```
> # FOURIER SINE SERIES OF A SQUARE WAVE

> # f(x) = 1 on (0,Pi); f(x) = -1 on (-Pi,0); f has period 2*Pi.

> # First we need to calculate the Fourier coefficients.
> bn := (2/Pi)*Int(sin(n*x), x=0..Pi);
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$$bn := \frac{2\left(\int_0^{\pi} \sin(n\,x)\,dx\right)}{\pi} \tag{1}$$

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> value(%);
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$$-\frac{2\left(-1+\cos(\pi\,n)\right)}{\pi\,n} \tag{2}$$

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> # This is 0 unless n is odd.

> # Note that, unlike the coefficients of the triangle wave, these
  decrease like 1/n, not 1/n^2.

> bodd := k -> (4/Pi)*(1/(2*k+1));
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$$bodd := k \to \frac{4}{\pi\,(2\,k+1)} \tag{3}$$

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> partialsum := K -> sum(bodd(k)*sin((2*k+1)*x), k=0..K);
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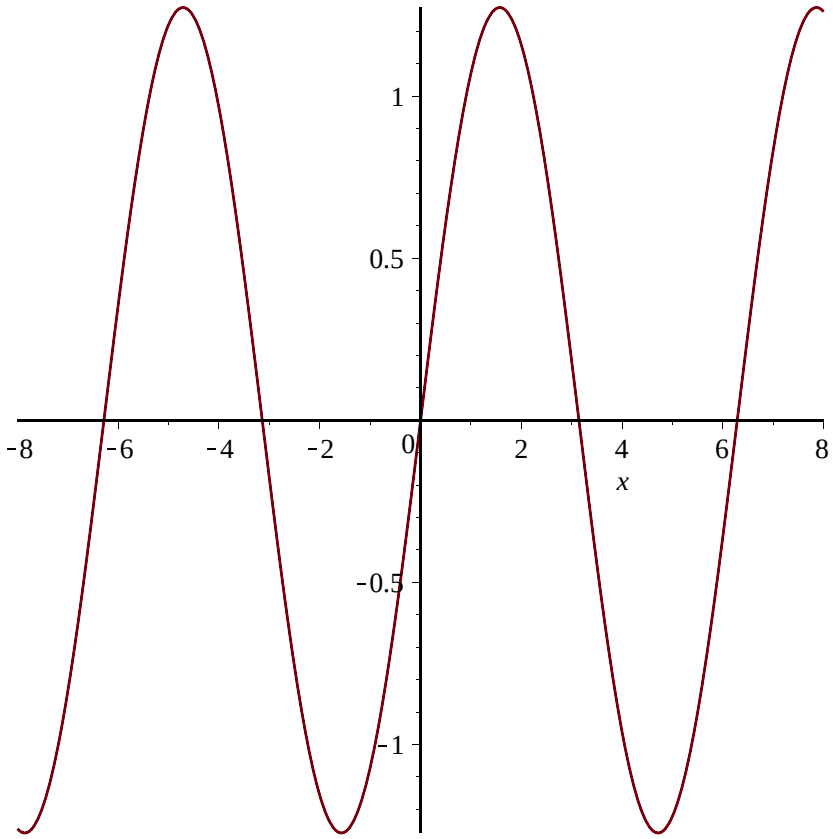
