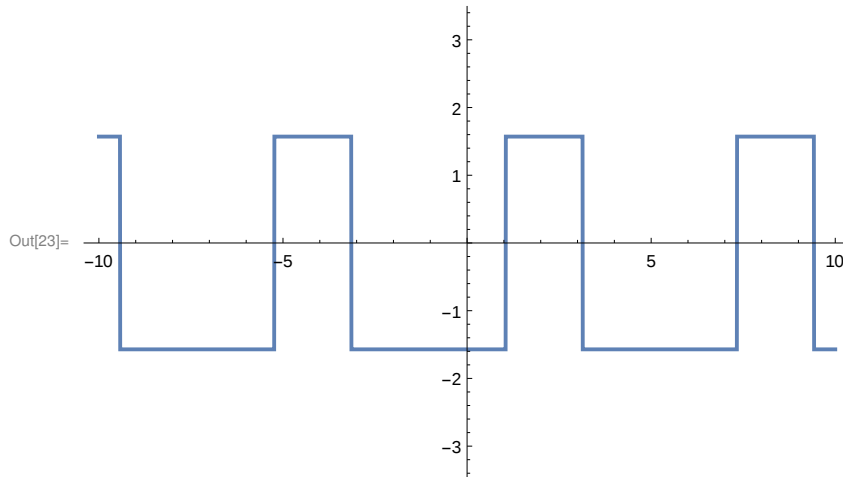


```
In[21]:= f[t_] := If[t <  $\pi/3$ ,  $-\pi/2$ ,  $\pi/2$ ];
```

```
g[u_] := f[Pi Mod[(u + Pi) / Pi, 2] - Pi];
```

```
Plot[g[u], {u, -10, 10}, PlotStyle -> Thick, PlotRange -> 3.5, ImageSize -> 400]
```



```
In[30]:= (* Długość rozwinięcia *)
```

```
max = 20;
```

```
(* Iloczyn skalarny w przestrzeni funkcji o okresie  $2\pi$  *)
```

```
 $\phi[x_, y_] := Integrate[xy, {t, -\pi, \pi}]$ 
```

```
In[32]:= (* Wyraz stały *)
```

```
a =  $\phi[f[t], 1] / (2\pi)$ 
```

Out[32]=  $-\frac{\pi}{6}$

```
In[33]:= (* Współczynniki przy cosinusach *)
```

```
b = Table[ $\phi[f[t], \text{Cos}[k t]] / \text{Pi}$ , {k, 1, max}]
```

Out[33]=  $\left\{ -\frac{\sqrt{3}}{2}, -\frac{\sqrt{3}}{4}, 0, \frac{\sqrt{3}}{8}, \frac{\sqrt{3}}{10}, 0, -\frac{\sqrt{3}}{14}, -\frac{\sqrt{3}}{16}, 0, \right.$   
 $\left. \frac{\sqrt{3}}{20}, \frac{\sqrt{3}}{22}, 0, -\frac{\sqrt{3}}{26}, -\frac{\sqrt{3}}{28}, 0, \frac{\sqrt{3}}{32}, \frac{\sqrt{3}}{34}, 0, -\frac{\sqrt{3}}{38}, -\frac{\sqrt{3}}{40} \right\}$

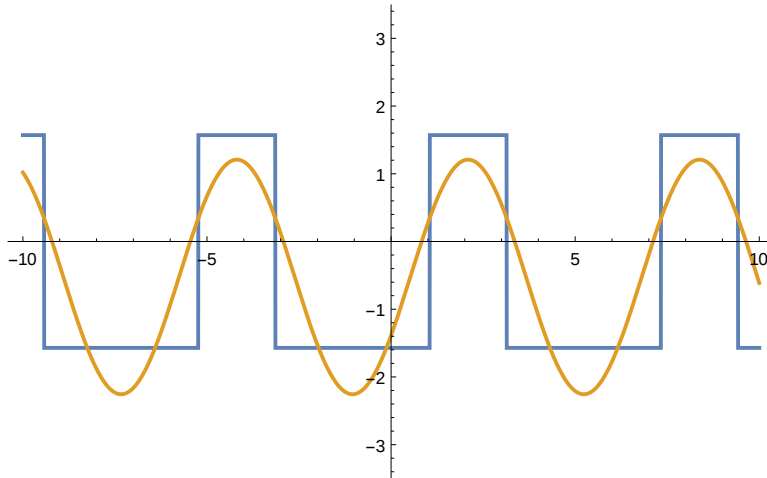
```
In[34]:= (* Współczynniki przy sinusach *)
```

```
c = Table[ $\phi[f[t], \text{Sin}[k t]] / \text{Pi}$ , {k, 1, max}]
```

