

> #`Альромхин Джорж, гр.858301, Лаб 3

> $f := \text{piecewise}\left(-\pi \leq x < 0, \frac{\pi - x}{2}, 0 \leq x < \pi, -\frac{\pi}{2}\right)$

$$f := \begin{cases} \frac{\pi}{2} - \frac{x}{2} & -\pi \leq x < 0 \\ -\frac{\pi}{2} & 0 \leq x < \pi \end{cases}$$

(1)

> *fourierseries* := **proc**(*f*, *x*, *x1*, *x2*, *n*)

local *a*, *b*, *s*, *l*, *k*;

l := $\frac{(x2 - x1)}{2}$;

a[0] := $\frac{\text{int}(f, x = x1 .. x2)}{l}$;

a[*k*] := $\frac{\text{int}\left(f \cdot \cos\left(\frac{k \cdot \pi \cdot x}{l}\right), x = x1 .. x2\right)}{l}$;

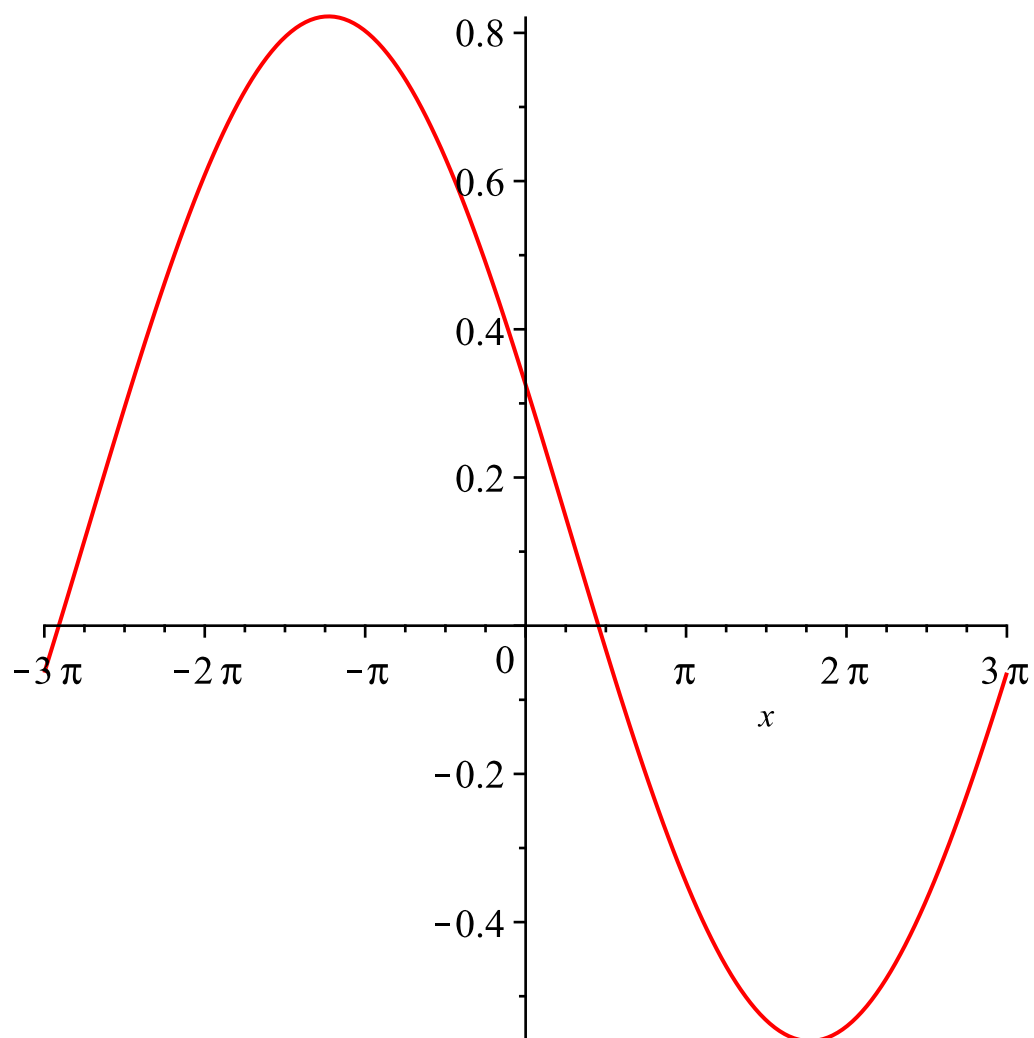
b[*k*] := $\frac{\text{int}\left(f \cdot \sin\left(\frac{k \cdot \pi \cdot x}{l}\right), x = x1 .. x2\right)}{l}$;

s := $\frac{a[0]}{2} + \text{sum}\left(a[k] \cdot \cos\left(\frac{k \cdot \pi \cdot x}{l}\right) + b[k] \cdot \sin\left(\frac{k \cdot \pi \cdot x}{l}\right), k = 1 .. n\right)$;

