

#7

unassign('y(x)')
y(x)

$$\text{eqn} := (x + 1) \cdot \text{diff}(\text{diff}(y(x), x), x) - (2 - x) \cdot \text{diff}(y(x), x) + y(x) = 0 \quad (1.1)$$

$$\text{eqn} := (x + 1) \left(\frac{d^2}{dx^2} y(x) \right) - (2 - x) \left(\frac{d}{dx} y(x) \right) + y(x) = 0 \quad (1.2)$$

dsolve(eqn)

$$y(x) = _C1 \text{KummerM}\left(\frac{2}{5}, \frac{3}{2}, \frac{5x^2}{2}\right) x + _C2 \text{KummerU}\left(\frac{2}{5}, \frac{3}{2}, \frac{5x^2}{2}\right) x \quad (1.3)$$

mylhs := x → (x + 1) · diff(diff(y(x), x), x) - (2 - x) · diff(y(x), x) + y(x)

$$\text{mylhs} := x \rightarrow (x + 1) \left(\frac{d}{dx} \left(\frac{d}{dx} y(x) \right) \right) - (2 - x) \left(\frac{d}{dx} y(x) \right) + y(x) \quad (1.4)$$

$$y := x \rightarrow \sum_{k=0}^{20} (c[k] \cdot x^k)$$

$$y := x \mapsto \sum_{k=0}^{20} c_k \cdot x^k \quad (1.5)$$

mylhs(x)

$$\begin{aligned} (x + 1) & \left(2 c_2 + 6 c_3 x + 12 c_4 x^2 + 20 c_5 x^3 + 30 c_6 x^4 + 42 c_7 x^5 + 56 c_8 x^6 + 72 c_9 x^7 + 90 c_{10} x^8 \right. \\ & + 110 c_{11} x^9 + 132 c_{12} x^{10} + 156 c_{13} x^{11} + 182 c_{14} x^{12} + 210 c_{15} x^{13} + 240 c_{16} x^{14} \\ & + 272 c_{17} x^{15} + 306 c_{18} x^{16} + 342 c_{19} x^{17} + 380 c_{20} x^{18} \left. \right) - (2 - x) \left(c_1 + 2 c_2 x + 3 c_3 x^2 \right. \\ & + 4 c_4 x^3 + 5 c_5 x^4 + 6 c_6 x^5 + 7 c_7 x^6 + 8 c_8 x^7 + 9 c_9 x^8 + 10 c_{10} x^9 + 11 c_{11} x^{10} + 12 c_{12} x^{11} \\ & + 13 c_{13} x^{12} + 14 c_{14} x^{13} + 15 c_{15} x^{14} + 16 c_{16} x^{15} + 17 c_{17} x^{16} + 18 c_{18} x^{17} + 19 c_{19} x^{18} \\ & + 20 c_{20} x^{19} \left. \right) + c_0 + c_1 x + c_2 x^2 + c_3 x^3 + c_4 x^4 + c_5 x^5 + c_6 x^6 + c_7 x^7 + c_8 x^8 + c_9 x^9 \\ & + c_{10} x^{10} + c_{11} x^{11} + c_{12} x^{12} + c_{13} x^{13} + c_{14} x^{14} + c_{15} x^{15} + c_{16} x^{16} + c_{17} x^{17} + c_{18} x^{18} \\ & + c_{19} x^{19} + c_{20} x^{20} \end{aligned} \quad (1.6)$$

#yp:=D(y)

#ypp:=D(yp)

