```
load(orthopoly);
```

(%o1) /opt/homebrew/Cellar/maxima/5.47.0_19/share/maxima/5.47.0/share/orthopoly/orthopoly.lisp

Legendre polynomials

```
ratsimp(legendre_p(2,x));
```

$$\frac{3\,x^2-1}{2}$$

Normalization (note the interval, [-1,1])

```
integrate(legendre_p(2,x)·legendre_p(2,x),x,−1,1);
```

$$\frac{2}{5}$$

Ortogonality

```
integrate(legendre_p(2,x)·legendre_p(1,x),x,−1,1);
```

(%o4) 0

Testing some recursion relations (the sum must be zero)

```
n: 3;
```

n 3

1st relation

```
ratsimp(n·legendre_p(n−1,x)−(2·n+1)·x·legendre_p(n,x));
```

$$-\left(\frac{35\,x^4-30\,x^2+3}{2}\right)$$

```
ratsimp((n+1)·legendre_p(n+1,x));
```

$$\frac{35\,x^4-30\,x^2+3}{2}$$

2nd relation

```
ratsimp(diff(legendre_p(n+1,x),x) − (legendre_p(n,x) + 2·x·diff(legendre_p(n,x),x)));
```

(%o24) $-(3\,x)$

```
ratsimp(diff(legendre_p(n−1,x),x));
```

(%o26) $3\,x$

3rd relation

```
ratsimp(diff(legendre_p(n−1,x),x) + (2·n + 1)·legendre_p(n,x));
```

$$\frac{35\,x^3-15\,x}{2}$$

```
ratsimp(−diff(legendre_p(n+1,x),x));
```

$$-\left(\frac{35\,x^3-15\,x}{2}\right)$$

4th relation

```
ratsimp(diff(legendre_p(n−1,x),x)+n·legendre_p(n,x));
```

$$\frac{15\,x^3-3\,x}{2}$$

```
ratsimp(−x·diff(legendre_p(n,x),x));
```

$$-\left(\frac{15\,x^3-3\,x}{2}\right)$$

5th relation

```
ratsimp((n+1)·legendre_p(n,x) + x·diff(legendre_p(n,x),x));
```

(%o35) $\frac{35\,x^3-15\,x}{2}$

➔ `ratsimp(-diff(legendre_p(n+1,x),x));`

(%o36) $-\left(\frac{35\,x^3-15\,x}{2}\right)$