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16/ENR07020
Petroleum Engineering
ENR381 Assignment II

solo

$$y = e^{x^2+x}$$

$$y' = (2x+1)e^{x^2+x}$$

$$u = 2x+1; u' = 2$$

$$v = e^{x^2+x}; v' = (2x+1)e^{x^2+x}$$

$$y'' = uv' + vu'$$

$$y'' = (2x+1)[(2x+1)e^{x^2+x}] + e^{x^2+x} \cdot 2$$

$$\text{Sub } y' = (2x+1)e^{x^2+x} \text{ into } y'' = y'(2x+1) + 2y$$

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

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

$$\text{let } A = y''$$

$$u = y^A; u' = y^{A+1}$$

$$v = 1; v' = 0$$

$$y'' = u'v + uv' = y^{A+1}$$

$$y'' = y^{A+1} + 2y^{A+1} = 0$$

$$y'' = y^{A+2} \Rightarrow A'$$

$$\text{let } B = y'(2x+1)$$

$$u = y^B; u' = y^{B+1}$$

$$v = 2x+1; v' = 2; v'' = 0$$

$$y'' = y^{B+1}(2x+1) + ny^{B+1} \cdot 2$$

$$y'' = y^{B+1}(2x+1) + 2ny^{B+1} \Rightarrow B'$$

$$\text{let } C = 24$$

$$u = y^C; u' = y^{C+1}$$

$$v = 2; v' = 0$$

$$y'' = y^{C+1} + ny^{C+1} = 0$$

$$y'' = 24y^C \Rightarrow C'$$

$$A - B - C = 0$$

$$A' - B' - C' = 0$$

$$y^{n+2} - [y^{n+1}(2x+1) + 2ny^n] - 24 = 0$$

$$y^{n+2} = y^{n+1}(2x+1) + 2ny^n + 24$$

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

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

$$2 \quad y = e^{4x}, y' = 4e^{4x}$$

$$v = x^3, v' = 3x^2, v'' = 6x, v''' = 6, v^{(4)} = 0$$

$$y^n = 4^n e^{4x} x^3 + p 4^{n-1} e^{4x} (3x^2) + \frac{n(n-1)4^{n-2} x 6x}{2!} + \frac{n(n-1)(n-2)4^{n-3} 6}{3!} + \dots$$

3!

$$y^n = 4^n e^{4x} x^3 + 3x^2 \cdot n \cdot 4^{n-1} e^{4x} + 3x(n^2 - n) 4^{n-2} e^{4x} + n(n^2 - 3n + 2n) 4^{n-3} e^{4x}$$

$$y^n = 4^n e^{4x} x^3 + 3x^2 \cdot n \cdot 4^{n-1} e^{4x} + 3x(n^2 - n) 4^{n-2} e^{4x} + e^{4x} + (n^3 - 3n^2 + 2n) 4^{n-3} e^{4x}$$

$$y^5 = 1024 e^{4x} x^3 + 3 \cdot 256 \cdot 5 x^2 e^{4x} + 3 \cdot (5^2 - 5) \cdot 4^{5-2} e^{4x} x + (5^3 - 3 \cdot 5^2 + 2 \cdot 5) \cdot 4^{5-3} e^{4x}$$

$$y^5 = 1024 x^3 e^{4x} + 3840 x^2 e^{4x} + 3840 x e^{4x} + 960 e^{4x}$$

$$y^3 = 64 e^{4x} x^3 + \left[16 + \frac{60}{x} + \frac{60}{x^2} + \frac{15}{x^3} \right]$$

$$11 \quad x^2 y'' + x y' + y = 0$$

$$y^n = r^n + n r^{n-1} v' + \frac{n(n-1)r^{n-2}}{2!} v'' + \frac{n(n-1)(n-2)}{3!} v''' + \dots$$

$$- r^{n-2} v^3 +$$

$$y = uv$$

$$\text{let } A = x^2 y''$$

$$u = y''; u' = y'''$$

$$u = x^2, v' = 2x; u'' = 2; v'' = 0$$

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

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

$$x' \Rightarrow y^n = y^{n+2} x^2 + n y^{n+1} 2x + n(n-1) y^n$$

$$\text{let } B = x y'$$

$$y = y^{-1}; u' = y^{n+1}$$

$$u = x; v' = 1; v'' = 0$$

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

$$B' \Rightarrow y^n = y^{n+1} x + n y^n$$

$$\text{let } C = y$$

$$C' \Rightarrow y^n = y^n$$

$$A + B + C = 0$$

$$A' + B' + C' = 0$$

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

$$+ y^n = 0$$

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

$$= 0$$

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