#mylhs:=ypp(x) - 5 · x·yp(x) + y(x)

expand(%)

$$\begin{aligned} 2 c_2 + c_0 - 2 c_1 - 2 c_2 x + 6 c_3 x + 2 c_1 x + 12 c_4 x^2 + 3 c_2 x^2 + 4 c_4 x^3 + 20 c_5 x^3 + 4 c_3 x^3 \\ + 10 c_5 x^4 + 30 c_6 x^4 + 5 c_4 x^4 + 18 c_6 x^5 + 42 c_7 x^5 + 6 c_5 x^5 + 28 c_7 x^6 + 56 c_8 x^6 + 7 c_6 x^6 \end{aligned} \quad (1.7)$$

$$\begin{aligned}
& + 40 c_8 x^7 + 72 c_9 x^7 + 8 c_7 x^7 + 54 c_9 x^8 + 90 c_{10} x^8 + 9 c_8 x^8 + 70 c_{10} x^9 + 110 c_{11} x^9 \\
& + 10 c_9 x^9 + 88 c_{11} x^{10} + 132 c_{12} x^{10} + 11 c_{10} x^{10} + 108 c_{12} x^{11} + 156 c_{13} x^{11} + 12 c_{11} x^{11} \\
& + 130 c_{13} x^{12} + 182 c_{14} x^{12} + 13 c_{12} x^{12} + 154 c_{14} x^{13} + 210 c_{15} x^{13} + 14 c_{13} x^{13} \\
& + 180 c_{15} x^{14} + 240 c_{16} x^{14} + 15 c_{14} x^{14} + 208 c_{16} x^{15} + 272 c_{17} x^{15} + 16 c_{15} x^{15} \\
& + 238 c_{17} x^{16} + 306 c_{18} x^{16} + 17 c_{16} x^{16} + 18 c_{17} x^{17} + 270 c_{18} x^{17} + 342 c_{19} x^{17} + 19 c_{18} x^{18} \\
& + 304 c_{19} x^{18} + 380 c_{20} x^{18} + 20 c_{19} x^{19} + 340 c_{20} x^{19} + 21 c_{20} x^{20}
\end{aligned}$$

sort(%x, ascending)

$$\begin{aligned}
& 2 c_2 + c_0 - 2 c_1 - 2 c_2 x + 6 c_3 x + 2 c_1 x + 12 c_4 x^2 + 3 c_2 x^2 + 4 c_4 x^3 + 20 c_5 x^3 + 4 c_3 x^3 \quad (1.8) \\
& + 10 c_5 x^4 + 30 c_6 x^4 + 5 c_4 x^4 + 18 c_6 x^5 + 42 c_7 x^5 + 6 c_5 x^5 + 28 c_7 x^6 + 56 c_8 x^6 + 7 c_6 x^6 \\
& + 40 c_8 x^7 + 72 c_9 x^7 + 8 c_7 x^7 + 54 c_9 x^8 + 90 c_{10} x^8 + 9 c_8 x^8 + 70 c_{10} x^9 + 110 c_{11} x^9 \\
& + 10 c_9 x^9 + 88 c_{11} x^{10} + 132 c_{12} x^{10} + 11 c_{10} x^{10} + 108 c_{12} x^{11} + 156 c_{13} x^{11} + 12 c_{11} x^{11} \\
& + 130 c_{13} x^{12} + 182 c_{14} x^{12} + 13 c_{12} x^{12} + 154 c_{14} x^{13} + 210 c_{15} x^{13} + 14 c_{13} x^{13} \\
& + 180 c_{15} x^{14} + 240 c_{16} x^{14} + 15 c_{14} x^{14} + 208 c_{16} x^{15} + 272 c_{17} x^{15} + 16 c_{15} x^{15} \\
& + 238 c_{17} x^{16} + 306 c_{18} x^{16} + 17 c_{16} x^{16} + 18 c_{17} x^{17} + 270 c_{18} x^{17} + 342 c_{19} x^{17} + 19 c_{18} x^{18} \\
& + 304 c_{19} x^{18} + 380 c_{20} x^{18} + 20 c_{19} x^{19} + 340 c_{20} x^{19} + 21 c_{20} x^{20}
\end{aligned}$$

collect(%x)

