Numerisk integrasjon

Vi kan bruke *Student[Calculus1]*-pakken til å regne ut integraler numerisk med trapesmetoden eller Simpsons metode. Den er også fin til å bruke til å visualisere situasjonen. Vi går frem slik:

```
with(Student[Calculus1])
```

[*AntiderivativePlot*, *AntiderivativeTutor*, *ApproximateInt*, *ApproximateIntTutor*, *ArcLength*, *ArcLengthTutor*, *Asymptotes*, *Clear*, *CriticalPoints*, *CurveAnalysisTutor*, *DerivativePlot*, *DerivativeTutor*, *DiffTutor*, *ExtremePoints*, *FunctionAverage*, *FunctionAverageTutor*, *FunctionChart*, *FunctionPlot*, *GetMessage*, *GetNumProblems*, *GetProblem*, *Hint*, *InflectionPoints*, *IntTutor*, *Integrand*, *InversePlot*, *InverseTutor*, *LimitTutor*, *MeanValueTheorem*, *MeanValueTheoremTutor*, *NewtonQuotient*, *NewtonsMethod*, *NewtonsMethodTutor*, *PointInterpolation*, *RiemannSum*, *RollesTheorem*, *Roots*, *Rule*, *Show*, *ShowIncomplete*, *ShowSolution*, *ShowSteps*, *Summand*, *SurfaceOfRevolution*, *SurfaceOfRevolutionTutor*, *Tangent*, *TangentSecantTutor*, *TangentTutor*, *TaylorApproximation*, *TaylorApproximationTutor*, *Understand*, *Undo*, *VolumeOfRevolution*, *VolumeOfRevolutionTutor*, *WhatProblem*] **(1)**

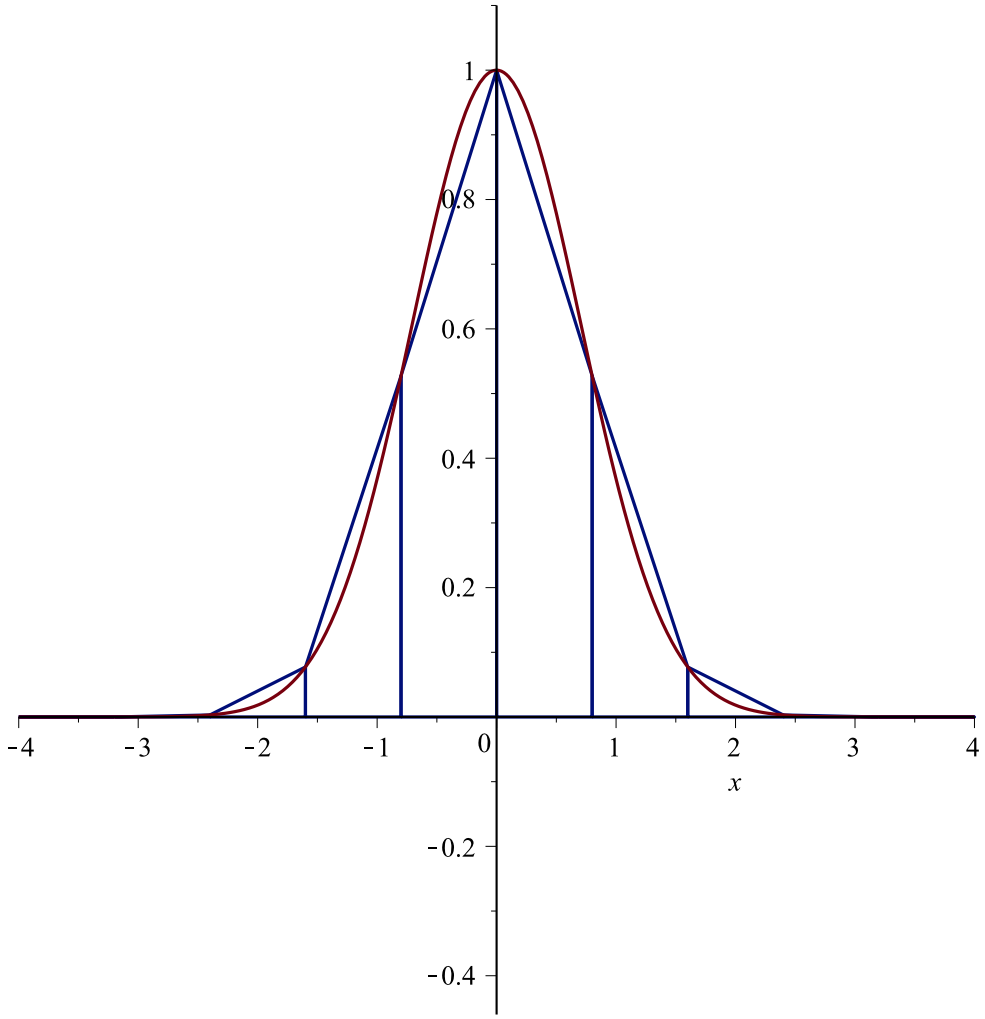
Vi vil approksimere det bestemte integralet

```
Int(exp(-x^2), x=-4..4)
```