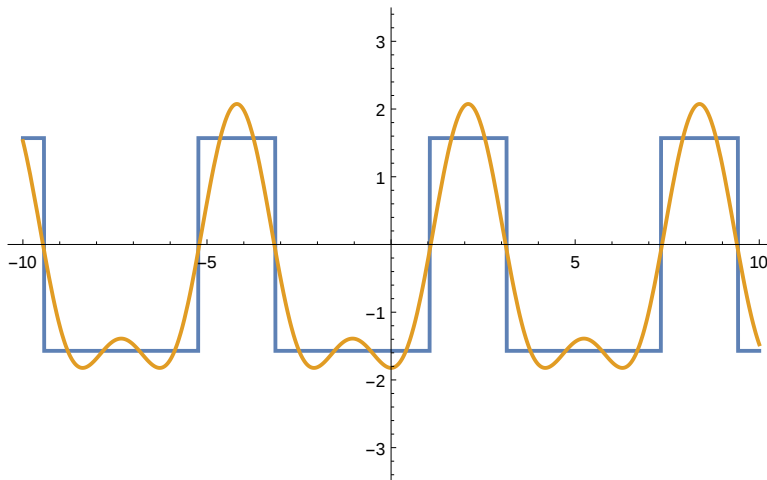
Out[34]=  $\left\{ \frac{3}{2}, -\frac{3}{4}, 0, -\frac{3}{8}, \frac{3}{10}, 0, \frac{3}{14}, -\frac{3}{16}, 0, -\frac{3}{20}, \frac{3}{22}, 0, \frac{3}{26}, -\frac{3}{28}, 0, -\frac{3}{32}, \frac{3}{34}, 0, \frac{3}{38}, -\frac{3}{40} \right\}$

```
In[35]:= (*
Rzut funkcji f na przestrzen rozpieta przez sin(kt) i cos (kt) dla k<n
*)
Do[szereg[t_] := a + Sum[b[[k]] Cos[k t] + c[[k]] Sin[k t], {k, 1, n}];
Print[szereg[t]];
Print[Plot[{g[t], szereg[t]}, {t, -10, 10},
PlotStyle -> Thick, PlotRange -> 3.5, ImageSize -> 400]], {n, 1, max}]
```

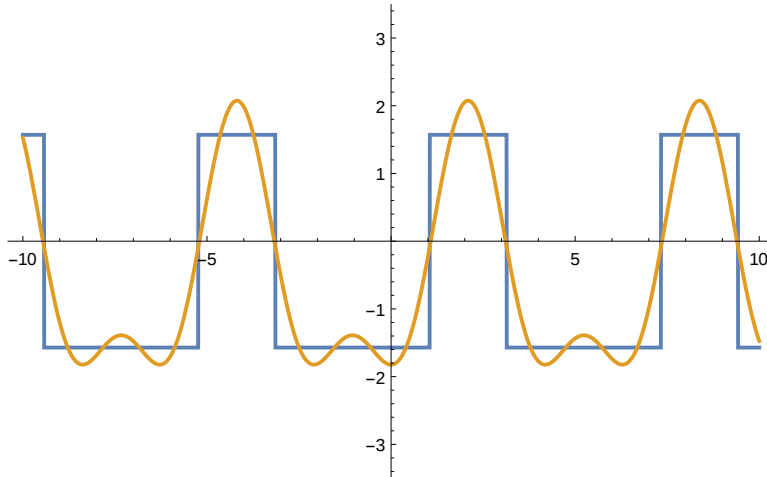
$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] + \frac{3 \sin[t]}{2}$$



