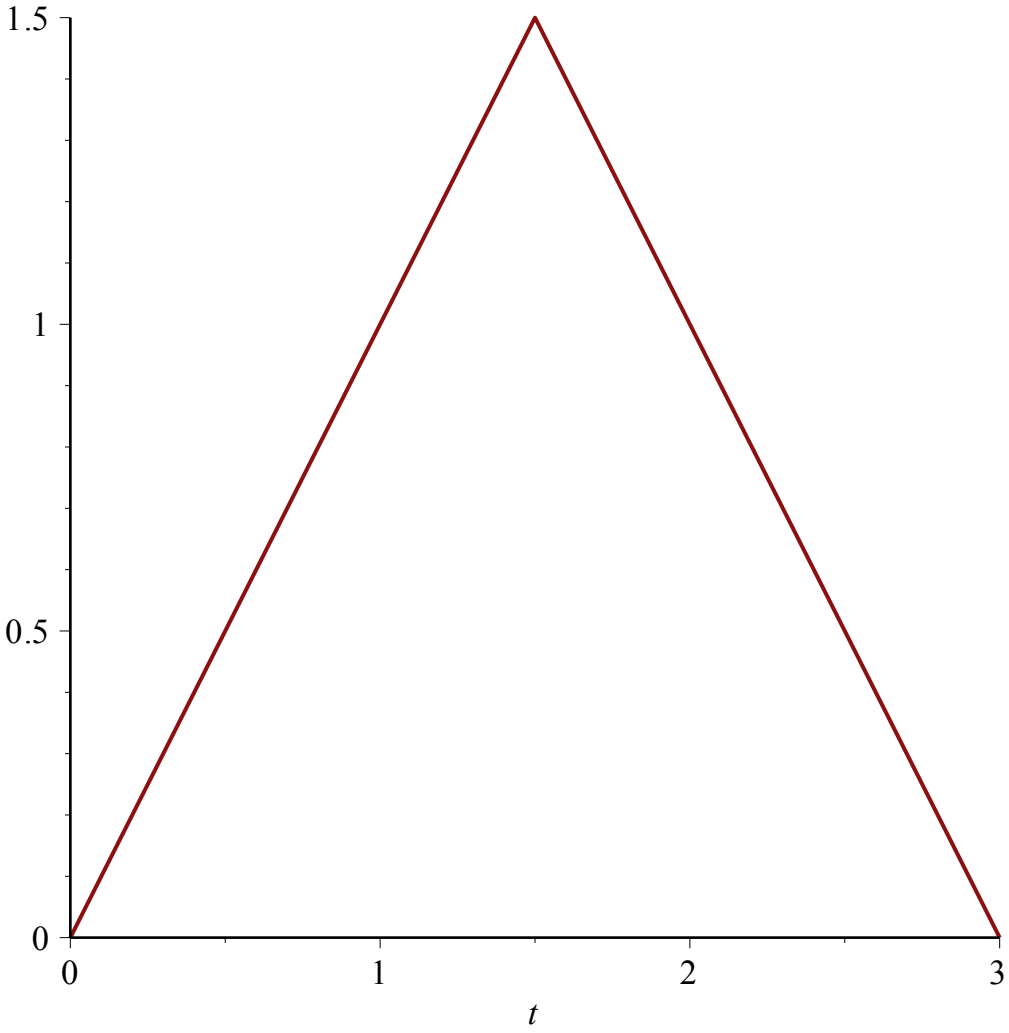
Example of Fourier expansion (period 2*l)

Function with period 3

```
> f := unapply( piecewise( t<3/2, t,
                           t >= 3/2, 3-t ), t) ;
```

$$f := t \to piecewise\left(t < \frac{3}{2}, t, \frac{3}{2} \le t, 3 - t\right) \quad (1)$$

```
> plot( f(t),t=0..3) ;
```




```
> ELL := 3/2 ;
```

$$ELL := \frac{3}{2} \quad (2)$$

```
> a0 := int( f(t), t=0..2*ELL) / ELL ;
```

$$a0 := \frac{3}{2} \quad (3)$$

```
> a1 := int( f(t)*cos(t*Pi/ELL), t=0..2*ELL) / ELL ;
  b1 := int( f(t)*sin(t*Pi/ELL), t=0..2*ELL) / ELL ;
```

$$a1 := -\frac{6}{\pi^2}$$

$$b1 := 0 \qquad (4)$$

```
> a2 := int( f(t)*cos(2*t*Pi/ELL), t=0..2*ELL) / ELL ;
  b2 := int( f(t)*sin(2*t*Pi/ELL), t=0..2*ELL) / ELL ;
```

$$a2 := 0$$

$$b2 := 0 \qquad (5)$$

```
> a3 := int( f(t)*cos(3*t*Pi/ELL), t=0..2*ELL) / ELL ;
  b3 := int( f(t)*sin(3*t*Pi/ELL), t=0..2*ELL) / ELL ;
```

$$a3 := -\frac{2}{3\,\pi^2}$$

$$b3 := 0 \qquad (6)$$

```
> a4 := int( f(t)*cos(4*t*Pi/ELL), t=0..2*ELL) / ELL ;
  b4 := int( f(t)*sin(4*t*Pi/ELL), t=0..2*ELL) / ELL ;
```

