Assignment 3

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$x(x-1)y'' + 3(x-1)y' + y = 0$

$= (x^2 - x)y'' + (3x-1)y' + y = 0$

$A_n = Y^{n+2}(x^2-x) + nY^{n+1}(2x) + \frac{n(n-1)}{2!}Y^n(2)$

$B_n = Y^{n+1}(3x-1) + nY^n(2)$

$C_n = Y^n$

$= Y^{n+2}(x^2-x) + nY^{n+1}(2x) + n(n-1)Y^n + Y^{n+1}(3x-1) + nY^n + Y^n$

$Y^{n+2}(x^2-x) + Y^{n+1}(2x-1)n + (3x-1) + Y^n(n^2-n+3n+1) = 0$

$Y^{n+2}(x^2-x) + Y^{n+1}(2x-1)n + 3x-1) + Y^n(n^2+2n+1)$

at $x = 0$

$Y^{n+1}(-n-1) + Y^n(n^2+2n+1)$

$Y^{n+1} = \frac{-Y^n(n^2+2n+1)}{-n-1}$

$Y^{n+1} = \frac{Y^n(n^2+2n+1)}{(1+n)} = \frac{Y^n(n+1)(n+1)}{(1+n)}$

$Y^{n+1} = Y^n(n+1)$

at $n = 0$

$Y^1 = Y^0(1) = Y^0$

at $n = 1$

$Y^{11} = Y^1(2) = 2(Y^0) = 2Y^1$

at $n = 2$

$Y^{111} = Y^{11}(3) = 3(2Y^0) = 6Y^1$

at $n = 3$

$Y^4 = Y^{111}(4) = 4(6Y^0) = 24Y^1$

at $n = 4$

$Y^5 = Y^5(5) = 5(24Y^0) = 120Y^1$

at $n = 5$

$Y^6 = Y^5(6) = 6(120Y^0) = 720Y^1$

at $n=6$

$y^6 = y^6(7) = 7(7204^0) = 50404^1$

at $n=7$

$y^7 = y^7(8) = 8(50404^0) = 403204^1$

$= y_0 + x(y^1)_0 + \frac{x^2}{2!}(y^{11})_0 + \frac{x^3}{3!}(y^{111})_0 + \cdots$

$= y_0 + x(y^1) + \frac{x^2}{2!}(2y^1)_0 + \frac{x^3}{3!}(6y^1) + \frac{x^4}{4!}(24y^1) + \frac{x^5}{5!}(120y^1)$

$+ \frac{x^6}{6!}(720y^1) + \frac{x^7}{7!}(5040y^1)$

$= y_0 + x(y^1) + x^2(y^1)_0 + x^3(y^1)_0 + x^4(y^1)_0 + x^5(y^1)_0$

$+ x^6(y^1)_0 + x^7(y^1)_0$

$y = (y_0) + y^1(fx)$

$y = 0.005$

at $x = 5, 8, 10$

at $x = 5$

$y = 0.005 + 0.0005\,[5^2 + 5^3 + 5^4 + 5^5 + 5^6 + 5^7]$

$= 0.005 + 0.0005\,(113125)$

$= 56.563$

at $x = 8$

$y = 0.005 + 0.0005\,[8^0 + 8^2 + 8^3 + 8^4 + 8^5 + 8^6 + 8^7]$

$y = 1198.373$

at $x = 10$

$y = 0.005 + 0.0005\,[10 + 10^2 + 10^3 + 10^4 + 10^5 + 10^6 + 10^7]$

$y = 0.005 + 5555.555$

$y = 5555.555$

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Syms x
Syms y
  x = (0:10);
  y = 0.005 + 0.0005 + (x+x.^2) +(x.^3) +x.^4)
+(x.^5) +(x.^6) +(x.^7)

Plot(x,y)
Grid on
Grid minor
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