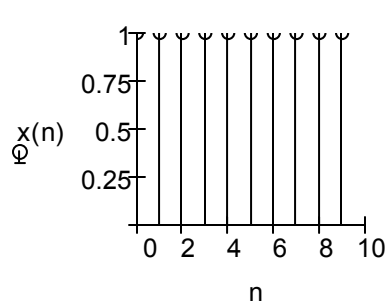
k_6

2. Непериодические сигналы

2.1 Цифровой единичный импульс

$$N := 10 \quad n := 0..N-1 \quad k := 0..N-1 \quad x(n) := 1$$

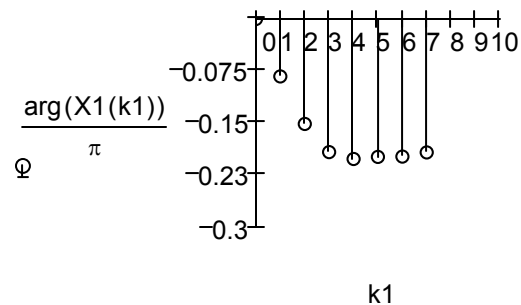
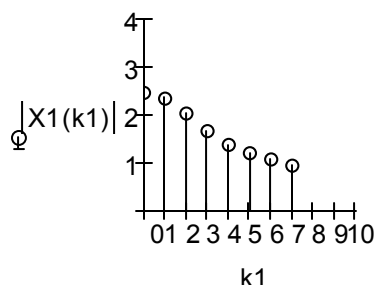
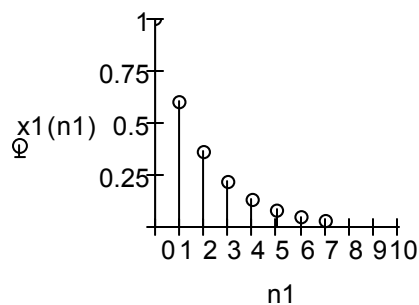
$$X(k) := \sum_{n=0}^{N-1} \left(x(n) \cdot e^{-i \frac{2\pi}{N} \cdot n \cdot k} \right)$$



2.2 Показательный импульс

$$a := 0.6 \quad N1 := 8 \quad L := 32 \quad n1 := 0..N1-1 \quad k1 := 0..N1-1 \quad x1(n1) := a^{n1}$$

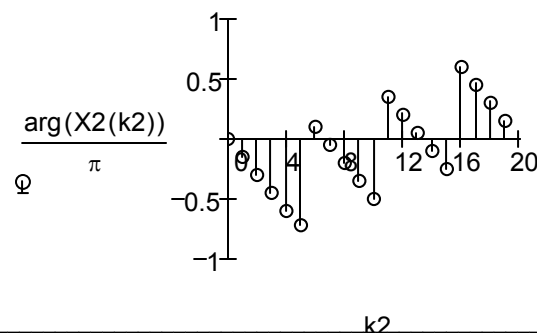
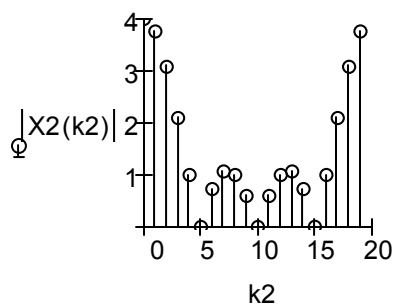
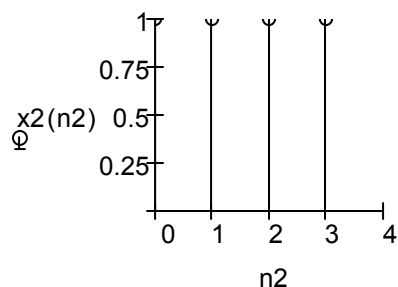
$$X1(k1) := \sum_{n1=0}^{N1-1} \left(x1(n1) \cdot e^{-i \frac{2\pi}{L} \cdot n1 \cdot k1} \right)$$



2.3 Прямоугольный импульс

$$\pi_1 := 4 \quad L1 := 20 \quad n2 := 0..\pi_1-1 \quad k2 := 0..L1-1 \quad x2(n2) := 1$$

$$X2(k2) := \sum_{n2=0}^{\pi_1-1} \left(x2(n2) \cdot e^{-i \frac{2\pi}{L1} \cdot n2 \cdot k2} \right)$$



2.4 Прямоугольный радиоимпульс

$$n_1 := 12 \quad n_s := 6 \quad L_2 := 48 \quad n_3 := 0..n_1 - 1 \quad k_3 := 0..L_2 - 1 \quad x_3(n_3) := \cos\left(\frac{2 \cdot \pi}{n_s} \cdot n_3\right)$$

$$X_3(k_3) := \sum_{n_3=0}^{n_1-1} \left(x_3(n_3) \cdot e^{-i \frac{2 \cdot \pi}{L_2} \cdot n_3 \cdot k_3} \right)$$