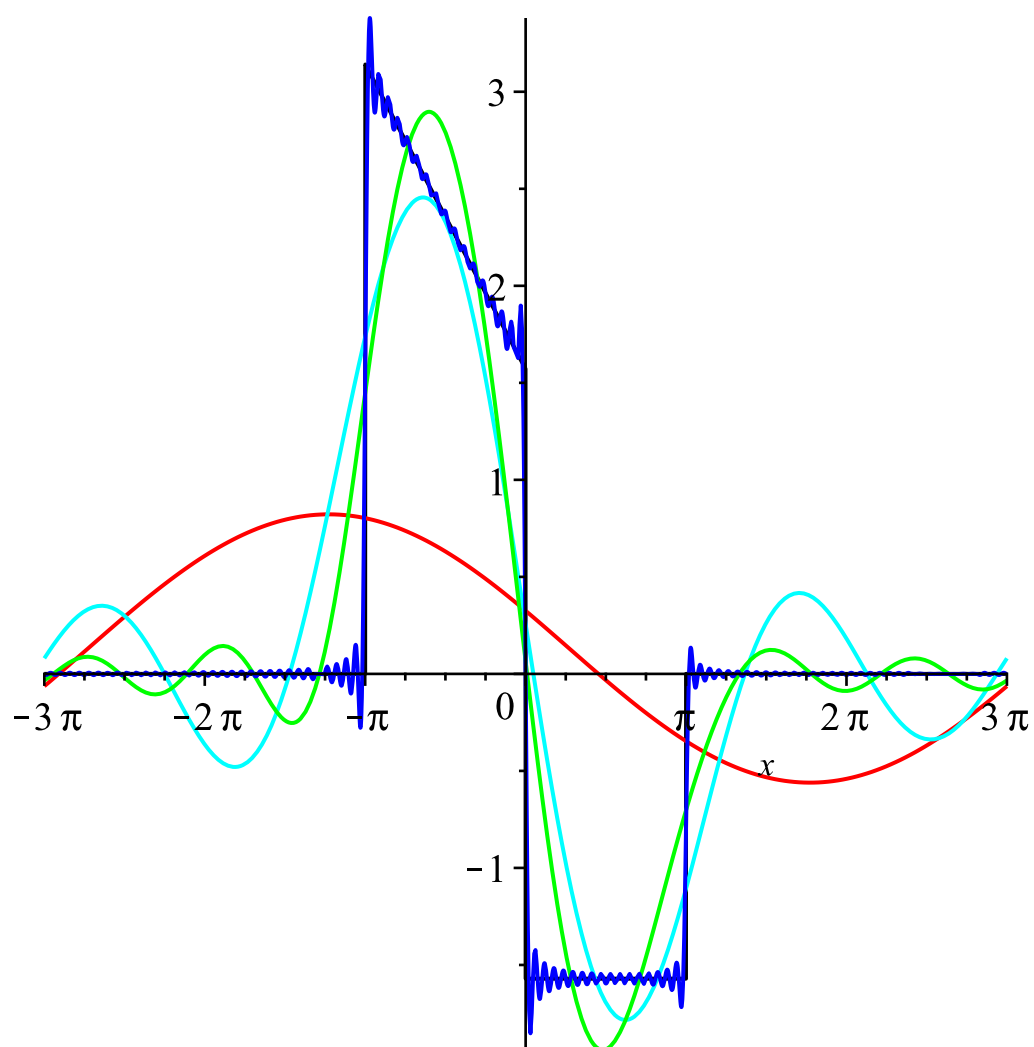
end proc;

> *g* := *t* → *fourierseries*(*f*, *x*, - 3 · π, 3 · π, *t*) :

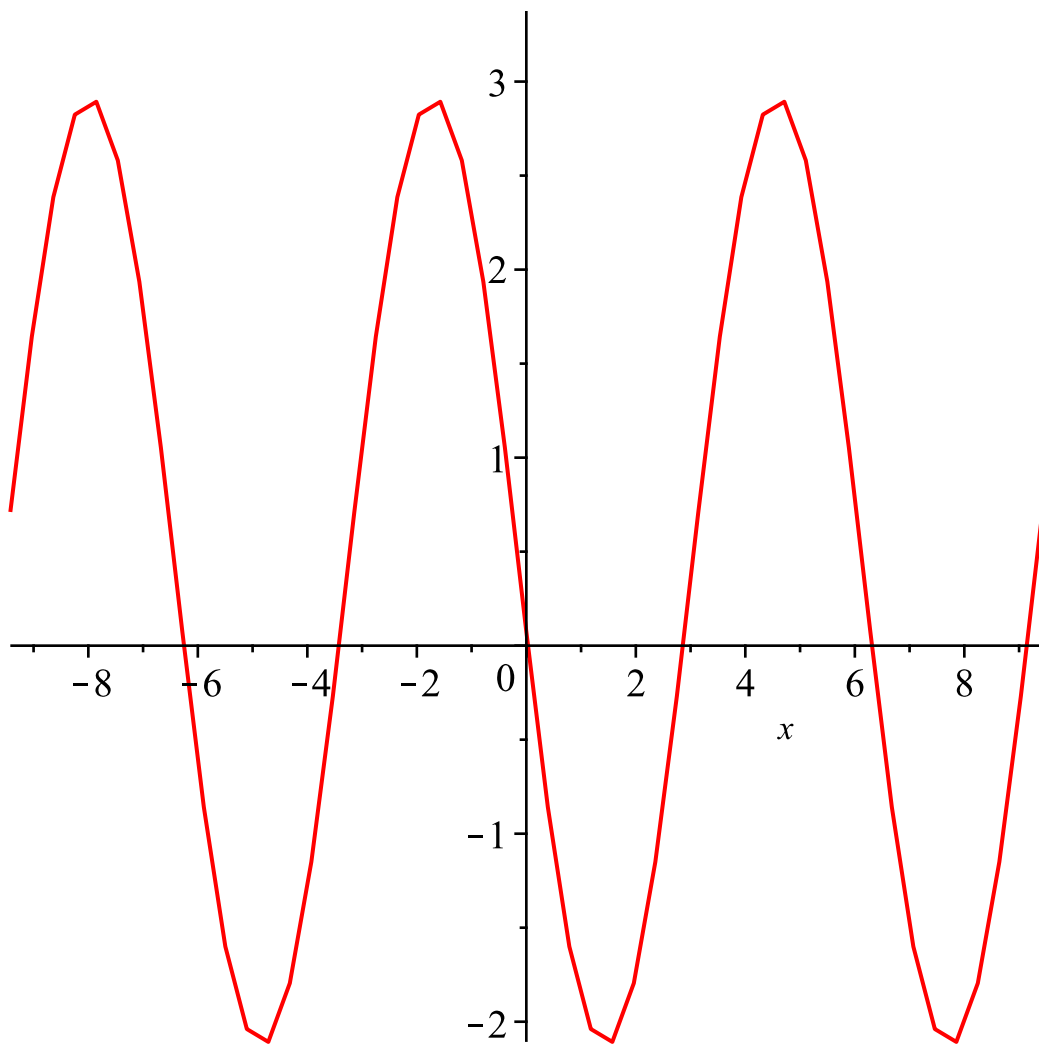
> *plot*(*g*(1), *x* = -3 · π .. 3 · π, *color* = red)