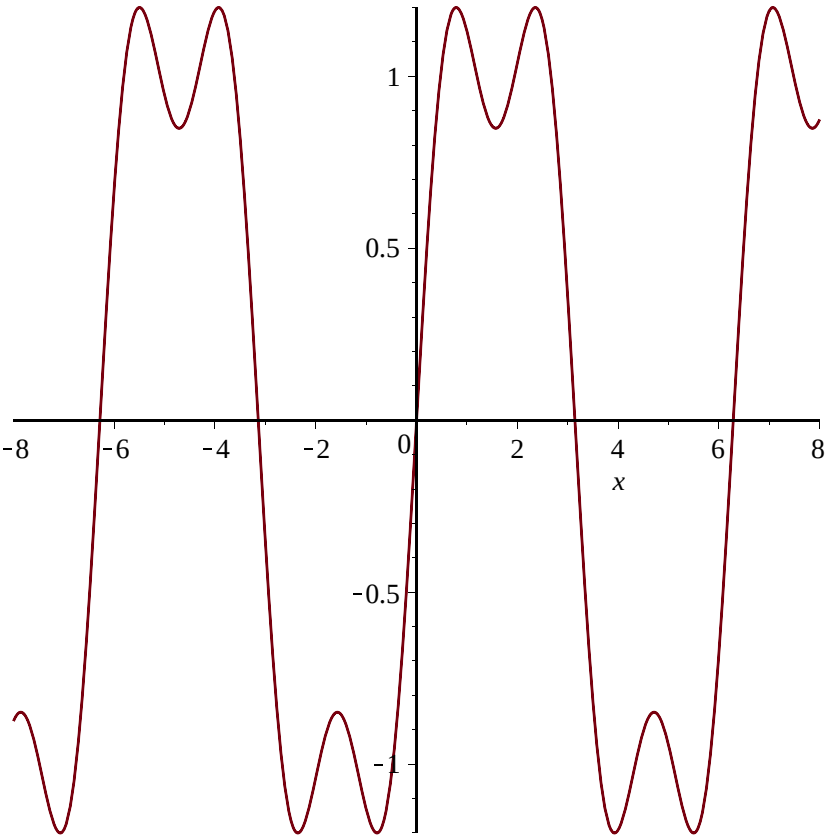
$$partialsum := K \to \sum_{k=0}^{K} bodd(k)\,\sin((2\,k+1)\,x) \tag{4}$$

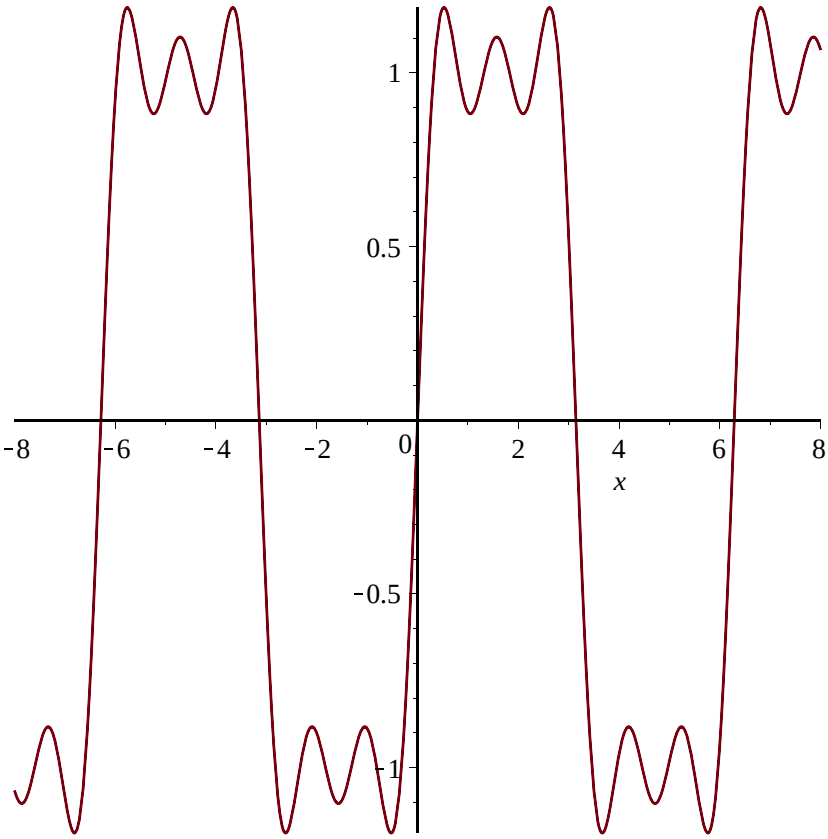
```
> plot(partialsum(0), x=-8..8);
```




```
> plot(partialsum(1), x=-8..8);
```




```
> plot(partialsum(2), x=-8..8);
```

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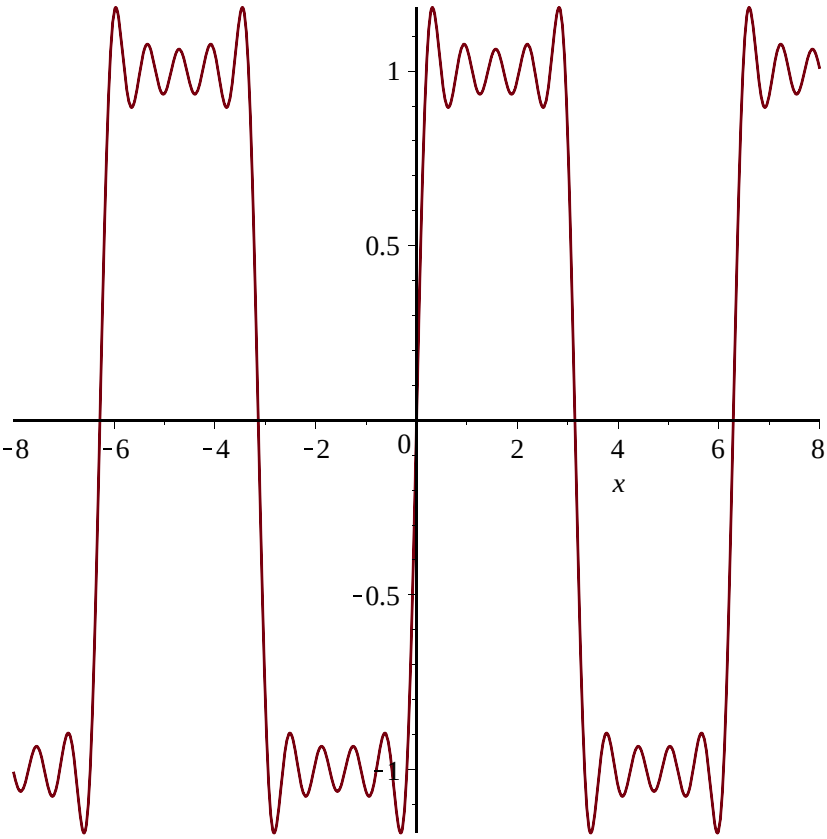