$$\begin{aligned}
& 2 c_2 + c_0 - 2 c_1 + (-2 c_2 + 6 c_3 + 2 c_1) x + (12 c_4 + 3 c_2) x^2 + (4 c_4 + 20 c_5 + 4 c_3) x^3 \quad (1.9) \\
& + (10 c_5 + 30 c_6 + 5 c_4) x^4 + (18 c_6 + 42 c_7 + 6 c_5) x^5 + (28 c_7 + 56 c_8 + 7 c_6) x^6 \\
& + (40 c_8 + 72 c_9 + 8 c_7) x^7 + (54 c_9 + 90 c_{10} + 9 c_8) x^8 + (70 c_{10} + 110 c_{11} + 10 c_9) x^9 \\
& + (88 c_{11} + 132 c_{12} + 11 c_{10}) x^{10} + (108 c_{12} + 156 c_{13} + 12 c_{11}) x^{11} + (130 c_{13} + 182 c_{14} \\
& + 13 c_{12}) x^{12} + (154 c_{14} + 210 c_{15} + 14 c_{13}) x^{13} + (180 c_{15} + 240 c_{16} + 15 c_{14}) x^{14} \\
& + (208 c_{16} + 272 c_{17} + 16 c_{15}) x^{15} + (238 c_{17} + 306 c_{18} + 17 c_{16}) x^{16} + (18 c_{17} + 270 c_{18} \\
& + 342 c_{19}) x^{17} + (19 c_{18} + 304 c_{19} + 380 c_{20}) x^{18} + (20 c_{19} + 340 c_{20}) x^{19} + 21 c_{20} x^{20}
\end{aligned}$$

sort(%x, ascending)

$$\begin{aligned}
& 2 c_2 + c_0 - 2 c_1 + (-2 c_2 + 6 c_3 + 2 c_1) x + (12 c_4 + 3 c_2) x^2 + (4 c_4 + 20 c_5 + 4 c_3) x^3 \quad (1.10) \\
& + (10 c_5 + 30 c_6 + 5 c_4) x^4 + (18 c_6 + 42 c_7 + 6 c_5) x^5 + (28 c_7 + 56 c_8 + 7 c_6) x^6 \\
& + (40 c_8 + 72 c_9 + 8 c_7) x^7 + (54 c_9 + 90 c_{10} + 9 c_8) x^8 + (70 c_{10} + 110 c_{11} + 10 c_9) x^9 \\
& + (88 c_{11} + 132 c_{12} + 11 c_{10}) x^{10} + (108 c_{12} + 156 c_{13} + 12 c_{11}) x^{11} + (130 c_{13}
\end{aligned}$$

$$\begin{aligned}
& + 182 c_{14} + 13 c_{12}) x^{12} + (154 c_{14} + 210 c_{15} + 14 c_{13}) x^{13} + (180 c_{15} + 240 c_{16} \\
& + 15 c_{14}) x^{14} + (208 c_{16} + 272 c_{17} + 16 c_{15}) x^{15} + (238 c_{17} + 306 c_{18} + 17 c_{16}) x^{16} \\
& + (18 c_{17} + 270 c_{18} + 342 c_{19}) x^{17} + (19 c_{18} + 304 c_{19} + 380 c_{20}) x^{18} + (20 c_{19} \\
& + 340 c_{20}) x^{19} + 21 c_{20} x^{20}
\end{aligned}$$

Copy-Paste:

$$\begin{aligned}
mysolutions := & x \mapsto 2 c_2 + c_0 - 2 c_1 + (-2 c_2 + 6 c_3 + 2 c_1) x + (12 c_4 + 3 c_2) x^2 + (4 c_4 + 20 c_5 \\
& + 4 c_3) x^3 + (10 c_5 + 30 c_6 + 5 c_4) x^4 + (18 c_6 + 42 c_7 + 6 c_5) x^5 + (28 c_7 + 56 c_8 + 7 c_6) x^6 \\
& + (40 c_8 + 72 c_9 + 8 c_7) x^7 + (54 c_9 + 90 c_{10} + 9 c_8) x^8 + (70 c_{10} + 110 c_{11} + 10 c_9) x^9 \\
& + (88 c_{11} + 132 c_{12} + 11 c_{10}) x^{10} + (108 c_{12} + 156 c_{13} + 12 c_{11}) x^{11} + (130 c_{13} + 182 c_{14} \\
& + 13 c_{12}) x^{12} + (154 c_{14} + 210 c_{15} + 14 c_{13}) x^{13} + (180 c_{15} + 240 c_{16} + 15 c_{14}) x^{14} + (208 c_{16} \\
& + 272 c_{17} + 16 c_{15}) x^{15} + (238 c_{17} + 306 c_{18} + 17 c_{16}) x^{16} + (18 c_{17} + 270 c_{18} + 342 c_{19}) x^{17} \\
& + (19 c_{18} + 304 c_{19} + 380 c_{20}) x^{18} + (20 c_{19} + 340 c_{20}) x^{19} + 21 c_{20} x^{20}
\end{aligned}$$