> `plot([f, g(1), g(3), g(7), g(100)], x = -3 · π .. 3 · π, color = [black, red, cyan, green, blue])`



> *with(plots) :*
animate(fourierseries(f, x, -π, π, t), x = - 3 · π .. 3 · π, t = 1 .. 10)



```
> # Task2
```

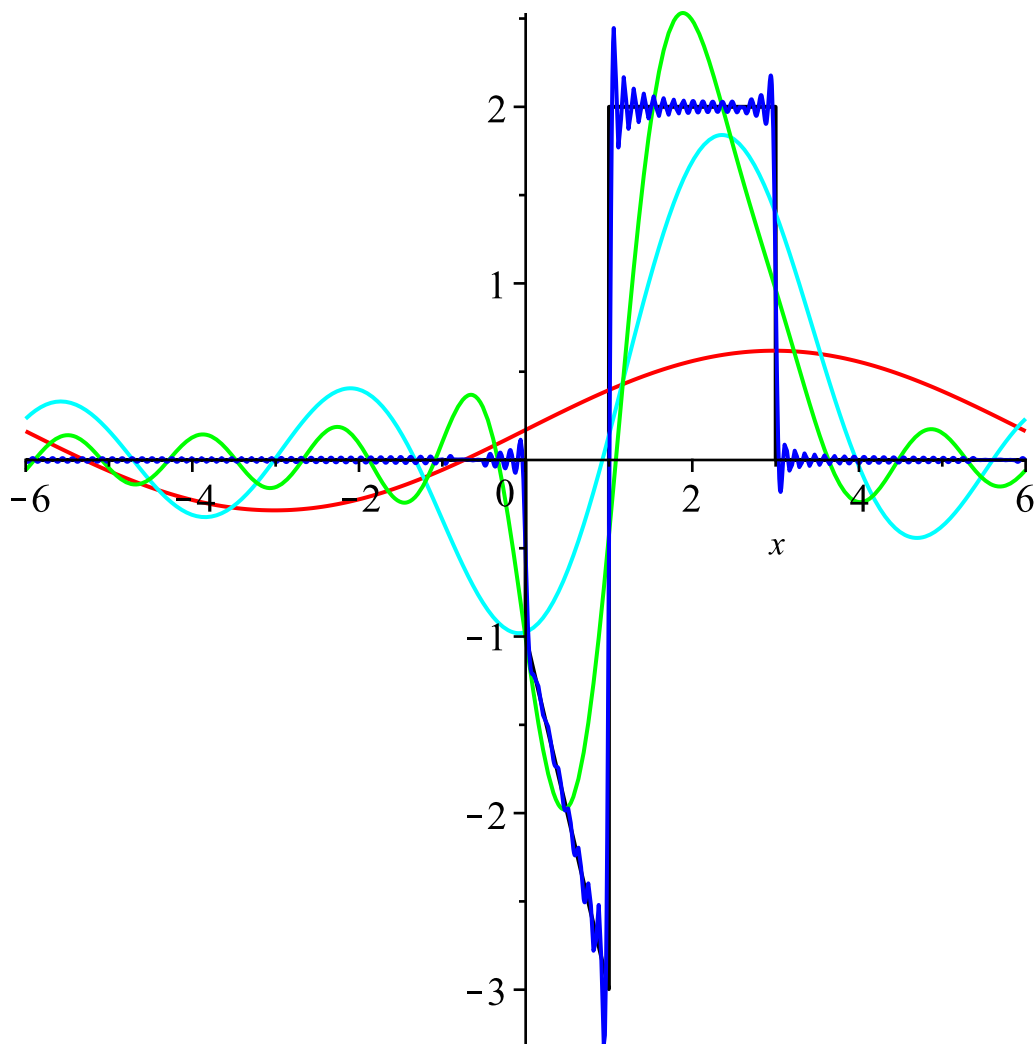
```
> f2 := piecewise(0 < x < 1, -2·x - 1, 1 ≤ x < 3, 2)
```

$$f2 := \begin{cases} -2x - 1 & 0 < x < 1 \\ 2 & 1 \leq x < 3 \end{cases}$$

(2)

```
> g2 := t → fourierseries(f2, x, -6, 6, t) :
```

```
> plot([f2, g2(1), g2(3), g2(7), g2(100)], x = -6..6, color = [black, red, cyan, green, blue])
```