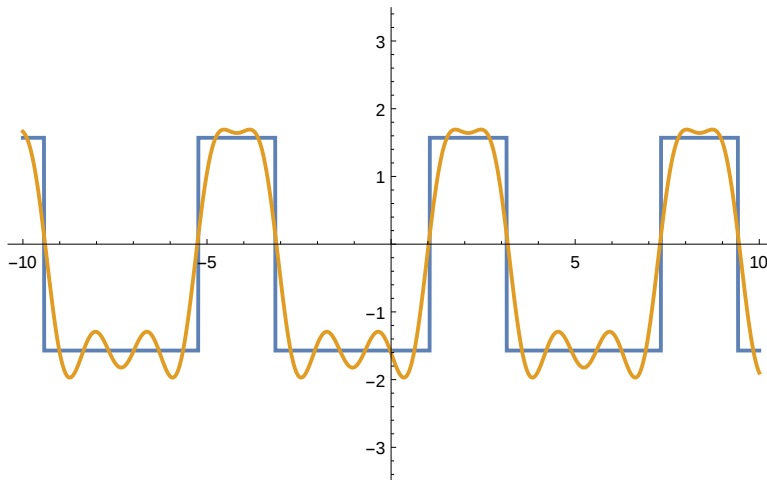
$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t]$$



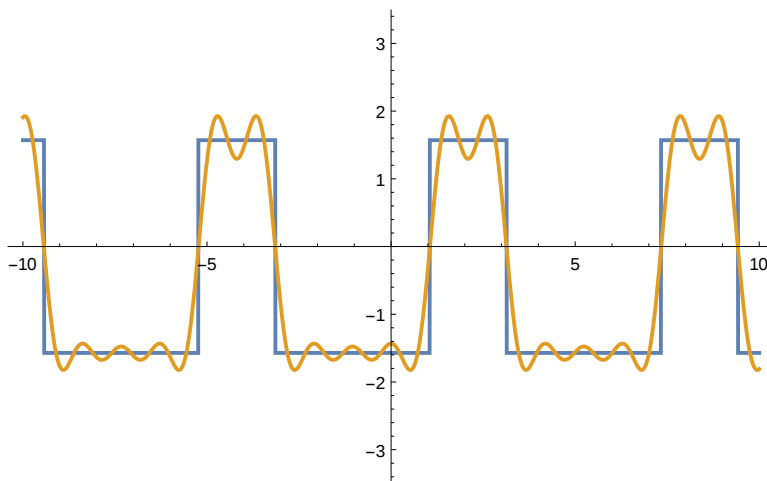
$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t]$$



$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t]$$

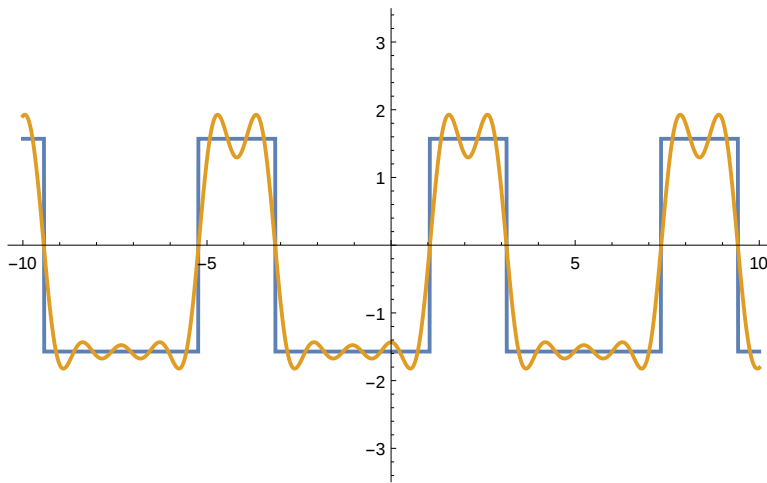


$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t]$$



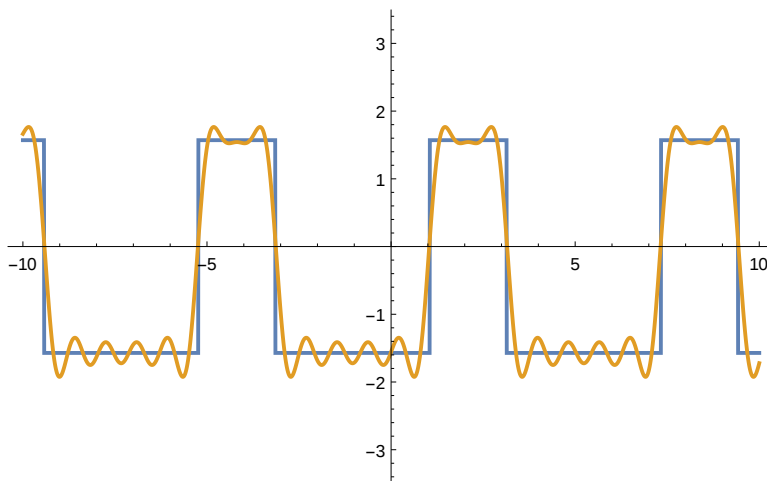
$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] +$$

$$\frac{1}{10} \sqrt{3} \cos[5t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t]$$



