Anyagon való áthaladást tartalmazó differenciál egyenlet megoldására vonatkozó kísérlet

```
(%i1) f(z,x,omega):=A(z,x,omega)*exp(-%i*integrate(kz(z,x,omega),z)-%i*integrate(kx(z,x,omega),x)); /* Kezdeti egyenlet*/
```

$$\mathrm{f}\left(z\,,x\,,omega\right):=\mathrm{A}\left(z\,,x\,,omega\right)\exp\left(-\%i\int\mathrm{kz}\left(z\,,x\,,omega\right)dz-\%i\int\mathrm{kx}\left(z\,,x\,,omega\right)dx\right)\qquad(\%\ o1)$$

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(%i2) expr1(z,x,omega):=diff(f(z,x,omega),z,2)+diff(f(z,x,omega),x,2)+k(z,x,omega)^ 2*f(z,x,omega)$
expr2(z,x,omega):=expand(expr1(z,x,omega))$
expr2(z,x,omega); /* Alak egyszerűsítés nélkül */
```

$$-\left(\%i\,\mathrm{A}\left(z\,,x\,,omega\right)\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,omega)dz)-\%i\int\mathrm{kx}(z\,,x\,,omega)dx}\int\frac{d^2}{dx^2}\mathrm{kz}\left(z\,,x\,,omega\right)dz\right)\qquad(\%\ o4)$$

$$-\mathrm{A}\left(z\,,x\,,omega\right)\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,omega)dz)-\%i\int\mathrm{kx}(z\,,x\,,omega)dx}\int\frac{d}{dx}\mathrm{kz}\left(z\,,x\,,omega\right)dz^{2}$$

$$-2\%i\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,omega)dz)-\%i\int\mathrm{kx}(z\,,x\,,omega)dx}\left(\frac{d}{dx}\mathrm{A}\left(z\,,x\,,omega\right)\right)$$

$$\int\frac{d}{dx}\mathrm{kz}\left(z\,,x\,,omega\right)dz-2\,\mathrm{A}\left(z\,,x\,,omega\right)\mathrm{kx}\left(z\,,x\,,omega\right)\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,omega)dz)-\%i\int\mathrm{kx}(z\,,x\,,omega)dx}$$

$$\int\frac{d}{dx}\mathrm{kz}\left(z\,,x\,,omega\right)dz-\%i\,\mathrm{A}\left(z\,,x\,,omega\right)\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,omega)dz)-\%i\int\mathrm{kx}(z\,,x\,,omega)dx}$$

$$\int\frac{d^2}{dz^2}\mathrm{kx}\left(z\,,x\,,omega\right)dx-\mathrm{A}\left(z\,,x\,,omega\right)\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,omega)dz)-\%i\int\mathrm{kx}(z\,,x\,,omega)dx}$$

$$\int\frac{d}{dz}\mathrm{kx}\left(z\,,x\,,omega\right)dx^{2}-2\%i\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,omega)dz)-\%i\int\mathrm{kx}(z\,,x\,,omega)dx}\left(\frac{d}{dz}\mathrm{A}\left(z\,,x\,,omega\right)\right)$$

$$\int\frac{d}{dz}\mathrm{kx}\left(z\,,x\,,omega\right)dx-2\,\mathrm{A}\left(z\,,x\,,omega\right)\mathrm{kz}\left(z\,,x\,,omega\right)\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,omega)dz)-\%i\int\mathrm{kx}(z\,,x\,,omega)dx}\int\frac{d}{dz}\mathrm{kx}\left(z\,,x\,,omega\right)d$$

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(%i3) expr3(z,x,omega):=subst(0,diff(A(z,x,omega),z,2),expr2(z,x,omega))$
expr4(z,x,omega):=expand(expr3(z,x,omega))$
expr4(z,x,omega); /* d^ 2 A /dz^ 2 = 0*/
```

$$-\left(\%i\,\mathrm{A}\left(z\,,x\,,omega\right)\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,omega)dz)-\%i\int\mathrm{kx}(z\,,x\,,omega)dx}\int\frac{d^2}{dx^2}\mathrm{kz}\left(z\,,x\,,omega\right)dz\right)-\mathrm{A}\left(z\,,x\,,omega\right)\%e^{-(\%i\int\mathrm{kz}(z\,,x\,,on}$$

$$(\%\ o7)$$

```
(%i4) expr5(z,x,omega):=subst(zcumphase,integrate(kz(z,x,omega),z),expr4(z,x,omega))$
expr6(z,x,omega):=subst(xcumphase,integrate(kx(z,x,omega),x),expr5(z,x,omega))$
expand(expr6(z,x,omega)); /* Feltételezzük, hogy az integrálok kumulatív szummaként felírhatok */
```

$$-\left(\%i\,\mathrm{A}\left(z\,,x\,,omega\right)\int\frac{d^2}{dx^2}\mathrm{kz}\left(z\,,x\,,omega\right)dz\,\%e^{-(\%i\mathrm{zcumphase})-\%i\mathrm{xcumphase}}\right)-\mathrm{A}\left(z\,,x\,,omega\right)\int\frac{d}{dx}\mathrm{kz}\left(z\,,x\,,omega\right)dz^{2}\%e^{-(\%izc}$$

$$(\%\ o10)$$

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(%i5) expr7(z,x,omega):=expr6(z,x,omega)/%e^ (-%i*(zcumphase+xcumphase))$
expand(expr7(z,x,omega)); /* e^ fázis-sal való osztás*/
```

$$-\left(\%i\,\mathrm{A}\left(z\,,x\,,omega\right)\int\frac{d^2}{dx^2}\mathrm{kz}\left(z\,,x\,,omega\right)dz\right)-\mathrm{A}\left(z\,,x\,,omega\right)\int\frac{d}{dx}\mathrm{kz}\left(z\,,x\,,omega\right)dz^{2}-2\%i\left(\frac{d}{dx}\mathrm{A}\left(z\,,x\,,omega\right)\right)\int\frac{d}{dx}\mathrm{k}$$

$$(\%\ o12)$$