> # Task3

> $y1 := x \rightarrow a \cdot x^2 + b \cdot x + c :$

$\text{solve}(\{$
 $y1(0) = -2.5,$
 $y1(1) = 0,$
 $y1(2) = -2.5,$
 $\}, [a, b, c])$

$[[a = -2.500000000, b = 5., c = -2.500000000]]$

(3)

> $y2 := x \rightarrow a \cdot x + b :$

$\text{solve}(\{$
 $y2(2) = -2.5,$
 $y2(4) = 0$
 $\}, [a, b])$

$[[a = 1.250000000, b = -5.]]$

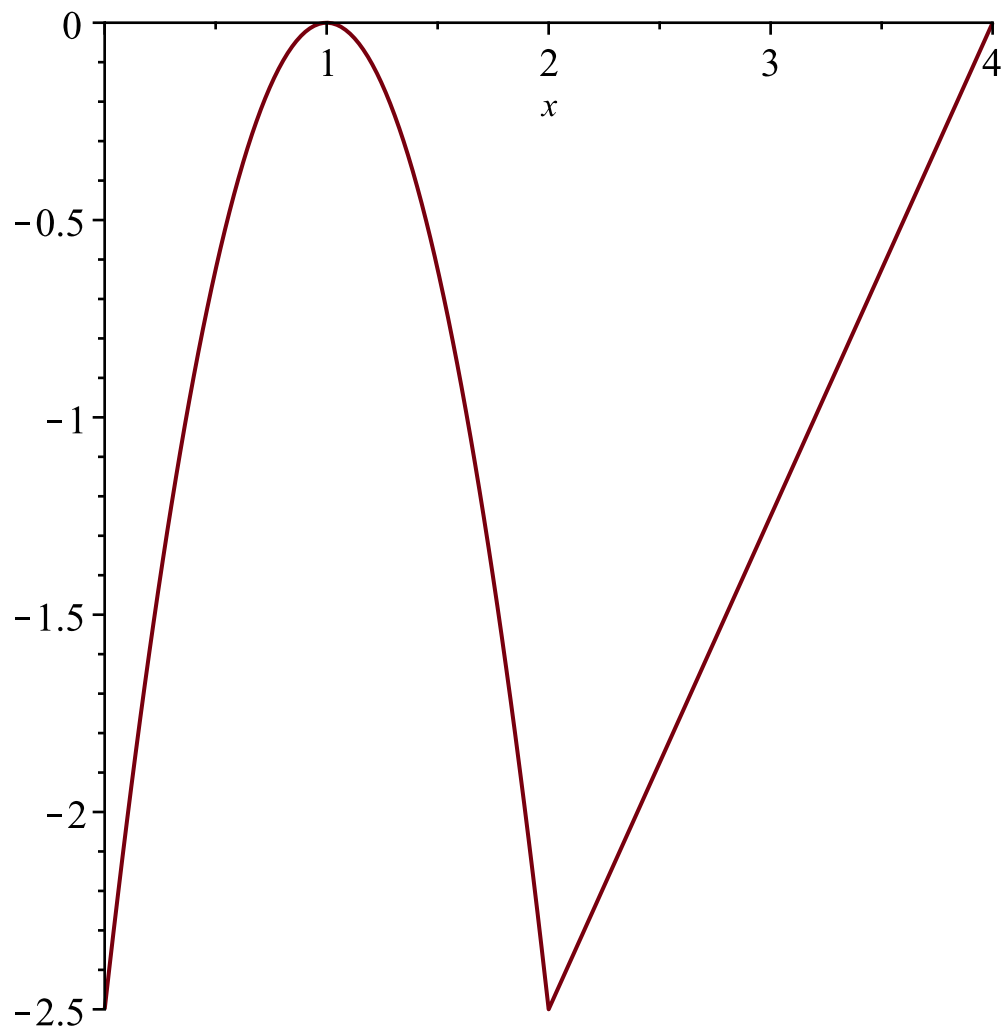
(4)

> $f3 := \text{piecewise}(0 \leq x < 2, -2.5 \cdot x^2 + 5 \cdot x - 2.5, 2 \leq x < 4, 1.25 x - 5)$