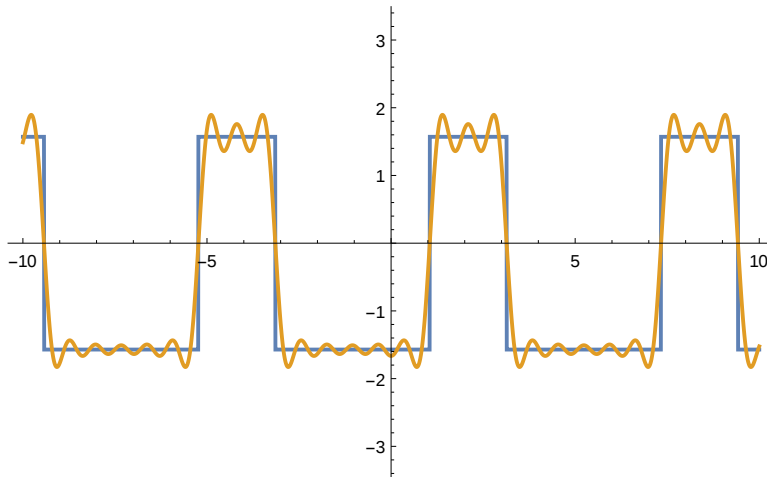
$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] -$$

$$\frac{1}{14} \sqrt{3} \cos[7t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t]$$



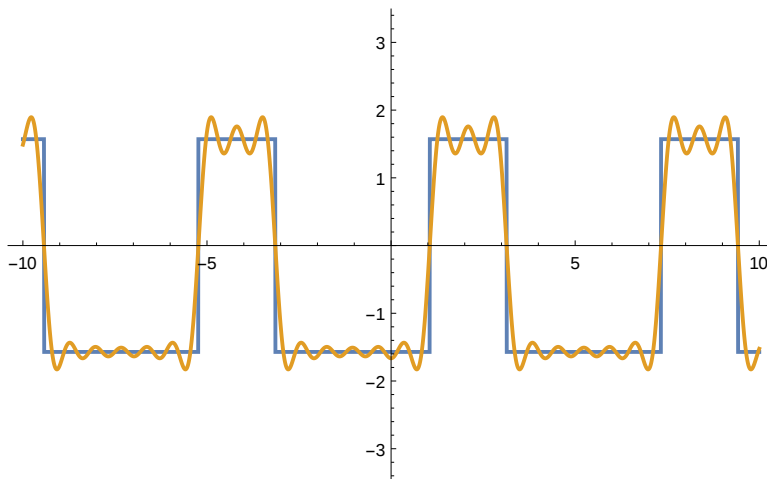
$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \frac{1}{14} \sqrt{3} \cos[7t] -$$

$$\frac{1}{16} \sqrt{3} \cos[8t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t]$$



$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \frac{1}{14} \sqrt{3} \cos[7t] -$$

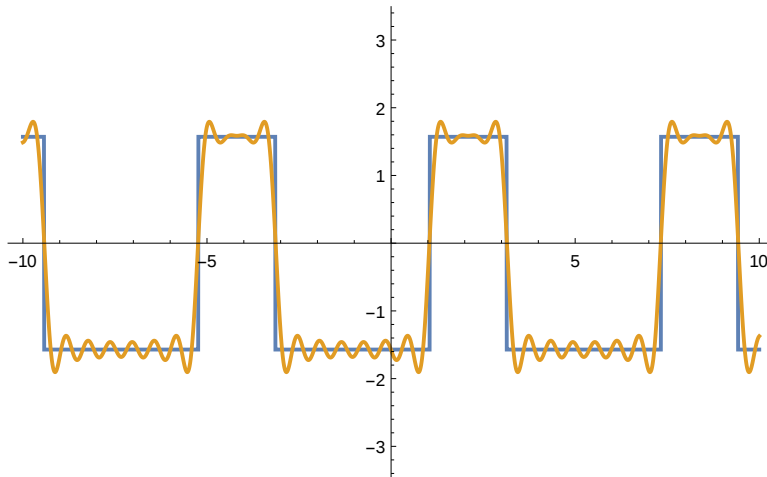
$$\frac{1}{16} \sqrt{3} \cos[8t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t]$$



