```
> restart;alias(y=y(z),psi=psi(z));
```

$$y, \psi \tag{1}$$

```
> epsilon[1]:=-1;epsilon[2]:=1;
```

$$\varepsilon_1 := -1$$

$$\varepsilon_2 := 1 \tag{2}$$

```
> EQ1:=z^2*diff(y,z,z)+z*diff(y,z)+epsilon[1]*epsilon[2]*(-epsilon
  [1]*epsilon[2]*nu^2+z^2)*y;
```

$$EQ1 := z^2 \left(\frac{\partial^2}{\partial z^2} y \right) + z \left(\frac{\partial}{\partial z} y \right) - \left(\nu^2 + z^2 \right) y \tag{3}$$

```
> y:=BesselJ(nu,sqrt(epsilon[1]*epsilon[2])*z):
> simplify(EQ1);
```

$$0 \tag{4}$$

```
> y:=psi*z^(-epsilon[1]*nu);
```

$$y := \psi z^{\nu} \tag{5}$$

```
> EQ1;
```

$$z^2 \left(\left(\frac{\partial^2}{\partial z^2} \psi \right) z^{\nu} + \frac{2 \left(\frac{\partial}{\partial z} \psi \right) z^{\nu} \nu}{z} + \frac{\psi z^{\nu} \nu^2}{z^2} - \frac{\psi z^{\nu} \nu}{z^2} \right) + z \left(\left(\frac{\partial}{\partial z} \psi \right) z^{\nu} + \frac{\psi z^{\nu} \nu}{z} \right) - \left(\nu^2 + z^2 \right) \psi z^{\nu} \tag{6}$$

```
> EQ2:=collect(numer(factor(expand(%))),diff,factor);
```

$$EQ2 := z^2 \left(\frac{\partial^2}{\partial z^2} \psi \right) z^{\nu} + z^{\nu} z \left(2 \nu + 1 \right) \left(\frac{\partial}{\partial z} \psi \right) - \psi z^{\nu} z^2 \tag{7}$$

```
> psi:=z^(epsilon[1]*nu)*(BesselJ(nu,sqrt(epsilon[1]*epsilon[2])*z)
  ):simplify(EQ2);
```

$$0 \tag{8}$$

```
> #z^2*(diff(psi, z, z))-z*(2*nu-1)*(diff(psi, z))+psi*z^2;
```