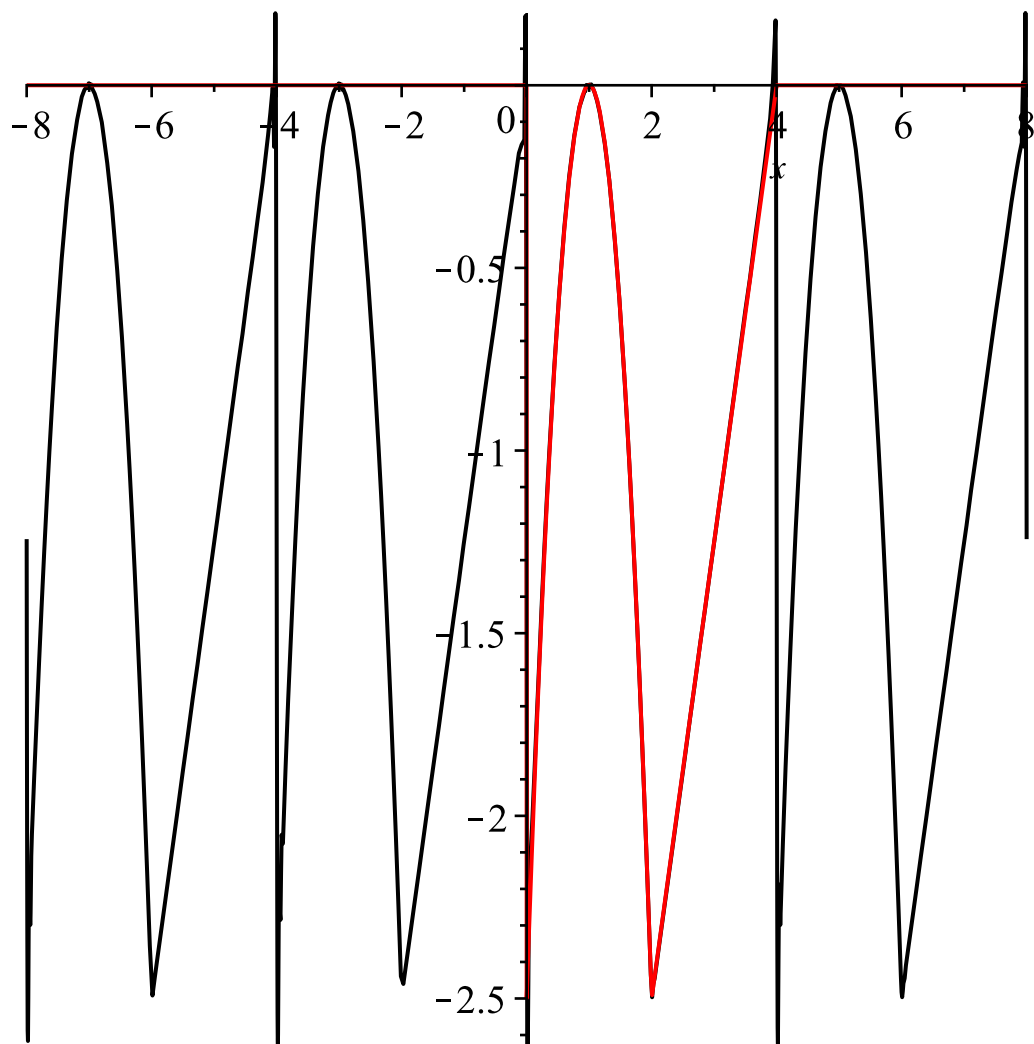
$$f3 := \begin{cases} -2.5 x^2 + 5 x - 2.5 & 0 \leq x < 2 \\ 1.25 x - 5 & 2 \leq x < 4 \end{cases}$$

(5)

