

# Differential Equations

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```
DSolve[y'[x] + a y[x] == 0, y[x], x]
```

```
{ {y[x] -> E^{-a x} C[1]} }
```

$$\int E^{a x} dx$$

$$\frac{E^{a x}}{a}$$

```
NIntegrate[x^3, {x, 0, 4}]
```

```
64.
```

?? BesselJ

BesselJ[n, z] gives the Bessel function of the first kind J(n, z).

```
Attributes[BesselJ] = {Listable, NumericFunction, Protected}
```

?? Series

Series[f, {x, x0, n}] generates a power series expansion for f about the point x = x0 to order (x - x0)^n. Series[f, {x, x0, nx}, {y, y0, ny}] successively finds series expansions with respect to y, then x.

```
Attributes[Series] = {Protected, ReadProtected}
```

```
Options[Series] = Analytic -> True
```

```
Series[BesselJ[0, x], {x, 0, 10}]
```

$$1 - \frac{x^2}{4} + \frac{x^4}{64} - \frac{x^6}{2304} + \frac{x^8}{147456} - \frac{x^{10}}{14745600} + O[x]^{12}$$

```
Series[BesselK[0, x], {x, 0, 4}]
```

$$(-\text{EulerGamma} + \text{Log}[2] - \text{Log}[x]) + \left( \frac{1}{8} (2 - 2 \text{EulerGamma}) + \frac{1}{4} (\text{Log}[2] - \text{Log}[x]) \right) x^2 + O[x]^4$$

```
Series[BesselJ[ $\frac{3}{2}$ , x], {x, 0, 6}]
```

$$\frac{1}{3} \sqrt{\frac{2}{\pi}} x^{3/2} - \frac{x^{7/2}}{15 \sqrt{2} \pi} + \frac{x^{11/2}}{420 \sqrt{2} \pi} + O[x]^{13/2}$$

```
DSolve[y''[x] + 6 y'[x] + 9 y[x] == 0, y[x], x]
```

```
{{y[x] -> E^{-3 x} C[1] + E^{-3 x} x C[2]}}
```