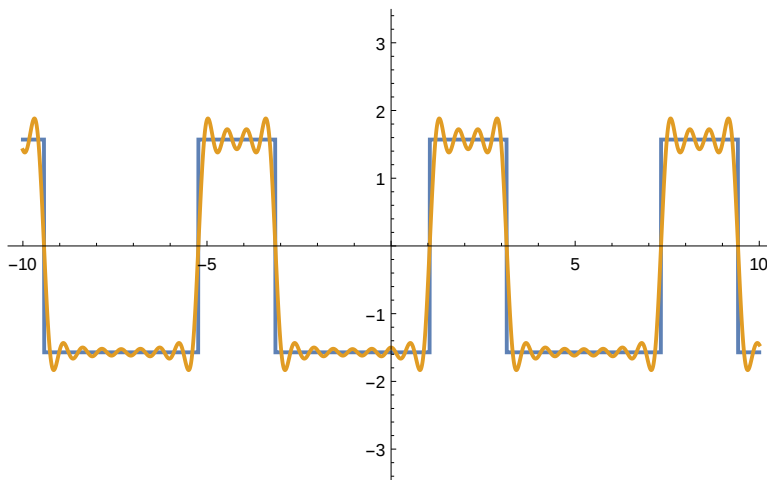
$$-\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] -$$

$$\frac{1}{14} \sqrt{3} \cos[7t] - \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] -$$

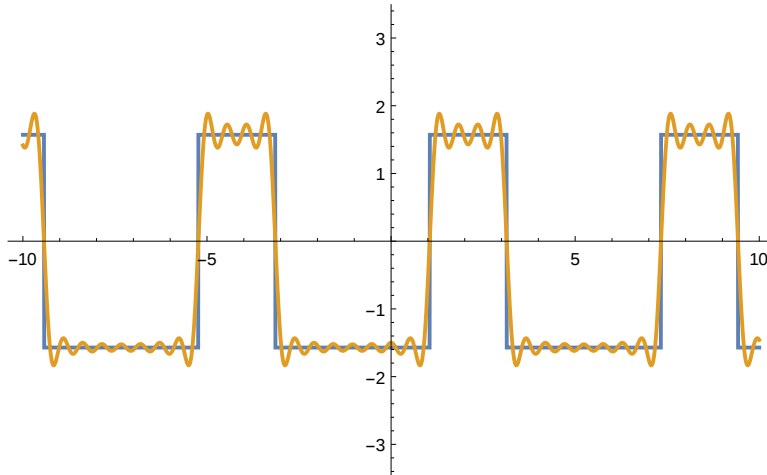
$$\frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \frac{3}{20} \sin[10t]$$



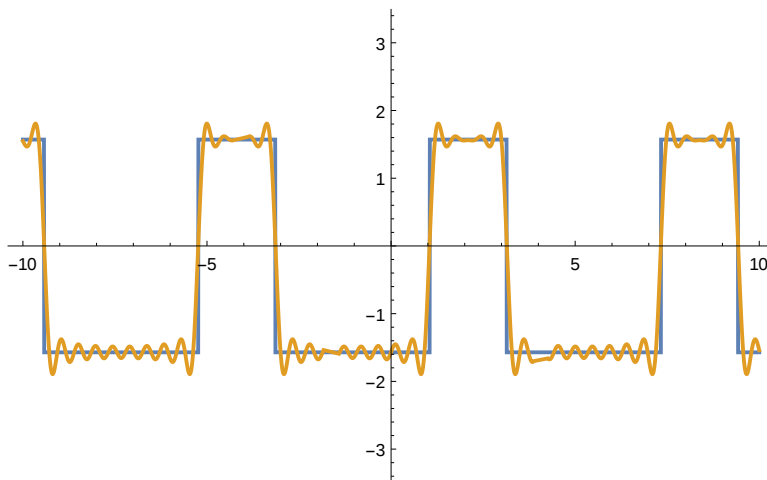
$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \frac{1}{14} \sqrt{3} \cos[7t] - \\
 & \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \\
 & \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \frac{3}{20} \sin[10t] + \frac{3}{22} \sin[11t]
 \end{aligned}$$