> plot(partialsum(4), x=-8..8);
```

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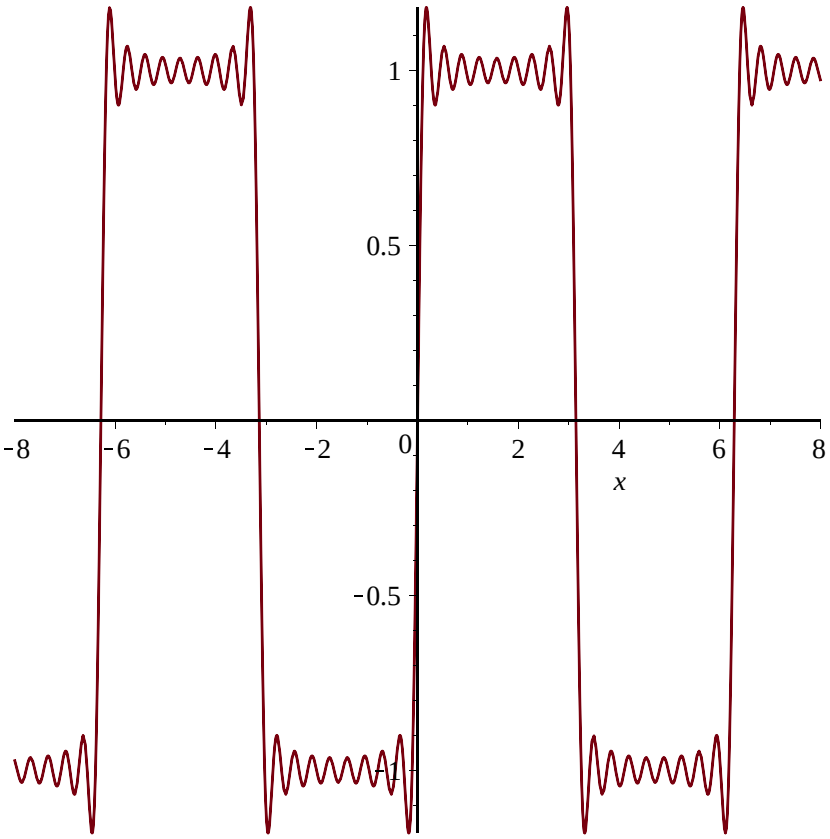
> plot(partialsum(8), x=-8..8);
```

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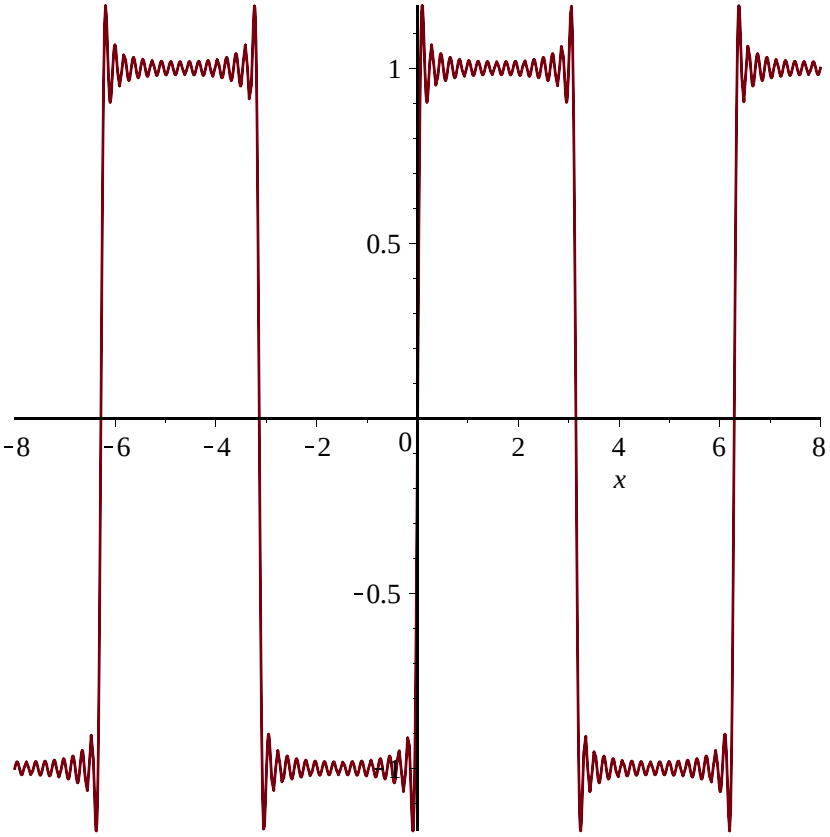
> plot(partialsum(16), x=-8..8);
```

