

# Inlever Ma 40901

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Opgave: als  $\mathcal{F}(x) = e^{-x^2/2}$ , dan is  $\mathcal{F}f(w) = e^{-w^2/2}$ .

a) Wat is de Fourier getransformeerde van  $x^n e^{-x^2/2}$ ?  
voor  $n = 1, 2$  en  $3$ .

$$A: \mathcal{F}(x^n e^{-x^2/2}) = (i \frac{d}{dw})^n e^{-w^2/2}$$

Voor  $n = 1, 2$  en  $3$ :

$$n=1: \mathcal{F}(x e^{-x^2/2}) = -i w e^{-w^2/2}$$

$$\begin{aligned} n=2: \mathcal{F}(x^2 e^{-x^2/2}) &= i \frac{d}{dw} (-i w e^{-w^2/2}) \\ &= e^{-w^2/2} (1 - w^2) \end{aligned}$$

$$\begin{aligned} n=3: \mathcal{F}(x^3 e^{-x^2/2}) &= i \frac{d}{dw} ((1 - w^2) e^{-w^2/2}) \\ &= -2i w e^{-w^2/2} - iw(1 - w^2) e^{-w^2/2} \\ &= -i(3w - w^3) e^{-w^2/2} \end{aligned}$$

b) Wat is de Fourier getransformeerde van  $\frac{d^n}{dx^n} e^{-x^2/2}$  voor  $n = 1, 2$  en  $3$ ?

$$A: \mathcal{F}\left(\frac{d^n}{dx^n} e^{-x^2/2}\right) = (iw)^n e^{-w^2/2}$$

$$\text{dus } \mathcal{F}(-x e^{-x^2/2}) = iw e^{-w^2/2}$$

$$\mathcal{F}((x^2 - 1) e^{-x^2/2}) = -w^2 e^{-w^2/2}$$

$$\mathcal{F}((3x - x^3) e^{-x^2/2}) = -i w^3 e^{-w^2/2}$$