$$\begin{aligned}
mysolutions := & x \mapsto 2 \cdot c_2 + c_0 - 2 \cdot c_1 + (-2 \cdot c_2 + 6 \cdot c_3 + 2 \cdot c_1) \cdot x + (12 \cdot c_4 + 3 \cdot c_2) \cdot x^2 + (4 \cdot c_4 \textbf{(1.11)} \\
& + 20 \cdot c_5 + 4 \cdot c_3) \cdot x^3 + (10 \cdot c_5 + 30 \cdot c_6 + 5 \cdot c_4) \cdot x^4 + (18 \cdot c_6 + 42 \cdot c_7 + 6 \cdot c_5) \cdot x^5 + (28 \cdot c_7 \\
& + 56 \cdot c_8 + 7 \cdot c_6) \cdot x^6 + (40 \cdot c_8 + 72 \cdot c_9 + 8 \cdot c_7) \cdot x^7 + (54 \cdot c_9 + 90 \cdot c_{10} + 9 \cdot c_8) \cdot x^8 + (70 \cdot c_{10} \\
& + 110 \cdot c_{11} + 10 \cdot c_9) \cdot x^9 + (88 \cdot c_{11} + 132 \cdot c_{12} + 11 \cdot c_{10}) \cdot x^{10} + (108 \cdot c_{12} + 156 \cdot c_{13} + 12 \\
& \cdot c_{11}) \cdot x^{11} + (130 \cdot c_{13} + 182 \cdot c_{14} + 13 \cdot c_{12}) \cdot x^{12} + (154 \cdot c_{14} + 210 \cdot c_{15} + 14 \cdot c_{13}) \cdot x^{13} \\
& + (180 \cdot c_{15} + 240 \cdot c_{16} + 15 \cdot c_{14}) \cdot x^{14} + (208 \cdot c_{16} + 272 \cdot c_{17} + 16 \cdot c_{15}) \cdot x^{15} + (238 \cdot c_{17} \\
& + 306 \cdot c_{18} + 17 \cdot c_{16}) \cdot x^{16} + (18 \cdot c_{17} + 270 \cdot c_{18} + 342 \cdot c_{19}) \cdot x^{17} + (19 \cdot c_{18} + 304 \cdot c_{19} + 380 \\
& \cdot c_{20}) \cdot x^{18} + (20 \cdot c_{19} + 340 \cdot c_{20}) \cdot x^{19} + 21 \cdot c_{20} \cdot x^{20}
\end{aligned}$$

mysolutions(*x*)

$$\begin{aligned}
& 2 c_2 + c_0 - 2 c_1 + (-2 c_2 + 6 c_3 + 2 c_1) x + (12 c_4 + 3 c_2) x^2 + (4 c_4 + 20 c_5 + 4 c_3) x^3 \quad \textbf{(1.12)} \\
& + (10 c_5 + 30 c_6 + 5 c_4) x^4 + (18 c_6 + 42 c_7 + 6 c_5) x^5 + (28 c_7 + 56 c_8 + 7 c_6) x^6 \\
& + (40 c_8 + 72 c_9 + 8 c_7) x^7 + (54 c_9 + 90 c_{10} + 9 c_8) x^8 + (70 c_{10} + 110 c_{11} + 10 c_9) x^9 \\
& + (88 c_{11} + 132 c_{12} + 11 c_{10}) x^{10} + (108 c_{12} + 156 c_{13} + 12 c_{11}) x^{11} + (130 c_{13} \\
& + 182 c_{14} + 13 c_{12}) x^{12} + (154 c_{14} + 210 c_{15} + 14 c_{13}) x^{13} + (180 c_{15} + 240 c_{16} \\
& + 15 c_{14}) x^{14} + (208 c_{16} + 272 c_{17} + 16 c_{15}) x^{15} + (238 c_{17} + 306 c_{18} + 17 c_{16}) x^{16} \\
& + (18 c_{17} + 270 c_{18} + 342 c_{19}) x^{17} + (19 c_{18} + 304 c_{19} + 380 c_{20}) x^{18} + (20 c_{19}
\end{aligned}$$