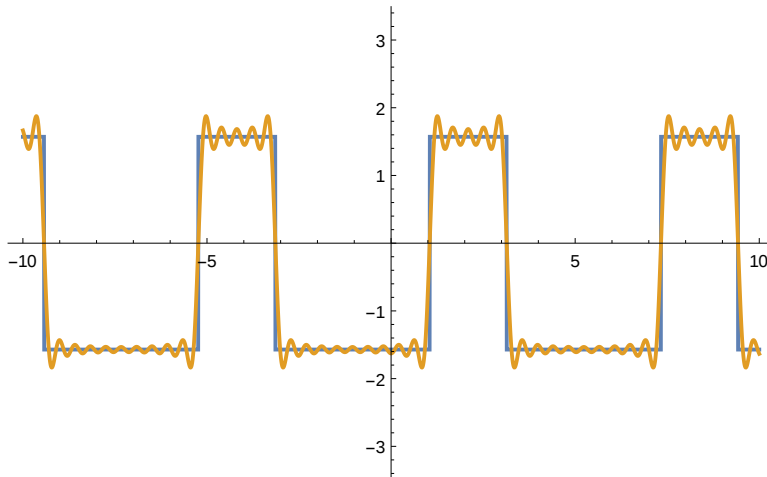
$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \frac{1}{14} \sqrt{3} \cos[7t] - \\
 & \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \\
 & \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \frac{3}{20} \sin[10t] + \frac{3}{22} \sin[11t]
 \end{aligned}$$



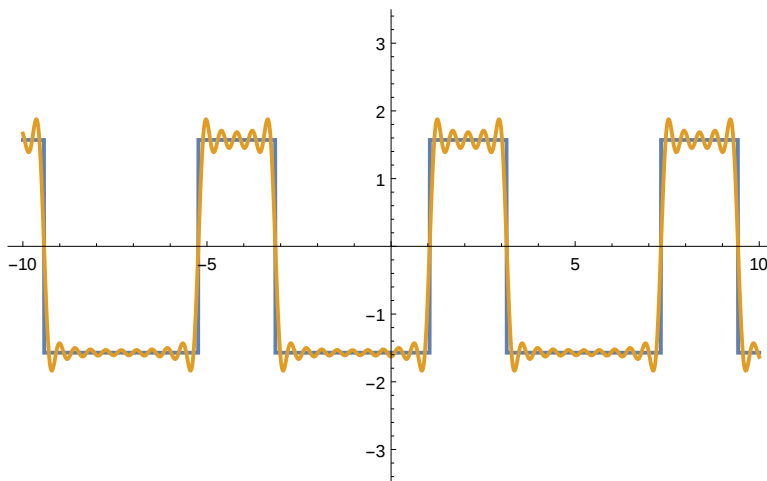
$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \frac{1}{14} \sqrt{3} \cos[7t] - \\
 & \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] - \frac{1}{26} \sqrt{3} \cos[13t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \\
 & \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \frac{3}{20} \sin[10t] + \frac{3}{22} \sin[11t] + \frac{3}{26} \sin[13t]
 \end{aligned}$$



$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \\
 & \frac{1}{14} \sqrt{3} \cos[7t] - \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] - \\
 & \frac{1}{26} \sqrt{3} \cos[13t] - \frac{1}{28} \sqrt{3} \cos[14t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \\
 & \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \frac{3}{20} \sin[10t] + \frac{3}{22} \sin[11t] + \frac{3}{26} \sin[13t] - \frac{3}{28} \sin[14t]
 \end{aligned}$$

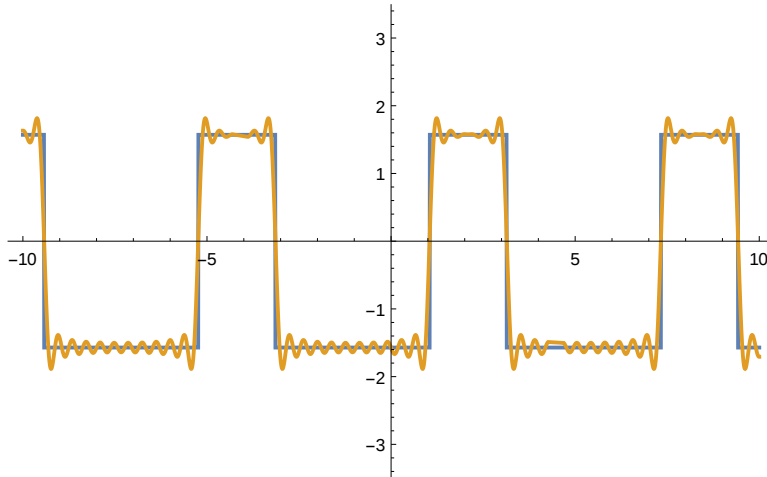


$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \\
 & \frac{1}{14} \sqrt{3} \cos[7t] - \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] - \\
 & \frac{1}{26} \sqrt{3} \cos[13t] - \frac{1}{28} \sqrt{3} \cos[14t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \\
 & \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \frac{3}{20} \sin[10t] + \frac{3}{22} \sin[11t] + \frac{3}{26} \sin[13t] - \frac{3}{28} \sin[14t]
 \end{aligned}$$

