

Name: Alkocha Chimzi Oshwaka
Matric: 16/ENG07/034
Course: ENG 381 Mathematics Assignment (II)

1)

$$\text{Pf } y = e^{x^2 + n}$$

$$u = x^2 + n$$

$$\frac{du}{dx} = 2x + 1$$

$$y = e^u$$

$$\frac{dy}{du} = e^u$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$= e^u \times 2x + 1$$

$$2x + 1 e^u \quad u = x^2 + n$$

$$\frac{dy}{dx} = 2x + 1 e^{x^2 + n}$$

$$\frac{d^2y}{dx^2} = 2e^{x^2 + n} + (2x + 1)(2x + 1)e^{x^2 + n}$$

$$= 2e^{x^2 + n} + 4x^2 + 4x + 1 e^{x^2 + n}$$

$$\frac{d^2y}{dx^2} = 2e^{x^2 + n} + 4x^2 + 4x + 1 e^{x^2 + n}$$

$$y'' = \frac{d^2y}{dx^2} \quad y' = \frac{dy}{dx} \quad y = e^{x^2 + n}$$

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

$$y'' = 2e^{x^2 + n} + 4x^2 + 4x + 1 e^{x^2 + n}$$

$$y' = (2x + 1) = (2x + 1)(2x + 1)e^{x^2 + n}$$
$$= 4x^2 + 4x + 1 e^{x^2 + n}$$

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

$$y'(2x + 1) + 2y = 2e^{x^2 + n} + 4x^2 + 4x + 1 e^{x^2 + n}$$

$$= 2e^{x^2 + n} + 4x^2 + 4x + 1 e^{x^2 + n}$$

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

\downarrow \downarrow \downarrow
 w_1 w_2 w_3

+

$$u = y'' \quad v = 1$$

$$u^n = y^{n+2} \quad v' = 0$$

$$= y^{n+2} \cdot 1 + 0$$

u2

$$u = y' \quad v = 2x+1$$

$$u^n = y^{n+1} \quad v' = 2$$

$$u^{n-1} = y^n \quad v = 0$$

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

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

w3

$$u = 2y \quad v = 1$$

$$u^n = y^n \quad v' = 0$$

$$= 2[y^n - 1] + 0$$

$$= 2y^n$$

$$w_1 = w_2 + w_3$$

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

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

2a) Using the Leibnitz theorem gives that
 $y = x^3 e^{4x}$ determine $y^{(5)}$.
 Solution

$$u = e^{4x} \quad v = x^3$$

$$y^{(5)} = \frac{u^{(5)}}{u^{(5)}} v + 5u^4 v' + 10u^3 v'' + 10u^2 v^3 + 5u' v^4 +$$

$$= 4^5 e^{4x} \cdot n^3 + 5(4^4 e^{4x} \cdot 3n^2) + 10(4^3 e^{4x} \cdot 6n) + 5(4^2 e^{4x} \cdot 6)$$

$$= 1024 e^{4x} n^3 + 1280 e^{4x} 3n^2 + 640 e^{4x} \cdot 6n + 80 e^{4x} \cdot 6$$

$$= 1024 e^{4x} n^3 + 3840 e^{4x} n^2 + 3840 e^{4x} n + 480 e^{4x}$$

$$(ii) \quad x^2 \frac{dy^2}{dx^2} + x \frac{dy}{dx} + y = 0$$

$$x^2 y'' + x y' + y = 0$$

$$w_1 \quad w_2 \quad w_3$$

$$w_1 + w_2 + w_3 = 0$$

for w_1

$$u = y^n \quad v = x^2$$

$$u^n = y^{n+2} \quad v' = 2x$$

$$u^{n-1} = y^{n+1} \quad v'' = 2$$

$$= y^{cn+2} (x^2) + n(y^{n+1}) 2x + n(n-1)y^n \cdot x = 0$$

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

for w_2

$$u = y' \quad u = x$$

$$u^n = y^{n+1} \quad u = 1$$

$$u^{n-1} = y^n \quad u'' = 0$$

$$= y^{n+1} \cdot x + n y^n \cdot 1 = 0$$

for w_3

$$u = y \quad v = 1$$

$$u^n = y^n \quad v' = 0$$

$$= y^n \cdot 1$$

$$w_1 + w_2 + w_3 = 0$$

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

$$x y^{n+2} + 2nx y^{n+1} + x y^{n+1} + n^2 y^n - n y^n + n y^n \cdot x$$

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