

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

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

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

$$B_n = y^{n+1}(3x-1) + n y^n(3)$$

$$C_n = y^n$$

$$= y^{n+2}(x^2-x) + n y^{n+1}(\underline{2x}) + n(n-1)y^n + y^{n+1}(\underline{3x-1}) + y^n(\underline{3})$$

$$+ y^n$$

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

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

at $x = 0$

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

$$y^{n+1} = -y^n(n^2+2n+1)$$

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

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

$$atn = 0$$

$$y' = y'(1) = 1y'$$

$$atn = 1$$

$$y'' = y''(2) = 2(1y') = 2y''$$

$$atn = 2$$

$$y''' = y'''(3) = 3(2y'') = 6y'''$$

$$atn = 3$$

$$y^{(4)} = y^{(4)}(4) = 4(6y''') = 24y^{(4)}$$

$$atn = 4$$

$$y^{(5)} = y^{(5)}(5) = 5(24y^{(4)}) = 120y^{(5)}$$

$$atn = 5$$

$$y^{(6)} = y^{(6)}(6) = 6(120y^{(5)}) = 720y^{(6)}$$

$$atn = 6$$

$$y^{(7)} = y^{(7)}(7) = 7(720y^{(6)}) = 5040y^{(7)}$$

$$atn = 7$$

$$y^{(8)} = y^{(8)}(8) = 8(5040y^{(7)}) = 40320y^{(8)}$$

$$= y_0 + x(y')_0 + \frac{x^2}{2!}(y'')_0 + \frac{x^3}{3!}(y''')_0 + \dots$$

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

$$+ \frac{x^5}{5!}(120y^{(5)})_0 + \frac{x^6}{6!}(720y^{(6)})_0 + \frac{x^7}{7!}(5040y^{(7)})_0$$

$$= y_0 + x(y')_0 + x^2(y'')_0 + x^3(y''')_0 + x^4(y^{(4)})_0 + x^5(y^{(5)})_0 + x^6(y^{(6)})_0 + x^7(y^{(7)})_0$$

$$y = \left(\int_0^x f(x) dx \right) + y'(f(x))$$

$$y = 0.0005 \neq y'$$

at $x = 5, 8$ & 10 .

at $x = 5$.

$$0.0005 = \int_0^5 [5^2 + 5^3 + 5^4 + 5^5 + 5^6 + 5^7]$$

$$\begin{aligned}
 y &= 0.0005 + 0.0005 \left[5^2 + 5^3 + 5^4 + 5^5 + 5^6 + 5^7 \right] \\
 &= 0.0005 + 0.0005 [113125] \\
 &= 0.0005 + 56.5625 = 56.563.
 \end{aligned}$$

at $x = 8$.

$$\begin{aligned}
 y &= 0.0005 + 0.0005 \left[8^2 + 8^3 + 8^4 + 8^5 + 8^6 + 8^7 \right] \\
 &= 0.0005 + 0.0005 (2396744)
 \end{aligned}$$

$$0.0005 + 1198.372$$

$$= 1198.373.$$

$y = (y_0)$

at $x = 10$

$$\begin{aligned}
 y &= 0.0005 + 0.0005 \left[10 + 10^2 + 10^3 + 10^4 + 10^5 + 10^6 + 10^7 \right] \\
 &= 0.0005 + 0.0005 (1111110)
 \end{aligned}$$

$$0.0005 + 5555.555$$

$$= 5555.555.$$

3) `syms x`
`syms y`
`x = (0:10);`

$$y = 0.0005 + 0.0005 * (x + (x.^2) + (x.^3) + (x.^4) + (x.^5) + (x.^6) + (x.^7))$$

Plot (x, y)

Grid on
 Grid minor