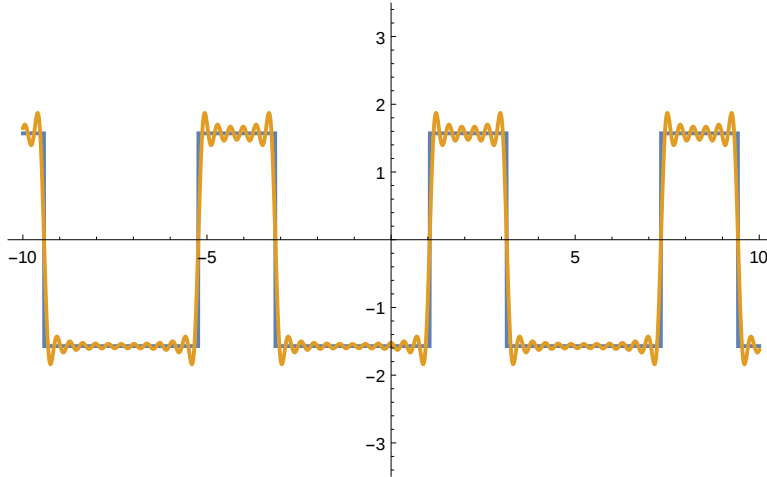


$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \frac{1}{14} \sqrt{3} \cos[7t] - \\
 & \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] - \frac{1}{26} \sqrt{3} \cos[13t] - \frac{1}{28} \sqrt{3} \cos[14t] + \\
 & \frac{1}{32} \sqrt{3} \cos[16t] + \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \\
 & \frac{3}{16} \sin[8t] - \frac{3}{20} \sin[10t] + \frac{3}{22} \sin[11t] + \frac{3}{26} \sin[13t] - \frac{3}{28} \sin[14t] - \frac{3}{32} \sin[16t]
 \end{aligned}$$