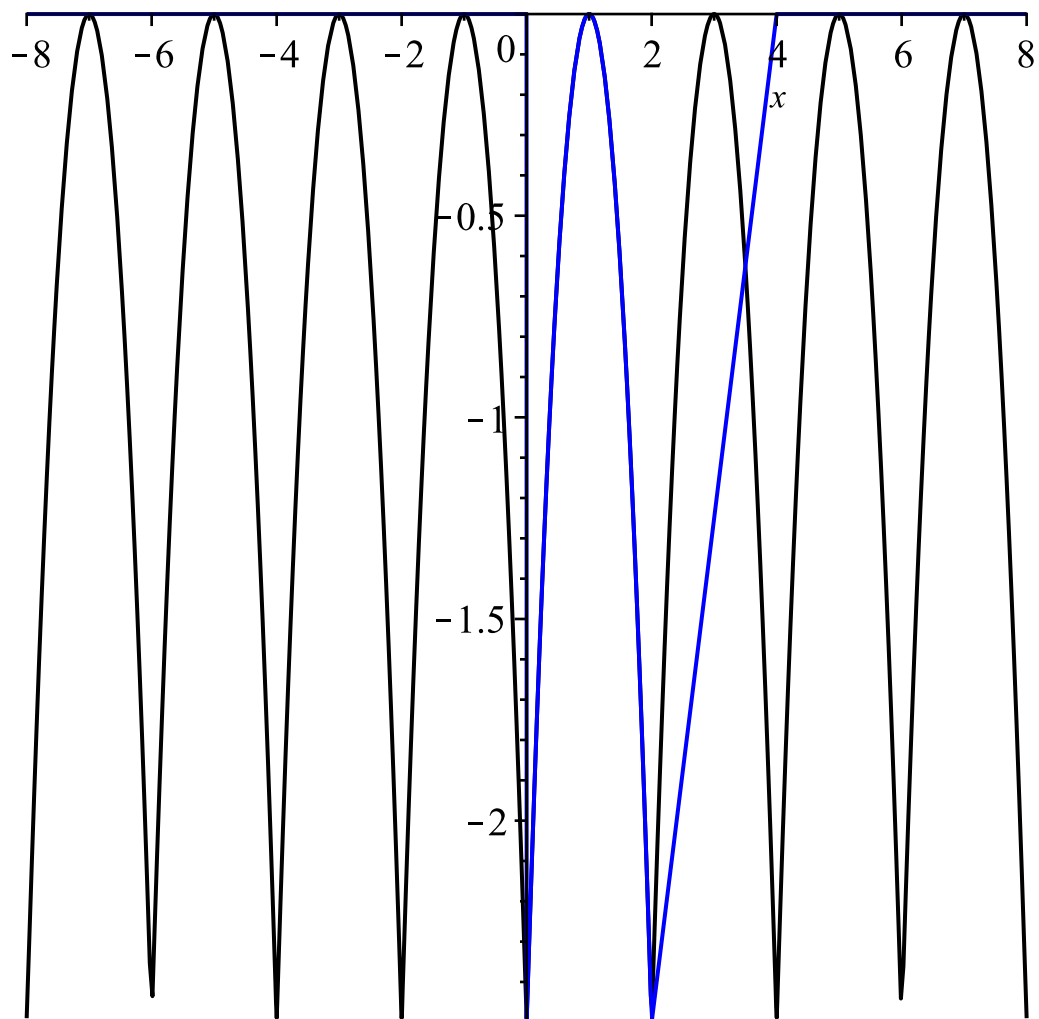
> *plot(f3, x=0..4)*



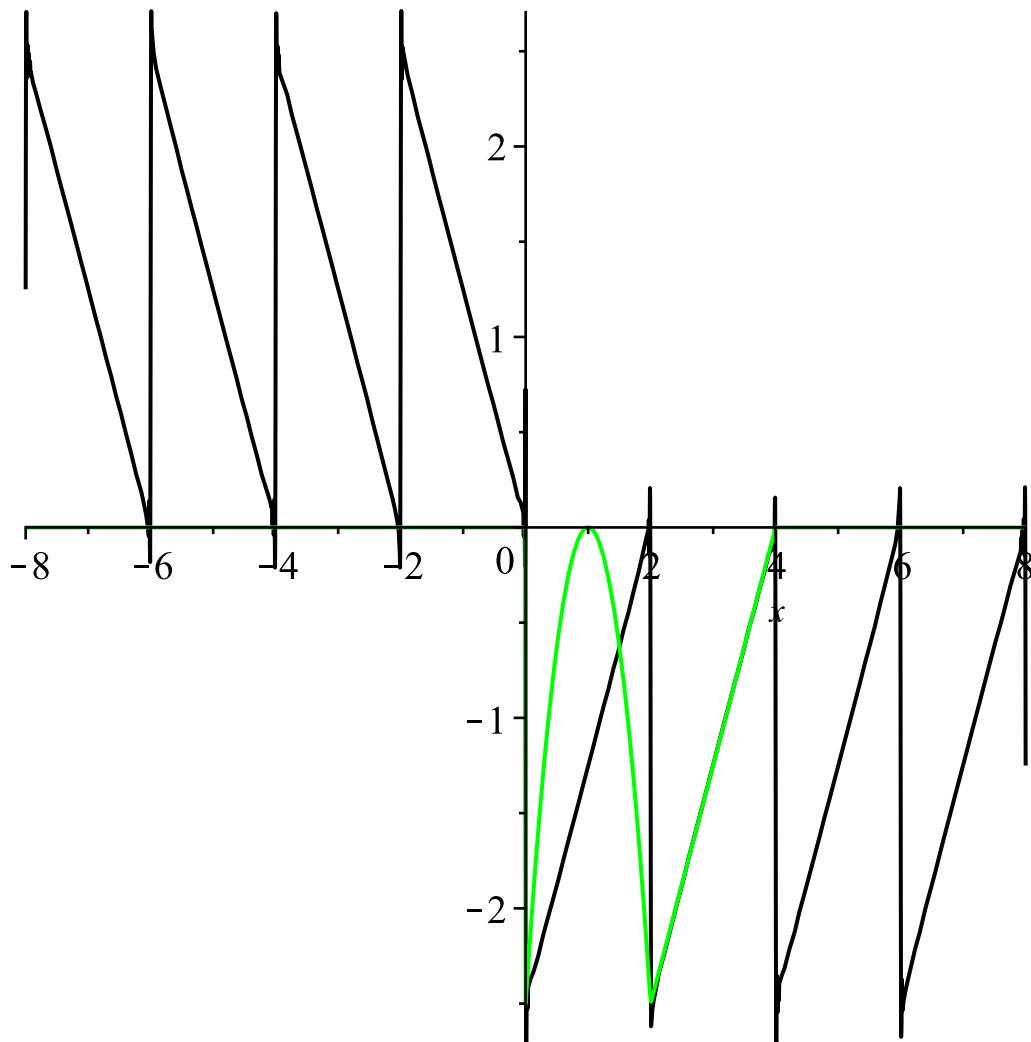
> *g1 := t→fourierseries(f3, x, 0, 4, t) :*
> *g2 := t→fourierseries(f3, x, 0, 2, t) :*
> *g31 := t→fourierseries(f3, x, 2, 4, t) :*
> *g32 := t→fourierseries(-f3, x, 2, 4, t) :*
> *g3 := t→piecewise(0 ≤ x, g31(t), x < 0, g32(t)) :*
> *plot({f3, g1(100)}, x=-8..8, color=[black, red])*



```
> plot( {f3, g2(100)}, x=-8..8, color=[black, blue])
```



`> plot({f3, g3(100)}, x=-8..8, color=[black, green])`



```
> # Task4
```

```
> f4_1 := 2 · sin3(4 · x)
```

$$f4_1 := 2 \sin(4x)^3$$

(6)

```
> f4_2 := 3 · arccos(x) + 2
```

$$f4_2 := 3 \arccos(x) + 2$$

(7)

```
> with(orthopoly) :
```

```
> with(numapprox) :
```

```
> cheb := proc(f, n)
```

```
  local s;
```