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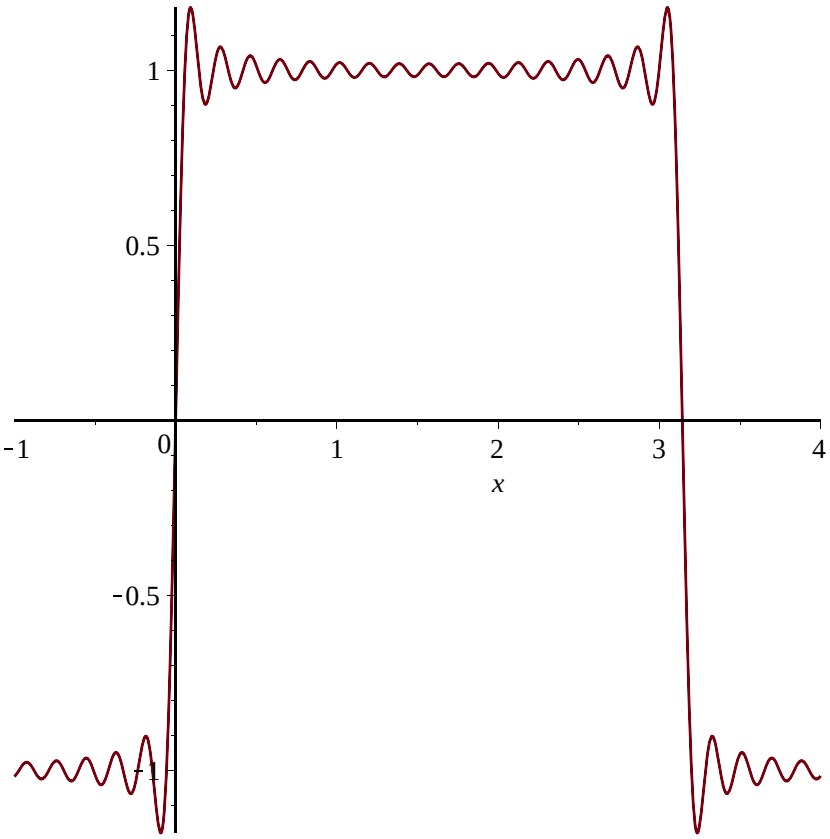
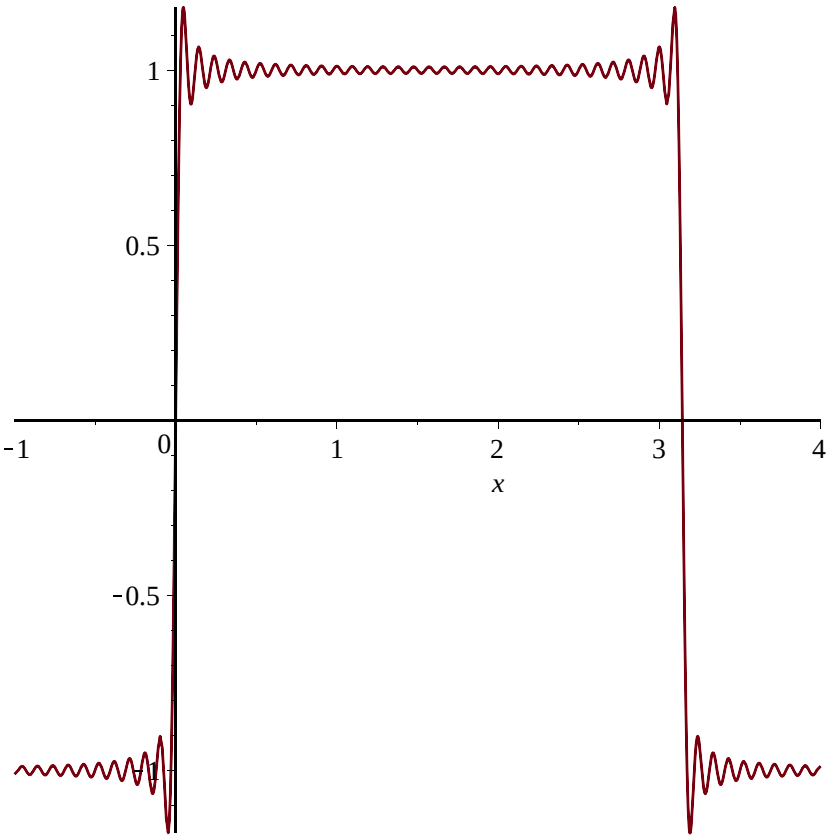
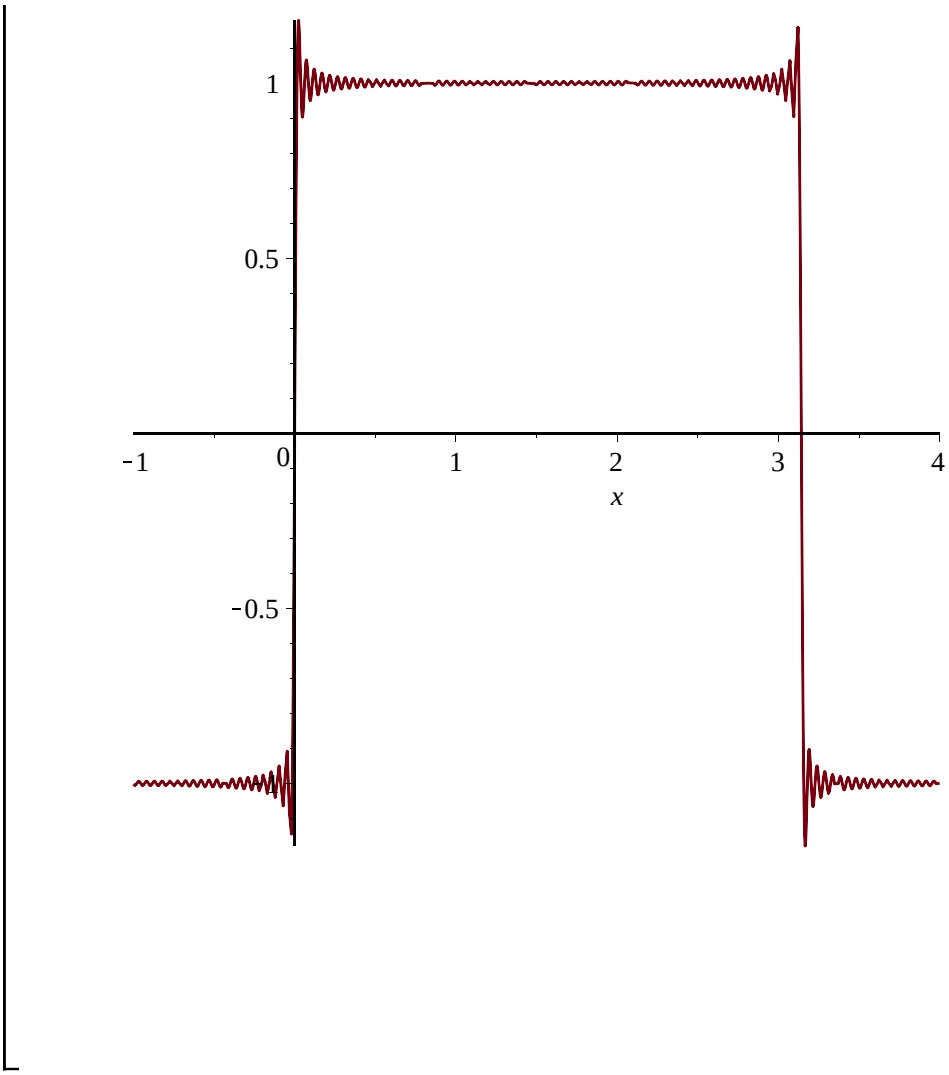
> # Let's look up close.
> plot(partialsum(16), x=-1..4);
```




```
> plot(partialsum(32), x=-1..4);
```




```
> plot(partialsum(64), x=-1..4);
```


1
0.5
-0.5
-1
0
1
2
3
4
x