$$+ 340 c_{20}) x^{19} + 21 c_{20} x^{20}$$

$$\text{subs}(c[1]=0, \text{mysolutions}(x))$$

$$\begin{aligned} & 2 c_2 + c_0 + (-2 c_2 + 6 c_3) x + (12 c_4 + 3 c_2) x^2 + (4 c_4 + 20 c_5 + 4 c_3) x^3 + (10 c_5 + 30 c_6 \quad \mathbf{(1.13)} \\ & + 5 c_4) x^4 + (18 c_6 + 42 c_7 + 6 c_5) x^5 + (28 c_7 + 56 c_8 + 7 c_6) x^6 + (40 c_8 + 72 c_9 \\ & + 8 c_7) x^7 + (54 c_9 + 90 c_{10} + 9 c_8) x^8 + (70 c_{10} + 110 c_{11} + 10 c_9) x^9 + (88 c_{11} \\ & + 132 c_{12} + 11 c_{10}) x^{10} + (108 c_{12} + 156 c_{13} + 12 c_{11}) x^{11} + (130 c_{13} + 182 c_{14} \\ & + 13 c_{12}) x^{12} + (154 c_{14} + 210 c_{15} + 14 c_{13}) x^{13} + (180 c_{15} + 240 c_{16} + 15 c_{14}) x^{14} \\ & + (208 c_{16} + 272 c_{17} + 16 c_{15}) x^{15} + (238 c_{17} + 306 c_{18} + 17 c_{16}) x^{16} + (18 c_{17} \\ & + 270 c_{18} + 342 c_{19}) x^{17} + (19 c_{18} + 304 c_{19} + 380 c_{20}) x^{18} + (20 c_{19} + 340 c_{20}) x^{19} \\ & + 21 c_{20} x^{20} \end{aligned}$$

$$\text{subs}(c[0]=0, \text{mysolutions}(x))$$

$$\begin{aligned} & 2 c_2 - 2 c_1 + (-2 c_2 + 6 c_3 + 2 c_1) x + (12 c_4 + 3 c_2) x^2 + (4 c_4 + 20 c_5 + 4 c_3) x^3 + (10 c_5 \quad \mathbf{(1.14)} \\ & + 30 c_6 + 5 c_4) x^4 + (18 c_6 + 42 c_7 + 6 c_5) x^5 + (28 c_7 + 56 c_8 + 7 c_6) x^6 + (40 c_8 \\ & + 72 c_9 + 8 c_7) x^7 + (54 c_9 + 90 c_{10} + 9 c_8) x^8 + (70 c_{10} + 110 c_{11} + 10 c_9) x^9 + (88 c_{11} \\ & + 132 c_{12} + 11 c_{10}) x^{10} + (108 c_{12} + 156 c_{13} + 12 c_{11}) x^{11} + (130 c_{13} + 182 c_{14} \\ & + 13 c_{12}) x^{12} + (154 c_{14} + 210 c_{15} + 14 c_{13}) x^{13} + (180 c_{15} + 240 c_{16} + 15 c_{14}) x^{14} \\ & + (208 c_{16} + 272 c_{17} + 16 c_{15}) x^{15} + (238 c_{17} + 306 c_{18} + 17 c_{16}) x^{16} + (18 c_{17} \\ & + 270 c_{18} + 342 c_{19}) x^{17} + (19 c_{18} + 304 c_{19} + 380 c_{20}) x^{18} + (20 c_{19} + 340 c_{20}) x^{19} \\ & + 21 c_{20} x^{20} \end{aligned}$$