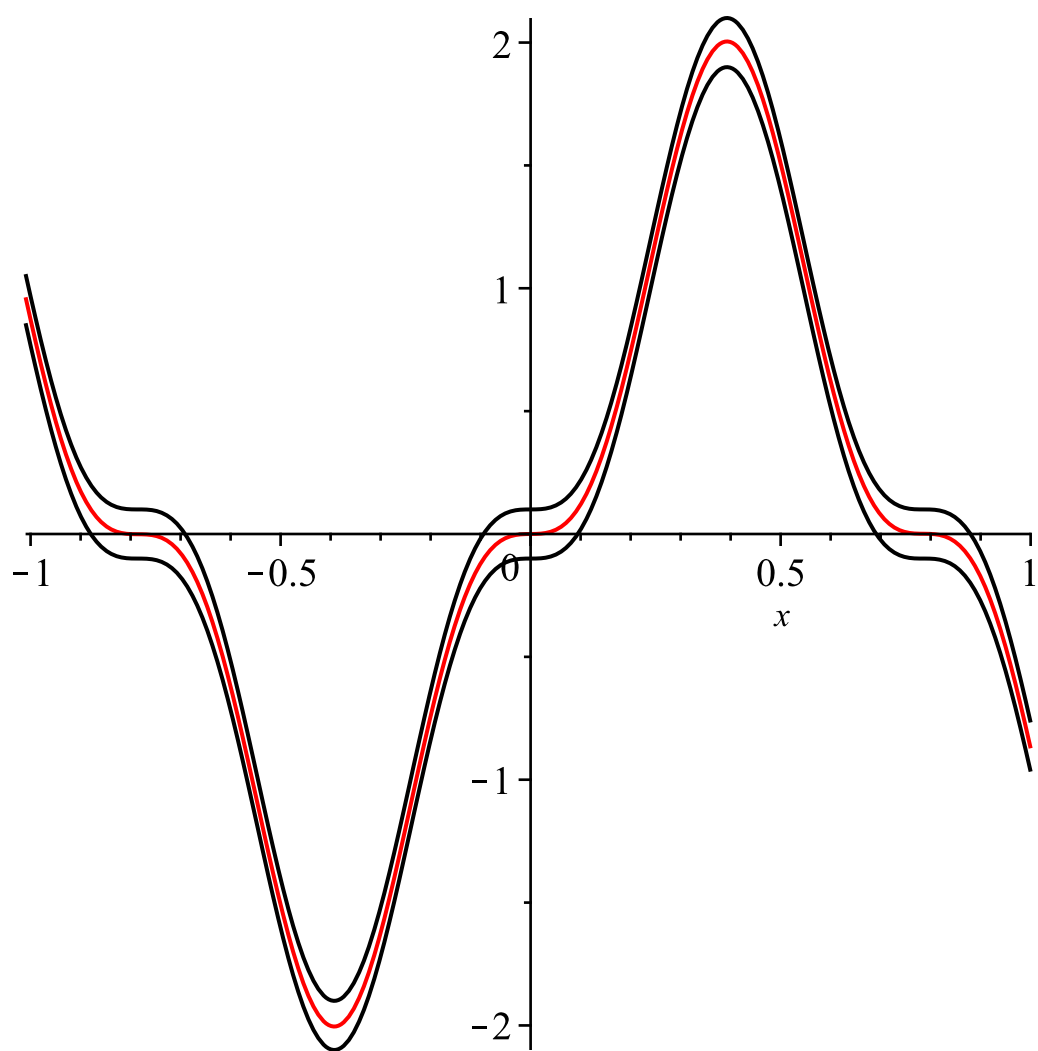
```
  with(numapprox) :
```

```
  Digits := n :
```

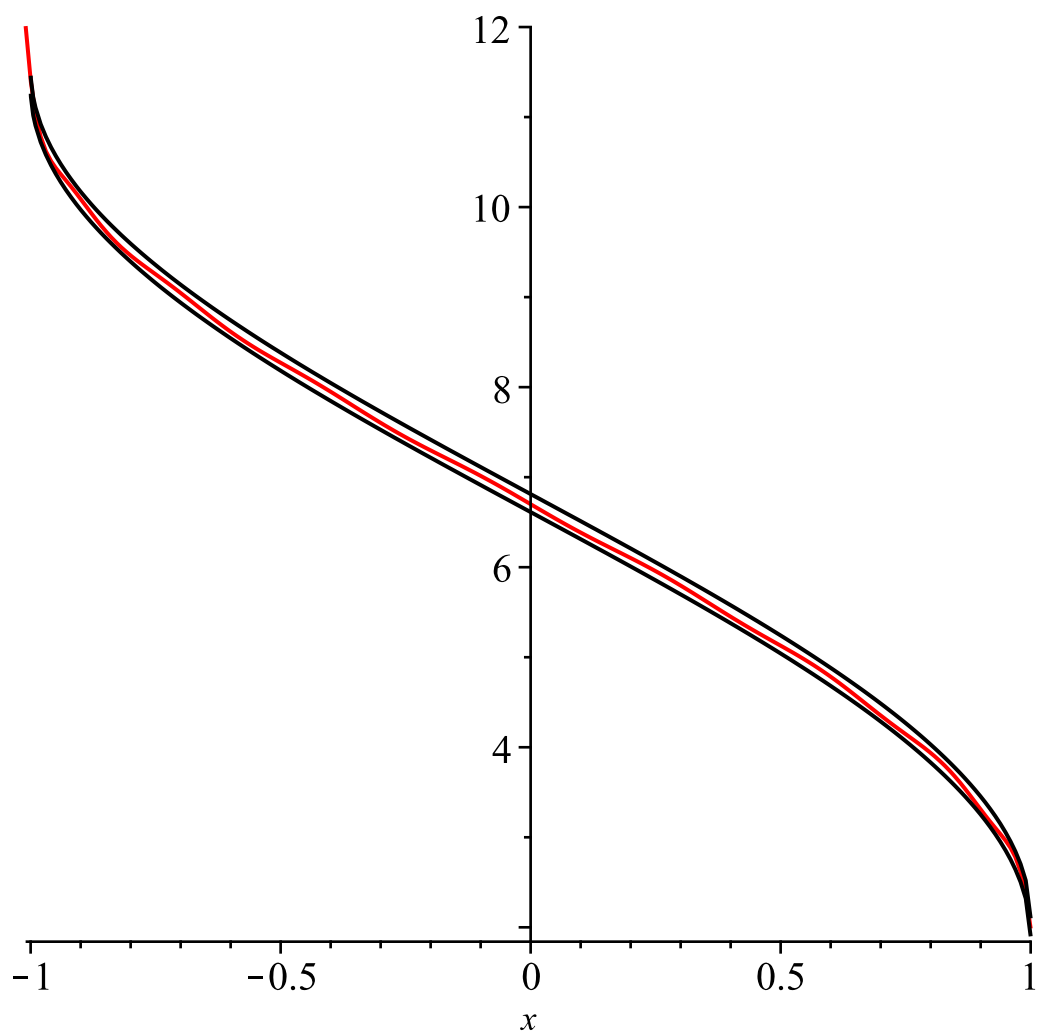
```
  s := chebyshev(f, x = -1 .. 1);
```

```
end proc;
```

