5-09 **<u>The Hermite Polinomials</u>**

```
> restart;
> with(orthopoly);
```

$$[G, H, L, P, T, U]$$

```
> for n from 0 to 7 do H(n,x) od;n:='n':
```

$$1$$

$$2x$$

$$-2+4x^2$$

$$8x^3-12x$$

$$12+16x^4-48x^2$$

$$32x^5-160x^3+120x$$

$$-120+64x^6-480x^4+720x^2$$

$$128x^7-1344x^5+3360x^3-1680x$$

```
>
```

1.

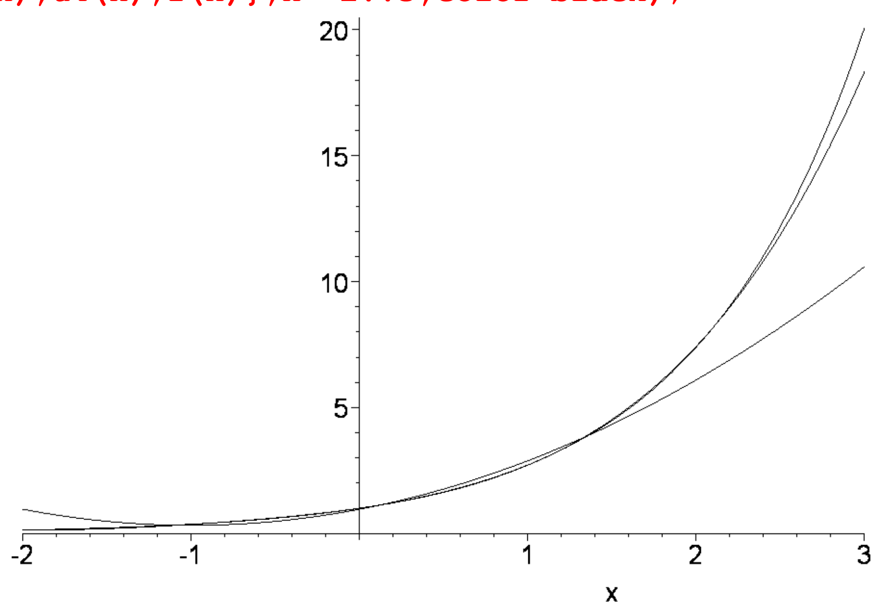
```
> f(x):=exp(x);
```

$$\mathrm{f}(x) := \mathbf{e}^x$$

```
> c[n]:=int(f(x)*H(n,x)*exp(-x^2),x=-infinity..infinity)/2^n/n!/sqrt
  (Pi);
```

$$c_n := \frac{1}{2^n\, n!\, \sqrt{\pi}} \int_{-\infty}^{\infty} \mathbf{e}^x\, \mathrm{H}(n, x)\, \mathbf{e}^{(-x^2)}\, dx$$

```
> u2(x):=sum(c[n]*H(n,x),n=0..2):
> u4(x):=sum(c[n]*H(n,x),n=0..4):
> plot({u2(x),u4(x),f(x)},x=-2..3,color=black);
```




```
>
```

2.

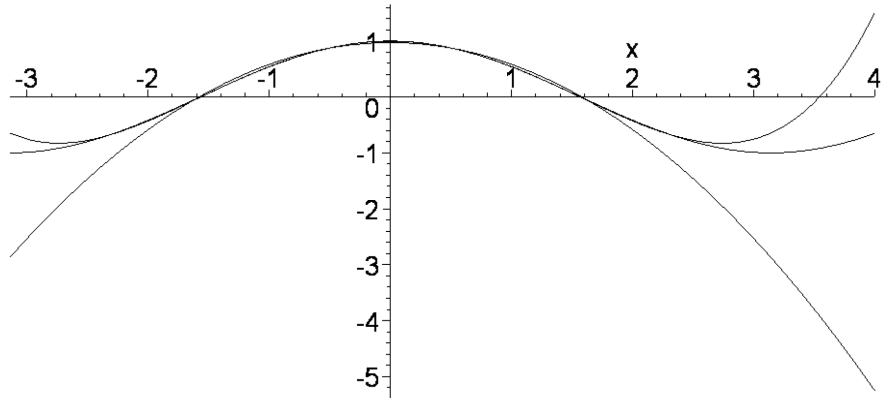
```
> f(x):=cos(x);
```

$$f(x) := \cos(x)$$

```
> c[n]:=int(f(x)*H(n,x)*exp(-x^2),x=-infinity..infinity)/2^n/n!/sqrt
  (Pi);
```

$$c_n := \frac{1}{2^n\, n!\, \sqrt{\pi}} \int_{-\infty}^{\infty} \cos(x)\, \mathrm{H}(n, x)\, \mathbf{e}^{(-x^2)}\, dx$$

```
> u2(x):=sum(c[n]*H(n,x),n=0..2):
> u4(x):=sum(c[n]*H(n,x),n=0..4):
> plot({u2(x),u4(x),f(x)},x=-Pi..4,color=black);
```



3.

```
> f(x):=Heaviside(x);
```

$$f(x) := \mathrm{Heaviside}(x)$$

```
> c[n]:=int(f(x)*H(n,x)*exp(-x^2),x=-infinity..infinity)/2^n/n!/sqrt
  (Pi);
```

$$c_n := \frac{1}{2^n\, n!\, \sqrt{\pi}} \int_{0}^{\infty} \mathrm{H}(n, x)\, \mathbf{e}^{(-x^2)}\, dx$$

```
> u4(x):=sum(c[n]*H(n,x),n=0..4):
> u8(x):=sum(c[n]*H(n,x),n=0..8):
> plot({u4(x),u8(x),f(x)},x=-3..3,color=black);
```