$$\int_{-4}^{4} e^{-x^2}\,dx \quad \textbf{(2)}$$

Først gjør vi dette med Trapesmetoden:

```
ApproximateInt(exp(-x^2), -4..4, method=trapezoid, output=plot)
```



An approximation of $\int_{-4}^{4} f(x)\ dx$ using trapezoid rule, where $f(x) = e^{-x^2}$ and the partition is uniform. The approximate value of the integral is 1.772454472. Number of subintervals used: 10.

Vi kan også få ut summen Maple bruker for å regne ut tilnærmingen slik:

$$ApproximateInt\left(\exp\left(-x^2\right), -4..4, method = trapezoid, output = sum\right)$$

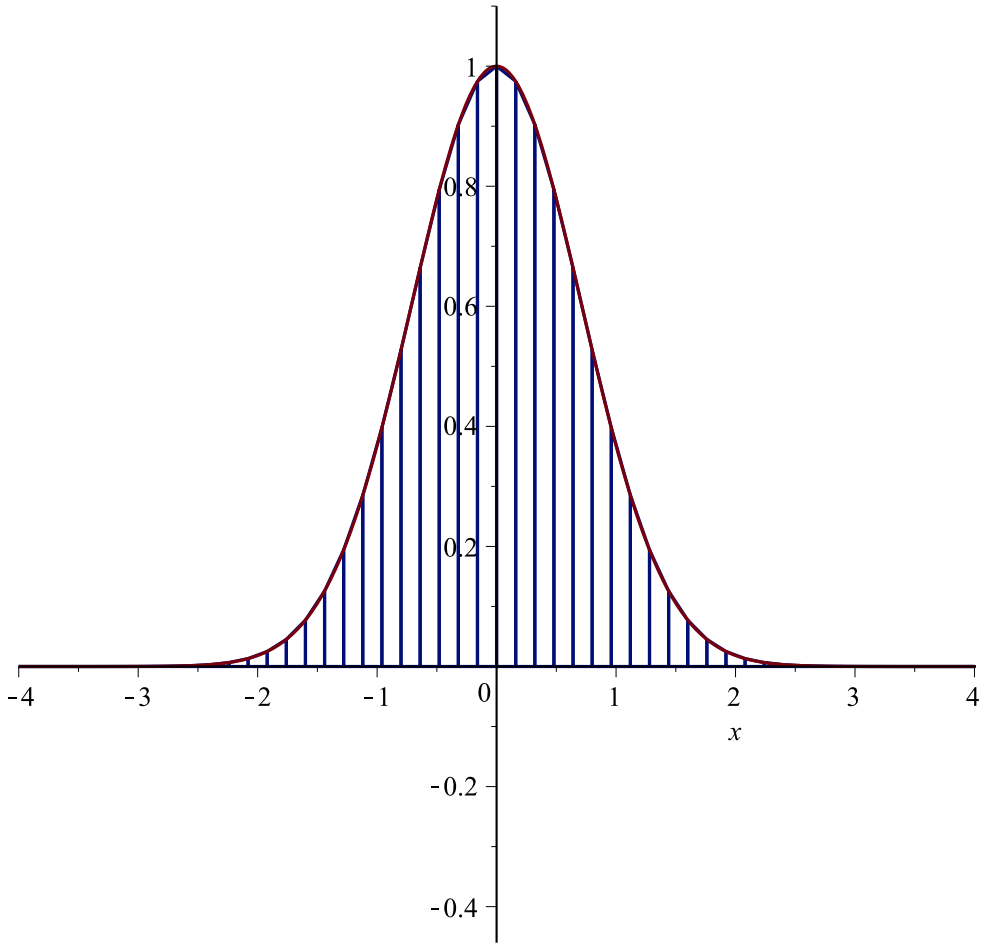
$$\frac{2}{5}\sum_{i=0}^{9}\left(e^{-\left(-4+\frac{4}{5}i\right)^2} + e^{-\left(-\frac{16}{5}+\frac{4}{5}i\right)^2}\right) \qquad \textbf{(3)}$$