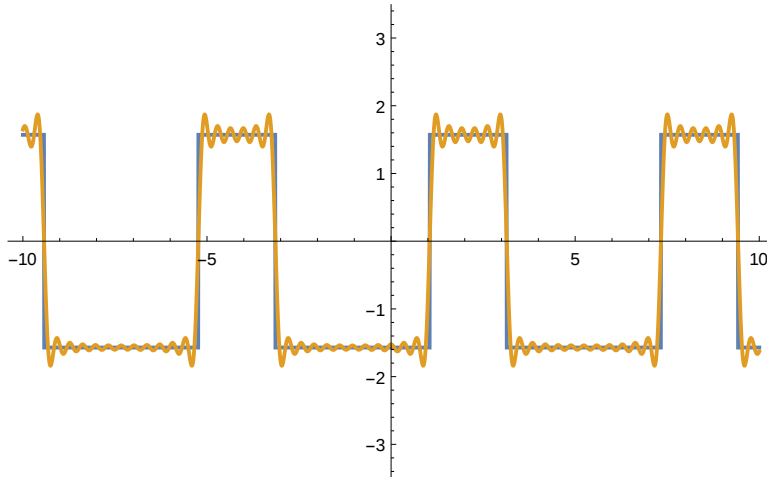




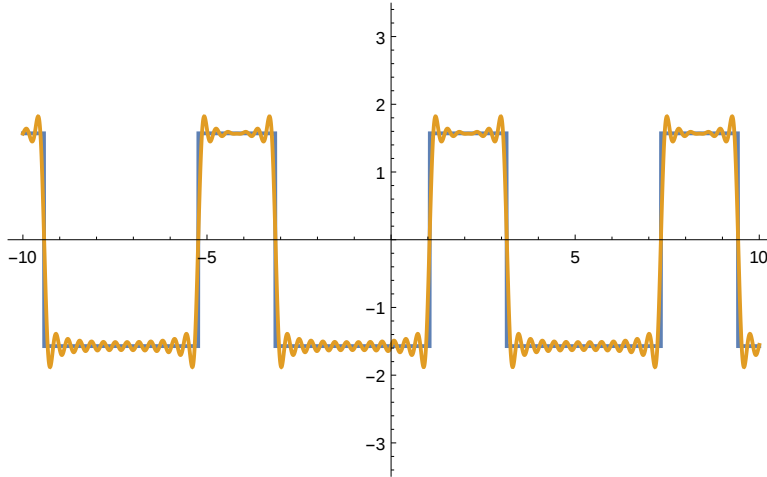
$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \\
 & \frac{1}{14} \sqrt{3} \cos[7t] - \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] - \\
 & \frac{1}{26} \sqrt{3} \cos[13t] - \frac{1}{28} \sqrt{3} \cos[14t] + \frac{1}{32} \sqrt{3} \cos[16t] + \frac{1}{34} \sqrt{3} \cos[17t] + \\
 & \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \\
 & \frac{3}{20} \sin[10t] + \frac{3}{22} \sin[11t] + \frac{3}{26} \sin[13t] - \frac{3}{28} \sin[14t] - \frac{3}{32} \sin[16t] + \frac{3}{34} \sin[17t]
 \end{aligned}$$



$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \\
 & \frac{1}{14} \sqrt{3} \cos[7t] - \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] - \\
 & \frac{1}{26} \sqrt{3} \cos[13t] - \frac{1}{28} \sqrt{3} \cos[14t] + \frac{1}{32} \sqrt{3} \cos[16t] + \frac{1}{34} \sqrt{3} \cos[17t] + \\
 & \frac{3 \sin[t]}{2} - \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \\
 & \frac{3}{20} \sin[10t] + \frac{3}{22} \sin[11t] + \frac{3}{26} \sin[13t] - \frac{3}{28} \sin[14t] - \frac{3}{32} \sin[16t] + \frac{3}{34} \sin[17t]
 \end{aligned}$$



$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \frac{1}{14} \sqrt{3} \cos[7t] - \\
 & \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] - \frac{1}{26} \sqrt{3} \cos[13t] - \\
 & \frac{1}{28} \sqrt{3} \cos[14t] + \frac{1}{32} \sqrt{3} \cos[16t] + \frac{1}{34} \sqrt{3} \cos[17t] - \frac{1}{38} \sqrt{3} \cos[19t] + \frac{3 \sin[t]}{2} - \\
 & \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \frac{3}{20} \sin[10t] + \\
 & \frac{3}{22} \sin[11t] + \frac{3}{26} \sin[13t] - \frac{3}{28} \sin[14t] - \frac{3}{32} \sin[16t] + \frac{3}{34} \sin[17t] + \frac{3}{38} \sin[19t]
 \end{aligned}$$



$$\begin{aligned}
 & -\frac{\pi}{6} - \frac{1}{2} \sqrt{3} \cos[t] - \frac{1}{4} \sqrt{3} \cos[2t] + \frac{1}{8} \sqrt{3} \cos[4t] + \frac{1}{10} \sqrt{3} \cos[5t] - \frac{1}{14} \sqrt{3} \cos[7t] - \\
 & \frac{1}{16} \sqrt{3} \cos[8t] + \frac{1}{20} \sqrt{3} \cos[10t] + \frac{1}{22} \sqrt{3} \cos[11t] - \frac{1}{26} \sqrt{3} \cos[13t] - \frac{1}{28} \sqrt{3} \cos[14t] + \\
 & \frac{1}{32} \sqrt{3} \cos[16t] + \frac{1}{34} \sqrt{3} \cos[17t] - \frac{1}{38} \sqrt{3} \cos[19t] - \frac{1}{40} \sqrt{3} \cos[20t] + \frac{3 \sin[t]}{2} - \\
 & \frac{3}{4} \sin[2t] - \frac{3}{8} \sin[4t] + \frac{3}{10} \sin[5t] + \frac{3}{14} \sin[7t] - \frac{3}{16} \sin[8t] - \frac{3}{20} \sin[10t] + \frac{3}{22} \sin[11t] + \\
 & \frac{3}{26} \sin[13t] - \frac{3}{28} \sin[14t] - \frac{3}{32} \sin[16t] + \frac{3}{34} \sin[17t] + \frac{3}{38} \sin[19t] - \frac{3}{40} \sin[20t]
 \end{aligned}$$