$$a4 := 0$$

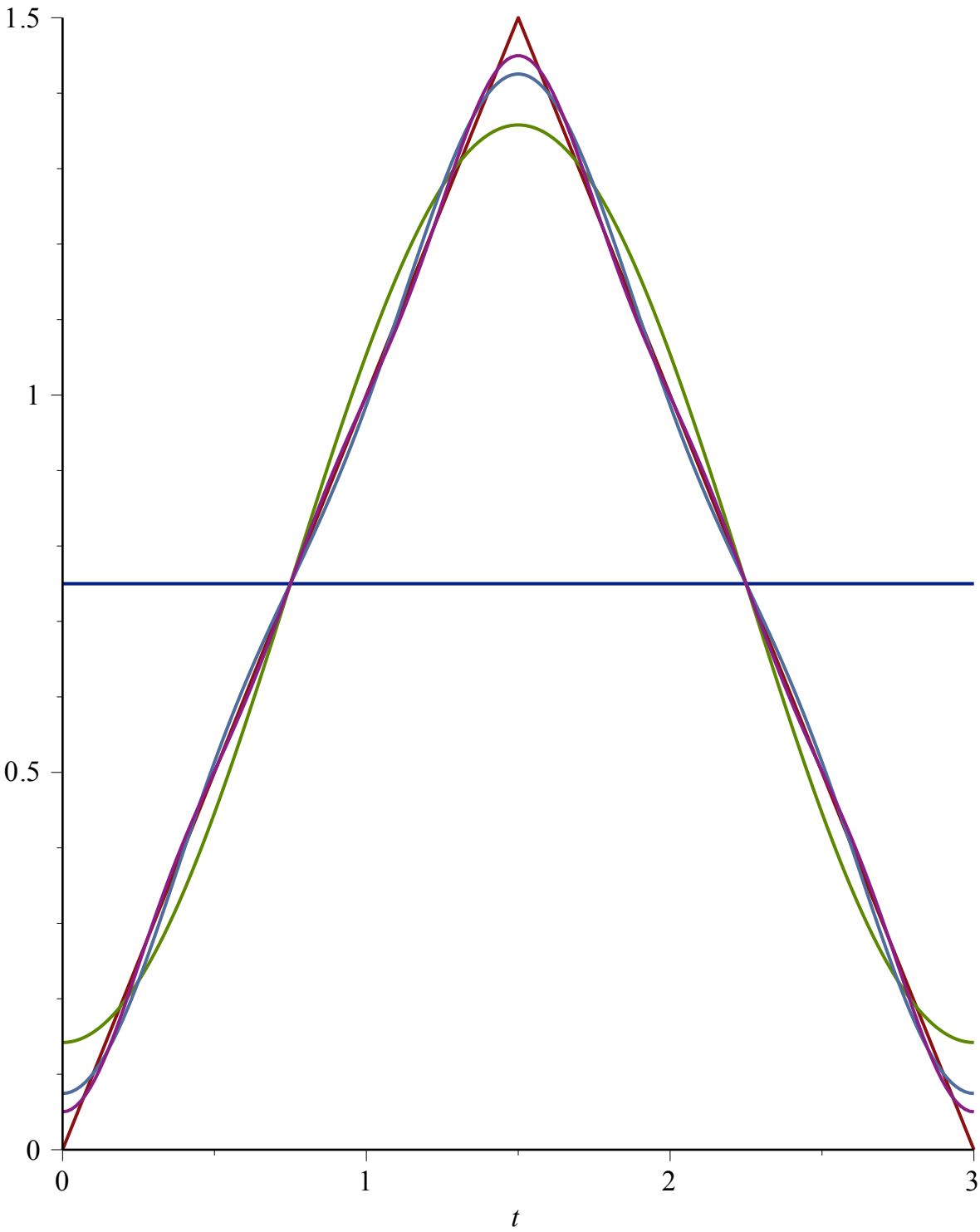
$$b4 := 0 \qquad (7)$$

```
> a5 := int( f(t)*cos(5*t*Pi/ELL), t=0..2*ELL) / ELL ;
  b5 := int( f(t)*sin(5*t*Pi/ELL), t=0..2*ELL) / ELL ;
```

$$a5 := -\frac{6}{25\,\pi^2}$$

$$b5 := 0 \qquad (8)$$

```
> plot( [f(t),a0/2,
         a0/2+a1*cos(t*Pi/ELL),
         a0/2+a1*cos(t*Pi/ELL)+a3*cos(3*t*Pi/ELL),
         a0/2+a1*cos(t*Pi/ELL)+a3*cos(3*t*Pi/ELL)+a5*cos(5*t*Pi/ELL)
  ],t=0..2*ELL) ;
```




```
> ak := int( f(t)*cos(k*t*Pi/ELL), t=0..2*ELL) / ELL ;
```

$$ak := \frac{3}{2}\,\frac{\sin(k\pi)\,k\pi+\cos(k\pi)-1}{k^2\,\pi^2}-\frac{3}{2}\,\frac{\sin(k\pi)\,k\pi+2\cos(k\pi)^2-\cos(k\pi)-1}{k^2\,\pi^2} \quad \textbf{(9)}$$

```
> ak := simplify(ak) assuming k::integer ;
```

(10)

$$ak := \frac{3\left(-1+(-1)^{k}\right)}{k^{2}\,\pi^{2}} \tag{10}$$

```
> ak := simplify(subs( k=2*q+1, ak)) assuming q::integer ;
```

$$ak := -\frac{6}{(2q+1)^{2}\,\pi^{2}} \tag{11}$$

```
> Sum( ak*cos((2*q+1)*t), q=0..infinity) ;
```

$$\sum_{q=0}^{\infty}\left(-\frac{6\cos((2q+1)t)}{(2q+1)^{2}\,\pi^{2}}\right) \tag{12}$$

```
> plot( sum( ak*cos((2*q+1)*t*Pi/ELL), q=0..5 ), t=-2*ELL..2*ELL) ;
```