$evalf(\%)$

1.772453580 **(4)**

Vi kan selv bestemme antal partisjoner med kommandoen *partition*:

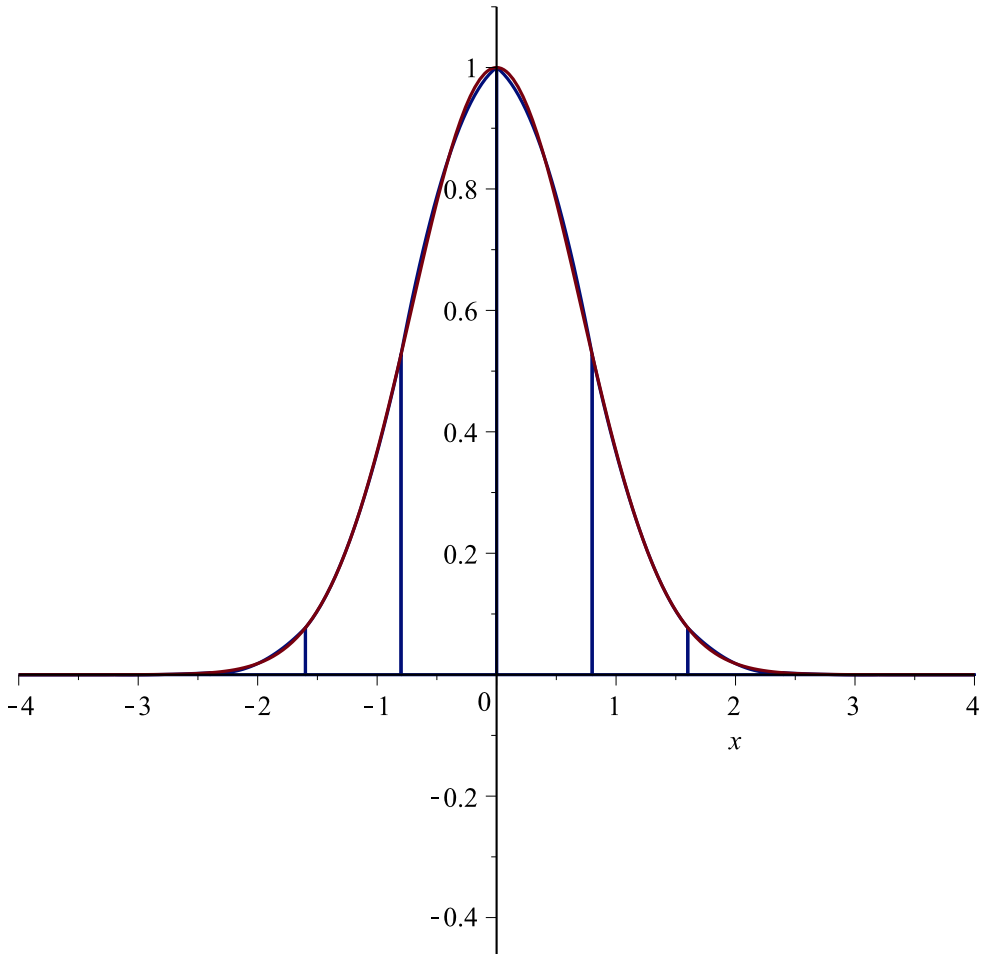
$$ApproximateInt\left(\exp\left(-x^2\right), -4..4, method = trapezoid, output = plot, partition = 50\right)$$



An approximation of $\int_{-4}^{4} f(x)\,dx$ using trapezoid rule, where $f(x) = e^{-x^2}$ and the partition is uniform. The approximate value of the integral is 1.772453820. Number of subintervals used: 50.

Vil vi heller bruke Simpsons metode skriver vi bare

$$ApproximateInt\left(\exp\left(-x^2\right),\ -4\ ..4,\ method=simpson,\ output=plot\right)$$



An approximation of $\int_{-4}^{4} f(x)\ dx$ using Simpson's rule, where $f(x) = e^{-x^2}$ and the partition is uniform. The approximate value of the integral is 1.772453579. Number of subintervals used: 10.

Også her kan vi forandre antal subintervaller vi bruker. For Simpsons metode ser summen slik ut:

$$ApproximateInt\left(\exp\left(-x^2\right),\ -4\ ..4,\ method=simpson,\ output=sum\right)$$

$$\frac{2}{15}\sum_{i=0}^{9}\left(e^{-\left(-4+\frac{4}{5}i\right)^2}+4\,e^{-\left(-\frac{18}{5}+\frac{4}{5}i\right)^2}+e^{-\left(-\frac{16}{5}+\frac{4}{5}i\right)^2}\right) \tag{5}$$