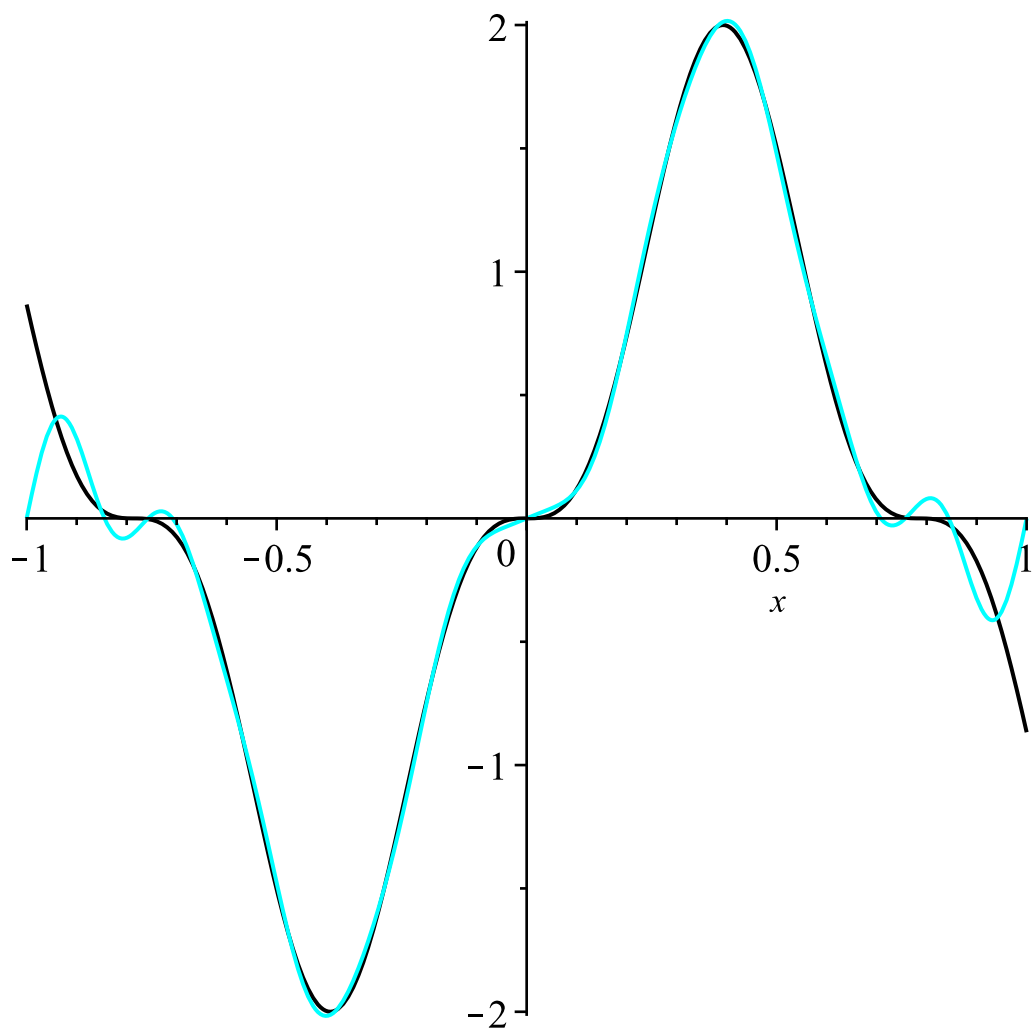
```
> plot([cheb(f4_1, 3), f4_1 + 0.1, f4_1 - 0.1], x = -1.01 .. 1, color = [red, black, black])
```



```
> plot([cheb(f4_2, 3), f4_2 + 0.1, f4_2 - 0.1], x = -1.01 .. 1, color = [red, black, black])
```



```
> plot([f4_1, fourierseries(f4_1, x, -1, 1, 10)], x=-1..1, color=[black, cyan])
```



```
> plot([f4_2, fourierseries(f4_2, x, -1, 1, 10)], x=-1..1, color=[black, green])
```

